

EAST BAY MUNICIPAL  
UTILITY DISTRICT

# Alameda–North Bay Farm Island Pipeline Crossings Project

Draft Environmental  
Impact Report  
Appendices

JULY 2016



PANORAMA  
ENVIRONMENTAL, INC.

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[www.panoramaenv.com](http://www.panoramaenv.com)



EAST BAY MUNICIPAL  
UTILITY DISTRICT

**Alameda–North Bay  
Farm Island Pipeline  
Crossings Project**

Draft Environmental Impact Report  
Appendices

**JULY 2016**

Prepared for:

East Bay Municipal Utility District  
Water Distribution Planning Division  
375 11th Street  
Oakland, CA 94607

Prepared by:

Panorama Environmental, Inc.  
One Embarcadero Center, Suite 740  
San Francisco, CA 94111  
650-373-1200  
info@panoramaenv.com





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SUMMARY OF PUBLIC SCOPING

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## NOTICE OF PREPARATION

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**NOTICE OF PREPARATION  
ENVIRONMENTAL IMPACT REPORT  
ALAMEDA–NORTH BAY FARM ISLAND PIPELINE CROSSINGS PROJECT  
EAST BAY MUNICIPAL UTILITY DISTRICT  
August 20, 2015**

**To Responsible Agencies and Interested Parties:**

The East Bay Municipal Utility District (EBMUD), acting as lead agency under the California Environmental Quality Act (CEQA), is preparing a project-level Environmental Impact Report (EIR) for the Alameda–North Bay Farm Island Pipeline Crossings Project. For this Notice of Preparation (NOP), EBMUD requests your input regarding the scope and content of the environmental information that should be considered or included in the EIR and that is germane to your agency's statutory responsibilities in connection with the project. CEQA requires that your response be submitted to EBMUD at the earliest possible date, but not later than September 21, 2015. Responses to, or questions regarding, this NOP should be directed to:

Aaron Hope, Project Manager  
East Bay Municipal Utility District  
375 Eleventh Street, MS 701  
Oakland, CA 94607  
(510) 287-1496  
[alamedacrossings@ebmud.com](mailto:alamedacrossings@ebmud.com)

**Project Purpose:** The Alameda–North Bay Farm Island Pipeline Crossings Project is needed to ensure continued reliable water service to customers located in the City of Alameda (both Alameda Island and North Bay Farm Island). Water service to the City of Alameda is provided by four existing underwater pipeline crossings at three separate locations between the City of Oakland, Alameda Island, and North Bay Farm Island. Failure of one of three existing crossing locations could lead to a reduction in the level of service for existing customers and potentially reduce the available water supply to Alameda Island and North Bay Farm Island. Three new pipeline crossings are proposed to replace the existing pipeline crossings to ensure long-term reliability and redundancy of the water distribution system, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

**Project Location and Description:** The project involves the construction and operation of three transmission pipelines (24-inch inner diameter) located within Alameda County in the Cities of Oakland and Alameda (see **Figure 1**). Construction of the pipelines within the streets would be by conventional open-trench construction methods; however, both horizontal directional drilling (HDD) and trenchless (bore and jack) methods would be used during construction of underwater crossings and individual road crossings when needed. In addition, the project would require temporary laydown of the three underwater crossing pipeline segments on local roads for pipeline fusion and testing before pulling them underwater (see **Figure 1**). Construction hours would typically occur between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) may be required when the proposed pipelines are connected to existing

pipelines, to minimize customer water service disruption, and for portions of the HDD operations on both sides of the crossings. Each pipeline crossing is described below.

- **Crossing #1.** Crossing #1 is known as the Estuary Park-Marina Village Crossing and is approximately 2.2 miles in length. The new pipeline would connect to existing transmission pipelines in the City of Oakland, cross under the Oakland Inner Harbor, and continue in the City of Alameda to its connection point. Crossing #1 would also include abandonment and replacement of an existing pipeline (see **Figure 2**). One alternative route option for open trench construction and one alternative route option for the replacement of an existing pipeline, both in the City of Oakland, are being considered (see **Figure 2**). Construction activities would occur within existing city streets, one business park parking lot (the Telecare Corporation) and Estuary Park.
- **Crossing #2.** Crossing #2 is known as the Alameda–North Bay Farm Island Crossing and is approximately 1 mile in length. The new pipeline would connect to existing transmission pipelines in Alameda Island, cross under the San Leandro Bay Channel, and continue on North Bay Farm Island to its connection point (see **Figure 3**). Construction activities would occur within existing city streets and Towata Park.
- **Crossing #3.** Crossing #3 is known as the Derby Crossing and is approximately 1 mile in length. The new pipeline would connect to existing transmission pipelines in the City of Oakland, cross under the Tidal Canal, and continue in the City of Alameda to its connection point. Crossing #3 would also include replacing an existing pipeline (see **Figure 4**). One alternative route option for open-trench construction in the City of Alameda is being considered. Construction activities would occur within existing city streets.


Construction of Crossing #1 is the highest priority, because it would replace the oldest and most vulnerable crossing, the existing Alice Webster Crossing. Crossing #1 is scheduled for construction over an approximate 13- to 21-month period in 2018/2019.

Crossings #2 and #3 would replace existing crossings that were constructed in the 1980s. Construction of Crossings #2 and #3 would be scheduled at a future date, after 2020 but before the existing pipelines reach the end of their useful lives. Construction of Crossing #2 and Crossing #3 would each occur over a separate approximate 9- to 17-month period.

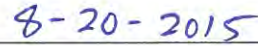
**Probable Environmental Effects.** Based on an Initial Study completed for the project, the environmental factors that could potentially be affected by this project (i.e., involving at least one impact that is a "Potentially Significant Impact") include aesthetics, air quality, biological resources, cultural resources, energy use, geology/soils, greenhouse gas emissions, hazards/hazardous materials, hydrology/water quality, noise, public services, recreation, transportation and traffic, and cumulative impacts.

**CEQA Process.** The Draft EIR is targeted for circulation in the spring of 2016, with action by EBMUD's Board of Directors anticipated in late 2016. Notice will be given of public meetings. At the end of the review and comment process, EBMUD's Board of Directors will determine

whether to certify the EIR and approve the Alameda–North Bay Farm Island Pipeline Crossings Project. Additional information about the Alameda–North Bay Farm Island Pipeline Crossings Project can be obtained from the EBMUD website ([www.ebmud.com](http://www.ebmud.com)).



\_\_\_\_\_  
Xavier J. Irias  
Director of Engineering and Construction  
East Bay Municipal Utility District



\_\_\_\_\_  
Date

XJI:DJR:ALH:dks  
sb15\_129c\_NOP

Attachments

Figure 1 Project Location



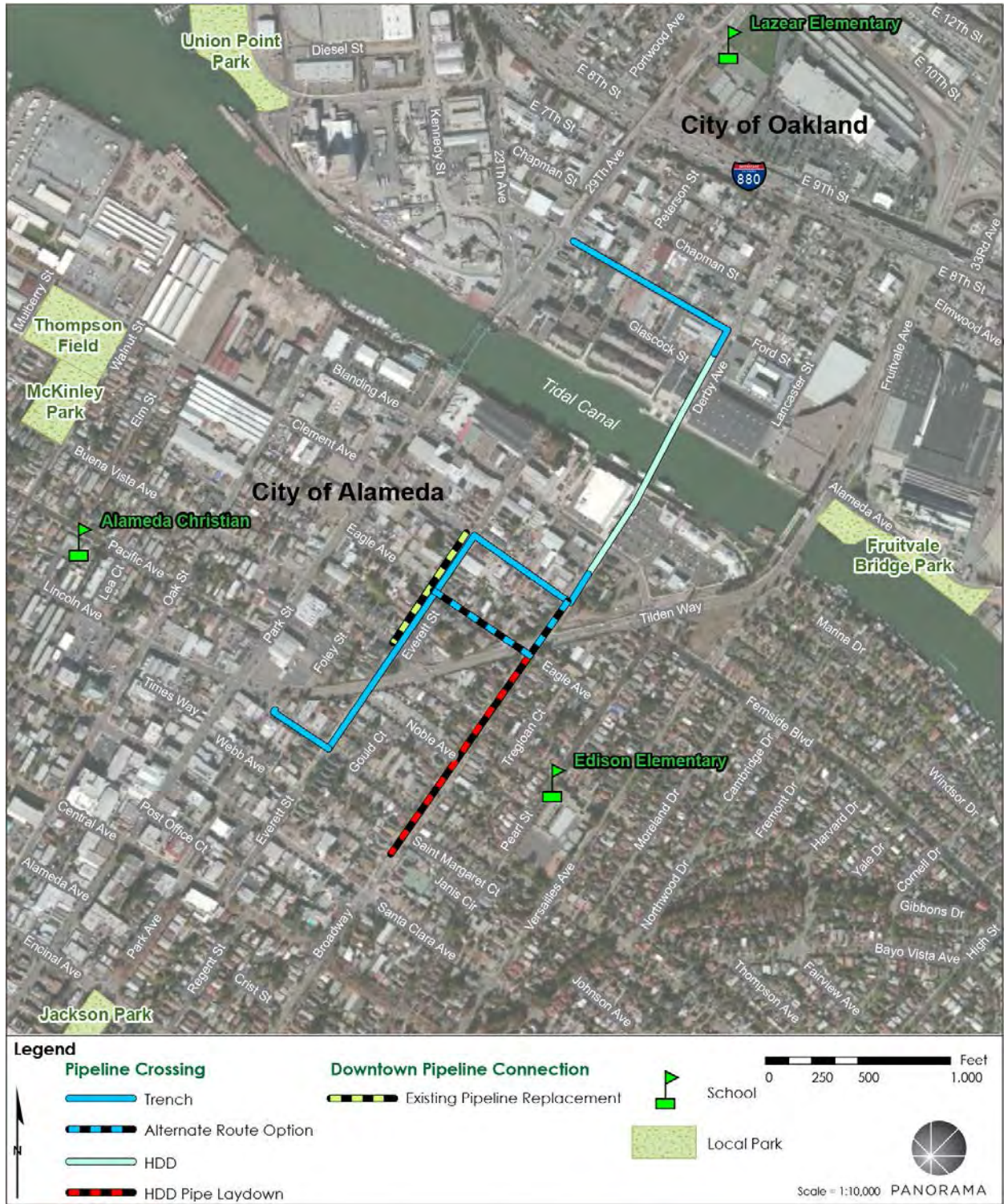
Figure 2 Crossing #1 Alignment



Figure 3 Crossing #2 Alignment



Figure 4 Crossing #3 Alignment





## NOTICE OF PREPARATION POSTCARD

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East Bay  
Municipal Utility District  
P.O. Box 24055, Oakland, CA 94623-1055

**Public Meeting Alameda–  
North Bay Farm Island Pipeline  
Crossings Project**

ALAMEDA-NORTH BAY FARM ISLAND  
PIPELINE CROSSINGS  
PROJECT  
OVERALL MAP



East Bay  
Municipal Utility District  
P.O. Box 24055, Oakland, CA 94623-1055

**Public Meeting Alameda–  
North Bay Farm Island Pipeline  
Crossings Project**

ALAMEDA-NORTH BAY FARM ISLAND  
PIPELINE CROSSINGS  
PROJECT  
OVERALL MAP





## Large Water Pipeline Construction In or Near Your Street

The East Bay Municipal Utility District (EBMUD) is currently in the planning stage for the Alameda-North Bay Farm Island Pipeline Crossings Project, which includes construction of three underwater pipeline crossings under the Oakland Estuary and new water transmission pipelines (24-inch inner diameter), some of which are in or near your street. The purpose of the project is to meet existing and future water demands, improve system reliability, and facilitate repair and replacement of aging infrastructure.

EBMUD is preparing an Environmental Impact Report (EIR) for the project in which the first step is a Notice of Preparation (NOP). The NOP was published on August 20, 2015. For more information about the project or to view the NOP, visit [www.ebmud.com](http://www.ebmud.com), click on "Construction in my Neighborhood," and then click on "Alameda-North Bay Farm Island Pipeline Crossings Project" listed under Alameda and Oakland. Written comments on the NOP should be submitted to Aaron Hope, Associate Civil Engineer, MS #701, 375 Eleventh Street, Oakland, California 94607-4240, or e-mailed to [alamedacrossings@ebmud.com](mailto:alamedacrossings@ebmud.com) by September 21, 2015.

The next steps include preparation of the Draft EIR which is scheduled for public review in spring 2016, with action by EBMUD's Board of Directors anticipated in late 2016. The first phase of construction would occur between 2018 and 2019.

### The following two public meetings are scheduled to discuss the project and the scope of the EIR:

<p><b>Tuesday, September 1, 2015 at 6:00 pm</b>  <b>Alameda Elks Lodge No. 1015</b>  <b>2255 Santa Clara Avenue, Rath Room (downstairs)</b>  <b>Alameda, CA</b></p>	<p><b>Thursday, September 10, 2015 at 6:00 pm</b>  <b>EBMUD Administrative Building</b>  <b>375 Eleventh Street, 2nd Floor Training Room</b>  <b>Oakland, CA</b></p>
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If you have questions about the public meetings, please contact Laura Luong, EBMUD Community Affairs, at [lluong@ebmud.com](mailto:lluong@ebmud.com) or 510-287-0140.



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If you have questions about the public meetings, please contact Laura Luong, EBMUD Community Affairs, at [lluong@ebmud.com](mailto:lluong@ebmud.com) or 510-287-0140.

## AGENCIES THAT RECEIVED NOP

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No.	Agency	Contact Person, Title	Address	City	State	Country	Zip
1	Alameda Chamber of Commerce		2210-D South Shore Center	Alameda	CA	USA	94501
2	Alameda Parks and Recreation	Towata Park	2263 Santa Clara Ave	Alameda	CA	USA	94501
3	United States Army Corps of Engineers (USACE)	Katerina Galacatos, South Branch Chief	1455 Market St. #16	San Francisco	CA	USA	94103
4	Association of Bay Area Governments	Miriam Chion, Planning and Research Director	P.O. Box 2050	Oakland	CA	USA	94604
5	Bay Area Air Quality Management District (BAAQMD)	Alison Kirk, Environmental Planner	939 Ellis Street San	San Francisco	CA	USA	94109
6	Bay Conservation and Development Commission (BCDC)	Jamie Michaels, Principal Permit Analyst	455 Golden Avenue Suite 10600	San Francisco	CA	USA	94102
7	California Department of Fish and Wildlife (CDFW) - Bay Delta Region	Scott Wilson, Regional Manager	7329 Silverado Trail	Napa	CA	USA	94558
8	California Department of Toxic and Substance Control - Headquarters	Elise Rothschild, Deputy Director	1001 I Street	Sacramento	CA	USA	95814
9	California Department of Toxic and Substance Control - Regional Office	Karen Toth, Unit Supervisor	700 Heinz Avenue Suite 200	Berkeley	CA	USA	94710
10	California Department of Transportation (Caltrans) - District 4	Melanie Brent District Deputy for Environmental Planning and Engineering	111 Grand Ave	Oakland	CA	USA	94612
11	California Public Utilities Commission (CPUC)	Consumer Protection and Safety Division Railroad Operations and Safety Branch	505 Van Ness Avenue	San francisco	CA	USA	94102
12	California State Lands Commission	Jennifer Lucchi, Executive Director	100 Howe Avenue, Suite 100 South	Sacramento	CA	USA	95825

No.	Agency	Contact Person, Title	Address	City	State	Country	Zip
13	California State Lands Commission	Grace Kato Stewart, Manager	100 Howe Avenue, Suite 100 South	Sacramento	CA	USA	95825
14	California State Lands Commission	Cy Oggins, Chief of Environmental Planning and Management Division Chief of Environmental Planning and Management Division	100 Howe Avenue, Suite 100 South	Sacramento	CA	USA	95825
15	City of Alameda Public Works	Erin Smith, Public Works Coordinator	950 West Mall Square	Alameda	CA	USA	94501
16	City of Alameda, Planning and Public Works	Andrew Thomas, City Planner	2263 Santa Clara Avenue	Alameda	CA	USA	94501
17	City of Alameda, Recreation and Parks Department	Amy Wooldridge, Director	2226 Santa Clara Ave	Alameda	CA	USA	94501
18	City of Oakland	Edwin Kawamoto, Real Estate Rep	1 Frank H. Ogawa Plaza	Oakland	CA	USA	94612
19	City of Oakland	James Golde, Real Estate Director	1 Frank H. Ogawa Plaza	Oakland	CA	USA	94612
20	City of Oakland, Parks and Recreation Department	Audree Jones- Taylor, Director	1 Frank H. Ogawa Plaza	Oakland	CA	USA	94612
21	City of Oakland, Planning and Public Works	Catherine Payne, City Planner	1 Frank H. Ogawa Plaza	Oakland	CA	USA	94612
22	Department of Boating and Waterways, California Coastal Commission (CCC)	Leandro Ramos, Environmental Supervisor	One Capitol Mall Suite 500	Sacramento	CA	USA	95814
23	Downtown Oakland Association	Michelle Lane, President	388 19th Street	Oakland	CA	USA	94612
24	Greater Alameda Business Association		P.O. Box 2892	Alameda	CA	USA	94501



No.	Agency	Contact Person, Title	Address	City	State	Country	Zip
25	Jack London District Association	Ben Delaney, President	655 3rd Street, PMB 21	Oakland	CA	USA	94607
26	National Marine Fisheries Service (NMFS)	Gary Stern, Fisheries Biologist	777 Sonoma Avenue	Santa rosa	CA	USA	95404
27	Oakland Chinatown Chamber of Commerce	Jennie Ong, Executive Director	388 9th Street, Suite 290	Oakland	CA	USA	94607
28	Owners of 1080 & 1092 Marina Village	Thomas Diamond, Brookfield Asset Management	Brookfield Place, Suite 300 181 Bay Street	Toronto	ON	Canada	M5J 2T3
29	Owners of 1080 & 1092 Marina Village	Melanie Guevara, Legacy Partners Property Manager	1150 Marina Village Parkway	Alameda	CA	USA	94501
30	Park Street Business Association		2447 Santa Clara Ave., #302	Alameda	CA	USA	94501
31	Port of Oakland	Pamela Kershaw, Director of Commercial Real Estate	Port of Oakland 530 Water Street	Oakland	CA	USA	94607
32	Port of Oakland	Richard Sinkoff, Programs and Planning	530 Water Street	Oakland	CA	USA	94607
33	San Francisco Bay Regional Water Quality Control Board (RWQCB)	Naomi Feger, Environmental Program Manager	1515 Clay Street	Oakland	CA	USA	94612
34	SF Bay Conservation & Development Commission	Brad McCree, Regulatory Program Director	455 Golden Gate Avenue, Suite 10600	San francisco	CA	USA	94102
35	Signature Development	Patrick Van Ness, Vice President	2335 Broadway, Suite 200	Oakland	CA	USA	94612
36	Union Pacific Railroad	Nick Anderson	1400 Douglas St. Stop 1690	Omaha	NE	USA	68179
37	West Alameda Business Association		1509 1/2 Webster Street, Suite B	Alameda	CA	USA	94501

No.	Agency	Contact Person, Title	Address	City	State	Country	Zip
38	Abel Guillen, Oakland City Council District 2	City Council Office, 2nd Floor	1 Frank H. Ogawa Plaza	Oakland	CA	USA	94612
39	Lynette Gibson- McElhaney, Oakland City Council District 3	City Council Office, 2nd Floor	1 Frank H. Ogawa Plaza	Oakland	CA	USA	94612
40	Noel Gallo, Oakland City Council District 5	City Council Office, 2nd Floor	1 Frank H. Ogawa Plaza	Oakland	CA	USA	94612

# NOTICE OF COMPLETION

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**Notice of Completion & Environmental Document Transmittal**

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613  
 For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

<b>SCH # 2015082048</b>
-------------------------

**Project Title:** Alameda-North Bay Farm Island Pipeline Crossings ProjectLead Agency: East Bay Municipal Utility DistrictContact Person: Aaron HopeMailing Address: 375 11th StreetPhone: (510) 287-1496City: OaklandZip: 94607County: Alameda**Project Location:** County: Alameda City/Nearest Community: Oakland, Alameda, North Bay Farm IslandCross Streets: Project location figures with street names are included in the NOP Zip Code: 94501, 94502, 94601, 94607Longitude/Latitude (degrees, minutes and seconds): The latitude and longitude for the three pipelines are attached Total Acres: Approximately 7.55 acresAssessor's Parcel No.: A list of APN numbers is attached Section, Twp, Range: Southwest portion of the San Antonio Landgrant Base: N/AWithin 2 Miles: State Hwy #: 580, 980, 880 Waterways: Oakland Inner Harbor, Tidal Canal, San Leandro Bay ChannelAirports: Oakland International Airport Railways: BART, Union Pacific Schools: Yes**Document Type:**

CEQA: <input type="checkbox"/> NOP	<input checked="" type="checkbox"/> Draft EIR	NEPA: <input type="checkbox"/> NOI	Other: <input type="checkbox"/> Joint Document
<input type="checkbox"/> Early Cons	<input type="checkbox"/> Supplement/Subsequent EIR	<input type="checkbox"/> EA	<input type="checkbox"/> Final Document
<input type="checkbox"/> Neg Dec	(Prior SCH No.) _____	<input type="checkbox"/> Draft EIS	<input type="checkbox"/> Other: _____
<input type="checkbox"/> Mit Neg Dec	Other: _____	<input type="checkbox"/> FONSI	

**Local Action Type:**

<input type="checkbox"/> General Plan Update	<input type="checkbox"/> Specific Plan	<input type="checkbox"/> Rezone	<input type="checkbox"/> Annexation
<input type="checkbox"/> General Plan Amendment	<input type="checkbox"/> Master Plan	<input type="checkbox"/> Prezone	<input type="checkbox"/> Redevelopment
<input type="checkbox"/> General Plan Element	<input type="checkbox"/> Planned Unit Development	<input type="checkbox"/> Use Permit	<input type="checkbox"/> Coastal Permit
<input type="checkbox"/> Community Plan	<input type="checkbox"/> Site Plan	<input type="checkbox"/> Land Division (Subdivision, etc.)	<input checked="" type="checkbox"/> Other: <u>Approval of new water pipelines</u>

**Development Type:**

<input type="checkbox"/> Residential: Units _____ Acres _____	<input type="checkbox"/> Transportation: Type _____
<input type="checkbox"/> Office: Sq.ft. _____ Acres _____ Employees _____	<input type="checkbox"/> Mining: Mineral _____
<input type="checkbox"/> Commercial: Sq.ft. _____ Acres _____ Employees _____	<input type="checkbox"/> Power: Type _____ MW _____
<input type="checkbox"/> Industrial: Sq.ft. _____ Acres _____ Employees _____	<input type="checkbox"/> Waste Treatment: Type _____ MGD _____
<input type="checkbox"/> Educational: _____	<input type="checkbox"/> Hazardous Waste: Type _____
<input type="checkbox"/> Recreational: _____	<input type="checkbox"/> Other: _____
<input checked="" type="checkbox"/> Water Facilities: Type <u>Three pipelines</u> MGD <u>N/A</u>	

**Project Issues Discussed in Document:**

<input checked="" type="checkbox"/> Aesthetic/Visual	<input type="checkbox"/> Fiscal	<input checked="" type="checkbox"/> Recreation/Parks	<input type="checkbox"/> Vegetation
<input type="checkbox"/> Agricultural Land	<input type="checkbox"/> Flood Plain/Flooding	<input type="checkbox"/> Schools/Universities	<input checked="" type="checkbox"/> Water Quality
<input checked="" type="checkbox"/> Air Quality	<input type="checkbox"/> Forest Land/Fire Hazard	<input type="checkbox"/> Septic Systems	<input checked="" type="checkbox"/> Water Supply/Groundwater
<input checked="" type="checkbox"/> Archeological/Historical	<input checked="" type="checkbox"/> Geologic/Seismic	<input type="checkbox"/> Sewer Capacity	<input type="checkbox"/> Wetland/Riparian
<input checked="" type="checkbox"/> Biological Resources	<input type="checkbox"/> Minerals	<input checked="" type="checkbox"/> Soil Erosion/Compaction/Grading	<input type="checkbox"/> Growth Inducement
<input type="checkbox"/> Coastal Zone	<input checked="" type="checkbox"/> Noise	<input checked="" type="checkbox"/> Solid Waste	<input type="checkbox"/> Land Use
<input type="checkbox"/> Drainage/Absorption	<input type="checkbox"/> Population/Housing Balance	<input checked="" type="checkbox"/> Toxic/Hazardous	<input checked="" type="checkbox"/> Cumulative Effects
<input type="checkbox"/> Economic/Jobs	<input checked="" type="checkbox"/> Public Services/Facilities	<input checked="" type="checkbox"/> Traffic/Circulation	<input type="checkbox"/> Other: _____

**Present Land Use/Zoning/General Plan Designation:** Primarily residential, commercial, and mixed-use with some central business, parks and open space, public/institutional/school, and general industry

**Project Description:** (please use a separate page if necessary)

The project description is included in the DEIR. The project involves the construction and operation of three transmission pipeline segments (24-inch diameters) within Alameda County in the City of Oakland, the City of Alameda, and on North Bay Farm Island (also in the City of Alameda). The proposed pipelines would be located within existing city streets, one business park parking lot, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, San Leandro Bay Channel surrounding Alameda Island, and Estuary Park.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

## Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with an "X".  
If you have already sent your document to the agency please denote that with an "S".

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Air Resources Board - Bay Area Air Quality Management District | <input type="checkbox"/> Office of Historic Preservation   |
| <input checked="" type="checkbox"/> Boating & Waterways, Department of                             | <input type="checkbox"/> Office of Public School Construction  |
| <input type="checkbox"/> California Emergency Management Agency                                    | <input type="checkbox"/> Parks & Recreation, Department of   |
| <input type="checkbox"/> California Highway Patrol   | <input type="checkbox"/> Pesticide Regulation, Department of   |
| <input checked="" type="checkbox"/> Caltrans District # <u>4</u>                                   | <input checked="" type="checkbox"/> Public Utilities Commission  |
| <input type="checkbox"/> Caltrans Division of Aeronautics  | <input checked="" type="checkbox"/> Regional WQCB # <u>2</u>   |
| <input type="checkbox"/> Caltrans Planning   | <input type="checkbox"/> Resources Agency  |
| <input type="checkbox"/> Central Valley Flood Protection Board                                     | <input type="checkbox"/> Resources Recycling and Recovery, Department of   |
| <input type="checkbox"/> Coachella Valley Mtns. Conservancy  | <input checked="" type="checkbox"/> S.F. Bay Conservation & Development Comm.                                      |
| <input checked="" type="checkbox"/> Coastal Commission   | <input type="checkbox"/> San Gabriel & Lower L.A. Rivers & Mtns. Conservancy                                       |
| <input type="checkbox"/> Colorado River Board  | <input type="checkbox"/> San Joaquin River Conservancy   |
| <input type="checkbox"/> Conservation, Department of   | <input type="checkbox"/> Santa Monica Mtns. Conservancy  |
| <input type="checkbox"/> Corrections, Department of  | <input checked="" type="checkbox"/> State Lands Commission   |
| <input type="checkbox"/> Delta Protection Commission   | <input type="checkbox"/> SWRCB: Clean Water Grants   |
| <input type="checkbox"/> Education, Department of  | <input type="checkbox"/> SWRCB: Water Quality  |
| <input type="checkbox"/> Energy Commission   | <input type="checkbox"/> SWRCB: Water Rights   |
| <input checked="" type="checkbox"/> Fish & Game Region # <u>3</u>                                  | <input type="checkbox"/> Tahoe Regional Planning Agency  |
| <input type="checkbox"/> Food & Agriculture, Department of   | <input checked="" type="checkbox"/> Toxic Substances Control, Department of  |
| <input type="checkbox"/> Forestry and Fire Protection, Department of                               | <input type="checkbox"/> Water Resources, Department of  |
| <input type="checkbox"/> General Services, Department of   | <input checked="" type="checkbox"/> Other: <u>City of Oakland Planning, Public Works, and Parks and Recreation</u> |
| <input type="checkbox"/> Health Services, Department of  | <input checked="" type="checkbox"/> Other: <u>City of Alameda Planning, Public Works, and Recreation and Parks</u> |
| <input type="checkbox"/> Housing & Community Development   | <input checked="" type="checkbox"/> Other: <u>National Marine Fisheries Service</u>                                |
| <input type="checkbox"/> Native American Heritage Commission                                       | <input checked="" type="checkbox"/> Other: <u>Port of Oakland</u>  |
|  | <input checked="" type="checkbox"/> Other: <u>U.S. Army Corps of Engineers</u>                                     |
|  | <input checked="" type="checkbox"/> Other: <u>US Coast Guard</u>   |

### Local Public Review Period (to be filled in by lead agency)

Starting Date 06/17/2016 Ending Date 08/01/2016

### Lead Agency (Complete if applicable):

Consulting Firm: <u>Panorama Environmental, Inc.</u>	Applicant: <u>East Bay Municipal Utility District</u>
Address: <u>One Embarcadero Center, Suite 740</u>	Address: <u>375 Eleventh Street</u>
City/State/Zip: <u>San Francisco, CA 94111</u>	City/State/Zip: <u>Oakland, CA 94607</u>
Contact: <u>Tania Treis</u>	Phone: <u>510.287.1496</u>
Phone: <u>650.373.1200</u>	

Signature of Lead Agency Representative: \_\_\_\_\_ Date: \_\_\_\_\_

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

## ATTACHMENT TO NOC

### ATTACHMENT TO NOC FOR THE ALAMEDA-NORTH BAY **FARM ISLAND** PIPELINE CROSSINGS PROJECT

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#### Latitude and Longitude for the Proposed Project

Crossing	Latitude	Longitude
Crossing #1	37.78295	-122.271375
Crossing #2	37.748806	-122.237034
Crossing #3	37.770149	-122.232952

#### List of Assessor's Parcel Numbers for the Proposed Project

Assessor's Parcel Numbers		
74-1040-1	74-906-39-5	73-414-35
74-906-3-1	74-906-39-6	74-1318-4
74-1334-54	74-1334-10	74-955-6-12
74-1334-9	74-1334-8	74-1332-80
74-1334-77-1	73-413-35	74-955-6-13
74-906-39-8	73-426-17	74-955-91
70-196-44	74-906-38-1	74-906-41-1
18-425-1-3	73-426-1	74-905-4-7
74-955-88	74-906-32-15	18-430-1-10
74-955-92-2	74-906-32-10	18-430-1-9
74-1334-47	73-413-34	18-430-1-8





## SCOPING COMMENTS

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1.2.1 California Department of Transportation

1.2.2 City of Oakland

1.2.3 Cyrus Ginwala

1.2.4 Daniel Bouie



**DEPARTMENT OF TRANSPORTATION**

DISTRICT 4  
P.O. BOX 23660  
OAKLAND, CA 94623-0660  
PHONE (510) 286-5528  
FAX (510) 286-5559  
TTY 711  
www.dot.ca.gov



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September 17, 2015

ALAVAR034  
SCH# 2015082048

Mr. Aaron Hope  
East Bay Municipal Utility District  
375 Eleventh Street  
Oakland, CA 94607

**Alameda-North Bay Farm Island Pipeline Crossings Project – Notice of Preparation**

Dear Mr. Hope:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the project referenced above. Our comments seek to promote the State's new mission, vision, and smart mobility goals for sustainability, livability, economy, safety and health. We have reviewed the Notice of Preparation and have the following comments to offer.

***Project Understanding***

The proposed project involves the construction and operation of three transmission pipeline segments within Alameda County in the City of Oakland, the City of Alameda, and on North Bay Farm Island, also in the City of Alameda. The proposed pipelines would be located within city streets, one business park parking lot, Towata Park, and underneath the Oakland Inner Harbor, Tidal Can, and San Leandro Bay Channel. The proposed crossing alignment locations and their route options may intersect or be within proximity to State Route (SR) 61, Interstate 880 (I-880), and Interstate 980 (I-980).

***Mitigation Responsibility***

As the lead agency, the East Bay Municipal Utility District is responsible for identifying and ensuring the coordinated implementation of all project mitigations. The project's fair share contribution, financing, scheduling, implementation responsibilities associated with planned improvements on Caltrans Right-of-way (ROW) should be listed, in addition to identifying viable funding sources per General Plan Guidelines.

***Transportation Impact Study***

During construction or starting "opening day," this project may generate traffic at volumes sufficient to impact the operations of nearby State highway facilities, and it may be necessary to prepare a Transportation Impact Study (TIS). If it is found that a TIS is not required, please

Mr. Steve Smith, City and County of San Francisco  
September 17, 2015  
Page 2

provide a verifiable explanation for this finding. The following criteria are among those that may be used to determine whether a TIS is warranted:

1. The project will generate over 100 peak hour trips assigned to a State highway facility.
2. The project will generate between 50 and 100 peak hour trips assigned to a State highway facility, and the affected highway facilities are experiencing noticeable delay; approaching unstable traffic flow (level of service (LOS) "C" or "D") conditions.
3. The project will generate between one to 49 peak hour trips assigned to a State highway facility, and the affected highway facilities are experiencing significant delay; unstable or forced traffic flow (LOS "E" or "F") conditions.

We recommend using the Caltrans *Guide for the Preparation of Traffic Impact Studies* for determining which scenarios and methodologies to use in the analysis. It is available at the following website: [http://dot.ca.gov/hq/tpp/offices/ocp/igr\\_ceqa\\_files/tisguide.pdf](http://dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf).

#### ***Transportation Management Plan***

A Transportation Management Plan (TMP) or construction TIS may be required of the lead agency for approval by Caltrans prior to construction where traffic restrictions and detours affect State highways. TMPs must be prepared in accordance with California *Manual on Uniform Traffic Control Devices*. Please ensure that such plans are also prepared in accordance with the transportation management plan requirements of the corresponding jurisdictions. For further TMP assistance, please contact the Office of Traffic Management Plans/Operations Strategies at 510-286-4579. TMP Information is also available at the following web address: <http://www.dot.ca.gov/hq/traffops/engineering/mutcd/pdf/camutcd2014/Part6.pdf>.

#### ***Transportation Permit***

Project work that requires movement of oversized or excessive load vehicles on State roadways requires a transportation permit that is issued by Caltrans. To apply, a completed transportation permit application with the determined specific route(s) for the shipper to follow from origin to destination must be submitted to: Caltrans Transportation Permits Office, 1823 14th Street, Sacramento, CA 95811-7119. See the following website for more information: <http://www.dot.ca.gov/hq/traffops/permits>.

#### ***Encroachment Permit***

Please be advised that any work or traffic control that encroaches onto the State ROW requires an encroachment permit that is issued by Caltrans. Where construction-related traffic restrictions and detours affect State highways, a Transportation Management Plan or construction TIS may be required. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating State

Mr. Steve Smith, City and County of San Francisco  
September 17, 2015  
Page 3

ROW must be submitted to the following address: David Salladay, District Office Chief, Office of Permits, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660. See the following website for more information:

<http://www.dot.ca.gov/hq/traffops/developserv/permits>.

Should you have any questions regarding this letter or require additional information, please contact Sherie George at (510) 286-5535 or by email at: [sherie.george@dot.ca.gov](mailto:sherie.george@dot.ca.gov).

Sincerely,



PATRICIA MAURICE  
District Branch Chief  
Local Development - Intergovernmental Review

c: State Clearinghouse

---

**From:** Payne, Catherine <CPayne@oaklandnet.com>  
**Sent:** Monday, September 21, 2015 10:40 AM  
**To:** Alameda Crossings Project  
**Cc:** Ranelletti, Darin; Hamilton, Daniel  
**Subject:** Response to NOP  
**Attachments:** Response to EBMUD NOP 092115.pdf

Thank you for the opportunity to comment on the Notice of Preparation of Environmental Impact Report for Alameda-North Bay Farm Island Pipeline Crossings Project. Attached, please find the response from the City of Oakland. If you have any questions, please feel free to contact Catherine Payne (contact information provided in signature line). Again, thank you.

Catherine Payne, Planner IV | City of Oakland | Bureau of Planning | 250 Frank H. Ogawa, Suite 2114 | Oakland, CA 94612  
| Phone: (510)238-6168 | Fax: (510) 238-3254 | Email: [cpayne@oaklandnet.com](mailto:cpayne@oaklandnet.com) | Website:  
[www.oaklandnet.com/planning](http://www.oaklandnet.com/planning)

Regular Hours: Monday through Friday, 8:00 a.m. – 2:30 p.m.



# C I T Y O F O A K L A N D

Bureau of Planning  
250 Frank H. Ogawa Plaza, Suite 3315, Oakland, California, 94612 - 2032

## VIA EMAIL AND U.S. MAIL

September 21, 2015

East Bay Municipal Utility District  
375 Eleventh Street, MS 701  
Oakland, CA 94607  
Attn. Aaron Hope, Project Manager

**RE: City of Oakland Comments on Notice of Preparation of Environmental Impact Report for Alameda-North Bay Farm Island Pipeline Crossings Project (dated August 20, 2015)**

Dear Mr. Hope:

Thank you for the opportunity to review and comment on the Notice of Preparation (NOP) of a Draft Environmental Impact Report (EIR) for the Alameda-North Bay Farm Island Pipeline Crossings Project (Project), for which the East Bay Municipal Utility District (EBMUD) is both the Project proponent and lead agency, and for which the City of Oakland is a responsible agency and affected land owner. As such, the City of Oakland would like to ensure that the EIR would be of sufficient detail and quality to evaluate how the proposed Project could impact the City of Oakland's interests.

### **Project Description**

The City of Oakland understands that the purpose of the proposed Project is to ensure continued reliable water service to the City of Alameda. The Project would involve construction of pipelines within City of Oakland streets and property, including Estuary Park, as well as underwater pipeline crossing activities in the City of Oakland. Construction activities related to the Project would also involve project staging to potentially be located on City of Oakland property. It is understood that any new utility alignments would be subject to easements that would be negotiated with the City of Oakland and could limit use of City of Oakland real property into the future.

The proposed Project would affect heavily used streets in Oakland, possibly including established truck routes. In addition, the Project would possibly affect a very popular and heavily used park along the Oakland waterfront, Estuary Park. Estuary Park is currently extensively used for pick-up field games (soccer and other team sports), picnicking, exercise and viewing the waterfront, an important regional destination. It should also be noted that Estuary Park was designed by Lawrence Halprin, a famous American Landscape Architect, whose body of work is both iconic and well respected throughout the world. The City of Oakland, of course, wishes to preserve this amazing legacy, and protect our ability to maintain the park's relevance into the future as both an important recreation and landscape design resource.

### Potential Environmental Impacts To Be Studied in the EIR

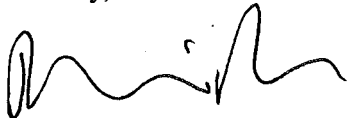
Thank you for identifying the following probable environmental effects related to the proposed Project: Aesthetics; Air Quality; Biological Resources; Cultural Resources; Energy Use; Geology/Soils; Greenhouse Gas Emissions; Hazards/Hazardous Materials; Hydrology/Water Quality; Noise; Public Services; Recreation; Transportation and Traffic; and Cumulative Impacts. The City of Oakland respectfully requests consideration of the following in the EIR:

- *Land Use:* Please consider addressing Land Use as a topical issue in the EIR. The proposed Project could potentially conflict with the Oakland Planning Code in terms of the approved and existing open space land uses of a portion of Estuary Park. Limiting use or future development of Estuary Park related to the placement of any new utility alignments could potentially result in increased use of other recreational facilities such that substantial physical deterioration of those facilities would occur or be accelerated. Increased demand for other recreational facilities could also result in increased demand for water for irrigation purposes, as well. Any land use and/or development restrictions on existing public open space would be contrary to the objectives of the General Plan and Oakland Municipal Code to meet per capita open space requirements and to support environmental sustainability initiatives. Please address the potential to mitigate any identified land use impacts through increased delivery of recycled water among other strategies.
- *Growth Inducement:* Please explore whether or not the proposed water delivery system would induce population growth and thereby result in increased water demand. In addition, please address the potential to mitigate any potential growth impacts through increased conveyance of recycled water in the service area.
- *Alternatives Analysis:* Please consider developing and analyzing a Project alternative that does not include a water conveyance alignment through Estuary Park. As noted above, Estuary Park is a valuable recreation and design resource for the City of Oakland. The City of Oakland is interested in maintaining and protecting the value of this resource into the future. In addition, the potential for increasing use at other City of Oakland parks raises concerns about potential impacts to those valuable resources, as well.

In general, the EIR should provide a complete project description that acknowledges the types of permissions (e.g., easements with no-build restrictions) that would be required from the City of Oakland for new utility alignments over City of Oakland real property and the possible limitations those permissions would entail for the City of Oakland. The EIR should then evaluate the potential environmental impacts related to those permissions and restrictions, as well as the potential environmental impacts of the proposed project to off-site resources.

Again, thank you for the opportunity to comment. The City of Oakland looks forward to reviewing the Draft EIR once it is available. If you have any questions, please contact **Catherine Payne** at **(510) 238-6168** or [cpayne@oaklandnet.com](mailto:cpayne@oaklandnet.com).

Sincerely,



Darin Ranelletti, Deputy Director  
Environmental Review Officer

cc: File; Robert Merkamp; Catherine Payne



---

**From:** cyrus ginwala [REDACTED]  
**Sent:** Sunday, August 23, 2015 4:41 PM  
**To:** Alameda Crossings Project  
**Subject:** North Bay Farm Crossings

Hi - I support this project. I hope the digging on Madison can be coordinated with the new proposed residential high rise structures at Madison and 4th, as well as Brooklyn Basin, so as to minimize inconvenience. Thanks

Cyrus Ginwala  
[REDACTED]

---

**From:** Daniel Bouie [REDACTED]  
**Sent:** Wednesday, September 09, 2015 12:21 PM  
**To:** Alameda Crossings Project  
**Subject:** Alameda Crossing #2

Mr. Hope

Thank you for your notice of the proposed Alameda-North Bay Farm Island pipeline crossing. I am the owner of the residential property at 3328 Bridgeview Isle in Alameda. This parcel was once owned by the City of Alameda, but has been privately owned since 2000.

Looking at your initial routing map, I am concerned that your proposal for crossing #2 appears to cross or impede my property. Please note that there is no utility easement on my property. Please confirm that the proposed project will not cross or impede my privately owned property.

Best Regards,  
Daniel Bouie

APPENDIX B:  
INITIAL STUDY

---

East Bay Municipal Utility  
District  
ALAMEDA-NORTH BAY  
FARM ISLAND PIPELINE  
CROSSINGS PROJECT  
Initial Study

August 2015



PANORAMA  
ENVIRONMENTAL, INC.

One Embarcadero Center, Suite 740 San Francisco, CA 94111 650-373-1200 [www.panoramaenv.com](http://www.panoramaenv.com)



# East Bay Municipal Utility District ALAMEDA-NORTH BAY FARM ISLAND PIPELINE CROSSINGS PROJECT Initial Study

August 2015

Prepared for:

East Bay Municipal Utility District  
Water Distribution Planning Division – MS 701  
375 11<sup>th</sup> Street  
Oakland, CA 94607

Prepared by:

Panorama Environmental, Inc.  
One Embarcadero Center, Suite 740  
San Francisco, CA 94111  
650-373-1200  
tania.treis@panoramaenv.com

**PANORAMA**  
ENVIRONMENTAL, INC.

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## 1 PROJECT DESCRIPTION

---

### 1.1 PROJECT TITLE

Alameda–North Bay Farm Island Pipeline Crossings Project

### 1.2 LEAD AGENCY NAME AND ADDRESS

East Bay Municipal Utility District  
Water Distribution Planning Division – MS 701  
375 11<sup>th</sup> Street  
Oakland, CA 94607

### 1.3 CONTACT PERSON

Aaron Hope  
East Bay Municipal Utility District  
Water Distribution Planning Division – MS 701  
375 11<sup>th</sup> Street  
Oakland, CA 94607  
(510) 287-1496  
[alamedacrossings@bmud.com](mailto:alamedacrossings@bmud.com)

### 1.4 PROJECT LOCATION/DESCRIPTION

#### Description of Project Components

The project involves the construction and operation of three transmission pipelines (24-inch inner diameter) located within Alameda County in the Cities of Oakland and Alameda (see **Figure 1**). Construction of the pipelines within the streets would be by conventional open trench construction methods; however, both horizontal directional drilling (HDD) and trenchless (bore and jack) methods would be used during construction of underwater crossings and individual road crossings when needed. In addition, the project would require temporary laydown of the three underwater crossing pipeline segments on local roads for pipeline fusion and testing before pulling them underwater (see **Figure 1**). Construction hours would typically occur between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) may be required when the proposed pipelines are connected to existing pipelines, to minimize

customer water service disruption, and for portions of the HDD operations on both sides of the Crossings. Each pipeline crossing is described below.

- **Crossing #1.** Crossing #1 is known as the Estuary Park-Marina Village Crossing and is approximately 2.2 miles in length. The new pipeline would connect to existing transmission pipelines in the City of Oakland, cross under the Oakland Inner Harbor, and continue in the City of Alameda to its connection point. Crossing #1 would also include abandonment and replacement of an existing pipeline (see **Figure 2**). One alternative route option for open trench construction and one alternative route option for the replacement of an existing pipeline, both in the City of Oakland, are being considered (see **Figure 2**). Construction activities would occur within existing city streets, one business park parking lot (the Telecare Corporation) and Estuary Park.
- **Crossing #2.** Crossing #2 is known as the Alameda–North Bay Farm Island Crossing and is approximately 1 mile in length. The new pipeline would connect to existing transmission pipelines in Alameda Island, cross under the San Leandro Bay Channel, and continue on North Bay Farm Island to its connection point (see **Figure 3**). Construction activities would occur within existing city streets and Towata Park.
- **Crossing #3.** Crossing #3 is known as the Derby Crossing and is approximately 1 mile in length. The new pipeline would connect to existing transmission pipelines in the City of Oakland, cross under the Tidal Canal, and continue in the City of Alameda to its connection point. Crossing #3 would also include replacing an existing pipeline (see **Figure 4**). One alternative route option for open trench construction in the City of Alameda is being considered. Construction activities would occur within existing city streets.

Construction of Crossing #1 is the highest priority because it would replace the oldest and most vulnerable crossing, the existing Alice Webster Crossing. Crossing #1 is scheduled for construction over an approximate 13 to 21 month period in 2018/2019.

Crossings #2 and #3 would replace existing crossings that were constructed in the 1980s. Construction of Crossings #2 and #3 would be scheduled at a future date, after 2020 but before the existing pipelines reach the end of their useful life. Construction of Crossing #2 and Crossing #3 would each occur over a separate approximate 9 to 17 month period.

## 1.5 PROJECT SPONSOR'S NAME AND ADDRESS

East Bay Municipal Utility District  
Water Distribution Planning Division – MS 701  
375 11<sup>th</sup> Street  
Oakland, CA 94607

## 1.6 GENERAL PLAN DESIGNATION

The proposed crossings would be located in areas with several different land use designations. On the City of Oakland side, the proposed project would be located within the estuary boundary and within the following land use designations:

- Mixed-use district
- Waterfront mixed-use
- Residential mixed-use
- Central business district
- Parks

On the City of Alameda side, the proposed project would be located within the following land use designations:

- Low-density residential
- Medium-density residential
- Neighborhood business
- Mixed use
- Public/ institutional/ school
- Community commercial
- Business park
- Park and public open space

Figure 1 Project Location



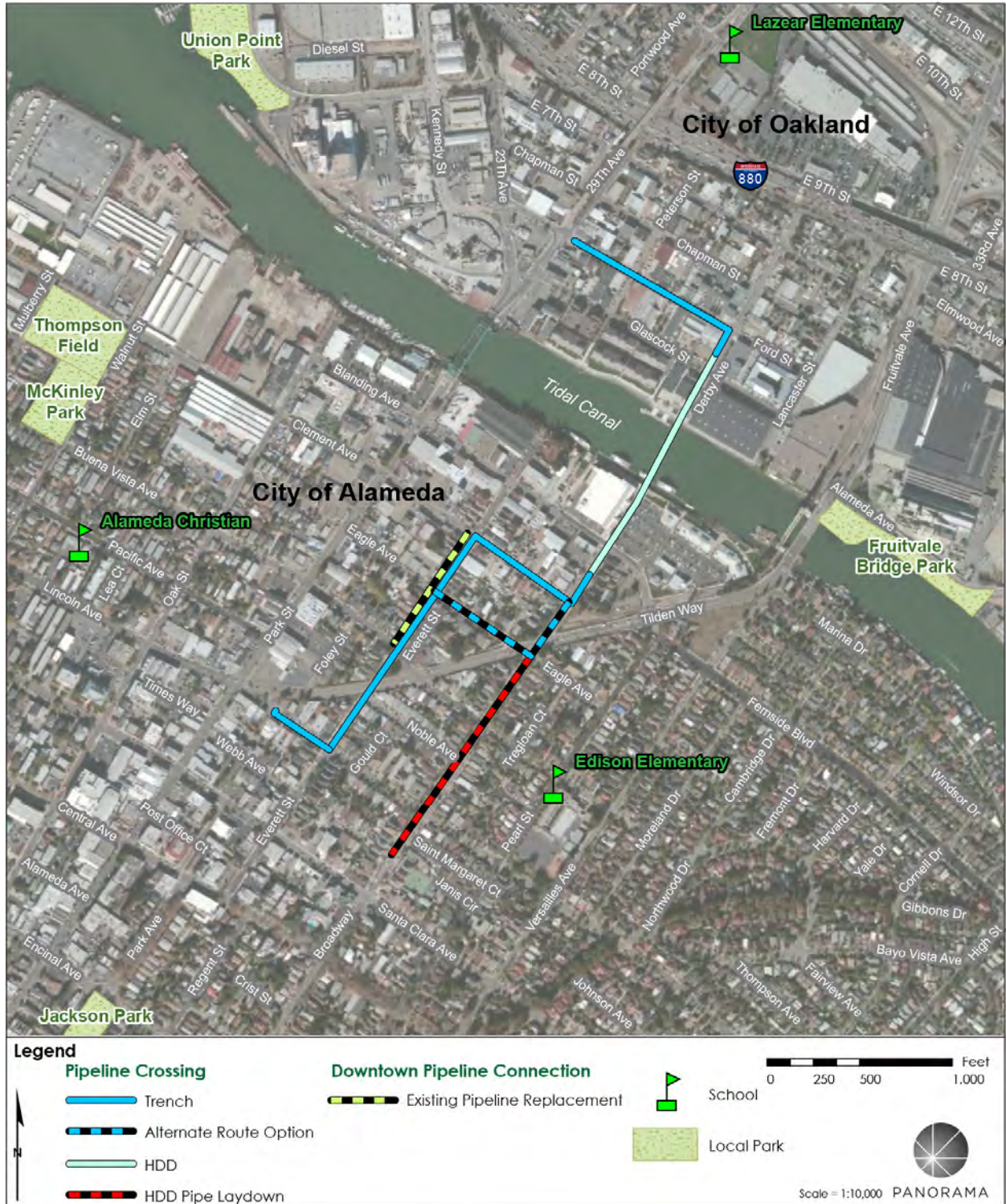
Figure 2 Crossing #1 Alignment



Figure 3 Crossing #2 Alignment



Figure 4 Crossing #3 Alignment



## 1.7 ZONING

The proposed pipeline routes are located within existing streets, a business park parking lot, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and the San Leandro Bay Channel. The areas surrounding the roads where the pipelines would be placed in the City of Alameda are zoned as the following:

- One family residential
- Two family residential
- Garden residential
- Neighborhood residential
- General residential
- Central business
- Community commercial
- Commercial manufacturing
- Mixed use
- General industry
- Workplace
- Open space

The areas surrounding the roads where the pipelines would be placed in the City of Oakland are zoned as the following:

- Residential, high-rise apartment
- Open space, region serving park
- Open space special use
- Lake Merritt station area district pedestrian commercial zone 2
- Lake Merritt station area district mixed commercial zone 4
- Light industrial
- Special and combining zone, design review
- Special and combining zone, health and safety protection overlay
- Central estuary district mix zone 3
- Commercial, community shopping

## 1.8 SURROUNDING LAND USES AND SETTING

The proposed project is located in a primarily urban/suburban environment. Land uses along the pipeline routes are primarily residential and commercial and include single and multi-family residences, schools, churches, parks, and commercial centers.



## 1.9 OTHER PUBLIC AGENCIES AND PRIVATE COMPANIES WHOSE APPROVAL IS POTENTIALLY REQUIRED AND/OR COORDINATIONS IS NECESSARY

Table 1 is a preliminary summary of the public and private agencies for which EBMUD may require approval and/or coordination is necessary in order to construct the proposed project. The EIR will confirm this list based upon input in response to the Notice of Preparation.

Table 1 Other Required Approvals and/or Coordination Necessary for the Proposed Project

Agency/ Stakeholder	Type of Jurisdiction	Type of Approval and/or Coordination Necessary
City of Oakland	Local	Encroachment permit for construction within city streets; Creek protection permit (if required). Approval for use of city sewer line or storm drains for dewatering activities.
City of Alameda	Local	Encroachment permit for construction within city streets. Approval for use of city sewer line or storm drains for dewatering activities.
Bay Conservation and Development Commission (BCDC)	Local	Permit for HDD near the San Francisco Bay.
Bay Area Air Quality Management District (BAAQMD)	Local	Approval for emissions generated from construction of the proposed project.
California State Lands Commission	State	Coordination for work within California State Lands Commission, as needed, for work within Tidelands Trust land.
California Department of Transportation (Caltrans)	State	Encroachment permits for construction within streets that are designated state highways and a transportation permit required for the movement of oversized or excessive load vehicles on state roadways.
California Department of Toxic and Substance Control	State	Outreach or coordination for work within potential open hazardous materials sites.
Regional Water Quality Control Board (RWQCB)	State and Federal	Regional Water Quality Control Board: National Pollution Discharge Elimination System (NPDES) Construction General Permit; Waste Discharge Requirements for dewatering and work within the bed and banks of waters of the U.S. and State.
Union Pacific Railroad	Private company	Approval from Union Pacific Railroad for work under railroad.

## 2 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

---

### 2.1 INTRODUCTION

The environmental factors checked below could potentially be affected by this project, but would be mitigated to a less than significant level as indicated by the checklist on the following pages.

- |  |  |   |
|--|--|---|
| <input checked="" type="checkbox"/> Aesthetics                         | <input type="checkbox"/> Agriculture and Forestry Resources    | <input checked="" type="checkbox"/> Air Quality                     |
| <input checked="" type="checkbox"/> Biological Resources               | <input checked="" type="checkbox"/> Cultural Resources         | <input checked="" type="checkbox"/> Energy Use                      |
| <input checked="" type="checkbox"/> Geology and Soils                  | <input checked="" type="checkbox"/> Greenhouse Gas Emissions   | <input checked="" type="checkbox"/> Hazards and Hazardous Materials |
| <input checked="" type="checkbox"/> Hydrology and Water Quality        | <input type="checkbox"/> Land Use and Planning                 | <input type="checkbox"/> Mineral Resources                          |
| <input checked="" type="checkbox"/> Noise                              | <input type="checkbox"/> Population and Housing                | <input type="checkbox"/> Public Services                            |
| <input checked="" type="checkbox"/> Recreation                         | <input checked="" type="checkbox"/> Transportation and Traffic | <input type="checkbox"/> Utilities and Service Systems              |
| <input checked="" type="checkbox"/> Mandatory Findings of Significance |  |   |

### 2.2 ENVIRONMENTAL DETERMINATION

On the basis of this initial evaluation:

I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

## Initial Study

I find that the proposed project MAY have a “potentially significant impact” or “potentially significant impact unless mitigated” impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

### 3 ENVIRONMENTAL IMPACT CHECKLIST

#### 3.1 AESTHETICS

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d) Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**a-b. No Impact.** The proposed project is located in an urban/suburban environment. No scenic vistas or scenic resources are located near the proposed project; therefore, there would be no impacts to scenic vistas.

**c. Less than Significant Impact.** The proposed project would place pipelines under roads within an urban/suburban environment. Because there would not be permanent structures visible to the public, there would be no permanent impacts to the visual character of the area.

The use of equipment during construction would cause a temporary impact to the visual quality of an area, including parks such as Estuary Park or Towata Park. Impacts to the visual quality of the area are anticipated to be less than significant because construction impacts would be temporary. This will be addressed in more detail in the EIR.

**d. Potentially Significant Impact.** Construction of the pipeline crossing using HDD may occur over several consecutive 24 hour periods requiring the use of night lighting to provide adequate illumination of the construction area. Use of night lighting would be a temporary, but potentially significant impact. The EIR will provide a detailed evaluation of potential impacts from use of night lighting near residences and other sensitive receptors. Mitigation measures will be identified, as appropriate, to minimize any potentially significant impacts.

### 3.2 AGRICULTURE AND FORESTRY RESOURCES

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with existing zoning for agricultural use or a Williamson Act contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined in Public Resource Code Section 4526), or timberland zoned Timberland Production (as defined in Government Code Section 51104 (g))?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Result in the loss of forest land or conversion of forest land to non-forest use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Involve other changes in the existing environment that, due to their location or nature, could result in conversion of Farmland to nonagricultural use or conversion of forest land to non-forest use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a-e. No Impact.** The proposed project would be located within an urban/suburban environment. No farmlands or forest land are located within the project area; therefore, there would be no impacts to agricultural and forestry resources.

### 3.3 AIR QUALITY

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Expose sensitive receptors to substantial pollutant concentrations?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Create objectionable odors affecting a substantial number of people?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**a-d. Potentially Significant Impact.** The proposed project would require the use of construction vehicles and machinery which could result in temporary, but potentially significant emission of criteria pollutants. The EIR will include a detailed analysis, including air quality modeling of construction emissions, to assess the potential impacts. Mitigation measures will be identified, as appropriate, and could include implementing the Bay Area Air Quality Management District’s (BAAQMD) recommended Basic Construction Mitigation Measures which includes Best Management Practices (BMPs), such as minimizing idling time and ensuring proper maintenance of construction equipment. Operation of the project would require limited maintenance. Air quality impacts from maintenance vehicles are expected to be minimal.

**e. Potentially Significant Impact.** The proposed project would generate odors from diesel exhaust emission during project construction. Sensitive receptors could also be affected by odor generated from equipment used for the HDD sites, which would take several weeks to complete. Impacts would be temporary but could be potentially significant. The EIR will address odor impacts during construction. Mitigation measures will be identified, as appropriate, and could include reducing idling time of construction equipment that produces diesel exhaust emissions and requiring that all equipment comply with the California Air Resources Board’s (CARB’s) Airborne Diesel Air Toxic Measures (ATCMs). Operation of the project would have no significant odor impacts.

### 3.4 BIOLOGICAL RESOURCES

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a. Potentially Significant Impact.** The proposed project is located in an urban/suburban environment and would not require disturbance of any natural habitat; therefore the potential to significantly impact special status species is low. HDD will occur deep under the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel; therefore, impacts to marine species are also not anticipated. The EIR will identify any potential for special status species and will provide an analysis of impacts.

In addition, trees are located in some areas of the project, including along sidewalks, in medians, in Towata and Estuary Parks, and in the Telecare business park. Impacts from construction noise on migratory and nesting birds could result in potentially significant

impacts. Nesting and migratory birds are protected under the Migratory Bird Treaty Act and Fish and Game Code Sections 3503 and 3503.5. The EIR will address impacts to migratory birds and include mitigation measures such as pre-construction surveys, establishment of work buffers for active nests, and on-site monitoring, if appropriate.

**b-c. Less than Significant Impact.** The proposed project is located in an urban/suburban environment. Project construction would not occur in any riparian or wetland areas. The proposed project will, however, be located near waters and estuaries. HDD is not anticipated to have any impacts on the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel; however, a detailed analysis of impacts to waters from HDD will be provided in the EIR.

**d. No impact.** The proposed project is located in an urban/suburban environment. No wildlife movement corridors are located within the vicinity of the proposed project. There would be no impact to wildlife movement corridors.

**e. Less than Significant Impact.** The proposed project may potentially require the trimming or removal of trees. The Cities of Alameda and Oakland have established ordinances for tree protection. EBMUD is not subject to permitting under these ordinances per California Code Section 53091; therefore, impacts associated with conflicting with local policies would be less than significant. However, EBMUD would work with the property owners where tree removal is required to replace established trees as necessary and would also implement standard practices consistent with tree protection ordinances for tree pruning and care.

**f. No Impact.** There is no adopted Habitat Conservation Plans (HCP), Natural Community Conservation Plans (NCCP), or other local, regional, or state habitat conservation plans within the proposed project area. There would be no impacts associated with conflicts with HCPs or NCCPs.

### 3.5 CULTURAL RESOURCES

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Disturb any human remains, including those interred outside of formal cemeteries?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



**a-c. Potentially Significant Impact.** Although the pipeline routes are in substantially disturbed areas given the built environment, construction has the potential to disturb or damage buried and previously undiscovered archaeological, paleontological or historic resources in the project area. The EIR will provide a detailed evaluation of potential cultural resource impacts. An archeological and a historical study will be prepared to identify areas of moderate or high potential for buried cultural, historic, or paleontological resources. Mitigation measures will be implemented to avoid or minimize effects to any archaeological, paleontological or historic resources.

**d. Potentially Significant Impact.** The proposed project would involve HDD beneath bodies of water, jacking and boring beneath two roadways and a railroad (if required), and trenching within roadways. There is a potential during HDD, jacking and boring, and trenching to uncover human remains. Impacts to human remains would be considered a potentially significant impact. The potential for impacts to human remains will be identified in the EIR. Mitigation measures will be implemented which would require EBMUD to implement state regulations, including PRC Section 5097.98 and Health and Safety Code Section 7050.5.

### 3.6 ENERGY USE

Environmental impacts may include:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) The project's energy requirements by amount and fuel type for each stage of the project including construction, operation, and maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) The effects of the project on local and regional energy supplies and on requirements for additional capacity	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) The effects of the project on peak and base period demands for electricity and other forms of energy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) The degree to which the project complies with existing energy standards	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) The effects of the project on energy resources	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) The project's projected transportation energy use requirements and its overall use of efficient transportation alternatives	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**a-f. Potentially Significant Impact.** Construction for the proposed project would require the use of fuels, including gas, diesel, and motor oil for construction activities. In addition, indirect

energy use would be required for the production of construction materials, including extraction of raw materials and manufacturing. Operation of the proposed project could also potentially require the use of energy for periodic flushing, anode replacement, leak detection, repair, and maintenance. Construction impacts would be temporary but impacts associated with energy use could still be potentially significant if standard practices are not followed or depending on the phasing of construction activities.

The EIR will provide a detailed evaluation of the energy that will be used for the construction and operation and maintenance of the proposed project. The EIR will include mitigation measures, as appropriate, including the implementation of standard practices such as reducing idling time for construction equipment and vehicles.

### 3.7 GEOLOGY AND SOILS

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ii) Strong seismic ground-shaking?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iii) Seismic-related ground failure, including liquefaction?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iv) Landslides?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Result in substantial soil erosion or the loss of topsoil?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), or collapsible soil, creating substantial risks to life or property?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a-d. Potentially Significant Impact.** The proposed project construction would occur in flat, urbanized areas; therefore, geologic impacts from ground and soil stability from construction are limited. However, long-term risks to the pipelines could be significant as soils are classified as having very high and moderate liquefaction risk, particularly in the areas of Crossings #1 and #2. The proposed pipelines may be susceptible to unstable soil or geologic conditions including seismic faulting, ground shaking, and ground failure and erosion. The EIR will provide a detailed evaluation of potential geology and soil impacts and mitigation measures to mitigate significant impacts.

**e. No Impact.** The proposed project does not include the development of a wastewater disposal system; therefore, there would be no impact associated with the development of a wastewater disposal system.

### 3.8 GREENHOUSE GAS EMISSIONS

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emission of greenhouse gases?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**a-b. Potentially Significant Impact.** Project construction would result in temporary emissions of greenhouse gases. The EIR will provide a detailed analysis of greenhouse gas emissions from construction. The air quality modeling prepared for the EIR will include an analysis of the potential increases in greenhouse gas emissions. Mitigation measures will be identified, as appropriate, and could include BMPs recommended by the BAAQMD and reduction of idling for vehicles and machinery. The EIR will identify the significance of greenhouse gas impacts and the mitigation measures that will be implemented to mitigate impacts.

### 3.9 HAZARDS AND HAZARDOUS MATERIALS

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 miles of an existing or proposed school?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, result in a safety hazard for people residing or working in the program area?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) For a project located within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the program area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a-c. Potentially Significant Impact.** Construction of the proposed project would require the use of typical construction-related hazardous materials (e.g., fuel, lubricants and solvents) that must be properly handled and disposed of to minimize effects on the environment. Soils in the project area may also contain hazardous materials based on historic land uses. Because the

proposed project would include excavation and HDD, there is the potential for the release of contaminated soil and/or groundwater, if encountered. Federal, state, and local laws regarding testing, management, and disposal of hazardous materials would be followed. Rupture of a subsurface gas pipeline during trenching and during jet-grouting construction could also generate a significant hazard. Jet grouting would be conducted at some of on-shore portions of the pipelines to improve soil stability for HDD.

The EIR will provide a detailed evaluation of the potential hazards based on previous data available for hazardous material sites and contamination in soils. Mitigation measures will be identified such as implementation of a Safety Environmental Awareness Program; preparation and implementation of a Spill Prevention, Control, and Countermeasure Plan; implementation of Best Management Practices; and potholing to identify subsurface utilities.

**d. No Impact.** The Cortese List is a compilation of several different lists of hazardous material release sites that meet criteria specified in Section 65962.5 of the California Government Code. There are currently no hazardous materials release sites reported within the proposed project area, which is predominantly located within the public ROW. Therefore, no impact would occur from being located on a site included on the Cortese List.

**e. Potentially Significant Impact.** The closest airport to the proposed project area is the Oakland International Airport. Development near airports can pose a potential hazard to people and property on the ground and can also create obstructions and other hazards to flights. Impacts would be potentially significant. The EIR will provide a detailed evaluation of potential impacts.

**f. No Impact.** There are no private airstrips located within 2 miles of the proposed project area; therefore, the proposed project would have no impact on the navigable airspace of private airstrips.

**g. Potentially Significant Impact.** Construction of the pipelines would require temporary lane and roadway closures during laydown of the pipelines and trenching. Pulling of the pipeline through the HDD on Crossing #1 could potentially block emergency access to Cardinal Point in the City of Alameda, which could impact senior residents living there. Other roadway closures could also impede emergency access. Impacts to emergency access would be potentially significant. The EIR will provide a detailed evaluation of potential impacts and will identify measures to mitigate significant impacts such as coordination with local emergency providers, and identification of alternative routes where appropriate.

**h. No Impact.** The proposed project is located completely in an urban/suburban area and would not include work in wildlands. The proposed project would not expose people or structures to a potential wildfire. There would be no impact to the public from wildfires.

3.10 HYDROLOGY AND WATER QUALITY

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off site?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) Otherwise substantially degrade water quality?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
j) Cause inundation by seiche, tsunami, or mudflow?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a, c, d. Potentially Significant Impact.** Construction of the project would require construction near the waterways surrounding the City of Alameda, which could potentially result in indirect impacts to waters through contaminated runoff or sedimentation. In addition, water in the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel could be potentially contaminated during HDD if drilling lubricants or other materials used during HDD were to be accidentally released from a frack out, which is when a soil fracture is created during drilling and liquids are released into the water body through the fracture. HDD would also require jet-grouting on some of the on-shore portions of the pipelines, which could potentially impact water quality through runoff or sedimentation. Furthermore, shallow groundwater would likely be encountered during construction and would require proper disposal. The EIR will provide a detailed evaluation of contaminated runoff and sedimentation impacts, the potential for frack out impacts, and impacts associated with the disposal of shallow groundwater encountered during construction. The EIR will include mitigation measures to minimize any potentially significant impacts, such as by properly disposing of groundwater and avoiding discharge into estuaries and the channels surrounding the City of Alameda and implementing standard practices during HDD to avoid frack out events and respond to accidental releases and prevent runoff or sedimentation from entering waterbodies during jet-grouting construction.

**b. Less than Significant Impact.** The proposed pipelines would be constructed primarily within existing roadways. As a result, the project would not substantially change the amount of groundwater recharge as it would not add impermeable surface. High groundwater is anticipated in several areas and dewatering may be necessary; however, the limited amount of dewatering compared to the available water would result in less than significant impacts to groundwater, which will be addressed further in the EIR.

**e-f. Potentially Significant Impact.** Pipeline trenching and excavation of bore and jack pits would likely encounter shallow groundwater in some areas, which would require dewatering during construction. Dewatering would require appropriate disposal of groundwater. Water would also be needed for hydrostatic testing prior to completion of construction. Hydrostatic water would be chlorinated and would require proper disposal. Adequate stormwater drainage would also need to be provided during the construction process if construction blocks existing storm drains. The EIR will provide a detailed evaluation of potential impacts and measures to mitigate significant impacts.

**g. No Impact.** The proposed project does not include the construction of housing; therefore, there would be no impact associated with placing housing within a 100-year flood hazard area.

**h. Less than Significant Impact.** Construction of the project would likely occur within the 100-year floodplain. The pipeline, equipment, and protective barriers would be staged during construction but the potential for a 100-year storm event during construction is low. The EIR will identify the 100-year storm event flooding areas and will provide an analysis of impacts.

Operation of the project would have no impacts to floodplains because all features would be installed underground.

**i. Less than Significant Impact.** The proposed project would not cause flooding due to the failure of a dam or levee, as no dams or levees are adjacent to the project nor would any be constructed. EBMUD maintains a Dispatch Center and field crew 24 hours a day, 7 days a week to respond to emergencies. The pipelines would be designed with isolation valves that can be closed to interrupt the flow of water to a ruptured pipe. The pipelines would be designed to withstand substantial stress and pressures, and the possibility of a rupture is considered remote. Due to the remote possibility of rupture and the level of protection inherent in the design of the pipeline, this impact is considered to be less than significant and will be described further in the EIR.

**j. No Impact.** The proposed project is not located in an area susceptible to seiches, tsunamis, or mudflows; therefore, there would be no impact.

### 3.11 LAND USE AND PLANNING

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Physically divide an established community?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a. No Impact.** The proposed project would place pipelines underneath existing roadway and would not physically divide any established communities. There would be no impact to communities associated with the division of an established community.

**b. Less than Significant Impact.** Pursuant to California Government Code Section 53091(e), county and city zoning ordinances do not apply to the location or construction of facilities for the transmission of water. The EIR will, however, consider resource policies in the zoning ordinances and general plans for the City of Oakland and the City of Alameda including North Bay Farm Island in corresponding EIR sections (e.g., Noise, Biological Resources).

**c. No Impact.** There is no adopted Habitat Conservation Plans (HCP), Natural Community Conservation Plans (NCCP), or other local, regional, or state habitat conservation plans within the proposed project area. There would be no impacts associated with conflicts with HCPs or NCCPs.



### 3.12 MINERAL RESOURCES

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a-b. No Impact.** The proposed project is located in an urban/ suburban environment. There are no mineral resources within the proposed project area. There would be no impact to mineral resource.

### 3.13 NOISE

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance or applicable standards of other agencies?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Expose persons to or generate excessive groundborne vibration or groundborne noise levels?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, expose people residing or working in the program area to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
f) For a project within the vicinity of a private airstrip, expose people residing or working in the program area to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a,b,d. Potentially Significant Impact.** Construction of the proposed project would require the use of machinery and equipment that would generate short-term noise and vibration. Several construction areas are in close proximity to housing although impacts would likely be limited in duration along any one block. HDD in Estuary Park for Crossing #1 would occur for several weeks in close proximity to a multi-family residential building and could result in significant noise impacts. The EIR will include a detailed analysis of impacts. A technical noise study will be performed to identify existing noise levels and sensitive receptors and provide an assessment of future noise levels with construction, including the duration of impacts. Mitigation measures will be identified, if appropriate, and could include using noise blankets on machinery to reduce noise, minimizing idling time, notifying residents of upcoming construction work, and coordinating with nearby schools.

**c. No Impact.** The proposed project would include the installation of new underground water pipelines, which would not generate any new source of ambient noise. There would be no impact associated with a permanent increase in ambient noise levels.

**e-f. No Impact.** The closest airport to the proposed project area is the Oakland International Airport. While Oakland International Airport is about 1.8 miles from Crossing # 2, the crossing is located in an urban environment with urban noise. The proposed project would not expose people residing or working near the airport to excessive noise levels; therefore, there would be no impact associated with exposing people near a public or private airport to excessive noise levels.

### 3.14 POPULATION AND HOUSING

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a-c. No Impact.** The proposed project would not create infrastructure that would induce unanticipated population growth. The proposed project would be constructed to meet water supply requirements for existing and projected future customer demands and to ensure long-term water supply to the City of Alameda. There would, therefore, be no impacts to population and housing associated with inducing population growth from operation of the proposed project. In addition, none of the activities of the proposed project would displace housing or people. There would be no population and housing impacts associated with the proposed project.

### 3.15 PUBLIC SERVICES

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered government facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
i) Fire protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
ii) Police protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iii) Schools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iv) Parks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
v) Other public facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a i. Less than Significant Impact.** The proposed project would improve the reliability of water for fire protection services in the City of Alameda and would not require the construction of new fire protection facilities. Impacts are not expected to be significant but will be addressed in the Hazards and Hazardous Materials section of the EIR.

**a ii, iii, v. No Impact.** Construction and operation and maintenance of the proposed project would not require the provision of new or alteration of existing police protection facilities, schools, and other public facilities. The proposed project would meet current demand and would not induce any growth that would require any new facilities. There would be no need for

new facilities and there would be no impact associated with the provision or extension of police protection services, schools, or other public facilities.

**iv. No Impact.** The construction and operation and maintenance of the proposed project would not require the provision of new parks; therefore, no impact would occur. The proposed project would, however, result in potential temporary impacts to the San Francisco Bay Trail, Estuary Park, and Towata Park and the impacts would be addressed in the Recreation section of the EIR.

### 3.16 RECREATION

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**a. Potentially Significant Impact.** The proposed project would involve construction within and near the San Francisco Bay Trail, Estuary Park, and Towata Park. Construction could generate a potentially significant impact to use of these park facilities due to noise, use of space for HDD, and hazards to users from hauling of sediments. The EIR will address impacts to parks, impacts from use of alternative parks, and will identify mitigation measures to maintain access along the Bay Trail and to minimize impacts to the use of the parks.

**b. No Impact.** The proposed project does not include recreational facilities as part of the proposed project but would have some direct and indirect impacts on existing parks and facilities. Implementation of the project would not result in the need for construction or expansion of recreational facilities. The project would have no impacts.

### 3.17 TRANSPORTATION AND TRAFFIC

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Result in inadequate emergency access?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**a-b. Potentially Significant Impact.** The construction of the proposed project would result in temporary lane and road closures. In addition, jet-grouting would result in temporary road damage during construction. The traffic disruptions associated with lane and road closures and road damage would be potentially significant. The EIR will include a detailed analysis of traffic impacts. A traffic study will be prepared that will identify traffic impacts from construction, including road and lane closures and traffic impacts. Detour routes will be identified. Mitigation measures will be identified to minimize traffic impacts, as feasible.

**c. No Impact.** The proposed project would not include any aeronautical equipment and would not include any activities that would interfere with the airspace. There would be no impact to the public associated with a safety risk from changes to air traffic patterns.

**d. Potentially Significant Impact.** The proposed project would require the use of heavy machinery, equipment, and materials in public roadways and parks, which could pose a hazard to the public using these roadways and parks. Jet-grouting is possible at some of on-shore portions of the pipelines to improve the soil stability as part of the proposed project. Jet grouting could potentially impact the Union Pacific railroad line near Crossing #3 causing settlement and/or heave. The EIR will provide a detailed analysis of hazards to traffic, potential impacts to the Union Pacific railroad line, and the public and will identify mitigation measures to reduce those impacts, as appropriate.

**e. Potentially Significant Impact.** Construction of the pipelines would require temporary lane and roadway closures during laydown of the pipelines and trenching. These land and roadway closures may impede emergency access, which would be considered a potentially significant impact. Pulling of the pipeline through the HDD on Crossing #1 could potentially block emergency access to Cardinal Point in the City of Alameda, which could impact residents living there. Other roadway closures could also impede emergency access. Impacts to emergency access would be potentially significant. The EIR will provide a detailed evaluation of potential impacts and will identify measures to mitigate significant impacts such as coordination with local emergency providers, and identification of alternative routes.

**f. Potentially Significant Impact.** Temporary lane and road closures could potentially affect bike lanes, pedestrian access, and public transit services. The EIR will include an evaluation of potential impacts to bike lanes, pedestrian access, and public transit services and will include mitigation measures to reduce impacts, as appropriate.

### 3.18 UTILITIES AND SERVICE SYSTEMS

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
e) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
g) Comply with federal, state, and local statutes and regulations related to solid waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**a-e. No Impact.** The proposed project would not include or require new expanded water or wastewater treatment facilities. In addition, the proposed project would not require additional water supplies; rather, the proposed project would ensure continuation of existing water supplies by replacing existing aging infrastructure, improving reliability and providing redundancy, as needed. There would be no impact to water or wastewater treatment facilities.

**f-g. Less than Significant Impact.** The proposed project would generate construction debris from trenching and HDD. Some of the construction debris may be used for fill and the rest would be disposed of according to all applicable local and state regulations. Construction debris would only be generated during construction and not during operation and the impact would therefore, be temporary. Considerable amounts of soil from the HDD may require disposal through trucking off-site. Other soils from trenching and jack and bore would also require disposal. Some of this soil may be contaminated requiring special disposal. Impacts are anticipated to be less than significant if all applicable regulations are followed.

The EIR will identify the approximate amount of debris that will be generated by the proposed project, will identify how the waste will be characterized and will identify the landfills that will serve the proposed project.

### 3.19 MANDATORY FINDINGS OF SIGNIFICANCE

Would the project:	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Measures Incorporated	Less-than-Significant Impact	No Impact
a) Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**a. Potentially Significant Impact.** The proposed project is located in an urban/suburban environment; therefore, it is unlikely that the proposed project would substantially degrade the quality of the environment or substantially reduce habitat for special-status species. The proposed project would include trenching and ground disturbance. Construction of the proposed pipelines, therefore, has the potential to disturb or damage previously undiscovered buried archaeological, paleontological and historic resources if they are encountered during construction. The EIR will provide a detailed evaluation of potential cultural and paleontological resource impacts and mitigation measures to mitigate significant impacts.

**b. Potentially Significant Impact.** Several other projects are anticipated to be underway during the construction of the proposed project, including but not limited to work at the Brooklyn Basin, park construction in the City of Alameda, bridge work, and several commercial and housing developments. Potential for cumulative traffic, noise, and air quality impacts could be significant. The EIR will include a description of projects that may overlap with the proposed project and will include an assessment of cumulative impacts. Mitigation measures will be identified, as appropriate.

**c. Potentially Significant Impact.** Construction of the proposed project would result in environmental impacts that have the potential to contribute to adverse effects on human beings such as from noise generation, generation of air quality impacts, and other safety hazards. The



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EIR will provide a detailed evaluation of potential impacts and mitigation measures to mitigate significant impacts.

APPENDIX C:  
CONSTRUCTION DETAILS

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## CONSTRUCTION DETAILS FOR CROSSING #1

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Project Name: Crossing #1

See Equipment Type TAB for type, horsepower and load factor

Project Size 1.1 total project acres disturbed  
 Construction Hours 7 am to 7 pm

Open Trench Operation

Total Length 10,890 Feet  
 Production Rate 80 Feet/Day  
 Days 136 Days  
 % of Time Total Days  
 Pavement Cutting 14% 19  
 Excavation 43% 58  
 Pipe Installation 29% 39  
 Repaving 14% 19

Note: % Times estimated based on West of Hills EIR

Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours
Demolition - Open Trench	Start Date:	Unknown	Total work	Varies	
	End Date:	Unknown	days:		
Concrete/Industrial Saws	81	0.73	8	19	156
Tractors/Loaders/Backhoes x2	97	0.37	16	19	311
Grading / Excavation - Open Trench	Start Date:	Unknown	Total work	Varies	
	End Date:	Unknown	days:		
Excavators	162	0.38	8	58	467
Tractors/Loaders/Backhoes	97	0.37	8	58	467
Dewatering Pumps x2	50	0.74	24	97	2334
Drilling/Casing - HDD	Start Date:	Unknown	Total work	Varies	
	End Date:	Unknown	days:		
Excavators x2	162	0.38	16	40	640
Tractors/Loaders/Backhoes x2	97	0.37	16	40	640
Bore/Drill Rig	205	0.50	8	20	160
Slurry Plant	150	0.50	8	42	336
Pick-Crane x2	226	0.29	16	122	1952
Generator Sets x2	84	0.74	16	82	1312
Pumps x2	84	0.74	16	82	1312
Welders	85	0.50	8	20	160
Cement and Mortar Mixers (Grouting)	9	0.56	8	60	480
Paving - Open Trench	Start Date:	Unknown	Total work	Varies	
	End Date:	Unknown	days:		
Cement and Mortar Mixers	9	0.56	8	19	156
Pavers	125	0.42	8	19	156
Paving Equipment	130	0.36	8	19	156
Rollers	80	0.38	8	19	156
Tractors/Loaders/Backhoes	97	0.37	8	19	156

Note: All phases and equipment were not used. Horsepower and load factor were modified as appropriate.

## CONSTRUCTION DETAILS FOR CROSSING #2

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Project Name: Crossing #2

See Equipment Type TAB for type, horsepower and load factor

Project Size 0.5 total project acres disturbed  
 Construction Hours 7 am to 7 pm

Open Trench Operation

Total Length 4,220 Feet  
 Production Rate 80 Feet/Day  
 Days 53 Days

% of Time Total Days

Pavement Cutting	14%	8
Excavation	43%	23
Pipe Installation	29%	15
Repaving	14%	8

Note: % Times estimated based on West of Hills EIR

Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours
Demolition - Open Trench	Start Date: Unknown	Unknown	Total work	Varies	
	End Date: Unknown	Unknown	days:		
Concrete/Industrial Saws	81	0.73	8	8	60
Tractors/Loaders/Backhoes x2	97	0.3685	16	8	121
Grading / Excavation - Open Trench	Start Date: Unknown	Unknown	Total work	Varies	
	End Date: Unknown	Unknown	days:		
Excavators	162	0.3819	8	23	181
Tractors/Loaders/Backhoes	97	0.3685	8	23	181
Dewatering Pumps x2	50	0.74	24	38	904
Drilling/Casing - HDD	Start Date: Unknown	Unknown	Total work	Varies	
	End Date: Unknown	Unknown	days:		
Excavators x2	162	0.3819	16	40	640
Tractors/Loaders/Backhoes x2	97	0.3685	16	40	640
Bore/Drill Rig	205	0.5	16	20	320
Slurry Plant	150	0.5	16	42	672
Pick-Crane x2	226	0.29	16	122	1952
Generator Sets x2	84	0.74	16	82	1312
Pumps x2	84	0.74	16	82	1312
Welders	85	0.50	8	20	160
Cement and Mortar Mixers (Grouting)	9	0.56	8	60	480
Paving - Open Trench	Start Date: Unknown	Unknown	Total work	Varies	
	Start Date: Unknown	Unknown	days:		
Cement and Mortar Mixers	9	0.56	8	8	60
Pavers	125	0.42	8	8	60
Paving Equipment	130	0.3551	8	8	60
Rollers	80	0.3752	8	8	60
Tractors/Loaders/Backhoes	97	0.3685	8	8	60

Note: All phases and equipment were not used. Horsepower and load factor were modified as appropriate.

## CONSTRUCTION DETAILS FOR CROSSING #3

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Project Name: Crossing #3

See Equipment Type TAB for type, horsepower and load factor

Project Size 0.5 total project acres disturbed  
 Construction Hours 7 am to 7 pm

Open Trench Operation

Total Length 4,495 Feet  
 Production Rate 80 Feet/Day  
 Days 56 Days

	% of Time	Total Days
Pavement Cutting	14%	8
Excavation	43%	24
Pipe Installation	29%	16
Repaving	14%	8

Note: % Times estimated based on West of Hills EIR

Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours
Demolition - Open Trench	Start Date:	Unknown	Total work	Varies	
	End Date:	Unknown	days:		
Concrete/Industrial Saws	81	0.73	8	8	64
Tractors/Loaders/Backhoes x2	97	0.3685	16	8	128
Grading / Excavation - Open Trench	Start Date:	Unknown	Total work	Varies	
	End Date:	Unknown	days:		
Excavators	162	0.3819	8	24	193
Tractors/Loaders/Backhoes	97	0.3685	8	24	193
Dewatering Pumps x2	50	0.74	24	40	963
Drilling/Casing - HDD	Start Date:	Unknown	Total work	Varies	
	End Date:	Unknown	days:		
Excavators x2	162	0.3819	16	40	640
Tractors/Loaders/Backhoes x2	97	0.3685	16	40	640
Bore/Drill Rig	205	0.5	16	20	320
Slurry Plant	150	0.5	16	42	672
Pick-Crane x2	226	0.29	16	122	1952
Generator Sets x2	84	0.74	16	82	1312
Pumps x2	84	0.74	16	82	1312
Welders	85	0.50	8	20	160
Cement and Mortar Mixers (Grouting)	9	0.56	8	60	480
Paving - Open Trench	Start Date:	Unknown	Total work	Varies	
	Start Date:	Unknown	days:		
Cement and Mortar Mixers	9	0.56	8	8	64
Pavers	125	0.42	8	8	64
Paving Equipment	130	0.3551	8	8	64
Rollers	80	0.3752	8	8	64
Tractors/Loaders/Backhoes	97	0.3685	8	8	64

Note: All phases and equipment were not used. Horsepower and load factor were modified as appropriate.

## CONSTRUCTION DETAILS FOR PIPELINE ABANDONMENT I

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Project Name: Alameda North Bay Island Pipeline - Abandoning the Crossings

See Equipment Type TAB for type, horsepower and load factor

Information below is for abandoning 1 crossing

Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours
Construction of Pits and Filling With Concrete	Start Date: End Date:	Unknown Unknown	Total work days:	Varies	
Concrete/Industrial Saws	81	0.73	8	10	80
Excavators	162	0.38	8	10	80
Tractors/Loaders/Backhoes	97	0.37	8	10	80
Dewatering Pumps x2	50	0.74	16	10	160
Generator Set	84	0.74	8	10	80
Welders	85	0.50	8	10	80
Cement and Mortar Mixers	9	0.56	8	10	80

*Note: All phases and equipment were not used. Horsepower and load factor were modified as appropriate.*

## CONSTRUCTION DETAILS FOR PIPELINE ABANDONMENT II

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Crossing #	Street/HDD	Length of Abandonment Requiring Grout (feet)	Outside Diameter "A" (Inches)	Duration of Construction (days)	Pipe Area (SF)	Grout Fill Volume (CF)	Daily Grout (cubic yards)	One-Way Grout Haul Truck Trips <sup>1</sup>	Material Trucks <sup>2</sup>	Maximum Worker Crew Size	Worker and truck vehicle trips/day	Pit size (SF)	Number of Pits (Feet)	Depth (Feet)	Excavation Volume (CF)	Excavation Volume (CY)	One-Way Haul Truck Trips <sup>1</sup>	Material Trucks <sup>2</sup>	Maximum Worker Crew Size	Worker and truck vehicle trips/day
1	5th Street	700	20	5	2.18	1,527	11	2	1	11	28	100	3	6	1,800	67	4	1	19	48
	Alice Webster Crossing	100	24	10	3.14	314	1	1	1	11	26	100	3	6	1,800	67	4	1	19	48
2	BFI 1 Crossing	700	16	10	1.40	977	4	1	1	11	26	100	4	6	2,400	89	5	1	19	50
	BFI 2 Crossing	400	24	10	3.14	1,257	5	1	1	11	26	100	4	6	2,400	89	5	1	19	50
3	High Crossing	350	12	10	0.79	275	1	1	1	11	26	100	4	6	2,400	89	5	1	19	50
	Blanding Crossing	700	24	10	3.14	2,199	8	1	1	11	26	100	4	6	2,400	89	5	1	19	50
	Park Crossing	100	16	10	1.40	140	1	1	1	11	26	100	3	6	1,800	67	4	1	19	48
	Derby Crossing	100	20	10	2.18	218	1	1	1	11	26	100	3	6	1,800	67	4	1	19	48

- 1) Assumes concrete truck with the following size: 9 CY
- 2) Material truck trips per day include deliveries of appurtenances and equipment
- 3) Assumes dump trailer with the following size: 20 CY

Summary Table

Crossing	Total Excavation (Cubic Yards)
Crossing 1	140
Crossing 2	180
Crossing 3	320
Total	640

## OPEN TRENCH CONSTRUCTION DETAILS

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## HDD CONSTRUCTION DETAILS

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Crossing #	HDD Operation	Length of Pipeline (feet)	Outside Drilled Diameter (inches)	Pipe Diameter "A" (inches)	Duration of Construction (days)	Drilled Area (SF)	Pipe Area (SF)	Drilling Pit Area7 (SF)	Drilling Pit Depth (ft.)	Drilling Pit Area7 (SF)	Drilling Pit Depth (ft.)	Excavation Factor	Excavation Volume (CF)	Excavation Volume (CY)	Grout/Slurry Fill Volume (CF)	Daily excavation (cubic yards/day)	Daily fill (cubic yards) <sup>1</sup>	One-Way Excavation Haul Truck Trips <sup>2,3</sup>	One-Way Grout/Slurry Import <sup>4</sup>	Material Trucks <sup>5</sup>	Maximum Worker Crew Size <sup>6</sup>	Worker and truck vehicle trips/day
Crossing 1	HDD	1790	42	30	40	9.62	4.91	120.00	5.00	80.00	3.00	1.20	21,674	803	8,435	20	8	1	1	2	25	58
Crossing 2	HDD	1400	42	30	40	9.62	4.91	120.00	5.00	80.00	3.00	1.20	17,171	636	6,597	16	6	1	1	2	25	58
Crossing 3	HDD	1370	42	30	40	9.62	4.91	120.00	5.00	80.00	3.00	1.20	16,825	623	6,456	16	6	1	1	2	25	58
Crossing 1	Grouting (see figure)				40										13,823		13		2		25	54
Crossing 2	Grouting (see figure)				40										13,823		13		2		25	54
Crossing 3	Grouting (see figure)				40										13,823		13		2		25	54
Crossing 1	Casing, HDPE Fusing & testing				42																25	50
Crossing 2	Casing, HDPE Fusing & testing				42																25	50
Crossing 3	Casing, HDPE Fusing & testing				42																25	50
Alternative 1A	Alternative Micro	1,300	48	30	40	12.57	4.91	700	85	300	85	1.20	121,604	4,504	9,955	113	9	6	2	2	25	70
Alternative 1B Micro	Alternative Micro	1,300	48	30	40	12.57	4.91	700	85	300	85	1.20	121,604	4,504	9,955	113	9	6	2	3	25	72
Alternative 1C	Alternative HDD	1,900	42	30	40	9.62	4.91	120	5	80	3	1.20	22,944	850	8,954	21	8	2	1	4	25	64
Alternative 1E	Alternative HDD	1,200	42	30	40	9.62	4.91	120	5	80	3	1.20	14,862	550	5,655	14	5	1	1	5	25	64
Alternative 2A Micro	Alternative Micro	900	48	30	40	12.57	4.91	700	85	300	85	1.20	115,572	4,280	6,892	107	6	6	1	2	25	68
Alternative 2B	Alternative HDD	2,200	42	30	40	9.62	4.91	120	5	80	3	1.20	26,408	978	10,367	24	10	2	2	6	25	70
Alternative 3B	Alternative HDD	1,400	42	30	40	9.62	4.91	120	5	80	3	1.20	17,171	636	6,597	16	6	1	1	7	25	68
Alternative 3C	Alternative HDD	1,400	42	30	40	9.62	4.91	120	5	80	3	1.20	17,171	636	6,597	16	6	1	1	8	25	70
Alternative 3D	Alternative HDD	1,400	42	30	40	9.62	4.91	120	5	80	3	1.20	17,171	636	6,597	16	6	1	1	9	25	72
Alternative 3E	Alternative HDD	1,400	42	30	40	9.62	4.91	120	5	80	3	1.20	17,171	636	6,597	16	6	1	1	10	25	74
Alternative 3A Micro	Alternative Micro	950	48	30	40	12.57	4.91	700	85	300	85	1.20	116,326	4,308	7,275	108	7	6	1	11	25	86

- 1) Includes native and non-native backfill
- 2) Assumes all material is hauled away and imported separately (none is stored on site for backfill).
- 3) Assumes dump trailer with the following size: 20 CY
- 4) Assumes concrete truck with the following size: 9 CY
- 5) Material truck trips per day include deliveries of drilling materials, fuel, etc.
- 6) Truck Trips do not consider "visitors" to the project.

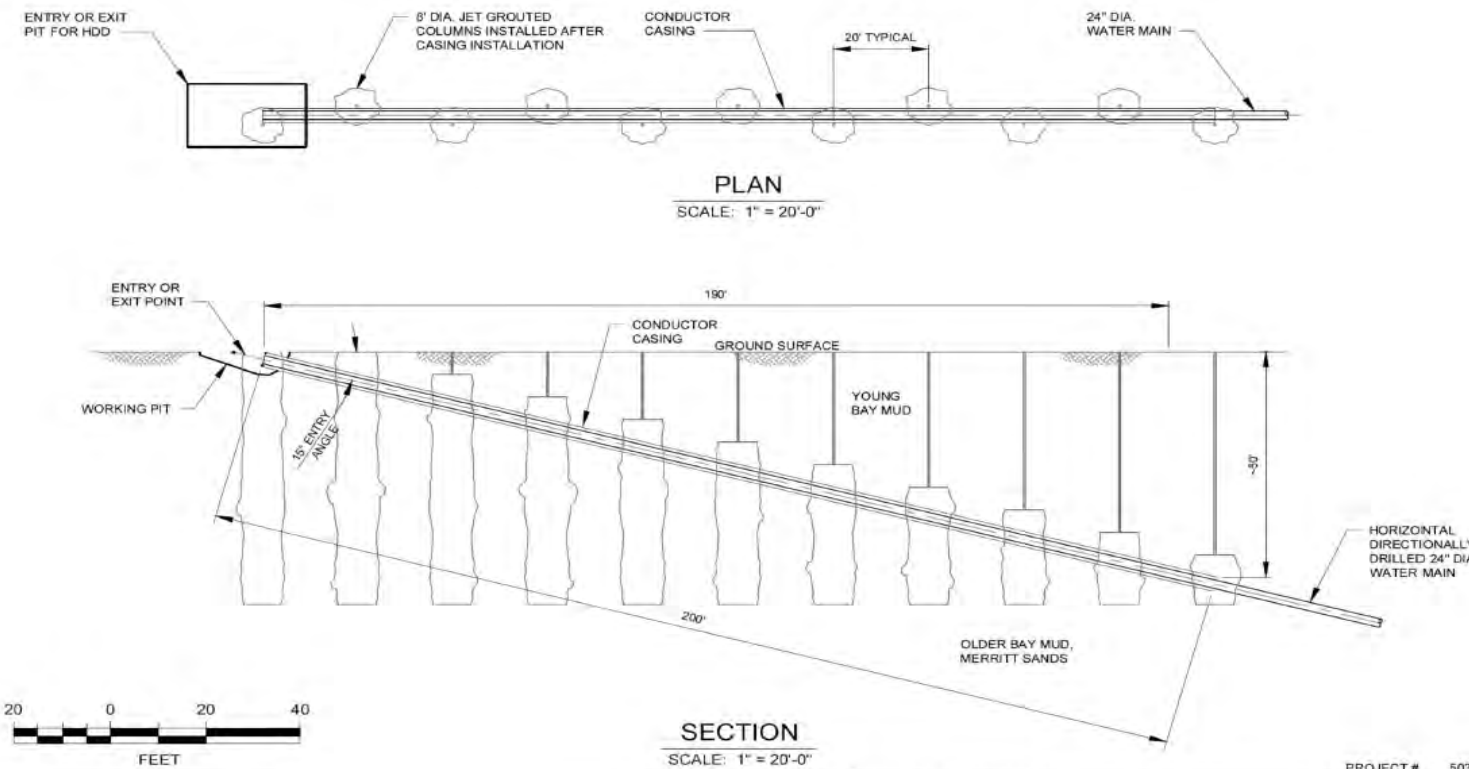
HDD Project Area 2500 square feet  
According to Jacobs. Applicable to each side of the HDD Operation

Grouting Calculations

Columns	11 No.
Diameter	8 Ft
Average Depth	25 Ft
Volume	13,823 CF
Volume	512 CY

Summary Table

Crossing	Total Length (Feet)	Excavation (Cubic Yards)
Crossing 1	1,790	803
Crossing 2	1,400	636
Crossing 3	1,370	523
Alternative 1A	1,300	4,504
Alternative 1B	1,300	4,504
Alternative 1C	1,900	850
Alternative 1E	1,200	550
Alternative 2A Micro	900	4,280
Alternative 2B	2,200	978
Alternative 3B	1,400	636
Alternative 3C	1,400	636
Alternative 3D	1,400	636
Alternative 3E	1,400	636
Alternative 3A Micro	950	4,308



PROJECT # 50336  
**JACOBS ASSOCIATES** ENGINEERS/CONSULTANTS  
 ALAMEDA-NORTH BAY FARM ISLAND CROSSINGS  
 ALAMEDA, CALIFORNIA  
 EXTENDED CASING WITH JET GROUT SUPPORT  
 MARCH 2014  
**E-5**

## DEWATERING VOLUMES FOR PIPELINE CONNECTIONS

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Crossing #	Location	Existing Transmission Connection	Diameter (inches)	Type	Total Outage Length	Dewater Length	Dewater Volume	Expected Dewatering Time Assuming 50 GPM	Expected Dewatering Time Assuming 300 GPM
					(Feet) <sup>1</sup>	(Feet)	(Gallons)	(Hours)	(Hours)
1	Madison & 8th	30SMM66	30	New Tee	6,200	1,500	55,100	19	4
	Jackson & 5th	20CM53 OR 20C16	20	New Tee	3,800	1,800	29,400	10	2
	Fallon & Embarcadero	12SMB74	12	Hot Tap	NA	NA	NA	NA	NA
	Marina Village	12SMB86	12	Hot Tap	NA	NA	NA	NA	NA
	Atlantic & Triumph	12SMB89	12	Hot Tap	NA	NA	NA	NA	NA
	Sherman & North of Eagle Ave	Blind Flange on New pipe, WSE 15024							
	Sherman & Lincoln	16 ML&PCS (2015)	16	New Tee	1,100	1,100	11,500	4	1
2	Veterans Ct.	24SMBM83	24	New Tee	1,300	1,300	30,600	11	2
	Pearl St & San Jose Ave	12CM52	12	New Tee	2,200	2,200	12,900	5	1
	Towata Park	16SMM52	16	New Tee	100	100	1,000	1	1
3	Ford St. & 29th Ave	24SMM44	24	New Tee	2,800	1,600	37,600	13	3
	Derby & Ford	8SMB07 or 12CM47	8/12	Hot or New	500	500	3,000	1/0	1/0
	Tilden and Lincoln Ave	16 ML&PCS (2015)	16	New Tee	800	800	18,800	7	2
	Broadway & Clement	24SMM51	24	New Tee	3,600	2,000	47,000	16	3

Crossing	Total Dewatered Volume (Gallons)
Crossing 1	96,000
Crossing 2	44,500
Crossing 3	106,400
Total	246,900

## **GEOTECHNICAL BORINGS CONSTRUCTION DETAILS**

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**CROSSING #1**

Timing	
Phase	Year
Crossing #1	2017

3 Borings Barge-Mounted Soil Borings (Crossing #1)			
Equipment	Motor/Engine Type	Hours per Day	Days in Use
Boat	2000HP	1 Hour	6
Drill Rig	350HP	10 hours	3

Waste Produced
Crossing #1
9, 55 gallon drums

4 Borings On Land Soil Borings (HDD and Jack and Bore Crossing #1)			
Equipment	Motor	Hours per Day	Days in Use
Drill Rig	350HP	10 hours	2

Waste Produced
Crossing #1
2, 55 gallon drums

Waste Hauling			
Equipment	Motor/Engine Type	Hours per Day	Days in Use
1 Truck	200 HP	0.5 hour	5

**CROSSING #2**

Timing	
Phase	Year
Crossing #2	2020

3 Borings Barge-Mounted Soil Borings (Crossing #2)			
Equipment	Motor/Engine Type	Hours per Day	Days in Use
Boat	2000HP	1 Hour	6
Drill Rig	350HP	10 hours	3

Waste Produced
Crossing #2
12, 55 gallon drums

4 Borings On Land Soil Borings (HDD and Jack and Bore Crossing #2)			
Equipment	Motor	Hours per Day	Days in Use
Drill Rig	350HP	10 hours	2

Waste Produced
Crossing #2
2, 55 gallon drums

Waste Hauling			
Equipment	Motor/Engine Type	Hours per Day	Days in Use
1 Truck	200 HP	0.5 hour	5

**CROSSING #3**

Timing	
Phase	Year
Crossing #2	2020

4 Borings On Land Soil Borings (HDD and Jack and Bore Crossing #3)			
Equipment	Motor	Hours per Day	Days in Use
Drill Rig	350HP	10 hours	2

Waste Produced
Crossing #3
2, 55 gallon drums

Waste Hauling			
Equipment	Motor/Engine Type	Hours per Day	Days in Use
1 Truck	200 HP	0.5 hour	2

## CONSTRUCTION TIMING DETAILS

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Trenched Portion

Open Trench Production Rate

80 feet/day

Feet	Name	Type	Open Trench Months
3,513	Crossing 1	Trench	3
1,518	Crossing 1	Trench	1
4,079	Crossing 2	Trench	3
1,111	Crossing 3	Trench	1
2,207	Crossing 3	Trench	2
4,759	Crossing 1	Trench	3
406	Crossing 3	Trench	1
692	Crossing 1	Trench	1
124	Crossing 2	Trench	1
Alternatives			
11,500	Alternative 1A	Trench	8
5,400	Alternative 2B	Trench	4
1,600	Alternative 3B	Trench	1
2,500	Alternative 3E	Trench	2

	Sum of Open Trench Months	Sum of Open Trench Miles
Crossing 1	8	1.99
Crossing 2	4	0.80
Crossing 3	4	0.71
Grand Total	16	3.49

Mobilization includes Oakland and Alameda Side	1
Locate and mark utilities for Oakland and Alameda side	1
Pipeline Pressure test includes Oakland and Alameda sides	1
Disinfect pipeline includes Oakland and Alameda sides	1
Repave	1
Total	5

Total Open Trench Time	Months
Crossing 1	13
Crossing 2	9
Crossing 3	9
Alternative 1A	13
Alternative 2B	9
Alternative 3B	6
Alternative 3E	7
Alternative 3A	9

Existing Crossing Abandonment

Abandonment Time	Months
Crossing 1	1
Crossing 2	1
Crossing 3	2
Alternative 1A	1
Alternative 2B	1
Alternative 3B	2
Alternative 3E	2
Alternative 3A	2

HDD portion

Name	HDD Feet	HDD Miles	Total Miles	Crossing Months min	Crossing Months Max
Crossing 1	1,785	0.338	2.323	6	8
Crossing 2	1,404	0.266	1.062	6	8
Crossing 3	1,374	0.260	0.966	6	8
		Alternative 2B		6	8
		Alternative 3B		6	8
		Alternative 3E		6	8
Microtunneling Alternatives					
		Alternative 1A (microtunneling)		8.25	10.25
		Alternative 3A (microtunneling)		8.25	10.25

HDD Schedule

Duration	Total Days	
Mobilization	1 month	20
Surface Casing	1 month	20
Install Jet Grouting	2 months	40
Drill and Ream	1 month	20
Fuse HDPE Pipe	4 weeks	20
HDPE Pullback	48 hours	2
Grout casing pipe	1 month	20
Demobilization	1 month	20

Microtunneling Schedule

	Min (Months)	Max (Months)
Mobilization	1	1
Shafts	3.25	3.25
Microtunneling*	3	5
Demobilization	1	1
Total	8.25	10.25

Total Construction Time

	Min (Months)	Max (Months)
Crossing 1	13	22
Crossing 2	9	18
Crossing 3	9	19
Alternative 1A	13	24
Alternative 2B	9	18
Alternative 3B	6	16
Alternative 3E	7	17
Alternative 3A	8	21

## CREW SIZE DETAILS

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Maximum Worker Size

	Foreman	Workers <sup>1</sup>	Heavy Equipment Operator <sup>4</sup>	Truck Driver	Flaggers <sup>3</sup>	Superintendent	EBMUD Inspector	City's Inspector	Total	Source
Trenching	1	7	3	3	2	1	1	1	19	Average of WOH Northern Pipelines EIR - Wildcat Pipeline & Lincoln Avenue Replacement Project
HDD <sup>2</sup>	2	11	4		4	2	1	1	25	Jacob's & Associates
Abandonment	0	4	1	1	2	1	1	1	11	Discussions with EBMUD staff (Marshall Mcleod)

1) Workers could include any of the following:

- Survey
- Plumber
- Welder
- Driller
- Rod Helper
- Drill positioner
- 2-4 mud engineers

Note: During HDD Pullback, workforce classifications will be different, but crew will be approximately the same size.

2) Includes both sides of HDD operation

3) Number of flaggers is site specific

4) In addition to typical heavy equipment, this includes drillers and Crane Operators

## EQUIPMENT TYPES

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Typical Equipment Type & Load Factors		
OFFROAD Equipment Type	Horsepower	Load Factor
Aerial Lifts	62	0.31
Air Compressors	78	0.48
Bore/Drill Rigs	205	0.5
Cement and Mortar Mixers	9	0.56
Concrete/Industrial Saws	81	0.73
Cranes	226	0.29
Crawler Tractors	208	0.43
Crushing/Proc. Equipment	85	0.78
Dumpers/Tenders	16	0.38
Excavators	162	0.38
Forklifts	89	0.2
Generator Sets	84	0.74
Graders	174	0.41
Off-Highway Tractors	122	0.44
Off-Highway Trucks	400	0.38
Other Construction Equipment	171	0.42
Other General Industrial Equipment	150	0.34
Other Material Handling Equipment	167	0.4
Pavers	125	0.42
Paving Equipment	130	0.36
Plate Compactors	8	0.43
Pressure Washers	13	0.2
Pumps	84	0.74
Rollers	80	0.38
Rough Terrain Forklifts	100	0.4
Rubber Tired Dozers	255	0.4
Rubber Tired Loaders	199	0.36
Scrapers	361	0.48
Signal Boards	6	0.82
Skid Steer Loaders	64	0.37
Surfacing Equipment	253	0.3
Sweepers/Scrubbers	64	0.46
Tractors/Loaders/Backhoes	97	0.37
Trenchers	80	0.5
Welders	46	0.45

APPENDIX D:  
EBMUD STANDARD PRACTICES AND PROCEDURES

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SECTION 01 35 24 ENVIRONMENTAL REQUIREMENTS

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## SECTION 01 35 24

### PROJECT SAFETY REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

###### A. Work Included:

1. Be solely and exclusively responsible for maintaining job-site safety and compliance with all pertinent Groups and Articles set forth in Title 8, California Code of Regulations (Cal/OSHA), and Title 29, Code of Federal Regulations (OSHA; where applicable).
2. Contractor shall be the Creating, Controlling, and Correcting Employer for purposes of compliance with Cal/OSHA's multi-employer worksite rule (8 CCR 336.10) for itself and all of its site workers.
3. Meet with the Engineer prior to commencement of the Work to review the project safety requirements as applicable to the Contractor's procedures and to develop mutual understandings relative to compliance with the safety requirements and administration of the Contractor's project safety programs.
4. Provide for public safety when working in \_\_\_\_\_.
  - a. Night operations should be set up pursuant to the National Cooperative Highway Research Program (NCHPP) report 476, guidelines for design and operation of nighttime traffic control for highway maintenance and construction.
5. Complete a \_\_\_\_\_ prior to starting work at \_\_\_\_\_ . See Appendix A.
6. Be trained on Pardee Section Safe Clearance Procedure (See Appendix \_). All Contractor personnel present on the project site shall be certified as Authorized Personnel under this procedure.

###### B. Site Activities

1. Control all harmful dusts, fumes, mists, vapors and gases exposures for all job-site workers, regardless of employer, so that respective permissible exposure limits (PEL) are not met or exceeded. Such hazards are contained in Title 8, California Code of Regulations (Cal/OSHA) § 5155 - Airborne Contaminants; Article 110 - Regulated Carcinogens; Construction Safety Order 1529 - Asbestos; and Construction Safety Order 1530.1 - Control of Employee Exposures from Dust-Generating Operations Conducted on Concrete or Masonry Materials.

2. Physically delineate and assign work areas and restrict access by unauthorized persons during the course of Work. See Section 01 35 53 Security Procedures for sign-in requirements.
3. Contractor shall not allow unsafe tools, equipment, or machinery to be brought onto the project. Unsafe tools, etc. shall be considered as those tools which are in need of repair, replacement, lacking proper maintenance, or are unsuitable for the task.
4. Contractor shall assemble, install, erect, and prepare safety related equipment, devices, and products in accordance with manufacturer specifications and recommendations. Manufacturer documentation shall be provided to the Engineer upon request.
5. Comply with the Federal Drug Free Workplace Act, Department of Transportation (DOT) testing regulations (49 CFR Part 32), CA State Vehicle Code (Section 34520) and all applicable legally valid rules and regulations regarding drug and alcohol misuse, including consumption, sale or possession.
6. Contractor personnel are specifically prohibited from bringing firearms, explosive devices, or other dangerous weapons on District property or while engaged in contract Work.
7. Contractor shall provide safe access for construction inspectors and other authorized District employees in order to inspect or review Work in progress.

C. Related Sections

1. Section 00 31 24 – Material Assessment Information
2. Section 00 62 00 – Insurance Requirements
3. Section 01 14 00 – Work Restrictions
4. Section 01 33 00 - Submittal Procedures
5. Section 01 35 44 – Environmental Requirements
6. Section 01 50 00 – Temporary Facilities and Controls
7. Section 02 82 13 - Asbestos Control Activities
8. Section 02 83 13 – Lead Hazard Control Activities

1.2 DEFINITIONS

- A. Where used in the Contract Documents, the following words and terms shall have the meanings indicated. The meanings shall be applicable to the singular and plural of the words and terms.



- B. Competent Person: As defined in Section 1504 of the Construction Safety Orders, Title 8, California Code of Regulations, one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.
- C. Confined Spaces: Shall mean any space not designed for human occupancy and having the characteristics identified in Title 8, California Code of Regulations (Cal/OSHA), Article 108 - Confined Spaces.
- D. Excavation: Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
- E. Hazardous Substance: Defined as any substance included in the list (Director's List) of hazardous substances prepared by the Director, California Department of Industrial Relations, pursuant to Labor Code Section 6382. Includes hazardous waste as defined herein.
- F. Exposure Assessment: An assessment of potential chemical and physical hazards encountered on the project site.
- G. LOTO: Lock-Out Tag-Out as defined by Title 8, California Code of Regulations, § 3314.
- H. OPU: Order Prohibiting Use. A tag affixed to a dangerous workplace condition or practice which constitutes an imminent hazard to workers. An OPU tag may be posted prohibiting entry to the worksite, or part of the worksite, use of machinery, devices, or apparatus.
- I. Safe Work Notice, or Safe Work Permit: A Notice or Permit required to be completed by the Contractor and District staff at water treatment plants and wastewater facilities. The Notice/Permit communicates work to be performed, the areas and potential hazards.
- J. Trench: A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less, (measured at the bottom of the excavation), the excavation is also considered to be a trench.

### 1.3 SUBMITTAL OF PLANS AND PROCEDURES

#### A. General:

1. Prepare and submit in accordance with the applicable provisions of Section 01 33 00- Submittal Procedures.

2. Allow 20 work days minimum for the Engineer's review plus transit time to and from the District offices.
3. The plans and procedures identified in this Article 1.3 shall be kept current. New hazards, mitigations, or procedures identified during the course of the Work shall be submitted as revisions to the identified plans and procedures within 5 days of being identified.
4. One copy of each plan and procedure submitted will be returned marked "Reviewed", as described below, or "Acknowledged Receipt" or "Returned without Review" as described in Section 01 33 00 Submittal Procedures.
  - a. "Reviewed" indicates that the plan has been reviewed for the protection of District employees in the Contractor work zones. Notations entered by the District will be applicable to District employees only.
  - b. Work described under the plan shall not begin until the submitted plan has been returned as "Reviewed" or "Acknowledged Receipt".

B. Project Safety and Health Plan:

1. Submit prior to start of the Work for the Engineer's review a Project Safety and Health Plan for the Work to be performed only if actual, potential, or anticipated hazards include: a) hazardous substances; b) fall protection issues; c) confined spaces; d) trenches or excavations; or, e) lockout/tagout. If the actual, potential, or anticipated hazards do not include one or more of these five hazards, no Plan is required.
2. Submit prior to start of Work the name of individual(s) who has been designated as:
  - a. Contractor's Project Safety and Health Representative
  - b. Submit principal and alternate Competent/Qualified Persons for:
    - 1) scaffolding; 2) fall protection systems and equipment; and 3) employee protective systems for trenches and excavations.
  - c. Qualified person to conduct and take samples and air measurements of known or suspect hazardous substance for personnel and environmental exposure. Sample results shall be submitted to the Engineer in writing and electronic format.
3. Plan shall include an emergency action plan in the event of an accident, or serious unplanned event (e.g.: gasoline break, fire, structure collapse, etc.) that requires notifying any responsive agencies (e.g.: fire departments, PG&E, rescue teams, etc).

C. Excavation Safety Plan

1. Submit detailed plan for worker protection and control of ground movement for the Engineer's review prior to any excavation work at jobsite. Include drawings and details of system or systems to be used, area in which each type of system will be used, de-watering, means of access and egress, storage of materials, and equipment restrictions. If plan is modified or changed, submit revised plan.
2. All surface encumbrances that are located and determined to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.
3. Tunnel work shall comply with the Tunnel Safety Orders.

D. Confined Space Operating Procedures:

1. Submit confined space operating and rescue procedures to the Engineer for review. Procedures shall conform to the applicable provisions of Sections 5156 through 5158, Title 8, California Code of Regulations.
2. If a pipeline is required to be entered, the Project Safety and Health Plan shall include a description of a safe access and rescue plan.

E. Fall Protection Procedures

1. Submit fall protection procedures to the Engineer for review prior to any work at heights at the jobsite.
2. The fall protection plan shall address control of fall hazards for any work occurring at heights greater than 7½ feet.
3. Procedures shall conform to applicable provisions of Sections 1669 through 1671.2, Title 8, California Code of Regulations.
4. The plan shall address scaffolds when used on site.
5. The plan shall address manlift equipment when used on site.
6. The plan shall address rescue of workers who may fall.

F. USA Marking Record

1. Submit utility locate and marking (USA marking) number and documents, and verification of markings. Make available to the Engineer the record of all subsequent utility marking events and meetings on the project.

G. Accident Reports

1. Upon request of the Engineer, complete and submit an accident investigation report. See Article 3.3.

## H. Electrical Safety Plan

1. Submit a detailed plan for worker protection from hazardous voltages on pipelines and appurtenances as a result of electromagnetic induction from nearby electrical transmission lines and short-circuits at the high-voltage lattice steel towers and tubular steel poles.
2. The safety plan shall include the following details at minimum:
  - a. Procedures to limit worker contact with the bare metal on the pipeline and appurtenances, either through direct body contact or via equipment which has a direct metallic path to the pipeline (e.g., a crane or backhoe using metallic slings or chains).
  - b. Procedures to avoid placing equipment and materials near any PG&E lattice towers or tubular steel poles.
  - c. Details of protective equipment and clothing to be used when worker contact with the pipeline is unavoidable.
  - d. Temporary pipeline grounding and bonding details to be used during construction.
  - e. Procedures for the installation of temporary pipeline grounding and bonding by qualified personnel (e.g., electrician).
  - f. Procedures to notify all persons on the job site of the electrical hazard.
  - g. Procedures to limit access to the pipeline to the public and unqualified personnel.

## 1.4 TRAINING REQUIREMENTS

- A. Ensure that all personnel who, as the result of work on this contract, will likely be exposed to hazardous conditions or hazardous substances at the site have received the appropriate training for the hazards they may encounter. Establish minimum training requirements and do not allow untrained workers to enter or perform Work at the site.

## 1.5 SAFETY VIDEO

- A. All Contractor personnel shall view a plant safety video provided by the District prior to working on the site. The video will be provided to the Contractor at the pre-construction meeting. Contractor shall provide on a monthly basis an updated listing of Contractor personnel who have viewed the video.

## 1.6 FIRE PREVENTION AND PROTECTION

- A. Perform all Work in a fire-safe manner and supply and maintain on the site adequate fire-fighting equipment capable of extinguishing incipient fires. Comply with

applicable federal, local, and state fire-prevention regulations. Where these regulations do not apply, applicable parts of the National Fire Prevention Standards for Safeguarding Building Construction Operations (NFPA No. 241) shall be followed.

## PART 2 - NOT USED

## PART 3 - EXECUTION

### 3.1 PROJECT SAFETY AND HEALTH PLAN

#### A. General:

1. A copy of the Contractor's Project Safety and Health Plan shall be available at the construction site while excavations, confined spaces, fall protection, or LOTO are being performed, or hazardous substances are present
2. Contractor's Project Safety and Health Plan shall apply to all personnel working at, or visiting the site including, but not limited to, Contractor's employees, suppliers, truckers, and District personnel.
3. The Contractor's Project safety and health representative shall verify that all persons are in compliance with applicable safety and health requirements, and take action to ensure compliance where deficiencies are identified.
4. Provide the Engineer a minimum of 48 hours advance notice of time and location of pre-entry briefings so that District personnel, who are required to enter the Project, may attend. A record of attendance shall be provided to the Engineer within 24 hours after the briefing.
5. Contractor shall take representative personnel air samples for employee exposure to dust, fume, mist, and vapors of materials and substances brought onto the project or generated during the course of Work on the project. See paragraph B. below.
6. Exercise extreme care when handling or disposing of materials or substances that are listed as hazardous substances in Section 339 of Chapter 3.2, California Occupational Safety and Health Regulations, Title 8, California Code of Regulations, or in Title 26 (Toxics) of the California Code of Regulations, or as evidenced by the manufacturer's MSDS.
7. Maintain a snake venom extractor kit including appropriate snake anti-venom on-site for the duration of the project.

#### B. Sampling and Testing of Samples Collected for Exposure Analysis:

1. Be responsible for all sampling, including sampling for airborne contaminants, and testing of materials suspected of containing hazardous substances to determine if such materials pose potential safety & health exposure hazards.

All sampling shall be conducted by qualified persons, and testing shall be performed by an OSHA certified laboratory.

2. Copies of the results of testing and sampling shall be made available to the Engineer within 5-days of time of receipt from the certified laboratory.
3. Each sample shall have an identifying sample number assigned by the Contractor when the sample is taken with the prefix **SPEC** \_\_\_\_\_.
  - a. Each sample number shall be included on the sampling chain of custody and in all reports, correspondence, and other documentation related to the sample. Each sample shall have a sampling chain of custody.
  - b. Chain of custody shall show the name and organization of each person having custody of the sample, and shall also show the sample number, job name and location, time of day and date sample taken, material sampled, and tests to be performed.

### 3.2 HAZARDOUS CONDITIONS

#### A. Confined Spaces:

1. Attention is directed to the provisions of Article 108 of the General Industry Safety Orders, Title 8, California Code of Regulations, and Article 4 on Dusts, Fumes, Mists, Vapors, and Gases of Subchapter 4, the Construction Safety Orders, Title 8, California Code of Regulations.
2. All spaces shall be designated by Contractor as either PERMIT REQUIRED or NON-PERMIT REQUIRED. When designated PERMIT REQUIRED, a copy of the PERMIT shall be conspicuously posted for the duration of the Work within the space. Confined spaces designated as PERMIT REQUIRED after assessment shall be supported by a rescue team(s).
3. Tests for the presence of combustible or dangerous gases and/or oxygen deficiency in confined spaces shall be made with an approved device immediately prior to a worker entering the confined space and at intervals frequent enough to ensure a safe atmosphere during the time a worker is in such a structure. A record of such tests shall be kept at the jobsite.
4. No employee shall be permitted to enter a confined space, where tests indicate the presence of a hazardous atmosphere, unless the employee is wearing suitable and approved respiratory equipment, or until such time that continuous forced air ventilation has removed the hazardous atmosphere from the confined space.
5. Confined spaces that contain or that have last been used as containers of toxic gases, light oils, hydrogen sulfide, corrosives, or poisonous substances, shall, in every case, be tested by means of approved devices or chemical analysis before being entered without wearing approved respiratory equipment.

6. Sources of ignition shall be prohibited in any confined space until after the atmosphere within the confined space has been tested and found safe.
7. Reservoirs, vessels, or other confined spaces having openings or manholes in the side as well as in the top shall be entered from the side openings or manholes when practicable.
8. Coordinate entry operations with the Engineer when both Contractor personnel and District personnel require permit space entry.

B. Excavation Safety:

1. Section 6705 of the Labor Code requires that the excavation of any trench 5 feet or more in depth shall not begin until the Contractor has received from the Engineer notification of the Engineer's acceptance of the Contractor's detailed plan for worker protection from the hazards of caving ground during the excavation of such trench.
  - a. Such plan shall show the details of the design of shoring, bracing, sloping or other provisions to be made for worker protection during such excavation.
  - b. No such plan shall allow the use of shoring, sloping or a protective system less effective than that required by the Construction Safety Orders, Title 8, California Code of Regulations, and if such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. Cal/OSHA Permit: Title 8, CCR §341(a)(1) requires excavators to obtain a permit prior to digging trenches or excavations which are 5 feet or deeper and into which a person is required to descend.
2. California Government Code: Various sections of § 4216 describe the requirements and procedures for excavation notifications and utility excavation.
3. Requirements of Protective Systems:
  - a. All excavations 5 ft. in depth or greater and not in stable rock shall have a protective system to prevent earth movement.
  - b. For excavations greater than 20 ft. in depth, the detailed plan for worker protection and control of ground movement shall be prepared, and signed and dated, by a California registered Civil or Structural Engineer. The registered engineer shall:
    - 1) Have at least five years' responsible experience in work of this nature.

- 2) Inspect the installation of the system prior to entry of any persons into the excavation and certify in writing to the District that the system is installed as designed.
  - 3) Perform any necessary additional work that may be required because of unanticipated movements, deflections, or settlements of the protective system or the ground.
- c. No changes or deviations from a protective system designed by a registered engineer shall be made without prior approval of the designing engineer.
  - d. In the event of any violation of Article 6 of the Construction Safety Orders or this paragraph, or deviation from the submitted plan for worker protection and control of ground movement, the Engineer may suspend Work or notify Cal/OSHA or both.

C. Fall Protection:

1. Section 1670 of the Construction Safety Orders, Title 8, California Code of Regulations, requires protective measures to be implemented whenever a worker is exposed to falls greater than 7½ feet.
2. On site activities shall conform to the requirements set forth in Sections 1669 through 1671.2, Title 8, California Code of Regulations.
3. A walkway or bridge, with standard guardrails, shall be provided where employees are required to cross excavations and trenches 6 feet or greater in depth per Section 1541 of the Construction Safety Orders, Title 8, California Code of Regulations.

D. Electrical:

1. For Work in which the Contractor must install temporary electrical circuits:
  - a. An electrical safety assessment (that includes ARCFLASH) shall be performed and provided to the Engineer.
  - b. The assessment shall be based on the NFPA 70 E (2012) Standard
  - c. Appropriate hazard labeling shall be provided.
2. For Work in which the Contractor installs electrical circuits required by the specification:
  - a. An electrical shock and ARCFLASH assessment shall be performed in accordance to the NFPA 70E (2012) Standard on installed equipment.



- b. Appropriate labels shall be made and installed on equipment rated in excess of 480V (for example MCC, switchboards, panelboards, industrial control panels, etc.).
  - c. Prior to labeling, the label shall be reviewed by the Engineer for acceptance.
- E. LOTO (Lock-Out Tag-Out): Title 8, California Code of Regulations requires control of hazardous energy sources where any employee may be exposed to potential harm.
  - 1. The Contractor with its subs shall meet with the District to share and reach agreement for implementation with LOTO plans and planning for any District equipment, process, or machinery that shall be locked-out.
  - 2. The distinction between LOTO and operational shut-down shall be made.
  - 3. Share and implement the following components of the LOTO plan:
    - a. LOTO locations,
    - b. Lock-out and tag-out methods and equipment,
    - c. De-energization verification,
    - d. Log of locked and tagged locations,
    - e. Stated emergency types and breach policy,
    - f. Return-to-service practice and removal of lock and tags.
- F. Pardee Section Safe Clearance Procedure Training.
  - 1. Schedule training of work personnel in the Pardee Section Safe Clearance Procedures with the Engineer.
  - 2. The training is anticipated to be one hour in duration. Training will be conducted at the Pardee Center located on Pardee Dam Road in Valley Springs on a normal work day.

### 3.3 ACCIDENT REPORTS

- A. Report any serious injury to the Engineer immediately. Examples of reportable injuries: broken limbs, amputation, chemical asphyxia, etc. Contractor is solely and exclusively responsible for notifying Cal/OSHA within 8-hours of the occurrence of a serious injury or fatality. Also promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to, the site, giving full details and statements of witnesses. Reports shall document the root cause of the accident, if the accident was

preventable, and how the accident will be prevented from reoccurring. Furnish further information to the District as requested.

- B. If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, arising out of or in connection with the performance of the Work, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.
- C. Notify the Engineer if representatives of Cal/OSHA or any other regulatory agency arrives at the job-site for any purpose, including inspections, consultations, or investigations. The notification shall be made to the Engineer within 30-minutes of the arrival of the representative to the project.

END OF SECTION

SECTION 01 35 44 ENVIRONMENTAL MITIGATION

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## SECTION 01 35 44

### ENVIRONMENTAL REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

###### A. Work Included:

1. Contractor shall be responsible for maintaining compliance with applicable Federal, State and Local environmental regulations in its execution of the Work.
2. Implement mitigations for construction impacts detailed in the Mitigation Monitoring and Report Plan (MMRP) certified under the California Environmental Quality Act (CEQA) for this project.
3. Contractor shall obtain, pay for, comply with, and where necessary at the end of the Work, properly terminating all necessary local, state and federal permits to perform the Work as specified.
4. Contractor shall implement all required environmental plans, procedures, and controls during performance of the Work.
5. Meet with the Engineer prior to commencement of the Work to review the project environmental requirements as applicable to the Contractor's procedures and to develop mutual understandings relative to compliance with the environmental protection requirements and administration of the Contractor's environmental pollution control programs.

###### B. Site Activities

1. No debris, soil, silt, sand, bark, slash, sawdust, asphalt, rubbish, paint, oil, cement, concrete or washings thereof, oil or petroleum products, or other organic or earthen materials from construction activities shall be allowed to enter into storm drains or surface waters or be placed where it may be washed by rainfall or runoff outside the construction limits. When operations are completed, excess materials or debris shall be removed from the work area as specified in the Construction and Demolition Waste Disposal Plan.
2. Excess material shall be disposed of in locations approved by the Engineer consistent with all applicable legal requirements and disposal facility permits.
3. Do not create a nuisance or pollution as defined in the California Water Code. Do not cause a violation of any applicable water quality standards for receiving waters adopted by the Regional Board or the State Water Resources Control Board, as required by the Clean Water Act.
4. Clean up all spills and immediately notify the Engineer in the event of a spill.

5. Stationary equipment such as motors, pumps, and generators, shall be equipped with drip pans.
6. Divert or otherwise control surface water and waters flowing from existing projects, structures, or surrounding areas from coming onto the work and staging areas. The method of diversions or control shall be adequate to ensure the safety of stored materials and of personnel using these areas. Following completion of Work, ditches, dikes, or other ground alterations made by the Contractor shall be removed and the ground surfaces shall be returned to their former condition, or as near as practicable, in the Engineer's opinion.
7. Maintain construction sites to ensure that drainage from these sites will minimize erosion of stockpiled or stored materials and the adjacent native soil material.
8. Furnish all labor, equipment, and means required and shall carry out effective measures wherever, and as often as necessary, to prevent Contractor's operations from causing visible dust emissions to leave the work areas. These measures shall include, but are not limited to, providing additional watering equipment, reducing vehicle speeds on haul roads, restricting traffic on haul roads, covering haul vehicles, and applying an Engineer-approved, environmentally safe, dust palliative to well traveled haul roads. The Contractor shall be responsible for damage resulting from dust originating from its operations. The dust abatement measures shall be continued for the duration of the Contract. Water the site in the morning and evening, and as often as necessary, and clean vehicles leaving the site as necessary to prevent the transportation of dust and dirt onto public roads. Dust control involving water shall be done in such a manner as to minimize waste and runoff from the site.
9. Construction staging areas shall be graded, or otherwise protected with Best Management Practices (BMPs), to contain surface runoff so that contaminants such as oil, grease, and fuel products do not drain towards receiving waters including wetlands, drainages, and creeks.
10. Furnish all labor, equipment and means required to prevent excessive noise from its Work activities. Comply with all local noise ordinances.
11. All construction equipment shall be properly serviced and maintained in good operating condition to reduce emissions. Contractor shall make copies of equipment service logs available upon request.
12. Any chemical or hazardous material used in the performance of the Work shall be handled, stored, applied, and disposed of consistent with all applicable federal, state, and local laws and regulations.
13. Contaminated materials excavated and/or removed from the construction area shall be disposed of consistent with all applicable local, state, and federal laws and regulations.

## C. Related Sections

1. Section 00 31 24 – Materials Assessment Information
2. Section 00 62 00 – Insurance Requirements
3. Section 01 14 00 – Work Restrictions
4. Section 01 35 24 – Project Safety Requirements
5. Section 01 50 00 – Temporary Facilities and Controls
6. Section 01 74 19 – Construction Waste Management and Disposal
7. Section 02 82 13 – Asbestos Hazard Control Activities
8. Section 02 83 13 – Lead Hazard Control Activities

## 1.2 DEFINITIONS

- A. Hazardous waste: A waste or combination of wastes as defined in 40 CFR 261.3, or regulated as hazardous waste in California pursuant to Chapter 11, Division 4.5, Title 22, California Code of Regulations, and Chapter 6.5, Division 20, California Health and Safety Code, or those substances defined as hazardous wastes in 49 CFR 171.8.
- B. See also Section 01 35 24, Article 1.2.

## 1.3 SUBMITTALS

### A. Storm Water Management

1. Permit Registration Documents (PRDs) and Notice of Termination (NOT)
  - a. The Contractor shall create a user account on the SWRCB's Storm Water Multi-Application & Report Tracking System (SMARTS). The Engineer will link the Contractor to the District's account as a Data Submitter. The Contractor shall prepare and upload to SMARTS Permit Registration Documents (PRDs), including, but not limited to, a Notice of Intent and a Storm Water Pollution Prevention Plan (SWPPP), for the Engineer's review, that meet the requirements of the SWRCB, for coverage under the General Construction Stormwater Permit (Order No. 2009-0009-DWQ) and amendments thereto. Upon acceptance by the Engineer, the Engineer will electronically certify and file the PRDs to gain permit coverage.
  - b. The Contractor shall be responsible for complying with the requirements of the General Construction Stormwater Permit. The Contractor's responsibilities include, but are not limited to, providing qualified professionals as described in the permit to prepare and certify all permit-required documents/submittals and to implement effective

stormwater/non-stormwater management practices, and conducting inspections and monitoring as required by the permit. The Contractor shall, in compliance with the permit, prepare and upload to SMARTS all required documents, photos, data, and/or reports (including the Annual Reports) and ensure permit coverage termination upon construction completion by preparing a Notice of Termination on SMARTS. The Contractor shall inform the Engineer when documents/reports are available on SMARTS for Engineer certification and submittal.

2. Alameda County Stormwater Permit
  - a. In addition to the State's General Construction Stormwater Permit, the Contractor shall obtain and comply with Alameda County Public Works Agency's Stormwater Permit to enable the inspection of C.6 construction stormwater BMPs.
3. Storm Water Pollution Prevention Plan
  - a. Submit for acceptance a Stormwater Pollution Prevention Plan that describes measures that shall be implemented to prevent the discharge of contaminated storm water runoff from the jobsite. Contaminants to be addressed include, but are not limited to soil, sediment, concrete residue, pH less than 6.5 or greater than 8.5, and chlorine residual.

B. Water Control and Disposal Plan:

1. Submit a detailed Water Control and Disposal Plan for the Engineer's acceptance prior to any work at the jobsite.
  - a. Plan shall comply with all requirements of the Specification and with regulations of the California Regional Water Quality Control Board, California Department of Fish and Wildlife, County Flood Control Districts, and any other regulatory agency having jurisdiction.
  - b. Plan shall include the sampling and analytical program for characterization of any wastewater, as needed, prior to disposal.
  - c. Plan shall describe measures for containment, handling, and disposal of groundwater (if encountered), runoff of water used for dust control, tank heel water, wash water, sawcut slurry, test water and construction water or other liquid that has been in contact with any interior surfaces of District facilities.
2. Obtain and provide to the Engineer documentation from the agency having jurisdiction, authorizing the Contractor to dispose of the liquid and describing the method of disposal. Where applicable, provide documentation indicating acceptance for disposal by a wastewater treatment plant or other disposal facility.

3. All information pertinent to the characterization of the liquid shall be disclosed to the District and the disposal facility. Submit copies of any profile forms and/or correspondence between the Contractor and the disposal facility.
4. Submit name and Environmental Laboratory Accreditation Program Certificate number of laboratory that will analyze samples for suspected hazardous substances. Include statement of laboratory's certified testing areas and analyses that laboratory is qualified to perform. Submit prior to any laboratory testing.

C. Construction and Demolition Waste Disposal Plan:

1. Prepare a Construction and Demolition Waste Disposal Plan and submit a copy of the plan for the Engineer's acceptance prior to disposing of any material (except for water wastes which shall be addressed in the Water Control and Disposal Plan).
  - a. The plan shall identify how the Contractor will remove, handle, transport, and dispose of all materials required to be removed under this contract in a safe, appropriate, and lawful manner in compliance with all applicable regulations of local, state, and federal agencies having jurisdiction over the disposal of removed materials.
  - b. Include a list of reuse facilities, recycling facilities and processing facilities that will be receiving recovered materials.
  - c. Identify materials that are not recyclable or not recovered which will be disposed of in a landfill (or other means acceptable by the State of California and local ordinance and regulations).
  - d. List the permitted landfill, or other permitted disposal facilities, that will be accepting the disposed waste materials.
  - e. Identify each type of waste material to be reused, recycled or disposed of and estimate the amount, by weight.
  - f. Plan shall include the sampling and analytical program for characterization of any waste material, as needed, prior to reuse, recycle or disposal.
2. Materials or wastes shall only be recycled, reused, reclaimed, or disposed of at locations approved of by the District, as provided in the list in Appendix \_\_\_\_\_.
3. Submit permission to reuse, recycle, reclaim, or dispose of material from reuse, recycling, reclamation, or disposal site owner along with any other information needed by the District to evaluate the acceptability of the proposed reuse, recycling, or disposal site and obtain acceptance of the Engineer prior to removing any material from the project site.



4. All information pertinent to the characterization of the material or waste shall be disclosed to the District and the reuse, recycling, reclamation, or disposal facility. Submit copies of any profile forms and/or correspondence between the Contractor and the reuse, recycling, reclamation, or disposal facility.
5. Submit name and Environmental Laboratory Accreditation Program Certificate number of laboratory that will analyze samples for suspected hazardous substances. Include statement of laboratory's certified testing areas and analyses that laboratory is qualified to perform. Submit prior to any laboratory testing.

D. Spill Prevention and Response Plan

1. Submit plan detailing the means and methods for preventing and controlling the spilling of known hazardous substances used on the jobsite or staging areas. The plan shall include a list of the hazardous substances proposed for use or generated by the Contractor on site, including petroleum products, and measures that will be taken to prevent spills, monitor hazardous substances, and provide immediate response to spills. Spill response measures shall address notification of the Engineer and appropriate agencies including phone numbers; spill-related worker, public health, and safety issues; spill control, and spill cleanup.
2. Submit a Material Safety Data Sheet (MSDS) for each hazardous substance proposed to be used prior to delivery of the material to the jobsite.

E. Dust Control and Monitoring Plan:

1. Submit a plan detailing the means and methods for controlling and monitoring dust generated by demolition and other work on the site for the Engineer's acceptance prior to any work at the jobsite. The plan shall also include measures for the control of paint overspray generated during the painting of exterior surfaces. The plan shall detail the equipment and methods used to monitor compliance with the plan. The handling and disposal of water used in compliance with the Dust Control Plan shall be addressed in the Water Control and Disposal Plan.
2. Containment, as described in Article 3.3, shall be utilized during any abrasive blasting of the exterior of structures.

F. Noise Control and Monitoring Plan

1. Submit a plan detailing the means and methods for controlling and monitoring noise generated by demolition and other work on the site for the Engineer's acceptance prior to any work at the jobsite. The plan shall detail the equipment and methods used to monitor compliance with the plan.

G. Vibration Control and Monitoring Plan

1. Submit a plan detailing the means and methods for controlling and monitoring surface vibration generated by demolition and other work on the site for the Engineer's acceptance prior to any work at the jobsite. The plan shall detail the equipment and methods used to monitor compliance with the plan.

#### H. Tuneup Logs

1. The Contractor shall submit a log of required tuneups for all construction equipment, particularly haul and delivery trucks, on a quarterly basis for review.

#### I. Hazardous Waste Manifests:

1. Contractor shall use the "Uniform Hazardous Waste Manifest," EPA form 8700-22. The manifest must be printed by a USEPA approved printer as listed at <http://www.epa.gov/epawaste/hazard/transportation/manifest/registry/printers.htm>. Contractor shall prepare and District will review all hazardous waste manifests for acceptability prior to use.
2. Submit the "Generator's Initial Copy" and a legible photocopy of the first page of hazardous waste manifests, land disposal restriction forms, or other documentation required by applicable regulations governing transport and disposal of hazardous wastes for disposal of hazardous substances within 5 days of offhaul.
3. Submit proof that the transporter is certified by the State to transport hazardous wastes prior to any offhaul of hazardous wastes.
4. Submit name of disposal site where hazardous waste will be disposed of for Engineer's approval. Hazardous waste may only be disposed of at hazardous waste disposal facilities approved by the District.

#### J. Analytical Test Results:

1. Submit laboratory analysis results of samples taken and analyzed, include collection methods, locations, and frequencies.
  - a. Include analytical methods for each material sampled.
  - b. Include sampling chain of custody from testing laboratory and QA/QC reports.
  - c. Specify any follow-up analysis to be run based on results.
  - d. Submit results of all follow-up analysis.
2. Provide characterization of all solid wastes, liquid wastes, and imported backfill materials to the Engineer prior to movement of those materials.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 SAMPLING AND ANALYSIS

- A. Contractor is responsible for characterizing all solid wastes, liquid wastes, and imported backfill materials.
- B. Sampling and Testing of Materials:
  - 1. All sampling and testing shall be performed by a laboratory that complies with and is certified under the Environmental Laboratory Accreditation Program (ELAP) of the California Department of Health Services.
  - 2. Sampling and analysis of wastes shall be conducted according to methods listed in Environmental Protection Agency Document SW 846. Sampling and analysis of wastes and solids shall be representative of total waste volume.
  - 3. Each sample shall have an identifying sample number assigned by the Contractor when the sample is taken. Sample number shall be included on the sampling chain of custody and in all reports, correspondence, and other documentation related to the sample. Each sample shall have a sampling chain of custody. Chain of custody shall show the name and organization of each person having custody of the sample, and shall also show the sample number, job name and location, time of day and date sample taken, material sampled, and tests to be performed.
  - 4. Engineer will witness sampling and may take samples for District records and for additional analyses if required. Notify the Engineer at least 24 hours prior to sampling.
  - 5. Contractor is responsible for sampling and testing all imported backfill materials prior to delivering on site.

3.2 WASTE DISPOSAL

- A. Engineer will review laboratory analysis results for District acceptance of Contractor Characterization of waste classification.
- B. Engineer will obtain a Hazardous Waste Generator's EPA ID Number if required for disposal of hazardous wastes.
- C. Engineer will give Contractor written notice to dispose of all or a portion of the waste material at a Class I disposal site if the Engineer determines that such disposal is required based on review of Contractor's waste characterization and the analytical results of samples collected. Additional payment for disposal (transport and dispose) at Class I site will be under Bid Items \_\_\_\_ . Additional payment for disposal (transport and dispose) at Class I site will be in accordance with Article 7

of the General Conditions. Non-hazardous waste shall be disposed as outlined in the approved Construction and Demolition Waste Disposal Plan.

- D. Waste materials from different sites shall not be transported or mixed until the material is determined to be non-hazardous. Excavation materials shall be stored or stockpiled at each site until classified and accepted for movement by the Engineer.
- E. Transport materials in accordance with all local, state, and federal laws, rules, and regulations.
- F. Contractor shall be responsible for all costs of disposal of construction and demolition waste material and liquid wastes, along with any waste generated by the Contractor's work including Hazardous Waste generated from hazardous materials identified in Document 00 31 24 Material Assessment Information except as outlined in paragraph C.

### 3.3 DUST CONTROL AND MONITORING

#### A. Dust Control During Abrasive Blasting:

- 1. Provide a containment system for the structure prior to beginning abrasive blasting operations. The system shall remain in place during the abrasive blasting operations and the painting of exterior surfaces.

#### B. Dust Control

- 1. Contractor shall implement all necessary dust control measures, including but not limited to the following:
  - a. Water and/or coarse rock all dust-generating construction areas as directed by Engineer to reduce the potential for airborne dust from leaving the site.
  - b. Cover all haul trucks entering/leaving the site and trim their loads as necessary.
  - c. Using wet power vacuum street sweepers to:
    - 1) Sweep all paved access road, parking areas and staging areas at the construction site daily or as often as necessary.
    - 2) Sweep public roads adjacent to the site at least twice daily or as often as necessary.
  - d. Gravel or apply non-toxic soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
  - e. Water and/or cover soil stockpiles daily.
  - f. Hydroseed or otherwise stabilize exposed soil/rock side slopes.

- g. Restrict on-site construction vehicle speeds to fifteen (15) mph or less.

C. Dust Monitoring During Demolition and Construction:

1. Provide air monitoring per the Dust Control and Monitoring Plan along the perimeter of the job site. A minimum of 4 stations, one on each side of the District property, shall be established, capable of daily measurement of total particulate concentration when any dust generating activity is occurring.
  - a. All environmental and personal air sampling equipment shall be in conformance with the Association of Industrial Hygiene and National Institute of Safety and Health (NIOSH) standards.
  - b. All analysis shall be completed by a California Department of Health Services certified laboratory for the specific parameters of interest.
  - c. The Contractor shall provide to the Engineer, within 72 hours of sampling all test results.
- D. The dust control system shall comply with the Dust Control and Monitoring Plan, the requirements of this section, and any applicable laws and regulations.

3.4 EMISSIONS CONTROL

A. Air Quality and Emissions Control

1. The Contractor shall ensure that line power is used instead of diesel generators at all construction sites where line power is available.
2. The Contractor shall ensure that for operation of any stationary, compression-ignition engines as part of construction, comply with Section 93115, Title 17, California Code of Regulations, Airborne Toxic Control Measure for Stationary Compression Ignition Engines, which specifies fuel and fuel additive requirements as well as emission standards.
3. Fixed temporary sources of air emissions (such as portable pumps, compressors, generators, etc.) shall be electrically powered unless the Contractor submits documentation and receives approval from the Engineer that the use of such equipment is not practical, feasible, or available. All portable engines and equipment units used as part of construction shall be properly registered with the California Air Resources Board or otherwise permitted by the appropriate local air district, as required.
4. Contractor shall implement standard air emissions controls such as:
  - a. Minimize the use of diesel generators where possible.
  - b. Limit idling of off-road compression ignition vehicles to 5 minutes or less.

- c. Minimize unnecessary idling of mobile construction equipment.
  - d. Follow applicable regulations for fuel, fuel additives, and emission standards for stationary, diesel-fueled engines.
  - e. Locate generators at least 100 feet away from adjacent homes and ball fields.
  - f. Perform regular low-emission tune-ups on all construction equipment, particularly haul trucks and earthwork equipment.
5. Contractor shall implement the following measures to reduce greenhouse gas emissions from fuel combustion:
- a. On road and off-road vehicle tire pressures shall be maintained to manufacturer specifications. Tires shall be checked and re-inflated at regular intervals.
  - b. Construction equipment engines shall be maintained to manufacturer's specifications.
  - c. Demolition debris shall be recycled for reuse to the extent feasible (excluding wood treated with preservatives).

B. Architectural Coatings

- 1. Architectural coatings used shall comply with appropriate Volatile Organic Compound limits as established in the Bay Area Air Quality Management District's Regulation 8, Rule 3 and/or the San Joaquin Valley Air Pollution Control District's Regulation IV, Rule 4601, and any amendments thereto.

3.5 VIBRATION CONTROL

- A. Limit surface vibration to no more than 0.5 in/sec PPV, measured at the nearest residence or other sensitive structure. See Section 01 14 00.

3.6 NOISE CONTROL

- A. Comply with sound control and noise level rules, regulations and ordinances as required herein and in the CEQA documents which apply to any work performed pursuant to the contract.
- B. Contractor is responsible for taking appropriate measures, including muffling of equipment, selecting quieter equipment, erecting noise barriers, modifying work operations, and other mitigations as needed to bring construction noise into compliance.
- C. Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer.

No internal combustion engine shall be operated on the project without said muffler.

- D. Best available noise control techniques (including mufflers, intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds) shall be used for all equipment and trucks, as necessary.
- E. Truck operations (haul trucks and concrete delivery trucks) will be limited to the daytime hours specified in Section 01 14 00.
- F. Stationary noise sources shall be located as far from sensitive receptors as possible. If they must be located near receptors, adequate muffling (with enclosures) shall be used. Enclosure opening or venting shall face away from sensitive receptors. Enclosures shall be designed by a registered engineer regularly involved in noise control analysis and design.
- G. Material stockpiles as well as maintenance/equipment staging and parking areas (all on-site) shall be located as far as practicable from residential receptors.
- H. If impact equipment is used, Contractor is responsible for taking appropriate measures, including but not limited to the following:
  - 1. If impact equipment (e.g., jack hammers, pavement breakers, and rock drills) is used during project construction, hydraulically or electric-powered equipment shall be used wherever feasible to avoid the noise associated with compressed-air exhaust from pneumatically powered tools. However, where use of pneumatically powered tools is unavoidable, an exhaust muffler on the compressed-air exhaust shall be used (a muffler can lower noise levels from the exhaust by up to about 10 dB). External jackets on the tools themselves shall be used, where feasible, which could achieve a reduction of 5 dB. Quieter procedures, such as drilling rather than impact equipment, will be used whenever feasible. It is the Contractor's responsibility to implement any mitigations necessary to meet applicable noise requirements.
  - 2. Erect temporary noise barriers or noise control blankets around the construction site, particularly along areas adjacent to residential buildings.
  - 3. Utilize noise control blankets around the major noise sources to reduce noise emission from the site.
  - 4. Evaluate the feasibility of noise control at the receivers by temporarily improving the noise reduction capability of adjacent buildings by the use of sound blankets for example.
  - 5. Limit the noisiest phases of construction to 10 work days at a time, where feasible.
  - 6. Notify neighbors/occupants within 300 feet of project construction at least thirty days in advance of extreme noise generating activities about the estimated duration of the activity.

END OF SECTION



# ENVIRONMENTAL COMPLIANCE MANUAL

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## 5.0 HAZARDOUS MATERIALS MANAGEMENT

### 5.1 Introduction

This section summarizes the District's hazardous materials management programs, including Hazardous Materials Business Plans (Section 5.3), California's Accidental Release Prevention Program (Section 5.4), Underground Storage Tanks (Section 5.5), and Aboveground Storage Tanks (Section 5.6).

### 5.2 Definitions of Key Terms

**Accidental Release Prevention Program:** A program designed to prevent accidental releases of substances that can cause serious harm to the public and the environment from short-term exposures and to mitigate the severity of releases that do occur.

**Business:** An employer, self-employed individual, trust, firm, joint stock company, corporation, partnership or association including businesses organized for profit and nonprofit. The law also includes the federal government, the California Community Colleges, the California State University, the University of California, and any cities, counties, and districts.

**Certified Unified Program Agency (CUPA):** A State-approved local administrative agency authorized to implement and enforce local and state requirements for six related programs: HMBPs, Accidental Release Prevention Programs, USTs, ASTs, hazardous waste generation, and hazardous waste treatment.

**Contingency Plan:** A document that describes spill response measures for facility staff to implement.

**Extremely Hazardous Substance (EHS):** Any substance or material listed on the federal list of extremely hazardous substances specified in Chapter 40 of the Code of Federal Regulations, Part 355 (40 CFR 355), Appendix A.

**Hazardous material:** Any material that, because of its quantity, concentration, or physical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. As specified in Chapter 6.95 of the California Health and Safety Code, Section 25501 (6.95 HSC 25501), hazardous materials include, but are not limited to, hazardous substances, hazardous waste, and any material which the handler or the CUPA has a reasonable basis for believing would be injurious to the public health and safety or to the environment if released.

**Oil:** Any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil. This includes crude oil, petroleum, and petroleum-refined products, as well as non-petroleum oils such as vegetable oils, animal fats, and essential oils.

**Primary Containment:** First level of containment, where the hazardous substance comes into immediate contact with the inner surface of the underground tank or piping.

**Risk Management Plan (RMP):** A plan that documents programs and procedures that are designed based on a hazard assessment to prevent and prepare for accidental releases of regulated toxic and flammable substances and to minimize potential offsite impacts.

**Secondary Containment:** Containment that is external to and separate from the primary containment.

**SIC:** Standard Industrial Classification number. This classification is used to identify the types of industries in the U.S.

**Spill Prevention Control and Countermeasures (SPCC) Plan:** A plan that describes the containment measures that a facility has in place to prevent oil from entering navigable waters (see Section 3.0 of this manual for definition of “navigable waters”).

**Storage Vessel:** Any tank, reservoir, or container.

**Threatened release:** A condition creating a substantial probability of harm, when the probability and potential extent of harm make it reasonably necessary to take immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment [6.95 HSC 25501(v)].

**Threshold quantity:** The quantity of hazardous materials at which local, state, or federal regulations require notification.

## 5.3 Hazardous Materials Business Plans (HMBPs)

### 5.3.1 Background

A Hazardous Materials Business Plans (HMBP) is a document that provides detailed information about:

- the types, quantities and locations of hazardous materials handled at a facility,
- the emergency response plans and procedures that are in place in the event of a release of a hazardous material,
- the initial and annual training for all employees on safety procedures in the event of a release or threatened release of a hazardous material.

HMBPs are required by local, state, and federal regulations and are intended to provide information to emergency responders (e.g., fire departments) regarding the potential hazards they may encounter at a site. The owner of any facility handling hazardous materials above specified threshold quantities is responsible for preparing and maintaining a HMBP.

### 5.3.2 Roles and Responsibilities

#### 5.3.2.1 District Work Groups

District staff, at facilities that require HMBPs, are responsible for notifying ECS staff of significant changes at the facility including, but not limited to, the following events:

- A 100 percent or more increase in the quantity of a hazardous material handled onsite;
- Any change in the storage location or the type of container in which a hazardous material above the threshold quantity is stored;
- Any change to the facility layout or any change to the emergency response plan.

In addition, District staff at facilities requiring HMBPs are responsible for:

- Providing hazardous materials inventory, emergency response plan, and other information, as requested by ECS staff, in a timely manner;
- Designating a facility representative to provide hazardous materials information and to participate in agency inspections;
- Designating a facility or departmental representative to be the Responsible Person for the Emergency Response Plan;

- Certifying the HMBP; and
- Maintaining a copy of the current HMBP at the site and being familiar with its contents.

#### 5.3.2.2 ECS Staff

ECS staff serves as the liaison between the District and the CUPAs. Their responsibilities include, but are not limited to:

- Conducting annual site visits at District facilities required to maintain HMBPs to verify accuracy;
- Incorporating data provided by the facility staff into an HMBP (e.g., assembling and formatting the hazardous material inventory, facility diagram, and emergency response plan), routing the HMBP for internal review, and submitting the HMBP to the appropriate CUPA;
- Maintaining duplicate hard copy files of each HMBP;
- Keeping abreast of legal and regulatory changes and providing guidance to facility staff of any changes requiring action;
- Conducting annual training;
- Coordinating and participating in facility inspections;
- Coordinating payment of fees; and
- Handling all communications between the District and the CUPAs, including HMBP transmittals, exception follow-ups, requests for information, and other correspondence as necessary.

#### 5.3.3 Summary of Applicable Regulations

The federal laws pertaining to HMBPs are specified in 42 USC 11022. The federal reporting requirements are specified in the Superfund Amendments and Reauthorization Act (SARA), Title III, in 40 CFR 370. These regulations require facilities handling certain types and quantities of hazardous materials to establish and implement a hazardous materials business plan consisting of: (1) an inventory of hazardous materials; (2) emergency response plans and procedures; and (3) training program information.

The State laws pertaining to HMBPs (e.g., the Hazardous Materials Release Response Plans and Inventory Act) are specified in 6.95 HSC 25500. The State regulations that specify the reporting requirements are specified in Title 19 of the California Code of Regulations (19 CCR), Division 2, Chapter 4, Article 4, Sections 2729 through 2732. A business is in compliance with federal laws when it submits its inventory on the state approved HMBP inventory forms. Typically, a facility is required to complete an HMBP when quantities equal or exceed 55 gallons of liquid, 500 pounds of a solid, and 200 cubic feet of compressed gas.

A CUPA may adopt either the state regulations or their own local HMBP ordinance; however, such ordinance must be at least as stringent as state and federal regulations. Of the CUPAs that oversee the administration of HMBPs for District facilities, only Contra Costa County and the City of Oakland have local ordinances. Table 5-1 summarizes the contact information, threshold quantities, and update requirements specific to each CUPA with jurisdiction over District facilities.

**Table 5-1: Specific CUPA Requirements**

CUPA	Threshold Quantity	Update Requirements
Alameda County Health Agency Division of Environmental Protection Department of Environmental Health 1131 Harbor Bay Parkway, 2 <sup>nd</sup> Floor Alameda, CA 94502 510-567-6700 <a href="http://www.acgov.org/aceh/index.htm">http://www.acgov.org/aceh/index.htm</a>	Standard (2)	Submit changes only
Amador County Health Department 810 Court St. Jackson, CA 95642 209-223-6439 <a href="http://www.co.amador.ca.us/index.aspx?page=379">http://www.co.amador.ca.us/index.aspx?page=379</a>	Standard (2)	Submit changes only
Calaveras County Government Center Environmental Management Agency 891 Mountain Ranch Road San Andreas, CA 95249 209-754-6399 <a href="http://www.co.calaveras.ca.us/cc/Departments/EnvironmentalManagementAgency/EnvironmentalHealthDepartment.aspx">http://www.co.calaveras.ca.us/cc/Departments/EnvironmentalManagementAgency/EnvironmentalHealthDepartment.aspx</a>	Standard (2)	Submit changes only
City of Berkeley Planning and Development Dept Toxics Management Division 2120 Milvia Street, 3 <sup>rd</sup> Floor Berkeley, CA 94704 (510) 981-7460 <a href="http://www.ci.berkeley.ca.us/SubUnitHome.aspx?id=23580">http://www.ci.berkeley.ca.us/SubUnitHome.aspx?id=23580</a>	Combined aggregate quantities of liquids, solids or gases above standard thresholds	Full submittal
City of Oakland Fire Services Agency 250 Frank Ogawa Plaza, Suite 3341 Oakland, CA 94612 510-238-3851 <a href="http://www.oaklandnet.com/fire/fpb/hazmat/">http://www.oaklandnet.com/fire/fpb/hazmat/</a>	Standard (2) except limit for liquids is $\geq 30$ gal	Submit changes only
Contra Costa Health Services Environmental Division 4585 Pacheco Boulevard Martinez, CA 94553-2295	Standard (2)	Full submittal (3)

925-335-3200 <a href="http://www.cchealth.org/groups/hazmat/">http://www.cchealth.org/groups/hazmat/</a>		
San Joaquin County Office of Emergency Services 2101 E. Earhart Ave., Suite 300 Stockton, CA 95206 209-468-3969 <a href="http://www.sjgov.org/oes/default.htm">http://www.sjgov.org/oes/default.htm</a>	Standard (2)	Full submittal (3)

1. For additional details regarding fees, see Section 5.3.7.
2. Standard threshold quantities are  $\geq 55$  gallons of a liquid,  $\geq 500$  pounds of a solid, or  $\geq 200$  cubic feet of a gas, or, for an EHS, equal to or greater than the applicable federal threshold planning quantity.
3. This agency sends out a package of forms and instructions annually.

#### 4. 5.3.4 EBMUD Facilities Subject to HMBP Requirements

Tables 5-2 lists the District facilities, by CUPA jurisdiction, that are required to maintain HMBPs. The tables also identify the District work group that is responsible for the facility, a partial list of the types of hazardous materials handled at each location, and the annual fees paid to the CUPA. The fees include, where applicable, HMBP fees, underground storage tank fees, aboveground storage tank fees, Cal-ARP fees, hazardous waste generator fees, and state surcharges.

Table 5-2: District Facilities Requiring HMBPs			
Within Alameda County Jurisdiction			
Facility	Responsible Party	Types of Hazardous Materials (1)	Annual Fee (2)
Pump Station R	Wastewater Trmt Div	diesel	\$318
Pump Station B	Wastewater Trmt Div	diesel	\$233
Pump Station C	Wastewater Trmt Div	diesel	\$318
Pump Station F	Wastewater Trmt Div	diesel	\$318
Pump Station M	Wastewater Trmt Div	diesel	\$318
South Area Service Center	DMC	gasoline, diesel, used oil, acetylene	\$2,629
Hypolimnetic Oxygenation System, USL Reservoir	Water Quality	liquid oxygen, diesel	\$2,041
Within Amador County Jurisdiction			
Facility	Responsible Party	Types of Hazardous Materials (1)	Annual Fee (2)
Camanche North Shore	Mokelumne Watershed and Recreation	gasoline, sodium hypochlorite	\$529
Camanche Hills Hunt	Concessionaire	gasoline	3



Club			
Pardee Powerhouse	Pardee Section	gasoline, oil	\$529
Pardee Rec Area	Mokelumne Watershed and Recreation	gasoline, sodium hypochlorite	\$529
<b>Within Calaveras County Jurisdiction</b>			
<b>Facility</b>	<b>Responsible Party</b>	<b>Types of Hazardous Materials (1)</b>	<b>Annual Fee (2)</b>
Camanche South Shore	Mokelumne Watershed and Recreation	diesel, sodium hypochlorite	\$361
Mokelumne Office	Mokelumne Watershed and Recreation	gasoline	\$227
Pardee Center	Pardee Section	gasoline, sodium hypochlorite	\$405
<b>Within City of Berkeley Jurisdiction</b>			
<b>Facility</b>	<b>Responsible Party</b>	<b>Types of Hazardous Materials (1)</b>	<b>Annual Fee (2)</b>
Pump Station Q	Wastewater Trmt Div	diesel	\$1,737
Claremont Center	Water Distribution	diesel	\$1,737
<b>Within City of Oakland Jurisdiction</b>			
<b>Facility</b>	<b>Responsible Party</b>	<b>Types of Hazardous Materials (1)</b>	<b>Annual Fee (2)</b>
AMC Admin Bldg	FMC	diesel	\$361
AMC Shops/Warehouse	FMC	sodium hypochlorite, used oil	\$2,102
Fleet Maintenance	FMC	used antifreeze, used oil	\$3,981
Adeline Fuel Facility	FMC	gasoline, diesel	\$1,990
Admin Bldg	FMC	diesel	\$719
Oakport Storage Facility	Purchasing	gasoline, diesel	\$730
Oakport WW Facility	Wastewater Trmt Div	diesel, sodium hypochlorite, sodium metabisulfite	3
Pump Station G	Wastewater Trmt Div	diesel	\$361
Pump Station H	Wastewater Trmt Div	diesel	\$361
Pump Station J	Wastewater Trmt Div	diesel	\$361
Pump Station K	Wastewater Trmt Div	diesel	\$361
San Antonio Creek WW Facility	Wastewater Trmt Div	diesel, sodium hypochlorite, sodium metabisulfite	3
SD-1 Main Wastewater Treatment Plant	Wastewater Trmt and Laboratory Services Division	diesel, gasoline, oil and waste oils, polymers, sodium hypochlorite, sodium bisulfite	\$361
Upper San Leandro WTP	Water Treatment Division	diesel, polymers, aluminum sulfate, ammonium	\$1,700

		hydroxide, hydrofluorosilicic acid, hydrogen peroxide, potassium permanganate, sodium hypochlorite, sodium hydroxide	
<b>Within Contra Costa County Jurisdiction</b>			
Facility	Responsible Party	Types of Hazardous Materials (1)	Annual Fee (2)
Bixler Chlorination Facility	Aqueduct Section	diesel, gasoline, sodium hypochlorite	\$3,277
Briones Disinfection Facility	Water Treatment Div	sodium hypochlorite	\$718
Danville Pumping Plant	Water Distribution	diesel	\$3,825
East Area Service Center	DMC	gasoline, diesel	currently not operating
Lafayette WTP	Water Treatment Div	diesel, polymers, ammonium hydroxide, hydrofluorosilicic acid, sodium hypochlorite, sodium hydroxide	\$14,000
Moraga Pumping Plant	Aqueduct Section	oil	\$718
North Area Service Center	DMC	gasoline, diesel	\$2,490
North Richmond Reclamation Center	Wastewater Trmt Div	hydrochloric acid, oil and waste oils, polymers, sodium hypochlorite, sodium hydroxide, sulfuric acid	3
Orinda WTP	Water Treatment Div	diesel, polymers, ammonium hydroxide, hydrofluorosilicic acid, sodium hypochlorite, sodium hydroxide	\$14,200
Orinda Watershed Headquarters	Watershed and Recreation Division	gasoline, diesel	\$3,113
Point Isabel WW Facility	Wastewater Trmt Div	diesel, sodium hypochlorite, sodium bisulfite	3
Pump Station N	Wastewater Trmt Div	diesel	3
Pump Station S	Wastewater Trmt Div	diesel	3
San Pablo Rec. Area	Concessionaire	gasoline	paid by concessionaire
San Ramon Service Area (Castanada)	DMC	gasoline, diesel	\$1,490
San Pablo WTP	Water Treatment Div	diesel	\$1,566
Sobrante WTP	Water Treatment Div	diesel, polymers, ammonium hydroxide, hydrofluorosilicic acid, sodium hypochlorite, sodium hydroxide	\$14,870

Walnut Creek PP 1&2	Aqueduct Section	gasoline, diesel	\$2,033
Walnut Creek PP 3	Aqueduct Section	diesel	\$329
Walnut Creek WTP	Water Treatment Div	diesel, polymers, ammonium hydroxide, hydrofluorosilicic acid, sodium hypochlorite, sodium hydroxide	\$14,000
<b>Within San Joaquin County Jurisdiction</b>			
<b>Facility</b>	<b>Responsible Party</b>	<b>Types of Hazardous Materials (1)</b>	<b>Annual Fee (2)</b>
Camanche Powerhouse	Pardee Section	oil	\$622
Mokelumne Fish Hatchery	CA Dept. of Fish and Game	gasoline	paid by CA DFG
Stockton Center	Aqueduct Section	gasoline	\$712

1. This is not an all-inclusive list of the hazardous materials onsite, but simply those handled in large quantities.
2. Fees shown are the amounts paid in FY10
3. Fee amount not available.

### 5.3.5 HMBP Elements

HMBPs must contain the following elements:

- An inventory of all hazardous materials handled onsite in quantities equal to or greater than the specified threshold quantities and a facility diagram showing the layout of the facility and hazardous material storage locations.
- Emergency response plans and procedures to be followed in the event of a release or threatened release of a hazardous material, including at minimum, notification, release mitigation, and evacuation procedures. Typically, the emergency response plans are checklist items provided by the CUPA
- Training program information.

If the CUPA for a given facility sends out an annual HMBP update package, follow the instructions provided with the package in preparing the plan. If the CUPA does not send out an annual HMBP preparation package, there are three possible sources for guidance in preparing a plan:

- **A prior plan prepared for the facility**, if it is relatively recent. Be aware that HMBP program requirements change over time, so both the content and format of the prior plan may or may not fulfill the current regulatory

requirements. Any prior plan must be updated to reflect the facility's current hazardous materials inventory, emergency response plan, and training procedures.

- **Visit <http://www.unidocs.org/catalog.html>.** Unidocs provides numerous standardized forms for HMBPs, underground and aboveground tanks, hazardous waste. Unidocs is recognized by many of the local CUPAs.
- **State regulations and local ordinances** are the ultimate source for guidance in preparing a HMBP. If the HMBP conforms to these requirements, the plan will be in compliance.

By January 1, 2013, all businesses will be required to file the HMBPs electronically through the Internet, using the California Environmental Reporting System (CERS). San Joaquin County is the only CUPA that requires electronic submittal of the HMBPs.

HMBP preparation requires much detailed information, some of which is common throughout District facilities. This information includes Dun & Bradstreet numbers, SIC codes, parcel numbers, and the Board of Equalization number for District facilities, as well fire code hazard classes and federal hazard categories for hazardous materials and state waste codes for hazardous wastes commonly handled at District facilities. This information is maintained by and available from ECS staff.

### 5.3.6 HMBP Update Requirements

State regulations require that the hazardous materials inventory be updated annually and submitted on or before March 1. If there are no inventory changes, the facility submits a signed certification statement to the CUPA. If there are inventory changes, the facility must submit a signed Business Owner/Operator page for the current reporting year and Updated Chemical Description pages showing the additions, deletions, or revisions to the previously submitted hazardous materials inventory. The entire HMBP (including the emergency response plan and training information) must be reviewed at least every 3 years and certified as being accurate.

The regulations also require a facility to submit amendments within 30 days of:

- A 100% or more increase in the quantity of a previously disclosed material;
- Any handling of a previously undisclosed hazardous material above the reportable threshold quantity; or

- A change of business address, business ownership, or business name.

In practice, San Joaquin County is the only CUPA that requires an annual submittal of the entire HMBP. The other CUPAs allow a certification that there have been no changes, or submittal of the pages that have revised information.

### 5.3.7 Fees

CUPAs are legally allowed to charge fees to recover the cost of administering the program from local governments. Each CUPA sets its own fees. Fees are typically based on the amount of chemicals stored, and may include factors such as number of employees and square footage of the facility.

### 5.3.8 Inspections

CUPAs are required to inspect facilities with HMBPs at least once every three years. Inspections may occur more frequently, depending upon the inspector's workload and level of hazard the facility may pose. Each agency has different inspection protocols that may vary over time and with individual inspectors. For example, some agencies document their findings in an inspection report and provide a copy to the District following the inspection, while others may only provide verbal comments.

### 5.3.9 Fines and Penalties

CUPAs may assess civil penalties of up to \$2,000 for each day in which a violation occurs. Any business that knowingly violates after reasonable notice of the violation may be liable for up to \$5,000 per day in civil penalties. If the violation results in, or significantly contributes to, an emergency, the full cost of the response may be assessed. Failure to report any release or threatened release to the CUPA or failure to provide access to the facility to state, city, county fire, public health and safety, or emergency rescue personnel is punishable by fines of up to \$25,000 for each day of the violation and/or imprisonment for up to one year.

### 5.3.10 Training

Businesses subject to the HMBP requirements must provide training that is reasonable and appropriate for the size of the business and the nature of the hazardous materials handled. The training must take into account the position of the employee (e.g. those who are not responsible for responding to a release and are not likely to come into contact with any hazardous materials at

materials at the facility may receive a lower level of training than those who are likely to respond to a release and/or handle hazardous materials). Initial and refresher training (the regulations do not specify a time period within which employees must be trained) must be provided to appropriate employees and must, at a minimum, include:

- Methods for safe handling of hazardous materials;
- Procedures for coordination with local emergency response organizations;
- Use of emergency response equipment and supplies under the control of the handler; and
- Emergency response plans and procedures associated with releases of hazardous materials.

#### 5.3.11 Recordkeeping

The recordkeeping requirements associated with HMBP regulations are to:

- Retain a copy of the current HMBP for a given facility at that facility; and
- Maintain records documenting employee training on emergency response plans and procedures.

## 5.4 California Accidental Release Prevention Program

### 5.4.1 Background

The California Accidental Release Program (CalARP) was established to prevent accidental releases of those substances determined to potentially pose the greatest risk of immediate harm to the public and the environment. CalARP requirements go beyond HMBP requirements in that facilities that store or use certain hazardous materials in excess of threshold quantities (e.g., ammonium hydroxide) must develop and implement a Risk Management Plan (RMP) that documents the programs and procedures that are designed to prevent and prepare for accidental releases, and that assesses and minimizes potential offsite hazards.

## 5.4.2 Roles and Responsibilities

### 5.4.2.1 District Work Groups

District staff at facilities that are subject to the CalARP requirements are responsible for:

- Notifying ECS staff of significant changes at the facility;
- Providing ECS staff with required information (e.g., process and instrumentation drawings, operating procedures, and specifications);
- Participating in hazard assessments when required;
- Participating in CUPA inspections when required;
- Certifying the RMP; and
- Implementing the RMP.

### 5.4.2.2 ECS Staff

ECS staff serves as the liaison between the District and the CUPAs. Their responsibilities include, but are not limited to:

- Developing the RMP for each applicable facility;
- Conducting site visits at District facilities to verify accuracy;
- Keeping abreast of legal and regulatory changes and providing guidance to facility staff of any changes requiring action;
- Coordinating and participating in facility inspections;
- Coordinating payment of fees; and
- Handling all communications between the District and the CUPAs, including transmittals, exception follow-ups, requests for information, and other correspondence as necessary.

### 5.4.3 Summary of Applicable Regulations

#### 5.4.3.1 Federal Regulations

The federal Accidental Release Prevention Program (Title 40, Code of Federal Regulations, Part 68), as mandated by the Clean Air Act Amendments of 1990, became effective June 1996. The federal program regulates facilities that have a greater than a threshold quantity of a regulated substance in a process. The list of federally-regulated substances includes 77 toxic chemicals and 63 flammable substances. Ammonia hydroxide solutions having a concentration less than 20% and digester gas are exempt from the federal program. Because of these exemptions, the federal regulations do not apply to District facilities.

#### 5.4.3.2 State Regulations

The California Accidental Release Prevention (CalARP) Program (Title 19, Division 2, Chapter 4.5 of the California Code of Regulations) became effective June 24, 2004. The CalARP regulation is more stringent than the federal program in the following areas: it regulates 276 toxic chemicals (versus 77); the threshold quantities of the chemicals are lower; it requires an external events analyses be performed, including a seismic analysis; it requires more interaction with the public and agencies; and ammonia hydroxide solutions having a concentration less than 20% are **not** exempt from the state program. As a result, the District's water treatment plants are covered under the state requirements.

### 5.4.4 District Facilities Subject to CalARP Requirements

Table 5-9 provides a listing of facilities subject to the CalARP requirements.



**Table 5-9: District Facilities Requiring RMPs**

Facility Name	CUPA	Regulated Substance	Program (1)	Fee (2)
Lafayette WTP	Contra Costa Health Services	ammonium hydroxide	1	\$2,185
Orinda WTP	Contra Costa Health Services	ammonium hydroxide	1	\$2,461
San Pablo WTP	Contra Costa Health Services	ammonium hydroxide	1	\$0
Sobrante WTP	Contra Costa Health Services	ammonium hydroxide	1	\$2,185
Upper San Leandro WTP	City of Oakland	ammonium hydroxide	1	NA
Walnut Creek WTP	Contra Costa Health Services	ammonium hydroxide	1	\$2,449

1. San Pablo WTP is out of commission. Should it be placed into operation for any length of service, a new RMP reflecting the aqueous ammonia process as Program 2 must be prepared and submitted to the CUPA.
2. Fee includes both State and CUPA fees.

#### 5.4.5 CalARP Elements

The CalARP regulation requires facilities to develop Risk Management Plans (RMPs) that document the programs and procedures that are designed to prevent and prepare for accidental releases of regulated toxic and flammable substances and to minimize potential offsite impacts. All RMPs must go through a comprehensive audit by the CUPA and a 45-day formal public review and comment period. There are three RMP program levels, depending on the facility's potential for impacting the public based on a hazard assessment and the facility's five-year accident history.

- **Program 1** facilities are those that contain a regulated substance above the state or federal threshold, but under a worst-case release scenario would not result in impacting the public above criteria set forth in the regulations, and those that have had no accidents with specific offsite consequences within the past five years. Program 1 facilities are required to develop, implement, and maintain a hazard assessment, worst-case release scenario, five-year accident history, and an Emergency Response Program.
- **Program 2** facilities are not eligible for Program 1 or Program 3. In addition to the Program 1 requirements, Program 2 facilities must also evaluate alternative release scenarios and develop, implement, and maintain a Prevention Program, which includes safety information, a hazard review, operating procedures, training, maintenance, incident investigations, compliance audits, and a management system to oversee the prevention program.

- **Program 3** facilities are those either subject to the OSHA's Process Safety Management standard and/or a petroleum refiner or chemical manufacturer. In addition to the Program 2 requirements, Program 3 facilities must also include in their Prevention Program a Process Hazard Analysis, a Management of Change procedure, pre-startup safety reviews, employee participation, contractors, and hot work permits.

The RMPs must be submitted to the CUPA, which, as the administrative agency, is also responsible for making the document available to government agencies and the public.

#### 5.4.6 RMP Update Requirements

State regulations require that the RMP be updated whenever a significant change occurs or at least every five years.

#### 5.4.7 Fees

RMP fees are assessed by both the state and the CUPA, see fees listed in Table 5-9.

#### 5.4.8 Inspections

Inspections are carried out by the CUPA.

#### 5.4.9 Fines and Penalties

The owner or operator of a stationary source that violates the statutes or regulations established for the CalARP Program may be liable for penalties or enforcement pursuant to provisions in Article 2 of Chapter 6.95 of the California Health and Safety Code, beginning with Section 25540, which includes civil liabilities ranging from \$2,000 to \$50,000 for each day in which the violation occurs.

#### 5.4.10 Training

Staff should be trained on the contents of the RMP, standard operating procedures for the ammonium hydroxide system, proper use of spill equipment, and appropriate spill responses. Training overlaps Hazwoper, Hazcom and HMBP training. A copy of the RMP must be available for employee use.

### 5.4.11 Recordkeeping

The recordkeeping requirements associated with the CalARP regulations are to:

- Retain a copy of the current RMP for a given facility at that facility; and
- Maintain records documenting employee training on the RMP, standard operating procedures, and emergency response plans and procedures for at least five years.

### 5.4.12 Spills and Leaks

Spills should be reported as outlined in the RMP.

## 5.5 Underground Storage Tanks (USTs)

### 5.5.1 Background

The District owns and operates 15 underground storage tanks (USTs) containing hazardous materials at 9 sites located in Alameda and Contra Costa Counties. This section addresses the various federal, state, and local laws set forth for regulating USTs that contain hazardous materials. These requirements and the District's obligations are discussed in the following sections.

### 5.5.2 Roles and Responsibilities

#### 5.5.2.1 District Work Groups

District staff are responsible for the operation and maintenance of the USTs including, but not limited to the following:

- Notifying ECS of any new installations, removals, or releases;
- Providing tank information, monitoring and response plans, tank registration forms and other information as requested by ECS staff in a timely manner;
- Reporting any monitoring system alarms to the ECS and Facilities Maintenance Construction Division (FMC);
- Coordinating UST repairs and/or modifications with the ECS and FMC;

- Designating an accounting contact to coordinate Quarterly Excise Tax inventory preparation;
- Designating a facility contact to be the Responsible Person for the monitoring plan, response plan, and tank registration forms;
- Designating a facility contact to provide tank information and participate in agency inspections; and,
- Maintaining a file at the site that includes the monitoring plan, response plan, equipment maintenance records, etc.

#### 5.5.2.2 ECS Staff

The ECS is responsible for the following:

- Maintaining a database for all District USTs;
- Maintaining duplicate hard copy files of tank information for each site;
- Keeping abreast of legal and regulatory changes and providing guidance to facility staff of any changes requiring action;
- Preparing quarterly tax statements for underground storage of petroleum;
- Coordinating completion of necessary information and documents for new tank installations and tank removals;
- Conducting annual site visits at each UST site to verify tank system monitoring and train facility staff on UST requirements;
- Maintaining air permits, as required;
- Coordinating and participating in agency inspections;
- Reviewing all tank system testing results and recommending any necessary corrective actions;
- Handling all communication between the District and the CUPAs, including permit transmittal, fee payments, and correspondence;

- Providing guidance on release reporting requirements and reviewing release reports before submittal to local agencies;
- Providing for annual monitoring system testing and triennial secondary containment testing.
- Reviewing Financial Statement annually and amending as necessary; and,
- Maintaining certifications, as required, as Designated Underground Storage Tank Operators (DUSTOs). DUSTOs are required to inspect each UST system monthly and conduct training to facility staff on UST requirements

### 5.5.3 Summary of Applicable Regulations

Federal regulations governing UST operations and the underground storage of hazardous substances are specified in 40 CFR 280 and 40 CFR 281 and may be found at <http://www.epa.gov/swerust1/fedlaws/cfr.htm>. The EPA has given the states the primary authority to implement the UST program.

State regulations, which incorporate and are more stringent than the federal laws, are codified in 19 CCR Division 3, Water Resources Control Board, Chapter 16 Underground Storage Tank Regulations (Title 23), and in State law at 6.7 HSC 25280 through 6.7 HSC 25299.7. The SWRCB has the overall responsibility for enforcing the state and federal UST laws. In addition, the SWRCB publishes Local Guidance (LG) letters. These LG letters provide the state interpretation on numerous aspects of the UST requirements. The state laws, regulations, and LG letters may be found at [http://www.waterboards.ca.gov/water\\_issues/programs/ust/](http://www.waterboards.ca.gov/water_issues/programs/ust/). The CUPAs are responsible for enforcing the state laws, and any requirements established by local ordinances.

### 5.5.4 EBMUD UST Installations

Table 5-10 summarizes information concerning UST installations located throughout the District:

Table 5-10: District Underground Storage Tanks						
Facility	Location	Size (gallons)	Construction	Contents	Installation Date	Fees (1)
Administration Building	Oakland	2,000 6,000	DW Fiberglass DW Fiberglass	Diesel Empty (2)	1990 1990	\$281
Adeline Fuel Facility	Oakland	10,000 10,000	DW Fiberglass DW Fiberglass	Diesel Gas	1998 1998	\$855
Adeline Fleet Maintenance	Oakland	600 2,500	DW Fiberglass DW Fiberglass	Used Antifreeze Used Oil	1996 1996	\$855
South Area Service Center	San Lorenzo	12,000 12,000	DW Fiberglass DW Fiberglass	Gas Diesel	1990 1990	\$737
Orinda WTP	Orinda	3,000	DW Fiberglass	Diesel	1994	\$200
San Pablo WTP	Kensington	550	DW Fiberglass	Diesel	1989	\$200
Sobrante WTP	El Sobrante	1,000	DW Fiberglass	Diesel	1988	\$200
Orinda Watershed Headquarters	Orinda	1,000 2,000	DW Fiberglass DW Fiberglass	Diesel Gas	Both reinstalled in 1995; originally installed in 1988	\$200
SD-1	Oakland	25,000 2,500 2,000	All USTs are DW Fiberglass	Diesel Slop oil Used oil	1993 1993 Unknown	(3)

(1) 2010 Fee information. Fees generally increase between 5 –10% annually.

(2) Tank is empty, and is not regulated.

(3) Not available

### 5.5.5 Tank Specifications

All new UST installations must have secondary containment on the tank and piping, striker plates, overfill and overspill protection, under dispenser containment, and a continuous monitoring system that will generate an alarm in the event that product is released from the primary containment.

The electronic monitoring system must be certified by the state (LG 113 provides a list of all certified monitoring methods and equipment). The monitoring system on new installations must be capable of detecting **both** liquid and vapor phases of the stored material in the interstitial space. In addition, the interstitial space of the UST must be maintained under constant

vacuum or pressure so that a leak can be detected before either the liquid or the vapor of the stored substance is released to the environment. An interstitial liquid level measurement method will satisfy this requirement.

If the UST system stores motor vehicle fuel, the continuous monitoring system must be equipped to shut down the fuel pumps and activate the alarm system when a release is detected, or if the system fails or is disconnected.

Overspill containment fits on the fill pipe, and is required to have a minimum capacity of 5 gallons. Alameda County requires overspill containment to have a minimum capacity of at least 15 gallons.

Overfill prevention must meet one of four requirements specified in the regulations (Title 23, Section 2635, (b) (2)). These requirements describe flow restriction or positive shut off at 90% capacity, with an alarm.

Prior to being placed into service, all new UST systems must be tested to ensure that primary and secondary containment systems are intact. The UST must be tested at the factory; all product piping must be tested after it is installed, and all secondary containment must be tested. To verify that the construction is vapor tight, an enhanced leak detection (ELD) test must be conducted on the entire system. This is a test method that determines the integrity of the UST system by introducing a “tracer” element into the UST system that can be detected outside of the UST system if it is not vapor tight.

All new installations must receive a compliance certificate and decal prior to the first fuel delivery, in order to conduct any required integrity test. The SWRCB recommends issuing the certificate after the primary and secondary piping containment have been completed. These documents indicate to fuel suppliers that the UST system is in compliance with state regulations and requirements. A fuel supplier is prohibited by law from delivering petroleum products to a facility that has not been certified by the CUPA.

#### 5.5.6 Permits

USTs that are intended for storage of hazardous materials must be permitted by the CUPA prior to UST installation. Once the USTs are installed, the owner/operator must maintain a permit to operate the USTs. The permit is valid for five years.

Other regulatory requirements for an UST system include construction of “Enhanced Vapor Recovery” equipment, an air permit from the local air district for gasoline dispensing, completion of a HMBP for storage of hazardous materials, and/or a generator ID number if the stored hazardous material is a

material is a hazardous waste.

An owner is not required to apply for a permit if the UST stores a non-hazardous material, nor if the storage tank can be visually observed from all sides. For example, the District laboratory has 3-3,200 gallon empty double-walled fiberglass USTs. These USTs were installed to store seawater for sea urchins that were used for an “Echinoderm Fertilization Test” (a permit requirement that has long since been removed). In addition, there is an empty 6,000-gallon UST at the Administration Building. At Pump Stations – and – the storage tank is contained in a vault and the entire exterior of the tank can be visually inspected.

#### 5.5.6.1 Permit Application Procedures

As noted above, permits are required for UST installation and UST operation. Both the Permit to Operate and the Installation Permit require the same information, with the exception that the installation permit usually includes an UST specification sheet. The required information includes tank registration forms, a site map, a monitoring plan, and documentation of financial responsibility. The CUPA is responsible for approving both permits. Descriptions of the required information are provided below and are available at: [http://www.waterboards.ca.gov/water\\_issues/programs/ust/forms/index.shtml](http://www.waterboards.ca.gov/water_issues/programs/ust/forms/index.shtml) (look under “UST Facilities”).

**Tank Registration Forms:** UST owners must complete 4 state-required forms: a Facility Information Operating Permit Application, a Tank Information Operating Permit Application, an Underground Storage Tank Monitoring Plan, and a Response Plan. A fifth form, Certificate of Compliance, is to be completed at the time the UST is installed. These forms are provided by the CUPAs.

- Facility Information Operating Permit Application (previously named “Form A”) is used to provide information about the UST location(s), owner, operator, property owner, and the financial responsibility mechanism that the tank owner uses. This form must be completed for each UST facility upon installation, removal, or permit renewal.
- Tank Information Operating Permit Application (previously named “Form B”) is used to provide information about each UST at the facility. The facility completes one Tank Information page for each UST. Information provided on the Tank Information Form includes tank description, tank contents, tank



tank construction, piping information, and tank leak detection method. In addition, during the installation process, a schematic diagram is submitted that provides the required information in a drawing. The site map may be a scaled diagram, design, or as-built drawing that identifies the location of the UST system with respect to buildings or other landmarks. If there is a site map that is used for the HMBP, this may be used.

- **Monitoring Plan:** This form includes information on monitoring methods for each UST system, the required periodic system testing, recordkeeping, employee training, and personnel responsibilities. This form provides, in checklist form, what used to be narrative provided by the UST owner.
- **Response Plan:** A checklist form that describes what facility personnel will do to respond to unauthorized releases.

**Financial Responsibility:** Federal and state laws require that owners of underground petroleum storage facilities provide a "Statement of Financial Responsibility." This consists of a certification from the owner or operator that ensures that there will be money to pay for the costs of corrective action and third party liability caused by an unauthorized release of petroleum from an UST. Federal law requires governmental entities that own petroleum USTs that have a monthly throughput of less than 10,000 gallons to demonstrate financial responsibility for \$500,000 per occurrence. In addition, owners of 100 USTs or less must demonstrate financial responsibility in the annual aggregate amount of \$1,000,000. This law applies to petroleum storage only.

The mechanism that the District uses to demonstrate financial responsibility is the local government bond-rating test. ECS staff routinely asks the Director of Finance to update this certification whenever there is a change in the mechanism for financial assurance or change in the Director of Finance.

#### 5.5.6.2 Permit Requirements

**General Permit Requirements.** Permits are issued for a term of five years. The permittee must post the permit at the facility and comply with all reporting and record keeping requirements. Any change in the storage of a hazardous substance must be reported to the CUPA within 30 days of the change by submitting a new Form

Form B for an amended permit.

**Reporting Requirements.** When a facility experiences an unauthorized release, it falls into one of two categories: Recordable and reportable.

A recordable release is defined as a release that has not escaped the secondary containment system, and which the operator is able to clean up within 8 hours after the release was detected. This type of release is to be noted in the operator's monitoring records.

A reportable release is one that has not been contained within the tank system. This must be reported to the CUPA within 24 hours of detection. A full report must be submitted within 5 working days of the release that describes the nature and volume of the release, any corrective or remedial actions necessary to clean up the release, and the time schedule for these activities.

There are no requirements for reporting "false alarms," which are instances when the alarm has sounded, and no release has been detected. All alarms should be treated as "real" alarms, and an initial investigation conducted by facility and FMC staff to determine if an actual release has occurred.

#### 5.5.6.3 Other Permits

In addition to the CUPA issuing a Permit To Operate the UST system, fuel facilities that dispense gasoline are required to have a permit to operate from the local air district. See Section 4 for more information.

### 5.5.7 Fees

The District pays annual fees for each UST to each CUPA (see Table 5-10). These fees include a state surcharge for state administration of the program.

In addition, quarterly excise taxes are levied on the amount of petroleum purchased and placed in the USTs by the Board of Equalization (BOE). Taxes are assessed quarterly, based on the BOE number included on all Facility Information Operating permit Application (the District's BOE number is TK HQ 44-002338). Accounting provides information to ECS on the amount of fuel purchased, and ECS calculates and pays the associated taxes.

### 5.5.8 Inspections

Regulations require that all UST systems be inspected monthly by a Designated Underground Storage Tank Operator (DUSTO). The DUSTO must be certified by the International Code Council, and certifications must be renewed every 2 years. The law allows a facility owner, operator, employee, or a third party to become a DUSTO. There are certified ECS that conduct the monthly inspections. The monthly inspections are documented on a state-approved form, and kept in the ECS files. The inspection forms and all attachments must be kept on file for the previous twelve months.

The electronic monitoring system, overspill and overfill equipment must be inspected annually by a state certified licensed tester. The tester is required to tag each component with the name of the tester and the date tested. The entire secondary containment system must be tested every three years, also by a state certified licensed tester. This requirement is waived if the primary and secondary containment is continuously hydrostatically monitored or under constant vacuum (currently not applicable at District facilities).

The CUPAs are required to annually inspect UST systems. Ideally, this inspection is done during the UST owner's electronic monitoring system inspection. Inspectors may inspect the entire UST system, from the electronic monitoring system to opening the manways to observe the watertight seals.

#### 5.5.9 Fines and Penalties

Civil penalties may range from \$500 to \$5,000 per day for each UST for:

- Operating an UST system without a permit;
- Violating any permit requirements;
- Failing to maintain records; or
- Failing to perform any required testing or monitoring.

In addition, any person that intentionally falsifies information or knowingly fails to report an unauthorized release may be fined between \$5,000 and \$10,000 and may be imprisoned in a county jail for up to one year.

### 5.5.10 Training

State law requires DUSTOs to provide annual training to facility staff on responding to alarms, spills and overfills. New hires must be trained within 30 days if they are responsible for responding to those items.

### 5.5.11 Recordkeeping

Written monitoring and maintenance records are to be maintained for at least 3 years, while cathodic protection maintenance records (steel USTs) are to be maintained for at least 6.5 years. Written performance claims pertaining to release detection systems, and associated calibration and maintenance records, are to be maintained for at least 5 years. Records of repairs, lining, and upgrades are to be maintained for the life of the UST at the facility. Monthly DUSTO inspections must be kept on file for the previous 12 months. Records may be kept either onsite or offsite, provided that they may be provided to the CUPA within 36 hours.

### 5.5.12 Leaks from UST Systems

In the event that the alarm system indicates a leak, the facility supervisor shall immediately notify the FMC and the ECS. FMC staff will investigate the cause of the alarm. Experience indicates that alarms have occurred because either the probe was positioned incorrectly, water seeped into the annular space or piping sump through a leaky seal, or condensation from the sump tops have triggered an alarm. Investigation findings should be documented in the monitoring records.

If the investigation shows that there is a loss of product, ECS will notify the CUPA within 24 hours of the unauthorized release as described in the Section 5.5.6.2 above, and will coordinate with FMC to remove fuel from the UST, if necessary. FMC and ECS will coordinate actions to conduct an investigation to determine the extent of the release, actions that are necessary to abate the release, and any necessary additional actions necessary concerning the existing UST system. Such actions may range from a simple piping repair and minor soil excavation to UST removal, free product removal, and groundwater monitoring.

Within 5 working days of detecting a release of material from the UST, ECS will submit a report to the CUPA that provides information on

- types and quantities of hazardous materials released,
- approximate date of release
- date of release discovery

- description of activities taken to control and stop release
- date release was stopped
- description of actions to be conducted to determine the nature and extent of soil, groundwater or surface water contamination
- proposed cleanup methods and a time schedule for conducting the proposed actions
- disposal of contaminated materials
- a description of additional actions taken to prevent future releases.

If any free product is discovered, the District will contract with appropriate companies to remove as much free product as possible and submit a report within 45 days of a reported release that documents the extent of, and actions taken, to recover free product.

### 5.5.13 UST Removal

In the event that the District needs to remove a UST, it must initiate a lengthy process that usually begins with contractor procurement through FMC or Engineering. The contractor that is hired is typically responsible for preparing and submitting the UST removal permit to the CUPA. The contractor must have the appropriate state license and a Hazardous Substance Removal Certification to install or remove USTs. The appropriate state licenses are Class A, General Engineering; Class B, General Building; and Class C-36, Plumbing. The remainder of this section describes the removal of USTs that store petroleum products. The District also stores sodium hypochlorite in USTs, and the same procedures must be followed when removing such USTs, but the degree of hazard and potential environmental contamination poses a much lower risk.

The steps during a tank removal are as follows:

- Permitting;
- Removing the UST;
- Sampling soil and groundwater; and
- Documenting the findings and results.

Generally, USTs are managed as hazardous waste, but state law does not prohibit reuse of the UST, nor does it prohibit the disposal of the UST as a non-hazardous material. This is a relatively recent development, and may be met with some resistance at the local level. Any residual petroleum product is considered hazardous waste, and must be managed appropriately.

### 5.5.13.1 Closure Permit

All UST removals must be performed under a closure permit issued by the CUPA. The closure permit application consists of:

- Completed Operating Permit Application Forms for both Facility Information and Tank Information that indicate a UST is being removed and summarizing other details concerning the UST;
- A site map;
- A Site Health and Safety Plan;
- The USEPA Generator ID numbers for the site, transporter, and disposal facility; and
- A description of sample locations, laboratory analyses, and name and certification number of the state certified laboratory conducting the analyses.

The permit application is reviewed and approved by the CUPA. This may take up to four weeks. During this process, the contractor is allowed to break concrete, excavate soil, and remove product from the tanks.

### 5.5.13.2 UST Removal Procedures

At the time of the UST removal, as much product as possible is removed. The UST is usually washed out (“triple rinsed”) to remove any remaining product. The resulting liquid is managed as a hazardous waste.

After the UST is triple-rinsed, the contractor usually places dry ice, or some other inert material, into the UST to displace the oxygen and act as a blanket for the explosive vapors. The contractor is responsible for using a calibrated combustible gas meter to read lower explosive limits and oxygen values from the bottom, middle, and top of the UST. Once the values are acceptable to the CUPA representative, the UST may be pulled out of the ground, loaded onto a truck, and taken to an appropriate disposal facility.

### 5.5.13.3 Soil and Groundwater Sampling

Following UST removal, soil and water sampling is performed to determine if there has been any unauthorized release from the UST.

The current chief guidance document for sampling at UST sites is titled *Tri-Regional Board Staff Recommendations For Preliminary Evaluation And Investigation Of Underground Tank Sites (published in 1990 by the North Coast, San Francisco Bay, and Central Valley Regional Water Quality Control Boards)*. This document is available on line at

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/underground\\_storage\\_tanks/](http://www.waterboards.ca.gov/centralvalley/water_issues/underground_storage_tanks/), along with the CV-RWQCB addendum “Appendix A – Reports: Tri-Regional Board Staff Recommendation for Preliminary Investigations and Evaluation of Underground Tank Sites”. This appendix was created by CV-RWQCB to provide a consistent format for documents, for a process for the regulated public, and to reduce the cost of reporting for dischargers and the UST Cleanup Fund.

These documents provide guidance for sampling in situations where water may be either present or absent in the tank pit. The sampling requirements are as follows:

<b>Table 5-11: Soil Sample Requirements</b>		
<b>Tank Size</b>	<b>Minimum Number of Soil Samples</b>	<b>Soil Sample Location (1)</b>
< 10,000 gal.	TWO per tank	One at each end of tank
> 10,000 gal.	THREE or more per tank	Ends and middle
Piping	-	Every 20 lineal feet

(1) Soil samples are to be taken at the native soil/backfill interface.

<b>Table 5-12: Soil and Water Sample Requirements</b>			
<b>Tank Size</b>	<b>Minimum Number of Soil Samples</b>	<b>Soil Sample Location</b>	<b>Minimum Number of Water Samples (1)</b>
10,000 gal. or less, or single tank	Two	From wall next to tank ends at soil/ground water interface	One
> 10,000 gal. or tank cluster	Four	From wall next to tank ends at soil/ground water interface	One

(1) When water is present, the tank pit may be purged and allowed to refill before sampling.

The guidance document also describes required laboratory analyses for soil and groundwater samples. These analyses include Total Petroleum Hydrocarbons, benzene, toluene, ethylbenzene, xylenes, and MTBE.

#### **5.5.13.4 Documentation**

After the UST has been removed, the owner must submit a closure report to the CUPA that documents all removal activities. This closure document includes a description of UST removal activities, sampling procedures (including a site map showing sample locations), laboratory analyses and results, and disposal documentation.

If the laboratory analyses indicate that there is no contamination, the case is closed. If there is some contamination, a site assessment may be required by the CUPA. If sampling indicates that a release has occurred, the owner is responsible for abating the release while preparing for a site assessment. Generally, the UST removal is the primary abatement step, and the owner may begin preparing for the site assessment. If free product is present, the owner is responsible for removing as much of it as possible.



#### 5.5.14 Site Assessment

Under Title 23, a site assessment is necessary and required when it appears that there has been a release from an UST into the soil. The purpose of a site assessment is to determine the extent of the contamination and if remediation is necessary. There are elements to a site assessment that require the oversight of either a professional engineer, registered geologist, or registered environmental assessor. In general, companies that have such licensed and registered professionals should be hired to conduct the entire site assessment.

A site assessment may include the following elements: an unauthorized release report, a work plan, a soil and groundwater assessment, groundwater monitoring, site remediation, and case closure. Once there is laboratory data on the soils and groundwater, the analytical data and site map are entered into an electronic database. The owner/operator is responsible for initiating the site assessment; however, many people wait to conduct the site assessment until they are directed by the CUPA, or if the CUPA does not have oversight authority, the Regional Water Quality Control Board (RWQCB) that has jurisdiction over the site. Additional guidance can be found at the SWRCB website. The SWRCB is currently revising the “Leaking Underground Fuel Tank Guidance Manual.” Commonly called the “LUFT Manual,” this document was first published in 1989 to attempt to outline best management practices and procedures for corrective action. SWRCB staff are currently revising the LUFT Manual to incorporate real life experiences from 20 years of investigation and remediation activities. The draft manual, available at [http://www.waterboards.ca.gov/water\\_issues/programs/ust/luft\\_manual.shtml](http://www.waterboards.ca.gov/water_issues/programs/ust/luft_manual.shtml), includes information on all the elements of site investigation and remediation, from how to access Geotracker to providing an overview of the different types of remediation technologies. While it appears to be a useful manual, it is not clear that all Regional Boards will adopt it in lieu of their existing requirements.

In addition, the SF Bay-RWQCB has adopted its own “Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater”, available at <http://www.waterboards.ca.gov/sanfranciscobay/esl.shtml>. This document presents “lookup tables” of environmental screening levels for over 100 chemicals commonly found at contaminated sites to use to help assess the level of effort required to remediate a site.

Each of the site assessment elements is discussed below.

#### 5.5.14.1 Unauthorized Release Report

An Unauthorized Release Report is a form that is submitted to the CUPA. The owner/operator is responsible for completing and submitting this form, but usually the CUPA will complete the form and submit it to the SWRCB. This report is entered into a database, and is used to track the progress of the investigation. The information provided in this report includes the name and address of the responsible party, type of substance released, abatement actions taken, and the implementing agency. This information is available to the public.

#### 5.5.14.2 Work Plan

A work plan is a document that describes proposed tasks and schedules to determine the extent of soil and groundwater contamination. The work plan is submitted to the oversight agency for review and approval. Upon approval, the responsible party may begin the assessment.

#### 5.5.14.3 Soil and Groundwater Assessment

The soil and groundwater assessment determines the extent and severity of contamination. For District UST sites, the typical assessment activity involves drilling soil borings and installing groundwater-monitoring wells. Samples are taken and analyzed to determine residual contamination in the soil and the impact to groundwater. The actual investigation activities at a District site would typically take no more than 3 days. If there is an impact to groundwater, the oversight agency will require quarterly groundwater monitoring.

#### 5.5.14.4 Groundwater Monitoring

The primary objectives of groundwater monitoring are to assess the impact of contamination upon groundwater quality and to determine the direction of groundwater flow. Occasionally, there may be enough contamination to cause free product, or light non-aqueous phase liquids (LNAPLs), to float on top of the water table. In such an event, regulatory agencies typically require the removal of free product, and may also require site remediation.

#### 5.5.14.5 Site Remediation

A primary objective of site remediation is to remove as much of the source of contamination as possible. There are many remediation alternatives that are available. They range from additional soil removal, to soil vapor extraction, groundwater pumping and treating, or the introduction of bacteria to accelerate natural degradation. Factors to consider in selecting an appropriate remediation alternative include the feasibility and effectiveness of the remediation alternative, agency acceptance, and cost.

#### 5.5.14.6 Case Closure

Case closure may occur at any point during the site assessment if the local agency has been satisfied that the assessment has defined the extent of the problem, and that the site poses no threat to human health or the environment. After the agency has determined that case closure may occur, the responsible party removes all groundwater-monitoring wells. The oversight agency provides a closure letter, and the site is removed from the agency's database.

#### 5.5.14.7 Electronic Data Reporting

State regulations require that analytical data and site maps be submitted electronically, via the Internet, to the SWRCB. This electronic system is called the Geotracker System (Geotracker).

A consultant, hired by the RP, may obtain access to the electronic database after receiving permission from the SWRCB. The ECS coordinates with the consultant for access to the District sites listed on Geotracker.

Additional information on Geotracker can be found at:

[http://www.waterboards.ca.gov/water\\_issues/programs/ust/electronic\\_submittal/index.shtml](http://www.waterboards.ca.gov/water_issues/programs/ust/electronic_submittal/index.shtml).

## 5.6 Aboveground Storage Tanks (ASTs)

### 5.6.1 Background

Installation, removal, modification, maintenance and operation of aboveground tanks may be regulated under various federal, state and local regulatory programs, depending on the type and quantity of material the tank

contains. ASTs containing hazardous materials are regulated by the International Fire Code (IFC). The IFC specifies tank design, labeling, and secondary containment requirements.

ASTs containing petroleum products may be subject to federal and state regulations promulgated to prevent and respond to releases of petroleum products to waterways. The quantity of petroleum products stored on a given site is the key factor in determining whether a facility is subject to this regulatory program. A facility subject to this program must prepare a Spill Prevention, Control and Countermeasure (SPCC) Plan.

ASTs containing volatile substances may be subject to regulation under air quality regulatory programs. This area of regulation applies most typically within the District only to ASTs containing gasoline to be dispensed. Permits are required by local air districts in all such cases.

ASTs containing non-hazardous materials are typically not regulated under any environmental-related program. Structural, health and safety and seismic concerns still need to be addressed in activities relating to ASTs but such concerns are outside the scope of this manual.

## 5.6.2 Roles and Responsibilities

### 5.6.2.1 District Work Groups

District staff involved in the design and construction of new tanks or modification or removal of existing tanks containing hazardous materials are responsible for:

- Ensuring compliance with the IFC and any other local administering agency requirements;
- Determining if a permit from the local IFC administering agency is required;
- Determining if a permit from the local air district is required;
- Applying for and obtaining permits from local agencies when required;
- Coordinating inspections with local agency inspectors when required;

- Providing ECS staff with information required to prepare or modify an SPCC plan for the facility when required;
- Providing copies of permits, permit application materials, correspondence with regulatory agencies, and documentation of all permit exemption determination decisions to ECS for review and filing in ECS files.

District staff involved in the operation and maintenance of ASTs containing hazardous materials are responsible for:

- Inspecting secondary containment areas on a regular basis to check for spills, leaks, and the integrity of the secondary containment system and functionality of any related alarm systems;
- Responding to alarms from secondary containment monitoring or tank level alarm systems (if applicable);
- Responding to spills or leaks into and outside of secondary containment according to the SPCC plan or to applicable internal Section, Division or Departmental procedures as appropriate;
- Reporting spills or leaks outside of secondary containment to ECS;
- Monitoring and maintaining tank and ancillary piping integrity according to procedures specified in the SPCC plan for the facility (if applicable) or according to manufacturers recommendations or any other applicable tank management practices;
- Characterizing and reusing or disposing of any hazardous material that has been spilled or leaked into or out of secondary containment appropriately or contacting ECS for assistance with this task if necessary;
- Responding appropriately to accidental mixtures of incompatible products in an AST or contacting ECS for assistance with this task if necessary;
- Complying with all procedures identified or referenced in the SPCC plan (if applicable).

### 5.6.2.2 ECS Staff Responsibilities

ECS staff are responsible for the following tasks associated with ASTs containing hazardous materials:

- Determining applicability of SPCC regulations to District facilities;
- Preparation and maintenance of SPCC Plans for all District facilities;
- Providing assistance to design and construction staff in determining and/or interpreting applicable regulatory requirements;
- Providing assistance to design and construction staff in completing permit application packages (ECS role is limited to review and advising);
- Maintaining air permits (if applicable);
- Providing assistance in characterizing and reusing or disposing of any hazardous material that has been spilled or leaked into or out of secondary containment upon request from the facility operations management;
- Providing assistance in responding appropriately to accidental mixtures of incompatible products in an AST upon request from the facility operations management;
- Notifying regulatory agencies as appropriate of leaks and spills of hazardous materials outside of secondary containment;
- Maintaining files of all permits and permit-related documentation for ASTs.

### 5.6.3 Summary of Applicable Regulations

#### 5.6.3.1 Federal Regulations

The federal regulations pertaining to SPCC Plan requirements are in 40 CFR 112. These regulations apply to owners/operators of certain facilities that drill, produce, gather, store, process, refine, transfer,

distribute, or consume oil. The definition and use of District ASTs falls under this broad category. The regulations apply to facilities that:

- Could reasonably be expected to discharge oil in harmful quantities into navigable waters (see Section 3.0 of this manual for definition of “navigable waters”) and
- Have a total aboveground storage capacity of greater than 1,320 gallons.

#### **5.6.3.2 State Legislation**

The state SPCC-related regulations are located in 6.67 HSC Division 20. The law adopts the federal regulations regarding SPCC Plans, and in 2008, transferred responsibility for program implantation, enforcement and administration of the program to the CUPAs.

#### **5.6.3.3 Local Requirements**

All petroleum AST installations must be approved by the local fire department.

#### **5.6.3.4 International Fire Code**

The International Fire Code, (IFC), formerly the Uniform Fire Code, is published by the International Conference of Building Officials. The IFC is updated and published every three years. The IFC is organized into Articles by type of fire hazard. Article 79 regarding Flammable and Combustible Liquids and Article 80 regarding Hazardous Materials are the most applicable sections of the code to District ASTs. Article 74 regarding compressed gases may also be useful in cases of bulk AST storage of compressed gas, such as large propane tanks.

#### **5.6.3.5 Local CUPAs**

On January 1, 2008, the state transferred the authority and responsibility of administering the program to the CUPAs. The CUPAs are required to inspect facilities with an aggregate aboveground petroleum storage of over 10,000 gallons every three years.

#### 5.6.4 EBMUD AST Installations

Table 5-13 provides a listing of current ASTs containing petroleum products located throughout the District. This list does not include petroleum storage in 'belly tanks' of portable generators, pumps, or stationary generators. Typically, storage in 'belly tanks' is 100 to 600 gallons.



Table 5-13: List of EBMUD Aboveground Storage Tanks

Facility Name	City	Tank Size (Gallons)	Product Stored	Year Installed	Tank Type	SPCC required	Tier
Oakport Wet Weather Facility	Oakland	6,000	Diesel	1991	Single-walled in double containment	Yes	II
Point Isabel Wet Weather Facility	Richmond	6,000	Diesel	1993	Single-walled in double containment	Yes	II
San Antonio Creek Wet Weather Facility	Oakland	1000	Diesel	1997		No	N/A
Pump Station H	Oakland	2000	Diesel	unknown	Convault	Yes	I
Pump Station Q	Berkeley	2,000	Diesel	unknown	Convault	Yes	I
Wastewater Treatment Plant (SD-1)	Oakland	1,000 2,000	Gasoline Diesel	unknown unknown	Convault Convault	Yes	I
Lafayette Water Treatment Plant	Lafayette	2,000	Diesel	1992	Convault	Yes	I
Sobrante WTP	El Sobrante	2,000	Diesel	1993	Convault	Yes	I
Walnut Creek WTP	Walnut Creek	8,000	Diesel	2003	Convault	Yes	II
Upper San Leandro WTP	Oakland	4,000	Diesel	1995	Convault	Yes	I
Bixler Chlorination Facility	Bixler	1,000 1,000 550	Gasoline Diesel	1990 1990 1990	Convault Convault Convault	Yes	I
Claremont Center	Berkeley	8,000	Diesel	2004	Convault	Yes	II
Danville Pumping Plant	Alamo	10,000	Diesel	2004	Convault	Yes	II
Walnut Creek Pumping Plant	Walnut Creek	1,000 split in two compartments	Gasoline Diesel	1993	Convault	No	N/A
Camanche Dam Powerhouse	Clements	1,000 500 350 300 250 200 65 50	All oil containing equipment	unknown	Single-walled Single-walled Single-walled Single-walled Single-walled Steel Generator Single-walled Single-walled	Yes	I
Camanche North Shore	Ione	2,000 2,000 2,000 2,000 1,000 split in two compartments	Gasoline	1997 1997 1999 1999 1998	Convault Convault Convault Convault Convault	Yes	I

**Table 5-13: List of EBMUD Aboveground Storage Tanks**

Facility Name	City	Tank Size (Gallons)	Product Stored	Year Installed	Tank Type	SPCC required	Tier
Camanche South Shore	Burson	10,000	Gasoline	1990	Double-walled AST Convault	Yes	Storage > 10,000 gal.
		1,000- split in two compartments		1997			Plan <i>must</i> be prepared by P.E.
Pardee Center	Valley Springs	1,000 500 300	Gasoline Diesel Used Oil	1991 1991	Convault Convault Dbl-walled	Yes	I
Pardee Recreation Area	lone	2,000 2,000 1,000	Gasoline	1997 1997 1997	Convault Convault Convault	Yes	I
Mokelumne Office	Clements	1,000 split in two compartments	Gasoline Diesel	1997	Convault	No	N/A
Stockton Center	Stockton	1,000 1,000	Gasoline Diesel	1989 1989	Convault Convault	Yes	I
FolsomSouth Canal	Sacramento	3,000 3,000		2009		Yes	I
East Area Service Center	Walnut Creek	2,000 2,000	Gasoline Diesel	1994 1994	Convault Convault	Yes	I
North Area Service Center	Richmond	2,000 2,000	Gasoline Diesel	2006	Convault Convault	Yes	I
Oakport Service Center	Oakland	1,000 1,000 500	Gasoline Diesel	1990 1990 1990	Convault Convault Convault	Yes	II
San Pablo Recreation Area	Orinda	1,000	Gasoline	1999	Convault	No	I
San Ramon Satellite Area	San Ramon	1,000 1,000	Gasoline Diesel	1991 1991	Convault Convault	Yes	I
Mokelumne Fish Hatchery (Note: Responsibility of Dept of Fish and Game)	Wallace	500	Diesel	1997	Convault	No	N/A

(1) SPCC and fees are the responsibility of the Hatchery staff.

### 5.6.5 Tank Specifications

ASTs installed at District facilities must be constructed according to nationally recognized standards. These standards include those published by the American Petroleum Institute (API), National Fire Protection Association (NFPA), and/or Underwriters Laboratory (UL), among others. Most ASTs equipped with integral secondary containment that are available on the market conform to these standards. The most common ASTs that meet these standards carry the brand name of “Convault” and “Hoover.” Most fire

departments require the contractor to verify that the AST has been listed by one of these associations.

Fire department approval for AST installation also requires labeling in accordance with the Uniform Fire Code, Article 79. These requirements specify the appropriate signage, vehicle protection, location of emergency shut-off switches, and location of fire extinguishers. In addition to the local fire department, the District's Workplace Health and Safety Section will work with the facility to ensure that ASTs are labeled and protected appropriately.

### 5.6.6 Spill Prevention Control and Countermeasure (SPCC) Plans

The purpose of a SPCC Plan is to identify: (1) operating procedures to prevent oil spills; (2) control measures installed to prevent a spill from reaching navigable waters, and (3) countermeasures to contain, clean up and mitigate the effects of an oil spill once it has reached navigable waters. A SPCC Plan focuses upon prevention of oil discharges, rather than responses to discharges.

Facilities that could cause “substantial harm” to the environment by discharging oil into navigable waters of the U.S. are required to prepare and submit to the USEPA a Facility Response Plan (FRP) for responding to a worst-case discharge of oil and to a substantial threat of such a discharge. A FRP differs from a SPCC Plan in that it is a more rigorous document that identifies possible worst-case spill response scenarios (similar in level of detail as the CalARP Risk Management Plan, see Hazardous Materials Section). As per 40 CFR 112, Appendix C, a facility meets the “substantial harm” criterion if the facility transfers oil over water to or from vessels and has a combined aboveground and underground storage capacity greater than or equal to 42,000 gallons; or the facility’s total oil capacity is greater than or equal to one million gallons.

Facilities that do not pose a substantial threat to the environment, as determined based on the substantial harm criteria, are not required to maintain a FRP; however, they must document, certify, and maintain their determination as part of their SPCC Plan.

At present, none of the District’s facilities meet the substantial harm criteria; therefore, the District is not required to prepare or maintain any FRPs. An example of the Substantial Harm Determination Form is located at the USEPA’s web site.

SPCC Plan requirements have been changing routinely in the last few years. Currently, the due dates for facilities that must have SPCC plans is as follows:

- If the facility was operating prior to August 16, 2002, it must maintain its existing SPCC plan, and amend and implement the plan by November 10, 2011;
- If the facility started operations after August 12, 2002, it must prepare and implement the SPCC plan by November 10, 2011;
- If the facility begins operations after November 10, 2011, it must prepare and implement an SPCC plan before beginning operations.

In 2008, the USEPA revised the SPCC regulations to allow a subset of regulated facilities to self-certify. These facilities are defined as Tier I and Tier II qualified facilities.

A Tier I qualified facility stores less than 10,000 gallons of oil aboveground, and no individual container is greater than 5,000 gallons in size.

A Tier II qualified facility stores less than 10,000 gallons of oil, and does not have individual containers greater than 5,000 gallons in size.

Additionally, to be able to self-certify, these Tier I and Tier II facilities must not have had

- Any single discharge of oil exceeding 1,000 gallons in the past 3 years, and
- Any two discharges that each exceed 42 gallons in any 12-month period.

A Tier I qualified facility may use a template prepared by USEPA to self-certify. This template is in Appendix G of the regulation, and can be found at this link: [Tier I template](#). The District has 17 Tier I facilities that can use the template.

A Tier II qualified facility may prepare a self-certified SPCC plan, or may have a Professional Engineer prepare and certify the SPCC plan. The District has 6 Tier II facilities.

Facilities that have aboveground storage greater than 10,000 gallons must have a professional engineer prepare and certify an SPCC plan. The District has one facility, Camanche South Shore Recreation Area, that has greater than 10,000 gallons of petroleum storage.

The required elements of a SPCC Plan are outlined in 40 CFR 112.7. When preparing an SPCC plan, each element must be addressed in sequence. If the sequence is not followed, the SPCC plan must include a section that cross-references the regulatory requirements. The required elements include:

- A cover page that includes name, type, and location of facility, name and address of owner or operator, management approval statement, and either a self-certification or a professional registered engineer certification;
- A written description of spills that have occurred within the past year;
- A description of the direction, etc. of a spill that can be reasonably predicted;
- A description of containment equipment to prevent a spill from reaching navigable waters;
- A Contingency Plan, when appropriate, to address how to clean up a spill should it reach navigable waters;
- A description of inspections;
- A description of security;
- A description of personnel training; and
- SPCC Plan review.

The USEPA has posted several guidance documents at <http://www.epa.gov/oilspill/index.htm>.

Each of these SPCC Plan elements is described in greater detail below.

*Cover Page:* the cover page identifies the facility, mailing and street address, owner, contact name, and includes a written description of the facility, the manager approval statement, and certification.

- The management approval statement documents the facility's commitment to the SPCC Plan. The text should read: "This SPCC Plan is fully approved by the management of (facility name) and has been implemented as described," or a similar phrase.
- The certification statement may be prepared by staff or an engineer. Staff may self certify an SPCC plan for facilities that store 10,000 gallons or less of oil, and have had no oil discharge to navigable waters exceeding 1,000 gallons, or two discharges of oil within any 12-month period that exceed 42 gallons. Self certification attests that the owner is familiar with the

requirements of 40 CFR Part 112, has examined the facility, that the SPCC Plan has been prepared in accordance with sound industry practices and standards, meets the qualifying criteria, and does not deviate from the requirements. A certification from a Professional Engineer includes similar language, and includes the registered professional engineer's stamp to the document.

*Written Description of Spills:* The SPCC Plan should include a description of the spills that have occurred within the previous twelve months and the corrective actions that were taken for each spill, including plans to prevent any future recurrence. There have been no spills or releases from District ASTs.

*Prediction of Spill Direction:* The regulation states that "where experience indicates a reasonable potential for equipment failure..." the plan should include a prediction of the direction, rate of flow, and total quantity of petroleum that could be discharged from the facility. Since District ASTs are equipped with secondary containment, the most reasonable potential for equipment failure would be a spill that is the result of either fuel dispensing or fuel delivery. The SPCC Plan should identify these types of incidents, and the type of spill containment equipment that is available. This information is included in the "Spill Prevention" portion of the SPCC Plan.

*Description of Containment Equipment.* The SPCC Plan identifies the types of containment equipment or diversionary structures available to prevent the spill from reaching navigable waters. If none are present, the SPCC Plan should identify those that should be in place. This information is included in the "Control" portion of the SPCC Plan. The secondary containment of the AST should be discussed here, along with the occasional tertiary diking that is provided at some facilities, and the attendant procedures for removing liquid accumulations. This section should also discuss fueling and delivery operations and measures taken to prevent spills. A description of all available spill equipment is to be included.

*Contingency Plan.* The contingency plan is the "Countermeasures" portion of the SPCC Plan. If it has been determined that the available containment structures will not prevent a release from entering navigable waters, the facility must include a contingency plan in the SPCC Plan. This document has two parts: (1) a contingency plan that is prepared in accordance with 40 CFR 109, and (2) a written commitment of manpower, equipment, and materials required to control and remove any harmful quantity of discharged oil. The plan should identify individuals that will be in charge of responding to the spill and contacting the necessary agencies, where the response team will meet, what agencies will be notified, and the identification and location of all

available emergency response equipment. The Emergency Response portions of HMBPs may be substituted for this contingency plan until further notice.

*Facility Inspections.* Inspection records should be kept with the SPCC Plan and maintained in the file for individual facilities for 3 years. There are no requirements for frequency of inspections. AST fuel facilities are inspected annual during the vapor recovery testing of gasoline dispensers.

*Security.* The SPCC Plan should include a description of security systems that are in place to prevent unauthorized entry to the AST area and any associated dispensing.

*Personnel Training.* Facility personnel are to be trained on the contents of the SPCC Plan and in appropriate spill response procedures (which is coordinated with Workplace Health and Safety).

*SPCC Plan Review.* The SPCC Plan must be reviewed and evaluated at least once every five years and amended to include more effective pollution control technology, if such technology will significantly reduce the likelihood of a spill and if that technology has been proven in the field. If there are changes in facility design, operation, or maintenance that materially affects the facility's potential to discharge oil, the SPCC plan must be amended within six months of the change and certified by a professional engineer. For District facilities, this would include increases or decreases in AST capacity.

SPCC Plans must be maintained at the facility, if the facility is normally staffed for at least eight hours per day. It is not necessary to submit SPCC Plans to the USEPA unless the facility spills 1,000 gallons of oil into navigable waters, or has two reportable oil spills within any 12-month period. If that happens, the facility must submit the SPCC Plan to the USEPA within 60 days of the incident. USEPA staff would review the SPCC Plan and propose any amendments as considered necessary. The facility would then be responsible for implementing the amendments within six months after the amendment is included in the SPCC Plan.

CUPAs have been delegated the state authority to conduct inspections. At this point, CUPA staff have not codified their inspection requirements and document submittals.

### **5.6.7 Fees**

Fees are assessed on ASTs by both local Fire Departments and by the CUPAs.

#### **5.6.7.1 Tanks Containing Combustible Materials**

ASTs of any size are regulated by the local fire departments, which is usually a flat fee for storage of flammable/combustible materials at the facility.

#### **5.6.7.2 Tanks Subject to SPCC Requirements**

On January 1, 2010, CUPAs were allowed to assess fees on those ASTs subject to SPCC requirements. Contra Costa County began assessing fees in 2010. Fees ranged from \$1,000 for storage from 1,320 gallons to 10,000 gallons and from \$3,100 for storage greater than 10,000 gallons.

#### **5.6.8 Inspections**

Both CUPAs and the USEPA are responsible for conducting periodic SPCC inspections. CUPAs are required to inspect AST storage facilities that store more than 10,000 gallons every three years. The USEPA does periodic inspections.

#### **5.6.9 Fines and Penalties**

The USEPA has the authority under the Clean Water Act to levy three types of penalties in the event of a spill: an administrative penalty against the facility, a judicial penalty, or criminal penalties.

An administrative penalty may be assessed against dischargers, facility owners, or operators. Class I violations may be assessed an administrative penalty of up to \$10,000 per violation, but no more than \$25,000 total. More serious Class II violations may be assessed penalties of up to \$10,000 per day, but no more than \$125,000 total.

Judicial penalties may be assessed against facility owners or operators. Judicial penalties may be as high as \$25,000 per day or up to \$1,000 per barrel of oil spilled. For discharges that are the result of gross negligence or willful misconduct, the penalties are \$100,000 and up to \$3,000 per barrel of oil spilled. If the facility fails to comply with its USEPA-approved SPCC Plan (which indicates that there have been previous spills at the facility), penalties of up to \$25,000 per day of violation may be assessed.

Criminal penalties may be assessed up to a maximum of \$250,000 for an individual or \$500,000 for a corporation, with a maximum prison sentence of five years.



Under HSC Section 25270.12, violations of the storage reporting, SPCC Plan reporting, fee submittal requirements, and any additional required monitoring, are subject to a civil penalty of \$5,000 per day of violation. Second offenses are subject to a \$10,000 civil penalty per day. Additional penalties exist for discharges to the environment under other hazardous materials/hazardous waste regulations.

#### **5.6.10 Training**

Staff must be trained on the contents of the SPCC Plan, proper use of spill equipment, and appropriate spill responses. Training overlaps Hazwoper, Hazcom and HMBP training. A copy of the SPCC Plan must be available on site for employee use, if the facility is routinely staffed (more than 4 hours/day).

#### **5.6.11 Recordkeeping**

Records of employee training and any tailgate meetings that discuss spill response should be kept for a minimum of three years. All maintenance and inspection records must be kept for a minimum of three years. Records are to be kept with the SPCC Plan.

#### **5.6.12 Spills and Leaks**

Spills should be reported as outlined in the facility HMBP. Part of the regulation reads that any sheen on the water should be reported; but in other parts, it is specified that oil spills greater than 42 gallons must be reported to the City, County, Office of Emergency Services, and National Response Center.

## 6.0 HAZARDOUS WASTE MANAGEMENT

### 6.1 Introduction

The management of hazardous wastes is strictly regulated to minimize the potential for impacts upon human health and the environment resulting from improper management and from spills and accidents involving hazardous wastes. This section summarizes key terms, responsibilities, requirements, policies, and procedures associated with complying with these hazardous waste regulations.

### 6.2 Definitions of Key Terms

**Hazardous Waste:** A waste that, because of its concentration, quantity, or physical, infectious, or chemical characteristics may cause or contribute to increased mortality or illness or pose a present or potential hazard to human health or the environment (e.g., ignitable, toxic, reactive, or corrosive). A hazardous waste may be classified as either a RCRA hazardous waste, which is federally regulated, or a non-RCRA hazardous waste, which is not federally regulated but is still regulated by the State of California.

**Hazardous Waste Generator:** Any person or business, by site, whose act or process produces hazardous waste or whose act first causes a hazardous waste to become subject to state or federal regulation.

**RCRA Hazardous Waste:** A federally regulated waste subject to the requirements of the Resource Conservation and Recovery Act (RCRA) and listed in 22 CCR 66261.

**Recyclable Hazardous Wastes:** Hazardous wastes that may feasibly be used, reused, or reclaimed (22 CCR 66266).

**Satellite Accumulation Area:** An area at or near the point of generation where wastes initially accumulate, which is under the control of the operator of the process (22 CCR 66262.34(e)).

**Treatment:** Any method that changes the physical, chemical, or biological character or composition of any hazardous waste.

**Uniform Hazardous Waste Manifest:** A shipping document required for transporting non-recyclable hazardous wastes.

**Universal Wastes:** Commonly generated hazardous wastes, such as batteries, cathode ray tubes (CRT), mercury-containing lamps and thermostats (see 22 CCR 66273.1).

The federal and state Universal Waste regulations reduce the regulatory burden on businesses that generate these wastes to encourage households and small business to reduce the amount of these items that are thrown into the trash.

*Waste:* A material that is discarded or disposed of; recycled or recyclable; or inherently waste-like (see 22 CCR 66261.2).

## 6.3 Roles and Responsibilities

### 6.3.1 District Work Units

The responsibilities of the facility manager or supervisor include, but are not limited to:

- Tracking routine and non-routine hazardous waste generated at District facilities, and informing the ECS of the status of hazardous wastes generated;
- Ensuring that all wastes that are generated, handled, stored, transported, or disposed in areas under their supervision are properly managed;
- Conducting weekly inspections of areas in which hazardous wastes are stored and maintaining a log of these inspections for at least three years;
- Verifying and certifying that the hazardous wastes to be disposed are properly accounted for on the Uniform Hazardous Waste Manifest;
- Ensuring that personnel under their supervision receive the appropriate training, and that all personnel training records are maintained as described in Section 6.11; and,
- Contacting the ECS for regulatory and technical support, as necessary.

### 6.3.2 ECS Staff

ECS staff is responsible for the following hazardous waste management activities, including, but not limited to:

- Developing effective waste minimization programs that minimize costs and liabilities to the District through recycling and reuse;
- Tracking new and emerging hazardous waste rules and regulations;
- Identifying applicable hazardous waste requirements and exemptions;

- Developing and maintaining Standard Operating Procedures (SOPs) for use by facility staff;
- Obtaining hazardous waste generator ID numbers;
- Arranging for the collection, transportation, and disposal of District-generated hazardous wastes;
- Procuring the services of hazardous waste management contractors and managing their activities District-wide;
- Maintaining all documentation associated with hazardous waste generation; and,
- Providing appropriate training, and maintaining documentation of training programs.

#### 6.4 Summary of Applicable Regulations

The regulation of hazardous wastes in California is governed by a complex system of federal and state laws and regulations.

The federal Resource Conservation and Recovery Act (RCRA) authorizes the Environmental Protection Agency (EPA) to regulate hazardous wastes from "cradle to grave" (e.g., from generation to disposal). Those who generate, transport, treat, store, and dispose of hazardous wastes are subject to strict waste management regulations promulgated under 40 CFR Parts 260 through 270. In addition, the Department of Transportation (DOT) specifies regulations for off-site shipment of hazardous wastes under 49 CFR Part 172 and the Occupational Safety and Health Administration (OSHA) specifies regulations under 29 CFR 1910.

California has received RCRA authorization from EPA, which allows Cal/EPA's Department of Toxic Substances Control (DTSC) to enforce the state's hazardous waste management rules. The majority of these requirements are contained in the Hazardous Waste Control Law (HWCL) in Health and Safety Code Section 25100, et seq. and in the regulations in 22 CCR, beginning with Section 66260.1. California's hazardous waste management rules and regulations incorporate more stringent state requirements with the federal requirements.

## 6.5 Hazardous Waste Source Reduction Program

The District has created a Hazardous Waste Source Reduction Program (HWSRP) to reduce the amount of hazardous wastes that are generated at its facilities (see Appendix 6-A). The primary objective of this pollution prevention program is to reduce the amount of hazardous wastes that are generated at the source to reduce the District's costs and potential liabilities associated with hazardous waste management.

Source reduction measures may include input changes, operational improvements, production process changes, product reformulation, or administrative actions. Elements of the District's pollution prevention program include the following:

- Identifying hazardous waste sources;
- Prioritizing waste streams for HWSRP evaluation;
- Conducting HWSRP evaluations; and
- Implementing waste minimization measures

In 1989, the state legislature adopted Senate Bill 14 (SB 14), the Hazardous Waste Source Reduction and Management Review Act Of 1989. SB 14 requires any generator that routinely generates more than 12,000 kilograms of hazardous waste, or 12 kilograms of extremely hazardous waste in a calendar year to prepare a Source Reduction Evaluation Review and Plan, a Hazardous Waste Management Performance Report, and a Summary Progress Report. The intent of the legislation is to promote source reduction. The District's Main Wastewater Treatment Plant generates more than 12,000 kilograms of used oil, and is complying with the SB 14 requirements.

## 6.6 Types of Hazardous Waste Generated by the District

Hazardous wastes generated by the District include both RCRA and non-RCRA wastes that are routinely and non-routinely generated. Routinely generated hazardous wastes may include universal wastes or expired or used materials such as bead blast, paint, or oil. See Appendix 6-B for a list of the District facilities that routinely generate hazardous wastes, the types of hazardous waste generated, and the frequencies of generation for each type of hazardous waste. Non-routinely generated hazardous wastes may include spilled chemicals (e.g., aluminum sulfate, ammonium hydroxide, fluorosilicic acid, polymer, sodium bisulfite, sodium hydroxide, sodium hypochlorite) or waste-contaminated trench spoils.

## 6.7 Waste Management Procedures

This section identifies standard operating procedures and labeling, storage, disposal, and spill response procedures.

### 6.7.1 Standard Operating Procedures

ECS has developed Standard Operating Procedures (SOPs) for managing the following routinely generated hazardous wastes. These SOPs are provided as Appendix 6-C.

Acetonitrile	Pesticides/Herbicides
Acids	Phosphoric Acid <sup>(a)</sup>
Aerosol Cans <sup>(c)</sup>	Photographic Chemicals <sup>(b)</sup>
Batteries, Dry-Cell <sup>(c)</sup>	Sodium Hypochlorite Recycling to SD-1
Batteries, Wet-Cell <sup>(a)(b)</sup>	Solvents
Bead Blast	Solvents, Parts Cleaning <sup>(b)</sup>
COD Vials	Spent Reagents from HACH Test Kits <sup>(a)</sup>
Copper Sulfate <sup>(a)</sup>	Transite Pipe
Cathode Ray Tubes (CRT) <sup>(c)</sup>	Thermostats containing Mercury <sup>(c)</sup>
Formic Acid <sup>(a)</sup>	Used Absorbents
Metal Processing Fluid <sup>(b)</sup>	Used Antifreeze <sup>(b)</sup>
Oily/Dirty Rags	Used Fluorescent Lamps <sup>(c)</sup>
Paint Chips containing Lead	Used Oil Filters <sup>(b)</sup>
Paint, Oil-based	Used Paint Filters
Paint, Water-based	Used/Waste Oil <sup>(b)</sup>
Paint Thinner	

<sup>(a)</sup> These wastes are typically accumulated at a satellite accumulation area.

<sup>(b)</sup> These wastes are typically recycled.

<sup>(c)</sup> These wastes are Universal Wastes.

### 6.7.2 Labeling and Storage

All containers of hazardous wastes must be properly packaged and labeled. The containers must be:

- Compatible with the contained waste and in good condition (no cracks, dents, or leaks);
- Closed, except when adding or removing waste;
- Handled in a manner that prevents rupture or leakage;
- Separated from incompatibles by berm, distance, pan, or other containment;
- Labeled with the words “Hazardous Waste” or “Workplace Accumulation Container”, the date that accumulation began, the date on which the accumulation period ends, composition and physical state of the waste, and the name and address of the generator (see Appendix 6-D for example label);
- Inspected weekly for leaks or deterioration (see Appendix 6-D for example checklist).

Most hazardous wastes must be disposed within 90 days of being generated. Universal Wastes and wastes collected at Satellite Accumulation Areas, within containers designated as Workplace Accumulation Containers, must be disposed within 365 days of when the waste first began accumulating.

California has a limited exemption for small quantity generators, under which generators of less than 1,000 kg of hazardous waste in any calendar month may accumulate the waste on-site for up to 180 days without a permit, or for up to 270 days if the waste will be transported more than 200 miles off-site for treatment, storage, or disposal.

Certain District facilities maintain hazardous waste storage lockers for storing hazardous wastes and minimizing the potential for spills. Each locker is equipped with chemical resistant coated surfaces, integral secondary containment, passive flow-through ventilation, and security locks. These lockers are not intended for the storage of flammable wastes. Flammable wastes must be accumulated in flammable storage cabinets that are available at each facility. Appendix 6-E summarizes the District's procedures for use of these hazardous waste storage lockers.

### 6.7.3 Disposal

Non-recyclable hazardous wastes intended for disposal must be accompanied by a Uniform Hazardous Waste Manifest (Manifest) and must be transported

by registered hazardous waste transporters to properly permitted Treatment, Storage, and Disposal Facilities (TSDFs).

The manifest is a legal document used for tracking the hazardous waste and consists of six copies. ECS retains one copy from the registered hazardous waste transporter, after District staff have verified and certified that the wastes to be disposed are properly accounted for on the manifest. ECS then retains another copy, after the waste arrives at the TSDF. The transporter, the TSDF, and the DTSC retain the four other copies. Appendix 6-F provides details on what is required in order to complete a manifest.

To ensure that District-generated wastes are properly disposed, ECS staff conducts routine audits of waste disposal facilities. Table 6-1 identifies the disposal facilities that were audited, recommendations, and the date of the most recent facility audit report. This is a living document, and subject to change. Please check with ECS staff for the most current listing.

#### 6.7.4 Contingency Plan

Facilities that store or accumulate hazardous wastes onsite must prepare a written contingency plan that identifies the actions that will be taken during and after emergencies or accidents involving hazardous wastes. The plan must be revised whenever it fails during an emergency or the contents or the regulations change and must include:

- Designating an emergency coordinator;
- Listing emergency procedures;
- Identifying and coordinating with emergency services;
- Describing and listing available emergency equipment; and,
- Establishing an evacuation plan.

The District typically incorporates these requirements into the facility Hazardous Materials Business Plan Emergency Response plan (see Section 5.0). Appendix 6-G provides additional chemical specific emergency response procedures for the District's water treatment plants.

## 6.8 Permits

Facilities or sites generating more than 100 Kg (27 gallons or 220 pounds) per month of a RCRA hazardous waste must have a federal Identification (ID) Number, issued by



the EPA. Facilities or sites generating less than 100 Kg of a RCRA hazardous waste, or any amount of a non-RCRA hazardous waste, require a California ID Number, issued by the DTSC. Each facility or site must have its own generator ID number; however, only one ID number is required per address. Table 6-2 provides a list of current hazardous waste generator ID numbers, by facility. If a new ID number is required, contact ECS.

A facility that treats, transports, or disposes of hazardous waste must obtain a permit from the EPA; however, there are no District facilities that treat, transport or dispose of hazardous waste.

**Table 6-1: Audit Findings of Waste Disposal Facilities**

Recommend	Facility Name	Type of Waste Accepted	Report Date
Acceptable	21 EMI/Philips Services	Consumer Type Batteries	4/30/99
	AERC Recycling Services	All Universal Wastes, e-wastes	8/27/07
	Acme Landfill	Class III Waste	7/2/97
	AETS	Transfer Facility	3/9/98
	American Recovery	Hazardous Waste (Liquid/Solid)	5/14/98
	BFI - Vasco Road	Class II/III Waste	9/15/97
	California Asbestos Monofill	Asbestos	11/6/97
	Crosby & Overton	Hazardous Waste (Liquid/Solid)	6/17/98
	Depressurized Tech. (DTI)	Aerosol Cans – Recycle	4/29/98
	Direct Computer Disposal	CRTs	5/21/08
	ECDC, Utah	Non-RCRA Hazardous Waste	5/23/07
	ENSCO West	Hazardous Waste (Liquid/Solid)	5/5/98
	Evergreen	Oil	9/15/97
	Forward Landfill	Class II Waste, Asbestos-containing waste	12/15/01
	GEM	Hazardous Waste	11/14/07
	Keller Canyon Landfill	Class II Waste	3/2/07
	Laidlaw Environmental Eng.	Hazardous Waste	10/9/97
	Rabanco	Non-RCRA Hazardous Waste	6/30/97
	Redwood Landfill	Class III Waste	7/2/97
	Republic Services Vasco Rd	Class II Waste	5/1/00
	RHO-CHEM	Lab Packs	4/30/99
	Rock Creek Landfill	Class II, accepts wastes generated in Calaveras County	2/23/01
	Romic	Solvents, Lab waste, Corr.	1/10/02
	Safety Kleen – Oakland	Solvents	12/31/97
	Safety Kleen - San Jose/SSI	Solvents and other hazardous waste liquids and solids	8/1/00
	Safety Kleen – Texas	Hazardous Waste	12/17/97
	Safety-Kleen - Buttonwillow	Class I	12/15/01
	Salesco Systems USA	Mercury wastes and fluorescent tubes, including ballasts	10/1/99

	Siemens Water Technology (formerly US Filter)	Hazardous Waste	12/5/07
	Solvent Services (Laidlaw S.J.)	Hazardous Waste	3/10/00
	US Ecology, Nevada	Hazardous Waste (Liquid/Solid)	5/1/00
	WCCSL	Class II/III Waste	9/15/97
	West Winton Landfill, Hayward	Non-Hazardous construction debris	8/1/00
	WMI - Altamont	Class II/III Waste	7/2/97
	WMI – Kettleman	Class I	11/21/97
	Aqua Clear	Drilling Mud	8/31/01
	Pacheco Pass Landfill	Asbestos	8/15/05
	Simco Road Regional Landfill	Mixed Liquid Wastes	7/13/05
	La Vista Quarry	Asbestos-containing Rock	6/25/05
Jess Ranch	Clean Fill	7/1/05	
Not Acceptable DO NOT USE	B&J Landfill		6/14/00
	Fulton Reclamation Facility	Drilling Mud	8/10/01
	MTI - Mercury Tech Int.	Mercury wastes and fluorescent tubes, including ballasts	10/10/00
	REMCO (Bay Area Soil)	TPH Soil	9/15/97
	Seaport	Non-haz aqueous waste	10/1/99
	Vulcan Material CalMat Props		9/5/00

<b>Table 6-2: EPA Hazardous Waste Generator ID Numbers</b>	
<b>Facility Name</b>	<b>State (or Federal) EPA ID#</b>
Adeline Maintenance Center (AMC)	CAD981382559
Bixler Yard	CAL000202807
Briones Pumping Plant	CAL000146322
Camanche Dam Powerhouse	CAL000240303
Claremont Center	CAL000146321
Danville Pumping Plant	CAL000269247
East Area Service Center	CAL000144347
Fleet Maintenance Center – 1199 21 <sup>st</sup> Street	CAR000074617
Lafayette Water Treatment Plant	CAL000117161
Main Administration Building (MAB)	CAL000157216
Mokelumne Aqueduct #2	CAR000102715
North Area Service Center	CAL000148340
North Richmond Water Reclamation Facility	CAL000196502
Oakport Storage Facilities No. 1 & 2	CAL000144348
Orinda Water Treatment Plant	CAR000109124
Orinda Watershed Headquarters	CAD108365735
Pardee Center	CAD983608092
Penn Mine	CAR000057810
San Pablo Water Treatment Plant	CAR000108837
Sobrante Water Treatment Plant	CAR000108845
South Area Service Center	CAL000082105
Stockton Center	CAL000635639
Upper San Leandro Water Treatment Plant	CAR000103739
Walnut Creek Pumping Plant #2	CAL000196503
Walnut Creek Water Treatment Plant	CAL000137583
Wastewater Treatment Plant (SD-1)	CAD980584684
Wastewater Treatment Plant Laboratory	CAL000158030

## 6.9 Fees

The ECS plans, budgets, and pays for hazardous waste generation fees associated with routine District operation and maintenance activities. Site-specific hazardous waste generation fees, particularly those associated with capital projects, are the generating department's responsibility. Accordingly, each department must plan and budget for the payment of hazardous waste generation fees, as appropriate. The ECS provides support by calculating payments due to the State Board of Equalization (BOE) and completing the necessary forms on behalf of various District departments that generate hazardous waste during capital projects.

Every generator that produces 5 tons or more of hazardous waste annually is required to pay the BOE a generator fee for each generator site for each calendar year, or portion thereof, unless the generator has paid a facility fee. Generators are required to report the amount of waste generated on a Hazardous Waste Generator Fee and Waste Reporting Surcharge Fee Return provided by the BOE. The rates listed in the following table are for CY 2005 and are adjusted annually to reflect increases or decreases in the cost of living measured by the Consumer Price Index in California.

Quantity Generated (tons/yr)	Rate	Fee
< 5	0% of Base Rate (Base Rate = \$3,949)	\$0
5, but <25	5% of Base Rate	\$197
25, but <50	40% of Base Rate	\$1,580
50, but < 250	100% of Base Rate	\$3,949
250, but < 500	5 times Base Rate	\$19,745
500, but <1,000	10 times Base Rate	\$39,490
1,000, but <2,000	15 times Base Rate	\$59,235
2,000 or more	20 times Base Rate	\$78,980

Generators that dispose of waste to land may be subject to land disposal fees imposed pursuant to HSC Section 25174.1.

In addition to the generator fee, hazardous waste generators, including, but not limited to those that are exempt from paying the generator fee because they have paid facility fees, are required to pay a surcharge to the BOE for each generator site for each calendar year or portion thereof.

## 6.10 Inspections

### 6.10.1 Conducted by Staff

The facility manager or supervisor are responsible for conducting weekly inspections of hazardous waste storage areas and for maintaining a log of these inspections for at least three years (see Appendix 6-D for example checklist).

### 6.10.2 Conducted by Outside Agencies

Under Section 66271.1 of California's Title 22 regulations, the DTSC or any duly authorized representative of the DTSC, including a local health officer or CUPA, is authorized to enter and inspect any location where hazardous wastes are stored, handled, processed, disposed of, or treated to recover resources. This inspection authority includes the right to:

- Collect samples of any material, including soil, suspected to be a hazardous waste or contaminated with hazardous waste, and to conduct laboratory analyses;
- Stop and inspect any vehicle reasonably suspected of transporting hazardous wastes, provided that the inspector is accompanied by a uniformed law enforcement officer in a clearly marked vehicle;
- Inspect and copy any records, reports, test results, or other information relating to hazardous waste management; and
- Photograph any waste, waste container, waste container label, vehicle, waste treatment process, waste disposal site, or condition observed during an inspection that is believed to constitute a violation of law.

During an inspection, the inspector is required to comply with all reasonable security, health and safety measures specified by the facility. The District has the right to split any samples that are collected, and to obtain copies of any photographs taken.

Upon concluding an inspection, the inspector must provide the operator with a written summary of all alleged violations before leaving the facility and must discuss any questions that the operator has concerning the inspection. The inspector must also provide a detailed inspection report to the operator within five days of its date of preparation, and in no event more than 65 days after the inspection. The operator must submit a written response to the inspection report within 60 days, unless an earlier response is requested by the DTSC. For each violation, the response must either document the corrective actions proposed or already taken to achieve compliance, or state that the violation is disputed. At the operator's request, the DTSC must meet and confer to discuss concerns about the inspection report.

Hazardous waste inspections are usually conducted by CUPA representatives in conjunction with other program inspections. For the most part the inspection will focus on proper documentation of legal disposal, and inspection of containers. Any findings during the investigation will be provided at the close of the investigation. Any significant findings may lead to

a more formal notice of violation, and the more formal inspection process described above.

### 6.11 Fines and Penalties

The DTSC has broad authority to issue a variety of administrative orders (e.g., corrective action orders, field orders, and desk orders) and to impose administrative penalties against parties that violate the Hazardous Waste Control Law or implementing regulations. The DTSC may also seek civil or criminal penalties, injunctive relief requiring correction of violations and to cease violating the law in the future, and the denial, suspension, or revocation of permits and licenses. The maximum statutory penalties for various hazardous waste violations range from \$1,000 to \$250,000 per day and imprisonment from 6 to 36 months.

## 6.12 Training

Hazardous waste training programs must:

- Be directed by a person trained in hazardous waste management;
- Contain information relevant to the employee's position and responsibilities, including contingency plan implementation and in-house waste management policies; and
- Be designed to ensure that employees may respond effectively to emergencies by familiarizing them with emergency procedures, safety equipment and hazardous waste management practices.

New employees must be trained within six months of hire and may not manage hazardous wastes in unsupervised positions until they have been trained. All employees must participate in annual refresher training.

## 6.13 Recordkeeping

The following table summarizes the recordkeeping requirements.

**Table 6-4: Recordkeeping Requirements**

Description	Maintain records for...
Hazardous waste storage area inspection logs	3 years minimum (see Section 6.7.2)
Uniform Hazardous Waste Manifests	3 years minimum
Training records, including but not limited the following data: <ul style="list-style-type: none"> <li>- Job title for each position involved in hazardous waste management, and the name of the employee in that position;</li> <li>- A written job description for each job listed, including required skill, experience, education or other qualifications, and duties of employees in each position;</li> <li>- A written description of the type and amount of training (introductory and continuing) that will be provided to each person in the listed positions; and</li> <li>- Documentation that the required training has been completed by each employee who is required to be trained.</li> </ul>	Indefinitely (per 22 CCR 66265.16)



## 9.0 TRENCH SPOILS FIELD MANAGEMENT PRACTICES

### 9.1 Introduction

The Trench Spoils Best Management Practices (BMP) program consists of a set of procedures to be followed prior to and during planned and unplanned trenching work by Distribution Maintenance and Construction Division (DMCD), Pipeline Construction and Equipment Division (PCED) and/or other departments to ensure that worker exposure to contaminants of concern is minimized and that trench spoils are disposed of properly. The program involves site investigations for all planned jobs, collection and analysis of soil, slurry and groundwater samples when required, and, depending on the results of the investigation, advance soil, slurry and groundwater disposal arrangements.

The management of trench spoils became the focus of concern in 1995, when District-owned disposal sites (DODS) started to reach capacity. As capacity issues began to be addressed, questions about soil contamination arose. The analytical results of soil samples collected at DODS on watershed property indicated that contamination was minimal. After reviewing the data, SFRWQCB staff classified the disposal sites as containing only inert material. To maintain this classification, a program was needed to ensure that contaminated soil would be kept out of the disposal sites.

In developing the trench spoils management program, the District addressed worker health and safety. Jobs had been shut down when evidence of soil, slurry or groundwater contamination was found, and field staff expressed concern about possible exposure to toxic contaminants. These jobs remained on hold for an excessive period of time because there were no programs or procedures in place to handle these situations.

A Contaminated Soils Committee comprised of staff from Design, PCED, DMCD, Construction Division, WHS, and ECS met throughout 1995 to devise a reasonable and practical program to address these issues. A four-month pilot program to test the proposed program began in mid-February 1996 and concluded at the end of June 1996. The program was implemented District-wide in April 1997.

In 2006, the District began to generate bentonite slurry as part of the Water Supply Improvement projects and as part of the linear trenching operation pioneered by PCED. Other kinds of slurries were also being generated, such as saw-cut, hydro-excavation and concrete waste slurry. As the District began generating this material, it became apparent that a comprehensive management and disposal methods were needed.

A Slurry Waste Committee comprised of staff from Infrastructure Management, Water Supply Improvements, Equipment Support and Environmental Compliance met throughout 2006 to devise a reasonable and practical program to address these issues. A one-month pilot run to test the proposed program began at Miller Road Landfill in early July 2006. During the pilot program, it was determined that Miller Road Landfill was not appropriate for the disposal of slurry because of its size and close proximity to surface water drain ditches. The program was relocated and implemented at Briones Landfill in August 2006. The program involves the collection and hauling of uncontaminated bentonite and other slurries, and properly disposing of these slurries at designated locations at Briones District-Owned Disposal Site (DODS) or off-site.

## 9.2 Definitions of Key Terms

**Groundwater:** For trenching purposes, groundwater is defined as naturally occurring subsurface water. If the groundwater level is higher than the maximum trench depth, dewatering and groundwater disposal may be required in order to work in the trench. Potable water from distribution system leaks or from irrigation sources may be encountered during trenching. Such water is NOT considered groundwater from a disposal point of view.

**Clean Soil:** The Trench Spoils Program defines soil as “clean” when the site investigation indicates no likely source of contamination or when analytical results are below the limits established for DODS.

**Industrial Zone:** Commonly referred to as the “Green Zone” because this zone was colored green in the Field Screening Maps. That part of the District service area which has been, or is currently, the site of industrial activity. It also includes a zone immediately adjacent to older freeways, where lead contamination of soil is likely.

**Hazardous Waste:** Waste that meets criteria established in State and Federal Law. Hazardous Waste can only be disposed of at Class I disposal facilities and can only be transported on public roads by licensed hazardous waste haulers.

**Inert:** Inert solid waste does not contain soluble pollutants likely to impact surface water or groundwater. Disposal of inert solid waste is not regulated.

**Large Job:** Jobs that generate more than 30 cubic yards of soil for disposal.

**Non-Hazardous:** Trench spoils may be classified as non-hazardous when analysis shows the existence of hazardous compounds at concentrations below hazardous

waste levels and above inert soil levels. Non-hazardous soil is disposed of at local Class II landfills.

**Planned job:** A planned job allows sufficient lead-time for a site investigation. All work generated by the New Business Office and Design Division and some jobs generated by the maintenance yards require a trench spoils site investigation.

**Small job:** Jobs that generate less than 30 cubic yards of soil for disposal. Trench spoils from small jobs may be stockpiled in bins at the maintenance yards under certain conditions.

**Slurry:** Technically, slurry is a mixture of bentonite or fine soil and water. Pure bentonite is a natural substance that is inert clay formed from volcanic ash which can absorb large amounts of water and expands to many times its normal volume. The analytical tests of pure bentonite slurry indicated that contamination was minimal. Therefore, the main concern with handling bentonite slurry is its proper disposal. In this BMP, slurry also refers to waste generated from saw-cut, hydro-excavation and concrete wash-out activities.

**Unplanned job:** Unplanned jobs are those with insufficient lead-time for a trench spoils site investigation; currently those with less than two weeks advance notice.

### 9.3 Roles and Responsibilities

#### 9.3.1 New Business Office (NBO) Staff

NBO staff responsibilities include:

- Conducting environmental database searches on all planned jobs;
- Referring sites in the industrial zone and/or with potential contamination to ECS staff for further evaluation;
- Communicating the District's Trench Spoils Program requirements to applicants, and obtaining applicant consent for sampling.

#### 9.3.2 Field Staff

Field staff responsibilities include:

- Reviewing the trench spoils package prior to starting work;

- Ensuring their familiarity with any requirements for Personal Protective Equipment (PPE), spoils disposal, etc.;
- Ensuring that the location of the excavation matches the location where any samples may have been taken;
- Determining if the excavation is within the industrial zone, and making the appropriate disposal arrangements for unplanned jobs;
- Being alert for signs of contamination. ***If soil, slurry, or groundwater contamination is unexpectedly encountered, field staff are to stop work immediately and contact WHS.***

### 9.3.3 Engineering Staff

Engineers are responsible for:

- Requesting site investigations using the Trench Spoils Investigation Request Form (see Appendix 9-A for the form);
- Incorporating the results of the investigation into the drawings and job orders for their project.

### 9.3.4 ECS Staff

ECS is responsible for:

- Conducting site investigations that extend beyond a database search;
- Arranging the disposal of trench spoils at commercial landfills. To arrange for trench spoils disposal in the most cost-effective manner, ECS staff manages three contracts: a trench spoils sampling and analysis contract, non-hazardous soil disposal contracts with local commercial Class II/III landfills, and non-RCRA hazardous waste contracts with out-of-state Class II landfills.
- Maintaining and improving the environmental database;
- Reviewing applicant-provided sampling and analytical data regarding potentially contaminated sites;
- Obtaining acceptance from commercial landfills for the disposal of trench spoils.

### 9.3.5 WHS Staff

WHS staff is responsible for:

- Reviewing analytical data and database reports to determine appropriate levels of Personal Protective Equipment (PPE) and other requirements at proposed excavation sites;
- Monitoring excavation sites that pose an appreciable risk of contamination; and
- Responding to incidents in which field staff unexpectedly encounters contamination.

## 9.4 Summary of Applicable Regulations

Section 6.0 of this manual includes an overview of hazardous waste management regulations. This section summarizes several key environmental and health and safety regulations associated with the District's Trench Spoils Management Program.

8 CCR Section 5194 requires employers to "provide employees with information and training on hazardous substances in their work area." This section further states that "employers ... are not required to follow any specific methods for determining hazards, but they must be able to demonstrate that they have adequately ascertained the hazards ..." While the law does not dictate how hazards are determined or evaluated, the employer has a clear responsibility to do so and the methods used must be scientifically defensible. Section 3204 requires employers to provide access to exposure data, if available.

22 CCR Section 66262.11 requires any generator of waste to determine if the waste is hazardous. This requirement is duplicated at the federal level. The criteria to be used to determine if a waste is hazardous are delineated in 22 CCR Chapter 11, as well as the waste management and disposal requirements in the event that it is so classified.

23 CCR Chapter 15, Division 3 contains the requirements for classifying, managing and disposing of non-hazardous, sanitary and inert wastes. The individual RWQCBs have the responsibility for regulating the landfills that accept such waste.

Based on analytical results from samples collected at the four DODS in 1994, the SFRWQCB has classified soil disposed of at these sites as inert. Future disposal at

these sites must not jeopardize this classification. In addition, runoff from these sites must not pose a threat to the District's water supply.

## 9.5 Site Investigations

All planned jobs performed by DMCD and PCED are subjected to trench spoils site investigations in advance to determine if health and safety precautions are required and to determine disposal methods for both trench spoils and/or groundwater. Unplanned jobs and contractor jobs may be investigated upon request. Persons requesting investigations should fill out a Trench Spoils Investigation Request Form (see Appendix 9-A for the form).

The first step in every site investigation is to determine whether the site lies within the Industrial Zone. The Trench Spoils FMP specifies that all trench spoils generated within this zone be sampled and characterized prior to disposal.

The second step in every site investigation is to perform a search of the environmental database. In some cases, an engineer may also perform a site visit and incorporate any observations recorded during the site visit into the site investigation.

The environmental database is based on data from about two dozen government agencies covering Superfund sites, leaking tanks, spills and other records of potential contamination. It includes both data purchased from third-party vendors and data generated by District soil and groundwater sampling. Some of the older database records are out of date and the locations of some sites are not accurately listed. When programming resources become available, ECS plans to upgrade the environmental database software so that new data can be added and errors can be corrected.

ECS and WHS staff reviews the results of the database search in order to determine PPE levels and disposal arrangements or to determine whether pre-sampling is required. Currently, between 5% and 10% of all site investigations are pre-sampled as a result of preliminary investigation.

Sampling is required for the following types of jobs:

- All large jobs in the industrial zone or large jobs where the environmental database indicates potential soil contamination;
- All jobs where the Environmental Database indicates potential contamination that may pose a health and safety risk;
- Stockpiles of soil that are potentially contaminated; and

- Jobs in which evidence of contamination has been found during excavation.

A contractor hired by the ECS normally performs sampling. Sampling is performed according to the protocol outlined in the “Generic Sampling Plan.” The contractor is responsible for obtaining encroachment and other permits and for coordinating sampling equipment and analyses with the District Laboratory. ECS has a Service Level Agreement with the Environmental Services Division (ESD), under which, District forces will assume sample responsibilities as scheduling limitations allow.

The results of the laboratory analysis of samples are reviewed by ECS to determine appropriate disposal requirements and by WHS to determine PPE levels and possible monitoring requirements.

The results of the site investigation for every planned job are contained in the Trench Spoils Handling and Disposal package. At a minimum, this includes: a Trench Spoils Handling and Disposal Form, indicating the soil classification; any Health and Safety concerns; and instructions for the disposal of soil and groundwater. If analytical data were reviewed as part of the site investigation, the package may also include: a sampling report; an analytical report; interpretative summaries for Health and Safety; disposal instructions; directions to Design Division staff concerning notes to be placed on the drawings for the job; and example manifests for disposal at local landfills. The analytical data and interpretative summaries are to be made available to field staff for review.

Capital projects will bear the costs of sampling, analysis and disposal that might be required. Sampling and analysis required by operations projects and most applicant projects will be paid out of the ECS trench spoils budget, with the field units paying for disposal charges. When soil and/or groundwater contamination requires unusual expenses by the District (typically when disposal of a hazardous waste is involved), the District will require the applicant to pay the sampling, analysis and disposal costs involved.

## 9.6 Soil Storage and Disposal Options

### 9.6.1 Soil Classification

The trench spoils site investigation described above results in the classification of trench spoils from a given site as being Inert, Non-Hazardous or Hazardous Waste. The disposal options for each classification are summarized below.

### 9.6.2 Soil Reuse

Reuse as backfill (direct reuse) is permitted in most situations, even if the soil is contaminated, provided that certain conditions are met. These conditions include excavation in the public right-of-way, contamination caused by a third party, and that the soil is simply excavated, stored nearby, and immediately placed back into the excavation. The District has received specific guidance from DTSC on this issue. Please contact ECS for additional information.

### 9.6.3 Soil Storage Bins

There are three soil storage bins at South Area Service Center, each having a capacity about 50 cubic yards (CY). There are two 80 CY bins at Construction Maintenance Services. Two 80 CY bins are normally used at North Area Service Center. There are three bins at Alameda Point, each about 40 – 50 CY. There are no trench spoils bins at East Area Service Center.

The primary purpose of the bins is to stockpile trench spoils from small jobs, allowing for post-excavation sampling and for consolidation of soil. The bins are primarily used by DMCD. Soil should be hauled to the bins under the following conditions:

- Soil from non-sampled small jobs in the industrial zone, both planned and unplanned;
- Soil that displays characteristics of contaminated soil; and,
- Soil from planned jobs near potential sources of contamination (the Trench Soils Handling and Disposal Form will indicate the bins as the disposal site).

The yard superintendent where the bin is located is considered the owner of the bin and has full authority and responsibility for bin use. Bin owners are responsible for logging all soil that is placed in the bins, notifying ECS to arrange sampling when the bins are full, and transporting non-hazardous soil from the bins to the indicated disposal sites.

When a bin is full, the DMCD yard will notify ECS and submit a fax copy of the bin log. ECS will arrange for the bin to be sampled and will make the appropriate disposal arrangements. ECS is responsible for negotiating contracts with local landfills, profiling the spoils and obtaining acceptance.



Disposal arrangements are based on the analytical results of the soil samples, and fall into three categories: Clean Soil, non-hazardous, and hazardous. Disposal arrangements for the categories are discussed below.

#### 9.6.4 Clean Soil Disposal

Soil can be classified as "clean", or inert, in two ways. First, soil from outside the industrial zone that is not located near any known sources of contamination will be presumed to be clean, unless evidence of contamination is encountered during excavation. Second, soil that has been sampled and found to meet the limits for a DODS will be classified as Clean Soil.

When District forces perform the trenching and excavating, Clean Soil will be transported to a DODS or equivalent site. If the work is a planned job, the Trench Spoils Handling and Disposal Form will indicate that a DODS should be used. At unplanned jobs, all soil generated outside the industrial zone will be transported to a DODS, unless evidence of contamination is found during the excavation.

On jobs completed by contractors, the contractor is responsible for the disposal of Clean Soil. Normally, the contractor will submit a material disposal plan to the District for approval prior to hauling trench spoils to a disposal site. Additionally, the District may send a letter to the disposal site disclosing any relevant information about the site (analytical results, Vista search) that the District used in determining that the spoils are clean.

#### 9.6.5 Clean Slurry Disposal

Slurry can be classified as "clean", or inert, in two ways. First, slurry from outside the industrial zone that is not located near any known sources of contamination will be presumed to be clean, unless evidence of contamination is encountered during generation. Second, slurry that has been sampled and found to meet the limits for a DODS will be classified as Clean Slurry.

When District forces perform the trenching and excavating, Clean Slurry will be transported to Briones Landfill. If the work is a planned job, the Trench Spoils Handling and Disposal Form will indicate that Briones Landfill should be used for disposal. The slurry may not be disposed at any other DODS. If the work is unplanned, all slurry generated outside the industrial zone will be transported to Briones Landfill, unless evidence of contamination is found during the excavation.

On jobs completed by contractors, the contractor is responsible for the disposal of Clean Slurry. Normally, the contractor will submit a material disposal plan to the District for approval prior to hauling trench spoils to a disposal site. Additionally, the District may send a letter to the disposal site disclosing any relevant information about the site (analytical results, Vista search) that the District used in determining that the spoils are clean.

While disposing of Clean Slurry at Briones Landfill, the truck must discharge the slurry in designated areas, where the site has been prepared in the form of evenly graded pads surrounded by levees to contain the slurry. ECS will make prior arrangements with Equipment Support Services (ESS) to ensure that enough pads are available to contain the entire volume of the slurry from the job. The discharged load must spread evenly on the flat surface to a thickness not exceeding 2 inches. The discharge must remain on the designated pad and not breach the levees and/or flow to other areas of the landfill. If this occurs, the driver must immediately notify the project manager and/or ESS and discontinue the disposal of the Slurry.

ECS must be notified at least three weeks prior to projects that create drilling mud. The notification must include the estimated volume to slurry to be generated, project location, slurry collection method and duration of the project. No slurry disposal shall occur at the Briones landfill without prior approval by ECS.

#### **9.6.6 Non-Hazardous Soil and Slurry Disposal**

Soil and slurry that does not meet the Clean Soil or Clean Slurry criteria, and is not classified as a hazardous waste, is considered to be “non-hazardous.” These spoils must be disposed of at Class II and Class III landfills. ECS will provide the non-hazardous manifests and other documentation. The work unit generating the non-hazardous soil is responsible for collecting weigh-tags from the landfills and ensuring that the necessary accounting information is entered into the FIS system. In some cases, contractor forces may transport non-hazardous spoils to the landfill, and the landfill will charge the District directly for disposal.

#### **9.6.7 Hazardous Soil and Slurry Disposal**

Soil or slurry that is classified as a hazardous waste under state or federal regulations must be handled in accordance with these regulations. Hazardous spoils must be transported by licensed hazardous waste transporters. Spoils must be disposed of at a Class I landfill within California, or at an out-of-state

Class II landfill for California-only hazardous wastes. ECS will negotiate the necessary contracts and make the necessary arrangements for disposal of hazardous wastes that are generated by District forces. Contractors will generally be responsible for disposal of hazardous wastes generated by their forces, under close oversight by ECS. District employees will sign hazardous waste manifests for all District jobs, including contractor jobs.

## 9.7 Groundwater Disposal

When groundwater is encountered above the maximum trench depth, the trench needs to be dewatered and the groundwater needs to be characterized for proper disposal, and as with soil data, to determine appropriate PPE. Groundwater is classified as non-contaminated or contaminated. The following is a description of the disposal methods for non-contaminated and contaminated groundwater.

### 9.7.1 Contaminated Groundwater Disposal

The environmental database is used to determine if groundwater should be considered uncontaminated or potentially contaminated. The excavation location is considered potentially contaminated, and groundwater must be sampled if:

- The location is located within the industrial zone;
- The location is not within the industrial zone, but with 250 of a potential source of contamination (such as a leaking underground fuel tank site);
- Evidence of contamination is present at a site where it was not anticipated.

Soil and groundwater samples are collected in the course of a trench spoils site investigation. The Trench Spoils Handling and Disposal Form will contain instructions for groundwater disposal in cases when groundwater has been characterized in advance. Groundwater that is considered potentially contaminated must be sampled prior to disposal if it is encountered during excavation activities. It may be necessary for the groundwater to be stored in temporary tanks pending the final arrangements for characterization and disposal.

The District compares the groundwater sample analytical data with state and federal Maximum Contaminant Levels (MCLs) to determine if the groundwater is to be considered contaminated. Groundwater sample results that exceed any MCL are considered contaminated and must be properly disposed of.

ECS will make arrangements for disposal of contaminated groundwater. The District has established wastewater discharge permits with SD-1, the City of San Leandro, Oro Loma Sanitary District, and the City of Richmond to discharge groundwater to the sanitary sewer. Typical permit requirements include submitting analytical data to the sanitary sewer agency prior to discharge, and submitting routine reports describing the dates and volumes of any discharges.

If the contamination exceeds the discharge limits established in these permits, ECS will make the necessary arrangements for groundwater disposal.

### 9.7.2 Non-Contaminated Groundwater Disposal

If the excavation location is outside the industrial zone, the environmental database does not indicate the presence of a potential source of contamination within 250 feet, or analytical results indicate that there are no values that exceed the MCL, the groundwater is considered uncontaminated. Uncontaminated groundwater may be discharged to the storm sewer without any regulatory oversight, provided that appropriate sediment control measures are used.

ENGINEERING STANDARD PRACTICE 512.1  
WATER MAIN AND SERVICE DESIGN CRITERIA

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<b>ENGINEERING STANDARD PRACTICE</b>	ESP	<b>512.1</b>
SUBJECT:	EFFECTIVE	09 OCT 06
WATER MAIN AND SERVICES DESIGN CRITERIA	SUPERSEDES	<b>15 AUG 00</b>

**PURPOSE**

To establish basic criteria for the design of water mains in the distribution system.

**DESIGN OF WATER MAINS**

**A. General**

1. Location of water mains shall be on the north or east side of the street and 7 feet from the face of curb, where practical, and shall avoid the centerline and gutter areas of the street when possible. (Refer to ESP 517.1 for location in right-of-ways.)
2. Clearance between water mains and other utilities shall be a minimum of 1 foot vertical and 5 feet horizontal wherever practical. (Maintain 10 feet horizontal separation from sewers wherever practical.) Where the vertical clearance cannot be maintained at 1 foot minimum between metallic pipes, refer to Standard Drawing 308-EA. When replacing existing mains, the new main shall be a minimum of 3 feet from those being abandoned.
3. Cover over the top of pipe shall be not less than 36 inches to finished grade and 24 inches to pavement subgrade, and shall not be less than 42 inches in unimproved areas where final street grade has not been established. Pipelines 16 inches and larger shall have 42 inches minimum cover in all areas.
4. Air valves shall be combination air release and vacuum valves, not less than 1 inch in size, and located to prevent the formation of entrapped air pockets and to assist in filling and emptying of the pipeline.
5. Blow offs shall be not less than the size required for adequate flushing of the mains as listed in ESP 862.1, and shall be installed at all dead ends and at low points as may be required to empty the pipeline.
6. Fire hydrants are normally located by the local Fire Agency at curb returns at intersections. If they are required between intersections, hydrants are normally located in the public right-of-way opposite lot lines. Hydrant laterals shall run at right angles from main to hydrant.
7. In cases where water quality is a concern, such as where low water use could potentially cause problems due to flow through and high water age or incremental residence time, or where pipeline constructability is problematic, pipe materials other than mortar-lined and plastic-coated steel (ML&PCS) or polyvinyl chloride (PVC) may be used in nonstandard applications. Alternative pipe materials will only be selected for new water mains if it is determined not only that the application is suitable, but that there is a District advantage afforded by the alternate technology application.

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**B. Valving**

1. Valves in 6-inch and 8-inch mains shall be spaced at approximately 600-foot intervals, and shall be installed so that a minimum length of distribution main is shut down at one time.
2. Valves spacing in 12-inch and 16-inch mains in the distribution grid shall be governed by operational requirements, but generally shall be approximately 1,000 feet.
3. Valve spacing in pure transmission mains (no services) shall not exceed 4,000 feet and shall be at closer intervals when there are connections to the distribution system.
4. Mainline valves at street intersections shall be placed at the extension of north or east property lines.
5. On mains 8 inches and smaller, valves shall be the same size as the main. On mains 12 inches and larger, valves shall normally be the same size as the main, but smaller sizes may be used when the main is reduced for incorporation of smaller meters or control valves.
6. Valves 12 inches and larger shall be butterfly valves except when used for making a wet tap.
7. All connections to 12-inch and larger mains, which cross other mains, shall be of the bypass type with a valve off the larger main. All side connections or appurtenances shall be valved at the main.
8. Bypass connections shall be one size larger than the smaller main, e.g., from a 12-inch main, use an 8-inch bypass to connect into a 6-inch crossing main.
9. For valves 24 inches and larger, an engineered by pass with a gate valve shall be required.

**C. Materials**

Either ML&PCS or PVC shall be used for all standard water main installations. Other pipe materials may be used in nonstandard applications subject to paragraph A7.

1. Nonmetallic materials
  - a. The primary/standard nonmetallic pipe used by EBMUD is PVC.
    - 1) 4-inch, 6-inch, 8-inch, and 12-inch PVC pipe shall be American Water Works Association (AWWA) C-900 or approved equal, class 200, with TYTON, TYTON compatible joints or fusible joints; 16-inch PVC pipe shall be AWWA C-905 or approved equal, class 235. PVC pipe greater than 8 inches is considered nonstandard and shall only be used for specialized applications if it is determined not only that the application is suitable, but that there is a District advantage afforded by the alternate technology application.



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2) 2-inch PVC pipe shall be SCH 80 with solvent welded joints.

3) Nonmetallic pipe shall be installed with a metallic tracer wire and identification tape in accordance with ESP 512.3.

- b. High density polyethylene (HDPE) pipe may be used as an alternative to PVC or steel, for specialized applications that require the use of trenchless technologies such as horizontal directional drilling, pipe bursting, or slip-lining. For new or replacement pipe applications, HDPE pipes and fittings shall have a maximum Standard Dimension Ratio (SDR) of 11, with fusion welded joints per AWWA C906, and shall be manufactured from PE 100 resin that is NSF/ANSI Standard 61 approved for potable water applications.

PE 3408 pipe material and fittings may be used as an alternative to PE 100, if SDR/pressure rating requirements are met. HDPE pipe with an SDR higher than 11 may be used for certain applications, if the required pull force, for a pipe bursting application, or other calculations can demonstrate that a lower pressure rating, or higher outside diameter to minimum wall thickness ratio, is acceptable.

HDPE pipe shall be black pipe with blue stripes for identification as potable water application.

- c. Nonmetallic materials shall only be used when none of the conditions exist as listed in C.2.c below.

2. Metallic materials

a. The standard metallic pipe shall be ML&PCS.

b. Steel pipelines shall be designed with welded joints.

c. Steel pipe shall be used when one or more of the following conditions exist.

1) Sizes are 12-inches and larger except when it is determined that there is both an advantage to using an alternate material and the product application is appropriate.

2) Lines that have working pressures exceeding 140 pounds per square inch (psi).

3) Lines that are installed where the grade is 15 percent or greater.

4) Lines that are installed in heavily traveled ways or at crossings of heavily traveled ways.

5) Lines that are installed prior to or during street construction (unless conditions permit the use of PVC) and in the immediate proximity of other proposed heavy construction.

6) Lines that are inlet-outlet lines to reservoirs or force mains from pumping plants.

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- 7) Lines that are installed with excessive cover (over 6 feet) or with little cover (less than 30 inches).
- 8) Lines that cross force main sewers for a minimum of 5 feet on either side of the sewers.
- 9) Lines that cannot be located at least 5 feet horizontally and 1 foot above any sewer line.
- 10) Lines that are installed where the soil or groundwater in the vicinity of the pipeline is or has been contaminated with compounds that could pose a public health risk to the water supply if the pipe was penetrated either by chemical diffusion or a physical break.
- 11) Lines that are installed under decorative concrete or pavement.
- 12) Lines that cross creeks, either buried or suspended on a structure.
- 13) Lines that are relocated prior to and above or below the planned crossing of EBMUD's pipeline by another utility.
- 14) Lines that are in right-of-ways where no well-defined street exists or in any roadway whose profile or alignment is likely to be modified.
- 15) Lines that are installed in hilly terrain where there is questionable ground condition and a high risk to downhill properties by damage resulting from pipeline failure.
- 16) Lines that cross over existing structures where differential settlement of soil or concentrated traffic loads may be expected.
- 17) Lines that are installed in slide areas, fill areas over bay mud, or other areas having evidence or potential of unstable ground.
- 18) Lines that cross potentially active geologic faults or are in the Alquist-Priola earthquake fault zone as shown on map sets issued by the Seismic Improvement Program. (Other materials may also be permissible. Refer to ESP 550.1 "Seismic Design requirements.")

3. Corrosion practices: All pipelines shall be designed in accordance with ESP 572.1

**D. Type of Joints**

Joints between pipe sections and at fittings are either restrained joints or unrestrained joints.

- 1. Restrained joints are designed to withstand separation forces without supplemental appurtenances or anchors. Examples are: welded joints in steel pipelines, flanged connections to valves, and fusible joints in PVC or HDPE pipelines.

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2. Unrestrained joints must have supplemental appurtenances or concrete anchors at locations where they are required to withstand separation forces. Examples are: "push-on" joints utilizing only a rubber ring to make a joint, flexible couplings, and compression type fittings.
3. Special joints may be required when crossing potentially active geologic faults, in unstable ground areas, and at connections to structures. Examples are butt welds or double welded joints designed for extra strength or reliability and restrained-articulated joints that are designed to provide specific limited movement while retaining unassisted restraint against separation.

**E. Seismic Considerations**

Pipeline design shall account for possible effects of earthquakes. Refer to ESP 550.1 "Seismic Design Requirements" for detailed provisions. In general, differential ground movements such as those caused by fault rupture, landslides or soil liquefaction are especially damaging to buried pipelines and require special attention including:

1. An alternate location based on potential property damage, effect of failure on the distribution system, particularly fire-fighting capability, and costs;
2. Pipe of greater strength or flexibility than otherwise needed;
3. Special backfill or casing to support pipe or allow motion;
4. Reduced spacing between valves to isolate potential breaks; and
5. Valves and possible emergency hose manifolds installed on each side of an identified, potentially active fault zone.

**DESIGN OF SERVICES**

**A. General**

1. Services shall be installed at right angles to the mainline whenever possible.
2. All services shall be metered. (Refer to ESP 521.2 for meter sizes.)
3. Meters shall be in a protected location adjacent to, but out of a traveled way to facilitate reading.
4. Connections to the main shall be made at the spring line.
5. Three-inch services shall have a 4-inch tap and piping.
6. One-inch is the minimum standard service piping for new services and service renewals.  
EXCEPTION: For polybutylene replacements, 3/4-inch service piping (with a maximum length of

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30 feet) to a 5/8-inch meter is allowed where the available static pressure is greater than 60 psi. Contact the Water Distribution Planning Division for any further determination.

**B. Valving**

1. All services shall be valved at the connection to the main using an AWWA main cock.
2. All services 2 inches and under, and all domestic, irrigation, industrial, and combined services also shall have valves before the meter.

**C. Materials**

1. Metallic materials

Copper (K)

Copper pipe is standard service lateral material for 1-inch to 2-inch sizes

Mortar Lined and Plastic Coated Steel (ML&PCS)

Service laterals 4 inches and larger shall use metallic materials compatible with the materials in the mainline or insulating joints and cathodic protection shall be added per Standard Drawings.

2. Nonmetallic materials

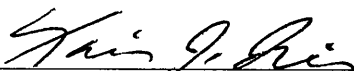
Polyvinyl Chloride (PVC)

High Density Polyethylene (HDPE)

PVC pipe can be used as an alternative to the metallic in 1 1/2-inch and 2-inch sizes. HDPE pipe shall only be used as an alternative to metallic or PVC services in 1 1/2-inch and 2-inch sizes, for specialized applications such as very long services and/or services located in areas that have difficult access.

**D. Types of Joints**

Flare and compression fittings are used on copper and on PVC. See Section D under Design of Water Mains for joints on steel pipe.

  
 \_\_\_\_\_  
 XAVIER J. IRIAS  
 Director of Engineering and Construction

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## 1.0 GENERAL

### 1.1 Purpose

The purpose of this Engineering Standard Practice (Standard) is to set forth criteria for the seismic resistive design of District facilities such as offices, operating centers, water treatment plants, water storage structures, pumping plants, and pipelines.

### 1.2 Intent

This Standard shall be used as a reference by all persons performing design of District facilities. It incorporates by reference, wherever appropriate, the applicable building codes and industry standard procedures normally used for the design of such facilities. These typically specify minimum seismic design. The seismic environment in which many of the District's facilities are located is severe and design above minimum levels is warranted in many situations. Therefore, specific modifications to building codes and industry standard procedures are indicated herein. This Standard provides design requirements which may exceed applicable building codes or industry standards for specific structures within the District. Nothing in this Standard shall be construed to allow design of new facilities to a level less than required by the applicable building codes and industry standards.

The Project Manager is responsible for the specific seismic criteria to be used on the particular project. The recommended criteria shall be subject to approval by the Design Division Engineering Manager.

### 1.3 Applicability

This Standard does not apply to design of the following types of facilities:

- Dams and associated components under California DSOD jurisdiction. DSOD shall be consulted regarding seismic evaluation/design criteria for the particular component under their jurisdiction.

### 1.4 Facility Importance and Performance Goals

Criteria contained in this Standard are intended to provide greater reliability for District facilities than would be obtained by straight application of the Uniform Build Code (UBC) and other similar standards, when such greater reliability is justified. Consideration shall be given to the intended function of the facility, system redundancy with regard to the facility or component, the level of service which the District would provide in the event of facility or component failure, and the



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difficulty of recovering from failure either by repairing or replacing failed components or providing a temporary replacement facility during the emergency recovery period.

For the purpose of design criteria selection, facilities are classified into three groups of importance as indicated in Table 1-1 below.

**Table 1-1  
Facility Importance and Performance Goals**

Facility Class	Description	Performance Goal
Standard	Administrative centers, repair shops, service centers and similar support facilities.	Provide substantial life safety protection for major earthquakes likely to affect the site. Facility may not be economically repairable in the event of such an event.
Important	Structures and components of the distribution, treatment and control systems with some level of redundancy or for which failure does not result in an unacceptable service level.	Provide substantial life safety protection for major earthquakes likely to affect the site. Facility may experience significant damage but should be capable of restoration to service within a limited period of time.
Critical	Structures and components of the distribution, treatment and control systems with no redundancy or redundancy having common-cause failure modes, and the failure of which results in an unacceptable service level.	Provide substantial life safety protection for major earthquakes likely to affect the site and provide reasonable expectation of post-earthquake operability.

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Where the detailed requirements of this Standard or referenced standards and codes require the application of an Importance Factor, *I*, such factor shall be determined in accordance with the Table 1-2.

**Table 1-2  
Occupancy Importance Factors**

Facility Class	<i>I</i>	Comment
Standard	1.0	Same as 1997 UBC Special occupancy, Standard occupancy or Miscellaneous structures categories as applicable (UBC Table 16-K)
Important	1.25	Same as 1997 UBC Essential or Hazardous facilities as applicable
Critical	1.5	Other requirements same as 1997 UBC Essential or Hazardous facilities as applicable

Pressure zones with pumping plants, reservoir sites and the like providing redundancy and having no common-cause failure modes, shall have their facilities classified as Important ( $I = 1.25$ ).

Common-cause failure modes are multiple failures resulting from a single cause. These are typically characterized by the failure of identical components, e.g., earthquake ground shaking at a pumping plant site could cause failure of all the multiple identical redundant electrical control systems associated with the multiple redundant pump sets. Attention must also be given to flow limitations within the pressure zone when assessing redundancy. Pressure zones (or parts thereof) having no redundancy or redundancy with common-cause failure modes, shall have their facilities classified as Critical ( $I = 1.5$ ).

However, not all components of even the most important facilities within the District's system will all qualify as Critical. As an example, consider a hypothetical pumping plant that will be the only source of supply for a pressure zone. Assume the District has determined that maintaining service to the zone following an earthquake, for purposes of fire protection is essential and that the station is to be designed with three identical pumps, one of which is a spare, and a single power system.

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In this case, the building, pumps and power system would be designated as Critical ( $I = 1.5$ ), since loss of these could result in failure of the pumping plant to function. Note that the pumps have redundancy, but they have a common-cause failure mode. Elements within the building, that are not essential to pumping plant operation, such as lighting and ventilation could be classified as Important ( $I = 1.25$ ).

## 1.5 Reference Codes and Standards

All District facilities shall as a minimum comply with the applicable provisions of codes and standards indicated in this Standard. These include the following.

- Buildings, structures & equipment - Uniform Building Code, International Conference of Building Association. 1997.
- Active Fault Near-Source Zones – Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, published by International Conference of Building Officials, February, 1998.
- Reinforced concrete water retention structures – Environmental Engineering concrete Structures, ACI 350R-89, American concrete Institute.
- Welded Steel Water Tanks – Welded Steel Tanks for Water Storage, ANSI/AWWA D100-96, American Water works Association.
- Bolted Steel Tanks – Factory-Coated Bolted Steel Tanks for Water Storage, ANSI/AWWA D103-97, American Water Works Association.
- Prestressed Concrete Tanks – Wire- and Strand-Wound Circular, Prestressed Concrete Water Tanks, ANSI/AWWA D110-95 (including Addendum AWWA D110a-96) American Water Works Association.

References cited in this Standard are available from: Seismic Improvement Program library and/or Design Division library.

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## 2.0 SITE CRITERIA

Site hazards are highly dependent on the individual locale and development of an appropriate design program should consider the project capital asset value and facility class. The best design programs are based on site-specific study and recommendations of a geotechnical engineer. The District Materials Engineering Section shall be consulted prior to commissioning of a site-specific study.

### 2.1 General

Siting of District facilities shall consider the seismic stability of each site, its susceptibility to earthquake induced ground failures such as liquefaction, landslides and fault rupture. In the event that substantial site hazards exist, appropriate mitigation techniques shall be identified which can be used to assure acceptable performance. Data specific to the District's service area are available in:

- Assessment of Earthquake-Related Geologic/Geotechnical Hazards at Service Area Facilities and Regional Hazard Assessments, Geomatrix Consultants Report No. 1990, Volumes 1 and 2, October 1993.

### 2.2 Ground Fault Rupture

Ground fault rupture consists of a direct offset or displacement of the ground surface along the trace of the causative earthquake fault. The best mitigation is not to build across the traces of known active faults. In some cases it is possible to incorporate design mitigations for ground fault rupture. Typically this requires that the structures be designed with flexibility and that foundations be configured to permit the ground offsets to be accommodated within a well defined length of the structure. Appropriate design requires careful definition of the probable fault location.

Approximate locations of active faults within the District service area can be found in:

- Alquist-Priolo Earthquake Fault Zone Maps, State of California, Revised official maps effective January 1, 1992.
- Map of Recently Active Traces of the Hayward Fault, Alameda and Contra Counties, California, Map MF-2196 published by U.S. Geological Survey, 1992.

The District's Seismic Improvement Program has information from the above references superimposed on District service maps. When considering a site within close proximity to these faults, reference should be made to the information source. Mapped traces of faults may not be

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indicative of exact fault location. A site specific geologic investigation may be required to confirm the extent of the hazard for sites located across or near mapped traces of faults.

## 2.3 Ground Shaking

For purposes of engineering design, the effect of ground shaking on structures at a site is typically characterized by an elastic acceleration response spectrum. Figure 16-3 of the 1997 UBC presents a design response spectrum intended for general use.

A site-specific response spectra may be used. It shall be an equal hazard spectrum, with a probability of exceedance of 10% in 50 years (approximately 500 year return period). For design purposes, 5% damping shall be used, except for reservoir and tanks structures. For these structures, design spectra for 2% and 1/2% damping shall be used for the impulsive and convective modes of response, respectively. In lieu of more sophisticated procedures, 2% and 1/2% spectra may be derived from a 5% spectrum using procedures in:

- Earthquake Spectra and Design, by N. M. Newmark and W. J. Hall, Earthquake Engineering Research Institute Monograph.

Unless noted otherwise, when using site-specific response spectra, the design seismic load need not exceed a load determined by using 1997 UBC static force procedures Section 1630.2 with a  $C_a$  value of 0.88 (and with the importance factor  $I$  per Table 1-2).

## 2.4 Liquefaction-Related Phenomena

**2.4.1 Liquefaction.** Liquefaction is a phenomenon in which loose, saturated, granular soils (silts and sands) lose strength when subjected to ground shaking.

Potential consequences of liquefaction include bearing capacity failure, floatation of lightweight embedded structures, landsliding (lateral spreads and flow slides), and differential settlement. Any site having loose to medium-dense sands or silts, beneath the ground water table can have the potential to liquefy. In the District Service Area, the most liquefiable soils are loose materials and fills that have been placed through Bay waters without compaction. Such areas are "man-made ground" adjacent to the margins of San Francisco Bay.

**2.4.2 Lateral Spreads and Flow Slides.** Lateral spreads are ground-failure phenomena that can occur on sloping ground underlain by liquefied soil. If the site has a significant slope, or is adjacent to an open cut, (e.g., depressed stream or road bed) liquefaction can cause the soils to flow down slope or towards the cut.

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**2.4.3 Settlement.** Differential settlement can damage structures. In addition to that caused by liquefaction, settlements may also occur in loose unsaturated materials above the ground water table. Differential settlement may be expected when different soil types vary in thickness and extent over a site. Buried pipes at locations where they enter vaults have the potential hazard of differential settlement.

### ***B. 2.5 Landsliding***

Landslides can be triggered by strong ground shaking, particularly in areas close to the causative fault. Any site adjacent to a steeply cut slope or bluff should be considered susceptible to landslide.

### ***C. 2.6 Seiches and Tsunamis***

Seiches are undulations of the surface of a body of water such as a bay, lake, or reservoir, caused by near or distant earthquakes.

Tsunamis, seismic sea waves, are caused by faulting or other abrupt ground movements on the ocean floor during large earthquakes.

Design of Critical facilities located immediately adjacent to large bodies of water, for example lakes or bays, should consider study of the potential for seiches and tsunamis.

## **3.0 BUILDINGS & BUILDING-LIKE STRUCTURES**

### **3.1 Applicability**

For the purposes of this section, a building is defined as any enclosed or partially enclosed above grade structure which provides for shelter of persons or equipment, and which is occasionally occupied. A building-like structure is any unenclosed above grade structure which has one of the lateral-force-resisting systems defined in Table 16-N of the 1997 UBC, except the following:

- Tanks
- Water Retention Basins
- Dams and associated facilities under California DSOD jurisdiction.

### **3.2 Design Basis**

The design of all elements of buildings, including structural elements of the lateral-force-resisting system, structural elements not part of the lateral-force-resisting system and non-structural elements shall as a minimum comply with all applicable sections of the 1997 UBC. Note that 1997 UBC forces are strength design seismic forces (1994 UBC forces are working stress design forces).

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Performance aspects such as vertical deflections at service level loads shall be evaluated where necessary to ensure appropriate performance. In addition, the requirements of this Standard shall apply.

### 3.3 Design Force Levels

**3.3.1 Lateral Force Procedure.** Buildings and building-like structures may be designed using either the Static Force Procedure or the Dynamic Force Procedure of the 1997 UBC. The Dynamic Force Procedure shall be utilized when any of the following apply:

- Structure has a stiffness, weight or geometric vertical irregularity of Type 1, 2 or 3, per UBC Table 16-L or Type 1 per UBC Table 16-M.
- Structure is on an  $S_F$  site and has a period in excess of 1 second.

Earthquake forces determined under the 1997 UBC should be scaled by a factor of 1/1.4 to account for the working stress level used for timber design. This same reduction is appropriate wherever working stresses are used, per 1997 UBC Section 1612.3.

**3.3.2 Design Force Levels.** Structures designed using the Static Force Procedure shall be proportioned to resist a minimum base shear according to Section 1630.2.1 of the 1997 UBC with the importance factor  $I$  defined in Table 1-2.

Structures designed using Elastic Dynamic Analysis Procedures of Section 1631 of the 1997 UBC shall be designed for a total base shear of not less than that obtained by the Static Force Procedure.

### 3.4 Special Detailing Requirements

In addition to all of the applicable detailing requirements of the 1997 UBC, the following shall apply.

#### 3.4.1 Timber Structures.

- a. The provisions of the 1997 UBC Section 2320 – Conventional Light-Frame Construction, shall not be used to satisfy the requirements for a lateral-force-resisting system.
- b. The following construction shall not be used as elements of the lateral- force-resisting systems for buildings:
  - Diagonally or straight sheathed timber diaphragms or shear walls
  - Gypsum board diaphragms or shear walls
  - Shear walls constructed of metal studs with diagonal strap braces
  - Braced shear panels consisting of let-in braces

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- Oriented Strand Board (OSB) shall not be used in applications subject to high moisture conditions or if it will be exposed to inclement weather during construction
- c. Wood diaphragms shall be provided with continuous chord elements at the perimeter of the diaphragm. Where chords change direction (e.g., T or L shaped structures) and for wall anchorage of concrete and masonry structures, local collector elements shall develop the resulting secondary forces into the main diaphragm or into a subdiaphragm, meeting the required span/depth requirements, which spans between continuous collectors in the main diaphragm.
- d. Wood diaphragms and shear walls shall be provided with local chords around all penetrations exceeding 2 feet in dimension. Chords shall be designed to develop the secondary forces due to flexure in the diaphragm. They shall extend a minimum of 2 feet beyond the edge of the opening of each direction. A recommended procedure can be found in:
  - Diekmann, E.F., "Diaphragms and Shear Walls", Chapter 8 from Wood Engineering and Construction Handbook, 2<sup>nd</sup> Edition, Keith F. Flaherty and Thomas G. Williamson, editors, McGraw-Hill.
- e. Requirements for panel field and edge nailing, nailing to chords, collectors, splices in members, and similar connections shall be clearly called out on the design drawings.
- f. Joists and rafters framing horizontal diaphragms shall be solidly blocked where bearing on shear walls or other vertical elements of the lateral-force-resisting system. Shear transfer between timber diaphragms and vertical elements of the lateral-force-resisting system shall not be accomplished with toe nails (use framing angles or other means not relying on toe nails).
- g. Diaphragms shall be provided with continuous seismic force collectors, capable of resisting both tension and compression at all shear walls or other vertical elements of the lateral-force-resisting system.
- h. Shear walls shall whenever practical be continuous from the roof to the foundation. Shear walls at an upper story of a structure shall not terminate on wood framing, unless that framing is designed for omega (1997 UBC Table 16-N) times the required seismic forces.
- i. Tensile ties between wood framing elements of diaphragms and shear walls shall be designed considering all eccentricities inherent in the connection and resulting from such eccentricities. In particular, posts containing hold down devices shall be designed for both bending and direct stresses considering eccentricities and reduction of section due to bolts or let-ins. Nailing of



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plywood sheathing shall be detailed to prevent tearing loose of the corner adjacent to the hold down device.

- j. All connections of wood framing incorporating bolted connections with metal side plates shall provide for shrinkage and contraction of the wood elements, perpendicular to the wood grain. Malleable iron or cut plate washers should be provided on all bolt heads and nuts bearing against wood members.

### 3.4.2 Masonry Structures.

- a. All masonry structures shall be of reinforced construction.
- b. Empirical design of masonry shall not be used (1997 UBC Section 2109).
- c. Determination of masonry strength shall be in accordance with 1997 UBC Section 2105.3.2.
- d. All hollow unit masonry shall be grouted solid. Running bond or stack bond construction is acceptable.
- e. All solid unit masonry shall be multi-wythe running bond construction with fully grouted reinforced cores present between wythes. Wythes of masonry shall be fully bonded to the reinforced cores using wire-type joint reinforcement or other similar mechanical attachment.
- f. Special inspection, per 1997 UBC Section 1701 shall be specified for all reinforced masonry construction. Special inspection should include verification of source and strength of masonry units, proportioning and mixing of mortar and grout, placement of reinforcement and embedded items, clean out of grout spaces prior to grouting, and grouting procedures.

### 3.4.3 Concrete Structures.

- a. All concrete construction shall be reinforced. Plain concrete shall not be used.
- b. Design of concrete structures shall conform to the applicable provisions of 1997 UBC Section 1921.
- c. Critical anchorage to concrete structures for seismic force resistance shall be accomplished by cast-in-place anchors wherever practical. Cast-in-place anchors shall be designed in accordance with the strength design provisions of 1997 UBC Section 1923.2. Drilled-in anchors, either adhesive or mechanical type, shall have ICBO certified permissible values. Drilled-in anchors shall be subject to special inspection, and 25% of all installed anchors should be field tension tested to 160% of their ICBO rated allowable capacities. Anchor design shall, whenever practical, be controlled by yielding of the steel anchor as opposed to shear failure of the

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concrete. If not, anchors shall be designed to have a strength equal to omega (1997 UBC Table 16-N) times the calculated seismic forces (with load factors of unity).

- d. Precast concrete elements shall not be used as continuous diaphragms or shear walls unless shear transfer between adjacent units is accomplished through the embedment of dowels from adjacent units in a common cast-in-place joining strip. Precast concrete elements may be used as individual, independent above grade shear walls, when designed for the overturning and shear demands on each panel.
- e. Mechanical couplers used to splice reinforcing bars shall be of uniaxial design and shall be certified capable of transferring 125% of the nominal strength of the coupled bars.
- f. Reinforcing bar to be welded shall conform to American Society for Testing and Materials (ASTM) Standard A-706, "Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement". Stud welded bars shall conform to ASTM Standard A-496, "Specification for Steel Wire, Deformed, for Concrete Reinforcement."
- g. Prestressed concrete elements shall be provided with mild steel reinforcement to resist stresses resulting from seismic forces (including vertical) unless pretensioning is designed to resist omega (1997 UBC Table 16-N) times the calculated seismic forces.

### 3.4.4 Steel Structures.

- a. Design of steel structures shall conform to the applicable requirements of 1997 UBC Sections 2210, 2211, 2212 and 2213, except as modified herein.
- b. All moment resisting frames shall be detailed in conformance with special moment frame requirements, including the requirements of:
  - Interim Guidelines: Evaluation, Repair, Modification and Design of Welded Steel Moment Frame Structures, Federal Emergency Management Agency, Report No. FEMA 267, 1995.
- c. Hollow sections (tubes and pipes) used as diagonal braces with thinner walls than that required by 1997 UBC Section 2211.4 (9.2.d) may be utilized if the section is completely filled with cementitious material. The effect of the cementitious fill on section properties (area, section modulus, moment of inertia, radius of gyration) shall otherwise be neglected.

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## 4.0 UNDERGROUND PIPING

### 4.1 Failure Mechanisms

Post-earthquake reconnaissance surveys have identified factors typically associated with underground piping failures as follows.

- Ground failures include liquefaction, lateral spreading and landsliding. Large deformation of the ground from these effects imposes similar deformation on embedded piping often causing pipe failure.
- Fault ruptures. Piping crossing the rupture zone can be subjected to abrupt deformation as the ground it is embedded in (on either side of the rupture) moves independently.
- Differential settlement. Embedded pipe will move with the surrounding soil. If one section of pipe moves due to settlement while adjacent sections are prevented from displacement either due to placement in firm soil or attachment to settlement resistant structures, pipe damage can occur.
- Rigid attachment to flexible structures. Underground piping frequently experiences damage at connections to tanks, buildings, basins and similar items. This damage results from differential movement of the structure in response to the ground motion, with respect to the pipe imbedded in the ground.
- Response to ground shaking. Piping embedded in ground which is responding to an earthquake is subjected to shearing, compression and tension forces corresponding with the seismic waves experienced by the ground. These forces can cause failure of weak or brittle piping components.
- Nonrestrained joints. Nonrestrained piping joints, such as caulked lead joints in cast iron pipe, are a frequent source of failure. As movement occurs in the ground around the pipes, these joints are forced to move and damage to the pipe seal is possible. In areas where gross ground failure occurs, complete disassembly of these joints can occur.

### 4.2 General Design Guidelines

For large diameter pipelines (having nominal diameters greater than 12 inches), the Project Manager shall set project-specific seismic design criteria for the project.

In addition to ESP 512.1 Water Main and Services Design Criteria, the following guidelines are provided.

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- Selection of appropriate routing. The best way to avoid failure of underground piping is to avoid routes through areas expected to experience either gross soil failures or ground fault rupture.
- Selection of appropriate materials. The best piping materials for underground service from a perspective of seismic performance are those which have significant ductility (ability to deform without rupture) and for which the pipe joints have equivalent or greater strength than the pipe itself. Current industry thinking on the relative seismic vulnerability of various classes of piping material is as follows (in order of increasing vulnerability).
  - a) Steel pipe with restrained joints (welded or bolted).
  - b) Ductile iron pipe with restrained joints.
  - c) Plastic pipe.
  - d) Precast concrete pipe with push-on joints.
  - e) Cast iron pipe with restrained joints.
  - f) Cast iron pipe with push-on joints.
  - g) Asbestos cement pipe.
  - h) Fiberglass pipe.
- Provision of flexibility at transitions. Wherever underground pipe is connected to a structure or equipment, or transitions from one subsoil condition to another, it is desirable to provide for flexibility in the design of the piping to accommodate differential ground and structure movements. Flexibility can be provided by:
  - a) Oversized sleeves with flexible gaskets at pipe penetrations through building and structure walls.
  - b) Flexible couplings in pipe adjacent to rigid connections to structures or equipment.
  - c) Routing piping above grade in areas where extreme differential ground movements are expected, and providing expansion loops in above grade piping (if feasible) to accommodate expected movements.
- Fault crossings. Steel pipe having restrained joints shall be used. Other pipe materials and joints may be used provided it is demonstrated by tests and/or calculations that the pipe can accommodate the ground movements without rupture. Isolation valves shall be

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provided on the line at both ends of the fault rupture zone. By-pass connections or hydrants may be used to permit post-earthquake connection of temporary hoses across the fault rupture zone. Pipe routes that induce pipe tension are preferred over those that induce pipe compression caused by fault rupture. The Seismic Improvement Program has maps of active faults in the District service area that can be used to assess potential fault crossing locations.

- Areas having liquefaction potential. Steel pipe having restrained joints shall be used. Other pipe materials and joints may be used provided it is demonstrated by tests and/or calculations that the pipe can accommodate the ground movements without rupture. Isolation valves shall be provided on the line at points where the pipeline enters into such areas. The Seismic Improvement Program has maps indicating zone of high liquefaction potential that can be used to assess this hazard.
- Landslide areas. Steel pipe having restrained joints shall be used. Other pipe materials and joints may be used provided it is demonstrated by tests and/or calculations that the pipe can accommodate the ground movements without rupture. Isolation valves shall be provided at points where the pipeline enters a slide area. By-pass connections or hydrants may be used to permit post-earthquake connection of temporary hoses across the slide area. The Seismic Improvement Program has landslide maps showing previously identified landslides in the District service area. Other mitigations include:
  - a) Setting the line back far enough from the up slope side of unstable slopes as to avoid being included in the probable zone of slippage;
  - b) Setting lines back far enough from or low enough below the toe of unstable slopes as to avoid being included in the probable zone of slippage; and
  - c) Providing buttress or retention structures or other measures to stabilize the slope.
- Allowable strain criteria for use in evaluation of steel pipe having restrained joints subject to ground movement load cases (e.g., fault crossing, liquefaction, settlement, and landslide) are as follows.
  - a) Flexural demand -  $p < 6 * e$
  - b) Tensile demand -  $p < 6 * e$
  - c) Compressive demand – no inelastic demand permissible

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A reference source for the seismic analysis and design of pipelines is as follows.

- Guidelines for the Seismic Design of Oil and Gas Pipeline Systems, ASCE Committee on Gas and Liquid Fuel Lifelines, 1984.

## 5.0 UNDERGROUND STRUCTURES

### 5.1 Loading Criteria

The 1997 UBC requirements shall apply, except as modified below.

Free standing retaining walls shall be designed in accordance with Sections 5.1.1 and 5.1.2 below only if the failure of the wall could result in loss of operability of either Important or Critical facilities.

**5.1.1 Firm Soil Sites.** Important and Critical facilities embedded in types  $S_A$ ,  $S_B$ ,  $S_C$  or  $S_D$  sites, with granular backfill material, where backfill is not saturated shall be designed for an incremental active earth pressure force per foot of length,  $\Delta P_a$  as given by Equation 5-1.

$$\Delta P_a = 0.35 \gamma_s h_t^2 C_a \frac{1}{R \tan \phi_f} (0.75 + 0.04i) \quad (5-1)$$

Where  $R$  shall be taken as 2.7, and  $C_a$  is defined in 1997 UBC. This is a factored (strength level) design loading. Equation 5-1 is adapted from:

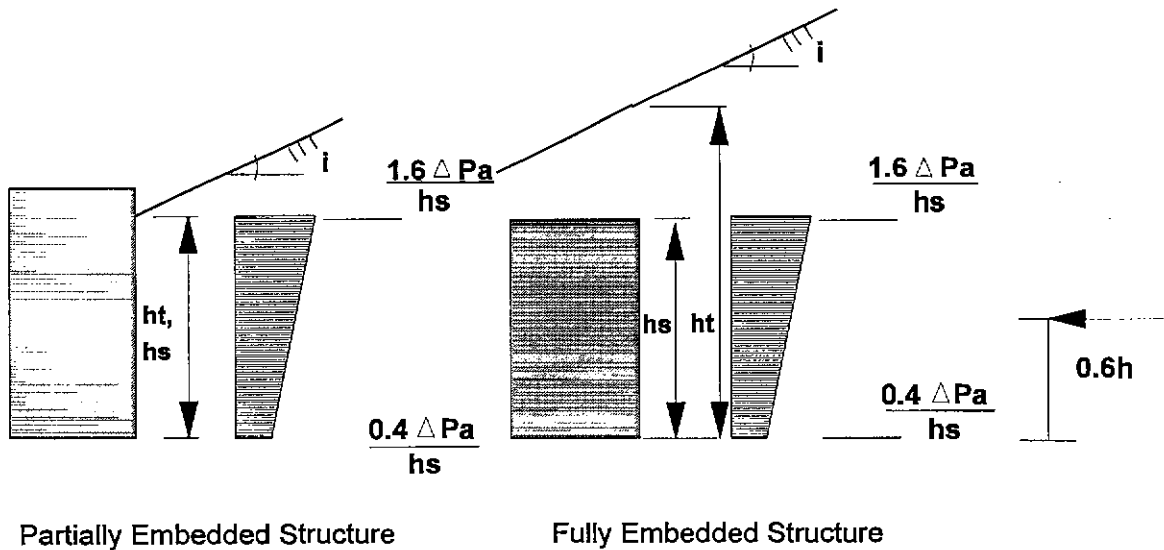
- "Design of Earth Retention Structures for Dynamic Loads," by M. B. Seed and R. V. Whitman, ASCE Journal of Soil Mechanics and Foundations Division, June 1970.

The incremental active pressure shall be assumed to be distributed against the walls of the structure as shown in Figure 5-1.

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**Figure 5-1 Distribution of Seismic Earth Pressures**

In addition to designing walls of structures for the increased pressures indicated above, the structure as a whole shall be designed to resist sliding as a result of such pressures. Sliding may be resisted by a combination of friction beneath the base of the structure and by soil bearing against the opposite wall of the structure, if embedded. Such pressures may be assumed to have a triangular pressure distribution, with a resultant located at 1/3 the depth of the backfill above the base of the structure on the resisting side.

**5.1.2 Soft Soil ( $S_E$  and  $S_F$ ) and Liquefiable Sites.** Important and Standard facilities embedded in soils subject to liquefaction, or in unconfined silts, poorly consolidated clays or other soft materials shall be designed for the most severe of the following two conditions:

- At rest earth pressures (depending on condition of restraint) acting on all sides of the structure.
- Active earth pressures (depending on condition of restraint) acting on all sides of the structure, together with the incremental earth pressure force of Equation 5-1 on one side of the structure.

Critical structures embedded in these soils shall be designed for dynamic earth pressures based on site specific geotechnical investigation.

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## 5.2 Detailing Requirements

Detailing of embedded concrete structures shall conform to that required by UBC Section 1921 and Section 3.4.3 of this Standard. All dowels across construction joints shall be fully developed by embedment or mechanical anchorage on either side of the joint.

## 6.0 WATER RETENTION STRUCTURES

### 6.1 Flat Bottom Steel Tanks

Tanks shall be designed in accordance with ANSI/AWWA D100-96 or D103-97 including the modifications contained herein. These are allowable stress design procedures.

- a. Tanks shall be anchored and have fixed steel or aluminum roofs.
- b. Tanks shall be designated as either Important or Critical facilities per Table 1-1.
- c. The use factor  $I$ , shall be assigned from Table 1-2.
- d. The zone coefficient  $Z$ , shall be replaced by the UBC seismic coefficient  $C_a$  (1997 UBC, Table 16-Q). The site amplification factor  $S$ , shall be taken as 1.0.
- e. A site specific response spectrum may be used to characterize local seismic conditions (D100-96 sections 13.3.3.2.3 and 13.4; D103-97 sections 12.3.2.3 and 12.4) with the following modifications.
  - The mean recurrence interval shall be 500 years (10% probability of exceedance in 50 years) and the reduction factor  $R_F$  shall be  $R_W$ .
  - The design seismic loads need not exceed loads determined using the standard equations (D100-96, eqns. 13-4 and 13-8; D103-97, eqns. 15 and 16) using UBC seismic zone coefficient  $C_a = 0.88$  (in place of  $Z$ ), use factor ( $I$ ) per Table 1-2, and site amplification factor  $S = 1.0$ .
  - The design seismic loads shall not be less than loads determined using the standard equations (D100-96, eqns. 13-4 and 13-8; D103-97, eqns. 15 and 16) using UBC seismic zone coefficient  $C_a$  (in place of  $Z$ ), use factor ( $I$ ) per Table 1-2, and site amplification factor  $S = 1.0$ .

A site specific response spectrum may be used to compute seismic hoop tensile loads (D100-96, eqns. 13-20 to 13-25; D103-97, eqns. 28 to 33) with the following modifications.



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- For equations 13-21 and 29,  $4.5 A_i$  replaces  $11.35 Z_I$ .  
For equations 13-22 and 30,  $2.8 A_i$  replaces  $6.98 Z_I$ .  
For equations 13-23 and 31,  $1.4 A_i$  replaces  $3.50 Z_I$ .  
For equations 13-24 and 32,  $A_C$  replaces  $17.55 Z_I C_1 S$ .
- The design seismic loads need not exceed loads determined by the standard equations (D100-96, eqns. 13-20 to 13-25; D103-97 eqns. 28 to 33) using the UBC seismic zone coefficient  $C_a = 0.88$  (in place of  $Z$ ), use factor (I) per Table 1-2, and site amplification factor  $S = 1.0$ .
- The design seismic loads shall not be less than loads determined by the standard equations (D100-96, eqns. 13-20 to 13-25; D103-97, eqns. 28 to 33) using the UBC seismic zone coefficient  $C_a$  (in place of  $Z$ ), use factor (I) per Table 1-2, and site amplification factor  $S = 1.0$ .

A reference source on the seismic behavior of tanks is as follows.

- Guidelines for the Seismic Design of Oil and Gas Pipeline Systems, ASCE Committee on Gas and Liquid Fuel Lifelines, 1984.
- f. Design shall include vertical earthquake acceleration effects wherever indicated in D100-96 or D103-97. The vertical stress in the tank shell shall include vertical acceleration effects. Shell buckling shall be checked by increasing the weight of the tank shell and the tributary roof on the shell by the vertical acceleration.
- g. Anchor bolts shall be spaced equally around the circumference of the tank. Bolts shall be designed for a tensile load using AWWA methods (D100-96, eqn. 13-19; D103-97, eqn. 27) except that the dead load shall be reduced by the vertical acceleration. Maximum spacing of anchor bolts shall be 20 feet. Each tank shall have a minimum of 12 bolts. Minimum size of anchor bolts is 0.75 inch diameter.
- h. Attachments of anchor bolts to tank shell and embedment in footing shall be capable of developing the tension yield force of the bolt.
- i. The effect of internal liquid pressure shall not be used to increase permissible buckling stresses on the shell, as permitted by D100-96, Section 13.3.3.7.4.
- j. Tanks shall be designed with a minimum freeboard using D110-95, Section 4.10 methods with the following modifications. Note that D110-95 is the prestressed concrete water tank standard.

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- The zone coefficient  $Z$ , shall be replaced by the UBC seismic coefficient  $C_a$ , and the importance factor ( $I$ ) shall be per Table 1-2.
- A site specific response spectrum may also be used to compute minimum freeboard according to D110-95 rules.

k. Critical piping connected to sides of tanks shall be designed to accommodate 12 inches uplift movement of the tank shell without severe damage or uncontrolled loss of contents. It is preferable that piping connected to the floor of the tank be located outside the zone of uplift identified by D100-96 (or D103-97) for unanchored tanks. If this is not possible, piping connected to the floor of the tank, which is within the "uplift" zone (of an equivalent unanchored tank), shall be designed assuming that 12 inches of uplift occurs at the tank wall.

l. Frictional resistance shall not be used to reduce the unbraced distance in designing roof members as permitted by D100-96, Section 3.6.

m. Interior columns supporting the roof shall be designed with a maximum slenderness ratio (length/radius of gyration) of 120 instead of 175 as permitted by D100-96, Section 3.4.

n. In addition to the requirements of D100-96 Section 13.6 (or D103-97 section 12.6), tank foundations shall be designed to resist sliding and overturning due to seismic forces. The overall stability against sliding and overturning shall be achieved with a safety factor of 1.5 or greater. Vertical accelerations need not be included in the calculation of overall sliding and overturning stability. The one-third increase in allowable stress permitted in D100-96 applies only to soil bearing stresses under the combined maximum load case of seismic and gravity loads acting simultaneously.

## 6.2 Prestressed Concrete Tanks

Prestressed concrete tanks shall be designed in accordance with ANSI/AWWA D110-95 as modified by this Standard. These are allowable stress design procedures.

- a. Tanks shall be designed with either a reinforced nonsliding base or anchored flexible base as defined in D110-95, Figure 4.
- b. Tanks shall be designated as either Important or Critical facilities per Table 1-1.
- c. The importance factor  $I$ , shall be assigned from Table 1-2.
- d. The zone coefficient  $Z$ , shall be replaced by the UBC seismic coefficient  $C_a$  (1997 UBC, Table 16-Q). The soil coefficient  $S$ , shall be taken as 1.0.

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- e. A site-specific response spectrum may be used to compute design forces according to D110-95 methods with the following modifications.
- $A_I$  is the peak spectral acceleration (in g units) consistent with the impulsive period at 2% damping. Also see section 2.3 of this Standard.
  - The design seismic loads need not exceed loads determined using the standard equations (D110-95, eqns. 4-1, 4-4, and 4-24) using UBC seismic zone coefficient  $C_a = 0.88$  (in place of  $Z$ ), use factor (I) per Table 1-2, and soil profile coefficient  $S = 1.0$ .
  - The design seismic loads shall not be less than loads determined using the standard equations (D110-95, eqns. 4-1, 4-4, and 4-24) using UBC seismic zone coefficient  $C_a$  (in place of  $Z$ ), use factor (I) per Table 1-2, and soil profile coefficient  $S = 1.0$ .
- f. Wall to roof joint connections shall be either flexibly or rigidly tied, with positive mechanical anchorage in the form of dowels, tension cables, or other suitable devices. Unrestrained, free joints are not permitted.
- g. Base shear shall be resisted entirely by shear friction, calculated in accordance with ACI 318, or by use of seismic cables.
- h. Bearing pads and water seals in tanks with anchored flexible base shall be designed to withstand the displacement resulting from the design base shear calculated using  $R_I = 1.0$  and  $R_C = 1.0$ .
- i. The following modifications apply to D110-95 Section 4.9 (Foundation Design). Vertical accelerations need not be included in the calculation of overall sliding and overturning stability. The overall safety factor for sliding shall not be less than 1.5.
- j. Steel reinforcement and anchor cables provided at the base of tanks shall be fully embedded on both sides of the base joint, to permit development of the full yield strength of the steel.
- k. A minimum of 2 inches of cover shall be provided over prestressing wires for fire protection of tanks located in high fire hazard areas.
- l. The beneficial effects of backfill against the wall of a tank with respect to sliding resistance may be considered if the fill is engineered and a geotechnical report is provided which provides appropriate passive pressure values to be used. In order to consider the beneficial effects, the

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backfill must be provided around the entire perimeter of the tank. If backfill height varies, only beneficial effects of minimum height shall be used.

### 6.3 Water Retention Basins

- a. Open roof, water retention basins shall be designed in accordance with ACI 350R-89 as modified herein.
- b. Circular basins shall be designed for seismic forces calculated in accordance with Section 6.2 of this Standard.
- c. The base shear and overturning moments resulting from seismic response in each direction shall be separately calculated using the procedures described by Housner for determining hydrodynamic forces in rectangular basins:
  - "Dynamic Analysis of Fluids in Containers Subject to Accelerations," by George W. Housner, ASCE Technical Seminar, Seismic Design Today: State-of-the-Art Applications, July 25-26, 1980, Los Angeles.

The impulsive acceleration shall be taken as the UBC seismic coefficient  $C_a$  (1997 UBC, Table 16-Q). Strength design forces shall be computed by scaling the above forces by  $1/R$ , where  $R = 2.2$ . The effects of the two orthogonal directions shall be combined on a square-root-sum-of-squared (SRSS) basis. Earth pressures from seismic actions shall be determined according to Section 5.0 of this Standard.

- d. Division walls in retention basins shall be designed as end walls of individual basins using unbalanced hydrostatic forces resulting from one basin full and the adjacent basin empty. Hydrodynamic forces shall be determined by the method for rectangular basins cited in Section c above.

### 6.4 Submerged Components

This section applies to all internal components (including mechanical equipment) and structures within reservoirs and water retention structures including roof support structures, piping, ladders, paddles, agitator shafts, and similar items. It is based (simplified and modified) on a research report by:

- Earthquake Response Considerations of Broad Liquid Storage Tanks, by F. J. Cambra, Earthquake Engineering Research Center UCB/EERC 82/25, Nov. 1982.

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a. In addition to other loads, resulting from self weight, operating forces, etc., internals shall be designed to resist a uniform allowable stress design seismic lateral force per unit height of internal as follows:

$$f_p = (1/R_w) 2.5 C_a (w_p + w_w) + f_w \quad (6-1)$$

Where  $R_w$  is taken as appropriate from Table 6-2,  $C_a$  is taken from 1997 UBC and:

$$f_w = 0.75 \gamma D_c (\pi D_c \dot{u} + C_d u^2) / g \quad (6-2)$$

$$u = 1.84 d g T_w (1 / 2\pi R) \{ J_1'(1.84r/R) \} \quad (6-3)$$

$$\dot{u} = 1.84 d g (1 / R) \{ J_1'(1.84r/R) \} \quad (6-4)$$

where,  $d$  = maximum sloshing wave height =  $0.837 R A_c / g$ ,  $R$  = inside radius of tank, and  $J_1'(1.84r/R)$  = Bessel function value from Figure 6-1.

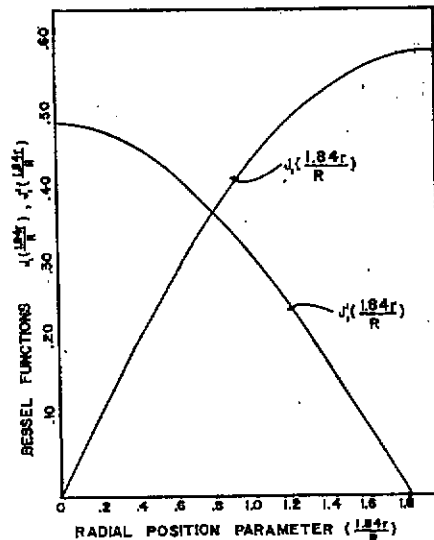


Figure 6-1 Bessel Function Values (from UCB/EERC-82/25)

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The expressions given by formulas 6-2, 6-3 and 6-4 are for the maximum values at the water surface. The resulting unit force ( $f_w$ ) may be used for points below the water surface recognizing that the actual forces may be less. Alternatively, the unit force ( $f_w$ ) may be evaluated at several locations along the height of the submerged object to obtain a distribution of hydrodynamic force along the length of the object. In this case, refer to the equations contained in Appendix A of UCB/EERC 82/25.

Components located just above fluid surfaces may be subject to damage due to sloshing and should be investigated by rational methods.

**Table 6-2**  
**Rw Coefficients for Submerged**  
**Components**

Component	Rw
Structural columns with axial stress ratio $f_a/F_a < 0.15$	8
Structural columns with axial stress ratio $f_a/F_a \geq 0.15$ but less than 0.4	6
Structural columns with axial stress ratio $f_a/F_a \geq 0.4$	3
Welded steel pipe	8
Other pipe	6
Ladders, davits, similar appurtenances	6
Baffles	8
Launders	3
Rotating parts, scrapers	3

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## 7.0 RESERVOIR OUTLET TOWERS

### 7.1 Design Basis

This section applies to terminal reservoirs, and earth embankments dam reservoirs with outlet towers.

a. Free-standing reservoir towers in terminal reservoirs shall be designed to withstand seismic forces, using the latest edition of the UBC and an elastic analysis procedure such as described by:

- Earthquake Analysis and Response of Intake – Outlet Towers, by A. Goyal and A. K. Chopra, Earthquake Engineering Research Center UCB/EERC 89/04, 1989.
- “Earthquake Resistant Design of Inlet-Outlet Towers”, by A. K. Chopra and C. Y. Liaw, ASCE Journal of the Structural Division, Vol. 101, No. ST7, July 1975.

Hydrodynamic effects of water, both inside and outside the tower shall be considered in determining the weight of the structure to be used in the design. Concrete sections shall be evaluated using the latest edition of ACI-318 and Section 3.4.3. of this standard. The tower should be evaluated for all load cases including when the reservoir is full, and the effect of varying the water height to empty conditions.

b. Outlet towers in terminal reservoirs shall be considered Critical structures because their failure may affect the structural integrity of the dams and potentially block inlet/outlet pipe; and design shall be based on site-specific design spectra.

c. All towers shall be designed such that the tower nominal shear strength exceeds the shear corresponding to the nominal flexural strength, when the tower is subjected to a vertical distribution of lateral forces proportional to the weight distribution of the structure.

d. Strength design response modification factor for all outlet towers  $R$ , shall not exceed 2.2, unless capacity of the tower to withstand anticipated inelastic deformations without significant damage is substantiated through appropriate inelastic analyses and laboratory data.

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## 8.0 PUMPING PLANTS

### 8.1 Structural Criteria

- a. Enclosing structures for pumping plants shall be designed in accordance with Sections 3 or 5 of this Standard.
- b. Equipment, including pumps, switchgear, transformers, and similar items, as well as above ground piping shall be designed in accordance with Section 9 of this Standard.
- c. Underground piping at pumping plants shall be designed in accordance with Section 4 of this Standard.

## 9.0 EQUIPMENT

### 9.1 General

- a. All equipment (pumps, piping, ductwork, etc.) shall as a minimum be designed to comply with the seismic requirements of Section 1632 of the 1997 UBC, as modified in this document.

### 9.2 Anchorage to Concrete

Anchorage to concrete shall be performed in accordance with the provisions of Section 3.4.3(c) of this Standard.

### 9.3 Vibration Isolation

- a. In general, equipment should be rigidly mounted to supporting foundations and structures, without the aid of vibration isolation devices. Exceptions are mechanical equipment in which vibrations transmitted from the equipment would be troubling to building occupants or other equipment within the building.
- b. When vibration isolation mountings are required for equipment, the mountings, and their attachments to the supporting structure shall be designed as flexible mountings in accordance with Section 1632 of the 1997 UBC. The supplier of vibration isolation mounting hardware shall submit certified calculations, sealed by a State of California registered Civil or Structural engineer, indicating the adequacy of the hardware and attachment anchorage to meet this criteria.

### 9.4 Critical Equipment

Equipment defined as Critical, under the criteria of Table 1-1, is expected to be operable after an earthquake. In addition to the requirements of Sections 9.1 through 9.3 of this Standard, Critical equipment shall be subject to the requirements of this section.



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a. Critical equipment, which is not prequalified as structurally and functionally rugged, in accordance with Table 9-1, shall be subject to functional seismic qualification. Functional seismic qualification is the verification that the equipment will remain functional without repair after the Design Earthquake Motions.

For equipment mounted at grade, below grade or located in areas of structures which do not amplify the earthquake ground motions (e.g., ground floor of buildings), the Design Earthquake Motions shall be defined by either of the following.

- The 1997 UBC design response spectra (Figure 16-3) multiplied by the Importance Factor from Table 1-2 ( $I = 1.5$  for Critical Facilities).
- The 1997 UBC design response spectra (Figure 16-3) scaled to have the site-specific peak ground acceleration at zero period. The site-specific peak ground acceleration shall have a 10% probability of exceedance in 50 years. The Design Earthquake Motions shall not be less than the 1997 UBC design response spectra (Figure 16-3).
- A site-specific response spectrum having a 10% probability of exceedance in 50 years. The Design Earthquake Motions shall not be less than the 1997 UBC design response spectra (Figure 16-3).

For equipment mounted in areas of structures which amplify the earthquake ground motions (e.g., upper floors of buildings), the Design Earthquake Motions shall be defined by either of the following.

- The in-structure response spectra computed using rational methods such as those indicated in: Seismic Analysis of Safety-Related Nuclear Structures and Commentary on Standard for Seismic Analysis of Safety Related Nuclear Structures, ASCE Standard, ASCE 4-86, September 1986. The in-structure response spectra shall have a 10% probability of exceedance in 50 years. The Design Earthquake Motions shall not be less than the response spectrum defined for equipment mounted at grade, below grade or located in areas of structures which do not amplify the earthquake ground motions.
- The Required Response Spectra (Figure 5-15) in: Network Equipment-Building System (NEBS) Requirements: Physical Protection, Bellcore Document GR-63-CORE, Issue 1, October, 1995.

Functional seismic qualification can be demonstrated by testing an identical component, testing a similar component, or structural analysis. However, test data or test data with analysis is preferable to structural analysis only due to the complexity of equipment. All analyses used to

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demonstrate compliance with the above requirements shall be certified by a Professional Engineer registered in the State of California having appropriate education and experience.

- b. Standard industry test methods are acceptable (e.g., Bellcore Document GR-63-CORE, Issue 1, October, 1995, Network Equipment-Building System (NEBS) Requirements: Physical Protection; ANSI/IEEE C37.81 Seismic Qualification of Class 1E Metal-Enclosed Power Switchgear Assemblies; ANSI/IEEE C37.98, Seismic Testing of Relays; ANSI/IEEE 344, Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations); or IEEE 693, Recommended Practices for Seismic Design of Substations, Sections A.1.1.1 or A.1.1.2. The test response spectrum shall envelop (i.e., be larger than) the Design Earthquake Motions at the equipment natural frequencies. It is important to compare the test response spectrum and the Design Earthquake Motions at the same damping factor. Response spectra may be adjusted for comparison purposes using the methods indicated in Section 2.3.
- c. Test data for similar equipment types may be accepted subject to District approval. The installed equipment is similar to the tested equipment if they are constructed of similar materials, function in similar ways, are exposed to the same level or greater seismic excitation (including any amplification within non-rigid enclosures), and are mounted to the shake table or cabinet enclosure in similar ways.
- d. Qualification by analysis shall be completed in accordance with IEEE 693 Sections A.1.5 Dynamic Analysis, A.1.7 Static Coefficient Method, or Section 7.7 Qualification by Seismic Experience Data. The analysis shall be documented in a report formatted similar to IEEE 693 Annex R.

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**01 JUL 94****Table 9-1****Prequalified – Structurally & Functionally  
Rugged Equipment**

Valves
Engines
Motors
Generators
Turbines
Horizontal & Vertical Pumps
Hydraulic & Pneumatic Operators
Motor Operators
Compressors
Small factory-manufactured boilers
Transformers with anchored internal coils

**9.5 Important Equipment**

Equipment defined as Important under the criteria of Table 1-1 need not remain functional through the design earthquake or even be capable of immediate restoration to service. Nevertheless, such equipment should be able to resist damage adequately to permit repair and return to service within a short period of time, following a major earthquake. In addition to the requirements of Sections 9.1 through 9.3 of this Standard, Important Equipment shall meet the requirements of this section.

- a. Important equipment, which is not prequalified as structurally and functionally rugged, in accordance with Table 9-1, or as structurally rugged in accordance with Table 9-2, shall be subject to structural seismic qualification. Structural seismic qualification consists of calculations demonstrating that the structural framework (internal and external) is capable of withstanding

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forces as specified in Section 9.1. Calculations shall be sealed by a State of California registered Civil or Structural Engineer.

**Table 9-2**  
**Prequalified - Structurally**  
**Rugged Equipment**

Air handling equipment and fans (without internal or external vibration isolators)
Instrumentation Cabinets
Control Panels
Lighting and Distribution Panels
Solid State Battery Chargers
Batteries in Battery Racks (see Note)
Floor -mounted inverters up to 5 KVA
Chillers

Note: Battery racks must have longitudinal "X" braces, double rails to restrain the batteries, snug-fitting spacers between cells, and shims between cells and the rails (see Seismic Equipment Qualifications Using Existing Test Data, Electric Power Research Institute [EPRI] Report NP-4297, October 1985).

## 9.6 Aboveground Piping

a. Piping shall as a minimum, be provided with braces that satisfy SMACNA requirements for Seismic Hazard Level A (highest hazard level) unless demonstrated capable of resisting the required seismic forces under other support conditions.

- Seismic Restraint Manual Guidelines for Mechanical Systems, Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), 1991.

Connection Level 1 (corresponds to approved research report values) shall be used for structures of all importance levels. For pipes larger than those covered in the SMACNA document, design loads shall be based on 1997 UBC Section 1632.

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b. Plastic piping shall be braced laterally at intervals not exceeding twice that recommended by the manufacturer for vertical support.

c. Piping crossing expansion joints between adjacent structures shall be provided with expansion fittings, multiple bends, or other suitable provisions to ensure capacity to sustain expected differential movement between the structures.

d. Special care shall be taken to ensure that small branch lines off piping headers do not by virtue of their attachment to structures or equipment, act as the brace for the header unless demonstrated by calculation to have suitable capacity for this service.

### 10.0 EXISTING FACILITIES

#### 10.1 Additions, Alterations & Change of Function

a. The purpose of the section is to present guidelines for seismic evaluation and upgrade of existing facilities.

b. Seismic evaluation and upgrade of the entire facility (site stability, equipment, structure, piping, etc.) shall be considered when any of the following actions are planned.

- Facility upgrade that increases nominal operating capacity by 20% or more.
- Facility upgrade in which 30% or more of the major pieces of operating equipment are replaced, such that the expected design life of the facility is extended.
- Facility repair, as for example from fire or other damage, that has a construction cost in excess of 30% of the replacement cost of the facility.
- Addition of floor space in excess of 20% of existing space.
- Addition of a partial or full story.
- Change in occupancy or structure utilization to a more restrictive occupancy group.
- Change in live or equipment load by more than 20%.

The level of evaluation and upgrade shall be based on consideration of facility capital asset value and facility class.

c. The seismic evaluation of individual foundations and underground piping connections for items of major equipment (pumps, switchgear, tanks, vessels, etc.) shall be reviewed whenever such piping and foundations are re-used at the time new equipment is installed.

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## 10.2 Assessment Criteria

The following relaxed seismic evaluation criteria shall be used for existing facilities.

- a. Components of Standard importance shall be considered acceptably reliable if they provide 75% of the strength required by this Standard for new construction of Standard importance.
- b. Components indicated as Important shall be considered acceptable if they meet the requirements of this Standard for new construction of Standard importance.
- c. Critical components shall be considered as providing acceptable reliability if they provide 90% of the strength and essentially all of the operability safeguards specified by this Standard for new construction of Critical importance.

## 10.3 Retrofit Design Criteria

- a. Facilities found to have unacceptable seismic adequacy, in accordance with Section 10.2 shall be brought into full compliance with the requirements of this Standard for new construction.
- b. Where the structural detailing of existing components does not comply with the requirements of this Standard, the utilization of such components shall be based on procedures in accordance with principals of mechanics such as:
  - NEHRP Guidelines for the Seismic Rehabilitation of Buildings, Federal Emergency Management Agency, FEMA – 273, October 1997.
  - NEHRP Commentary on the Guidelines for the Seismic Rehabilitation of Buildings, Federal Emergency Management Agency, FEMA-274, October 1997

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**11.0 Symbols & Notation**

When used in this Standard, the symbols and notation below shall have the specific meaning indicated.

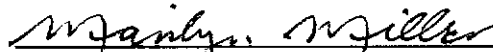
$f_p$	Seismic force on component - lbs/ft
$f_w$	Hydrodynamic force on submerged component - lbs/ft
$g$	Acceleration due to gravity = 32.2 ft/sec <sup>2</sup>
$h_t$	Height of fill above base of embedded structure - ft
$h_s$	Height of fully embedded structure - ft
$i$	Angle of backfill slope with respect to horizontal - degrees
$r$	Radial distance from center of tank to submerged object - ft
$t$	Time - sec
$u$	Fluid particle velocity - ft/sec
$\dot{u}$	Fluid particle acceleration - ft/sec <sup>2</sup>
$w_p$	Unit weight of component - lbs/ft
$w_w$	Unit weight of water displaced by component - lbs/ft
$A_i, A_j$	Spectral acceleration of tank shell and contents in impulsive mode, - g (can be taken as peak spectral acceleration from spectrum) for a 2% damped spectrum
$A_c$	Spectral acceleration at fundamental period of tank contents in convective (sloshing) mode - g, for a 1/2% damped spectrum
$C_a$	Numerical coefficient specified in UBC Section 1630.2 to represent spectral amplification at a period T, for a 5% damped spectrum
$C_d$	Drag coefficient, taken as 1.0 for circular sections and 1.16 for open sections such as structural shapes
$D$	Diameter of tank - ft
$D_c$	Diameter of circle that circumscribes perimeter of submerged object at level under consideration - ft
$H$	Total height of the fluid in the tank - ft
$I$	Importance factor per Table 1-2

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- R Response modification factor per UBC Table 16-N, except as otherwise specified herein
- $R_F$  Response spectra reduction factor
- $R_I, R_C$  Structure coefficients for type of tank
- $R_W$  Response modification factor
- S Site coefficient for soil characteristics
- $T_W$  Sloshing period of water in tank per AWWA D-100 Section 13.3.3.1 - sec
- Z Seismic zone coefficient
- e Elastic tensile strain = (Yield Force)/AE
- p Plastic tensile strain equivalent to inelastic tensile elongation divided by the yielded length of element
- Unit weight of fluid - lbs/ft<sup>3</sup>
- $\gamma_s$  Unit weight of soil backfill - lbs/ft<sup>3</sup>
- e Elastic flexural curvature = (Yield Moment)/EI - radians/in
- p Plastic flexural curvature equivalent to inelastic rotation at a flexural hinge divided by length of plastic hinge - radians/in
- $\phi_f$  Internal soil friction angle for backfill - degrees
- $\Delta P_a$  Incremental dynamic earth pressure force due to seismic on embedded structures - pounds/foot width



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Marilyn L. Miller

Director of Engineering and Construction



ENGINEERING STANDARD PRACTICE 514  
IDENTIFYING BURIED CONFLICTS

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## PURPOSE

To provide pipeline project guidelines for the investigation needed to identify existing underground utilities, and to establish a uniform approach for site reconnaissance of existing buried conflicts, such as active and abandoned utilities. Minimum steps required to identify existing utilities are also provided. Efforts made during the planning, design, and pre-construction phases to identify existing buried conflicts should lessen the potential for subsequent impacts during construction.

### I. GENERAL

EBMUD's distribution system includes over 4,000 miles of pipeline. On average, EBMUD installs approximately 15 to 20 miles of new pipeline and replaces approximately 5 to 10 miles of existing pipeline per year. A significant portion of pipeline replacements occur in older urban areas where streets are often crowded with existing buried utilities, either in operation or abandoned, which make excavation difficult. The scope of this Engineering Standard Practice (ESP) is to provide investigation techniques that are available for identifying potential conflicts during the design of EBMUD pipeline projects, methods and terminology for identifying underground utilities of varying degrees of accuracy, and guidelines for evaluating when potholing should be performed.

### II. ABBREVIATIONS

ASCE	American Society of Civil Engineers
CEQA	California Environmental Quality Act
CGA	Common Ground Alliance
EIR	Environmental Impact Report
GPR	Ground Penetrating Radar
PCE	Pipeline Construction and Equipment Division
PG&E	Pacific Gas and Electric Company
RCO	Regulatory Compliance Office
RSP	Required Safety Practice
USA	Underground Service Alert

### III. REFERENCES

For further information on guidelines or recommendations for identifying existing underground utilities, the following references should be consulted. These documents provide recommendations and guidelines for identifying underground utilities during the planning, design, and construction phases of a project.

#### Design Standards and Guidelines:

- ASCE Standard 38-02, Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data, March 2002.
- California Government Code 4216.

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- Title 8, California Code of Regulations, Article 6, Excavations
- Title 17, California Code of Regulations, Division 1, Chapter 5, Group 4.
- Title 22, California Code of Regulations, Division 4, Chapter 3.
- EBMUD Workplace Health and Safety RSP 1100, Excavation Safety.

**Industry Best Practices:**

CGA, best practices for preventing damage to underground facilities, December 2004 (revised March 2008 to adopt ASCE Standard 38-02).

**IV. DEFINITIONS**

**High-priority utilities:** For the purposes of this ESP, a high-priority utility is considered equivalent to a subsurface installation that presents the potential for significant hazard.

CGA defines high-priority subsurface installations as high-pressure natural gas pipelines with normal operating pressures greater than 60 pounds per square inch, petroleum pipelines, pressurized sewage pipelines, high-voltage electric supply lines conductors or cables that have a potential to ground greater than or equal to 60 kilo-volts, or hazardous materials pipelines that are potentially hazardous to workers or the public if damaged.

**Quality Level Attributes for Identifying Underground Utilities:** ASCE has established standard guidelines to locate and mark underground utilities using four different "Quality Levels," namely, Quality Levels A, B, C, and D, with Quality Level A being the highest/maximum level and Quality Level D the minimum. These quality level attributes, which can be used on drawings during the design phase of certain pipeline projects, are defined as follows:

- **Quality Level D (minimum level of quality):** This quality level incorporates information from existing drawings and maps, site inspection, and utility records/as-built data.
- **Quality Level C:** In addition to the tasks described above that are performed for Quality Level D, Quality Level C also incorporates and correlates site survey data, conducted by a qualified surveyor, of all surface features along the proposed pipeline alignment.
- **Quality Level B:** In addition to the tasks described above that are performed for Quality Levels C, Quality Level B also includes surveying the location of all existing USA markings in combination with limited subsurface geophysical methods to locate underground utilities.
- **Quality Level A (maximum level of quality):** In addition to the tasks described above that are performed under Quality Level B, Quality Level A includes excavation of test holes, using potholing or other excavation methods, to survey the actual horizontal and vertical location of utilities (as well as record other test hole data such as pipe diameter, material type, etc.).

**V. REQUIREMENTS AND GUIDELINES FOR PLANNING, DESIGN, AND CONSTRUCTION**

**A. TECHNIQUES FOR IDENTIFYING POTENTIAL BURIED CONFLICTS**

Descriptions of available buried conflict identification techniques are given below. All of the methods require a preliminary estimate of the utility locations based on other sources,

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including utility as-built data and site investigations. This information shall be derived from the procedures presented in the next subsection (Minimum Steps Required to Identify Existing Utilities). A combination of several identification technologies may need to be utilized on a project to suit the particular level of quality. For example, if a high-priority utility cannot be successfully located using potholing with vacuum extraction, remote sensing devices such as ground penetrating radar or electromagnetic signaling may be needed to identify all underground utilities present in the area, followed by a second round of potholing.

Final field markings resulting from any of the locating methods discussed below (i.e., using potholing activities and/or remote sensing devices) should be surveyed to allow their locations to be accurately reported onto the pipeline design drawings.

**Direct Investigation:** Methods that require excavations, such as potholing by vacuum extraction or backhoe, to provide direct visual information regarding the location of the subject utility. An encroachment permit is necessary for methods that require excavation within the public right-of-way. The city or county may require the pavement to be patched beyond the excavation itself; therefore, photos should be taken prior to potholing. In some cases, potholing may be performed by PCE crews during construction, as required in the field. However, PCE does not generally perform potholing for design purposes or for alignment selection purposes.

1. **Vacuum Extraction Potholing:** By using vacuum extraction techniques such as air vacuum, crews can verify the location of underground utilities with only a small opening, typically 2 to 10 inches wide. This method of potholing is most common during design to determine the location of high-priority utilities or other potential buried conflicts. These utilities can include gas, water, sewer and other pipelines, as well as television, telephone and electric cables. Current regulations no longer require written permission from a utility owner prior to potholing to locate underground utilities if vacuum extraction methods are used.

This technique eliminates disruptive excavations and the risk of damage to the associated utility with more traditionally dug potholes using backhoes. However, before the vacuum extraction process, an accurate estimate of the locations of the subject existing utilities is first necessary, using USA markings, in order to prevent trial-and-error probing. Therefore, prior to potholing, USA shall be called to mark all utilities in the area to be potholed using vacuum extraction.

Vacuum extraction can also be used in combination with jetting: typically, this method entails using a metal rod that jets water under high pressure, with the rod being inserted into the excavation to separate the soil. A vacuum hose follows the rod to remove the loosened debris and sucks it into a truck-mounted container. The hole is backfilled with crushed rock or excavated material then capped to match existing surface conditions (typically asphalt or concrete when working in paved streets). Approximately 2-6 potholes per day can be completed using this method.

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2. **Dig and Patch Potholing:** A pipe crew, with backhoe, mobilizes to the site and digs holes through the pavement. The hole is dug, up to a 6-foot square, to a depth above the anticipated depth of the subject utility. Hand excavation is required when the excavation is within 24 inches of the subject utility system per EBMUD RSP 1100, Excavation Safety. An insulated metal rod or a fiberglass “pin bar” may be used to probe downward, or laterally, to locate an electrical conduit and to avoid electrical arching. If the top of the utility is found, the depth is then recorded using a tape measure and the surface location is surveyed. For high-priority utilities, the excavation should extend to one foot below the bottom of the pipe to check the invert elevation and to verify nothing is present below. If the utility in question is not located in the first location, additional test excavations are dug to continue the search. The excavations are backfilled and compacted with aggregate base then capped with asphalt or concrete in compliance with the encroachment permit.

**Non-Destructive Investigation:** Non-destructive methods of investigation generally do not require excavations, and are advantageous because they can be completed quickly. However, the data derived from these non-destructive methods are site specific and largely dependent on the interpretation of the technician. Also, introduction of locating devices into a utility system requires permission from the utility owner and may involve shutdown of the subject system. Non-destructive investigation methods are not as accurate as potholing, and high-priority utilities should therefore always be potholed.

1. **Ground Penetrating Radar:** GPR is a non-destructive investigation method that produces an underground cross-sectional image of different types of soil and metallic subsurface features above the water table. GPR was developed over the past 30 years for shallow, high-resolution, subsurface investigations of the earth. GPR is used to map geologic conditions that include depth and thickness of soil and sediment strata. Other applications include the location of objects such as pipes, cables, and mapping trench boundaries. GPR uses high-frequency pulsed electromagnetic waves to acquire subsurface information. Energy is propagated downward into the ground and is reflected back to the surface.

The applicability of GPR is site specific. The allowable exploration depths and resulting images vary through type of pavement or soil material encountered. Therefore, when this technology is utilized, the pavement thickness and geotechnical materials need to be determined in advance. The GPR method is also sensitive to unwanted signals (noise) caused by various geologic and external factors. Geologic (natural) sources of noise can be caused by boulders, which can cause unwanted reflections or scattering. External sources of noise include reflections from nearby buildings, power lines, and trees. Electromagnetic transmissions from cellular telephones and two-way radios may also cause noise. Shielded antennas can be used to limit these types of reflections. If the project conditions approach the limit of the GPR’s technical ability, interpretation is required to reach a valid conclusion. This technique would typically be used to

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identify the approximate location of all potential buried conflicts in a congested area, where little utility as-built data is available, to assist in selecting an alignment.

GPR can provide valuable data on the location of existing utilities (both in-service and abandoned) and other obstructions in the street that often cannot be found on as-builts, and may be particularly beneficial when planning a new alignment in an older urban area. GPR data can also be used during the design phase to determine where to pothole to ensure that a proposed alignment is not in conflict with subsurface features. GPR, in conjunction with potholing, should be considered for contract projects for large pipelines (greater than 16 inches) in older urban areas, and on any pipeline project that is "engineered" (i.e., when exact angles and bearings are required for pipe fabrication prior to the start of construction) to help reduce the potential for change orders during construction.

2. **Electromagnetic Signaling:** High performance radio-detection incorporated pipe and cable locators are non-destructive investigation methods that may be used for locating a utility. These locators have a receiver and a transmitter. The receiver detects electromagnetic signals emitted from metal pipes, with varying levels of accuracy. These signals can be naturally occurring electrical noise and low-frequency radio waves. Alternatively, these signals can be induced into the utility by using a transmitter, applying an electrical signal that is mounted directly on the pipe, or upon valves, appurtenances, or corrosion test stations. If a direct connection to the pipe is not available, a signal can be induced onto a pipe using a ring clamp that encircles the pipe or a coil lying above the pipe.

These locators can only detect metal pipes and cables that are welded, soldered or threaded together, unless a non-metallic pipeline has a tracer wire. Therefore, this method cannot be used to detect plastic pipes. Factors affecting accurate utility location using this methodology include the burial depth of the utility itself (major factor), strength of the signal and location of the attachment points versus area being scanned, type of scanning instrument, and training of the scanner. Other factors include the subject pipeline's coating system and adjacent metallic structures or overlying structures. This technique would typically be used by USA locators to identify the approximate location of metal pipe.

3. **Internal Radio Transmitter:** There are many pipes made of materials that cannot be detected with the electromagnetic methods identified above. These include pipelines made of plastic, clay, concrete, and insulated cast iron that are used for sewer, storm drain and conduit applications. A small radio transmitter is a non-destructive investigation method that may be inserted into the pipe. However, this may require a shutdown of the subject utility, which is often not feasible for water pipelines. Once inside, a pipe locator is used to locate the radio transmitter. The pipe's position is then marked on the ground. The transmitter is pushed farther into the pipe, the receiver relocates it and the pipe's position is again marked. This process is repeated until the desired section of pipe is traced.

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While this technique is typically not used to locate water pipelines because it requires an outage, it could be used, for example, to determine the exact location of an asbestos cement pipe that may be in conflict with the installation of a new pipeline using the horizontal directional drilling method. EBMUD's System Water Quality Section should be consulted prior to introducing a transmitter into the pipe.

4. **Automated Inspection Probes (Smart Pigs):** Automated inspection probes, known as "smart pigs," are used by utility owners to detect pipe corrosion and to determine pipe wall thicknesses. These devices are especially utilized by the petroleum industry to meet Federal guidelines on spill prevention. The probes travel through the pipe, between launching and receiving traps, to measure and record any internal wall anomalies. Magnets need to be installed and located using surveying equipment on both ends of the pipe segment to be investigated (on x/y axis) to calibrate the pig's position during the run. Although smart pigs are not pipe locating devices per se, the information obtained may be useful to the designer to document the existing site conditions. The precision of these probes is approximately  $\pm$  one foot to all depths. This technique would typically be used to inspect larger diameters pipes (i.e., greater than 16 inches in diameter). The location where the probe is inserted should be surveyed.
  
5. **Internal Metallic Tracing Wire:** This identification technique consists of introducing a spring steel narrow gauge "wire" into a pressurized non-metallic water service through a specialized adapter at the meter location. This narrow gauge wire, typically found on an electrician's "fish tape," is used to provide an electrical connection point for conventional tracing of the service. This system is typically relied upon for tracing polybutylene services and it has been adapted for use on non-metallic pipelines. This method is commonly utilized by the water industry for locating non-metallic pipelines and services.
  
6. **Sonic Signal Locators:** This method consists of attaching a vibratory hydraulic signal inducer to a fire hydrant, or other appurtenance, to impart a sonic vibration onto the exiting water column. This audible "pulse" is reflected back into the pipe allowing for signal amplification via ground microphones. This technique has mixed results depending on the condition of the surrounding backfill. It performs poorly in sound-absorbing backfill-like dry, loose soil or very wet ground. This method can also be utilized for locating non-metallic pipes and services.

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**B. MINIMUM STEPS REQUIRED TO IDENTIFY EXISTING UTILITIES**

Pipeline designer/project engineer should take the minimum steps outlined below during the design phase of a pipeline project to identify underground utilities and to avoid potential buried conflicts when selecting an alignment. If a pipeline is being designed by a consultant, EBMUD's project engineer or project manager should verify that these minimum steps have been taken.

- a) Request as-built documents, abandoned utility drawings, record drawings, and system maps from all utilities and companies that operate transmission facilities within the project area. Typically, this includes, but is not limited to, PG&E, sanitary sewer district, and fiber optic and cable companies. These documents should be used to show the locations of all known underground utilities on the design base drawings to the best accuracy possible, using common/known reference points, features, or lines such as property boundaries. Appurtenances and service laterals may not need to be shown if their presence can easily be inferred from the main transmission line itself or visible surface facilities by a competent field person (e.g., meters).

If there is evidence of recent pavement cuts for the installation of a new utility system, then a former system may have been abandoned in place. The designer should request information on the existence of any abandoned utilities from the utility owners and from city or county staff.

- b) Conduct an initial site visit to observe the following:
- Presence/markers for high-priority utilities in or near the proposed alignment.
  - Utility markers or pavement markings by utility owners, if any.
  - USA markings, if any, that may still be visible from previous projects. Note that unless potholing work is performed (which constitutes an "excavation activity"), USA cannot be called to mark the location of existing utilities during the design phase of a project.
  - Surface features such as manhole rims, grates, and valve pots.
  - Pavement type (asphalt or concrete), plus a review of cuts revealing previous trenching or other utility activities.
  - Traffic conditions during typical hours of construction work.
- c) Establish a preliminary estimate of the following items for the project pipe, based on the site visit and design base drawings:
- Pipe diameter
  - Depth of cover
  - Length of reach
  - Preliminary alignment
  - Trench width
  - Shaft size and construction, if applicable

*Note: The above factors will impact construction duration, based on alignment and permit restrictions, and project cost (for example, if feasible, some alignment should*



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*be along side of street to reduce repaving costs, since many cities require large T-cuts).*

- d) Contact the city, county, and/or utility owners in writing to inform them of the future project. This is first done by sending all cities and counties a list, typically every August as part of EBMUD's annual Pipeline Master Plan, or at the beginning of project planning/design, of all upcoming pipeline projects. A city, county, and/or utility owner shall be contacted again a few months prior to final design to verify that their utilities have been located and to confirm that there are no additional utilities along the pipeline alignment. Prior to starting construction, as part of a coordination effort and/or as part of the process of applying for an encroachment permit, Pipeline Infrastructure Division and/or PCE typically requests information on special traffic control, pavement section requirements, or work hour limitations anticipated to be imposed by the city or county. If the design is done by a consultant, EBMUD's consultant should verify these requirements prior to design completion.
- e) Request a trench spoils investigation from the Environmental Compliance Section of RCO during the initial design phase of a pipeline project. If the design is done by a consultant, EBMUD's consultant should perform an investigation to determine the handling and disposal requirements for all excavated materials. The initial step of this investigation typically includes checking a database for potential hazardous waste locations using a software program. If the software does not reveal any potential contamination, no additional investigation is required. If the database reveals the potential for hazardous materials, this task then requires cutting into the existing pavement section to sample the soil below (i.e., soil borings). If soil borings are required, the pipeline designer should request that the thickness of the pavement section be recorded during this task, and this information should be shown on the drawings.
- f) When crossing or running parallel to a high-priority utility, the pipeline designer or project engineer should discuss the findings of the field visits, preliminary utility research, and project parameters with the supervisor of the Distribution System Engineering Section or Manager of Pipeline Infrastructure, and with the Construction Division and/or PCE Pipeline Section, as deemed appropriate. A determination of the need for further investigation of buried conflicts should then be made.

Determination factors and issues for consideration are listed in Attachment A. Recognition is given to the fact that all of the determining factors are not of equal significance. For example, a pipeline alignment in a narrow space with a parallel high-priority utility or a project that crosses a busy intersection where utilities of various profiles exist may require additional investigation such as potholing.

- g) For larger pipeline projects and for contract projects, 90 percent draft documents should be completed and distributed to appropriate staff and owners of high-priority utilities for review and comment after the necessary utility information is gathered and shown on the drawings.

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If the work is to be constructed by EBMUD staff, input should be sought, during the 90 percent design stage, from the assigned General Pipeline Supervisor or Water Distribution Crew Foreman to determine if more information is warranted at particularly congested areas. Depending on the type of project, an additional job walk may be needed prior to finalizing the design. If the work is to be done by an applicant or by contract, input should be sought from the Construction Division.

**C. GUIDELINES FOR COLLECTING/DEPICTING UTILITY DATA DURING PLANNING, DESIGN, AND CONSTRUCTION**

**Planning**

1. For larger pipeline construction projects, discuss the potential impacts of subsurface installations during the CEQA phase (i.e., Negative Declaration or EIR) as part of the alignment selection process, including potential hazard/safety considerations associated with working near high-priority utilities. The following steps and considerations should be taken during the planning phase of these projects:
  - Obtain plat designation of existing underground facility easements.
  - Gather preliminary utility information for planning and design purposes.
  - Coordinate with other utilities. Send letters to high-priority utility owners requesting as-built information.
  - Discuss the presence of high-priority subsurface installations as a “potentially significant impact” if the project includes a proposed pipeline alignment that is located near (e.g., within same right of way) a high-priority subsurface installation.
  - As a separate item in a Mitigation, Monitoring and Reporting Plan, or as other mitigation measure, include a recommendation to identify subsurface installations during the design phase of the project in accordance with this ESP.
  - Highlight the presence and potential impact of priority subsurface installations as part of the “planning to design project handoff” memorandum.

**Design**

1. Use the following general guidelines to determine when to use Quality Level A, B, C, or D, as defined above, for identifying underground utilities:
  - Use potholing (**Quality Level A**), for both EBMUD-installed pipe and for contract projects, to survey actual horizontal and vertical location of high-priority utilities or other critical utilities that are in potential conflict with or within close proximity (i.e., within 5 feet from trench wall) to a proposed final pipeline alignment trench. Potential conflicts would include existing utilities that may be located within the anticipated trench of the proposed pipeline alignment. The

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frequency of potholes that should be performed will depend on the type of high-priority utility, the quality of as-built data, and other project-specific conditions.

Level A potholing is typically required under the following circumstances:

- To locate high-priority utilities, as defined above, when they are located within approximately 5 feet from trench wall of a proposed distribution pipeline alignment, based on existing available utility drawings or markings. At a minimum, potholing should be performed when a high-priority utility, associated appurtenances, or other structures necessary to install the pipeline (i.e., shafts) is located within 5 feet (clear distance) horizontally from the closest trench wall or excavation.
- To locate connection points to large diameter transmission pipes (greater than 16 inches in diameter) when exact angles and bearings are required for pipe fabrication.
- To locate another utility that is in direct conflict with a proposed pipe alignment, and for which there is insufficient or conflicting data and no other feasible alternative alignment (relatively rare). The reliability of existing as-built data should be checked when assessing if there is a potential conflict.
- To confirm location/depth and vertical alignment when it could significantly affect the scope of a pipeline project, such as a replacement, relocation, or applicant system extension project.

In the case of a high-priority utility that runs parallel to a proposed pipeline alignment, for example, multiple potholes are required to identify the alignment and depth of the utility in question along the entire shared alignment. All crossings (i.e., intersections – in plain view – between a proposed pipeline and a high-priority utility) shall be potholed. The number and location of potholes required for a high-priority utility should initially be determined by the pipeline designer or project engineer, with input from Construction Division and/or the Senior Engineer responsible for signing and stamping the project drawings. For larger projects and depending on the extent of the potential conflict, the number and location of potholes should also be reviewed with the PCE, Construction Division, and/or with the Director of Engineering and Construction.

Once the utility has been exposed, it should be visually verified in order to confirm that the correct utility has been exposed, and the following data should be collected: pipe material/coating type, pipe diameter, depth to top of pipe, and thickness of asphalt concrete. After backfilling, the pothole should be marked and the street markings surveyed, plotted on the corresponding pipeline design drawing, and listed in a pothole table.

- Use subsurface geophysical or potholing methods (**Quality Level B or A**) to mark underground utilities in certain locations such as congested, downtown

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urban areas where streets may be crowded with existing utilities and possibly with unknown subsurface features, and where existing utility as-built records are poor or non-existent. Surface geophysical or potholing methods should be used before finalizing a pipeline alignment.

The use of Level B geophysical methods is typically recommended when there is poor, non-existent, or conflicting utility data in congested locations, such as large roadway intersections in urban areas. The use of geophysical surveys typically requires judgment to correlate data, resolve differences, and interpret results.

A majority of EBMUD pipeline projects, which are performed by EBMUD crews that have potholing equipment to locate utilities during construction, do not warrant geophysical exploration during design.

- Use ASCE's **Quality Level C** as a minimum/standard level of effort for identifying underground utilities during the design phase of all EBMUD-installed pipeline projects, including replacement, system improvement, and relocation projects, and for more complex system extension/applicant projects installed by either the applicant or EBMUD.
- Use ASCE's **Quality Level D** as a minimum level of effort for identifying underground utilities during the design phase of new subdivision and non-complex applicant projects, which, for the most part, are installed by an applicant's contractor.

For all applicant projects, consider the need for requesting a higher level of quality for identifying existing underground utilities (i.e., Quality Level A, B, or C) on a case-by-case basis depending on actual location and site conditions. If a high-priority utility is located near a proposed pipeline alignment for an applicant project, request that the high-priority utility be potholed by the applicant prior to start of design.

When incorporating existing utility information, the quality of as-built data obtained from other utilities should be field checked (i.e., against visible appurtenances such as manholes, valves, etc.) to determine if additional investigation is needed to more accurately locate certain utilities. EBMUD currently uses this minimum level of quality for new subdivision and non-complex applicant projects (system extensions), which typically rely on information provided by the applicant, such as subdivision/track maps and improvement plans.

2. If potholing is needed during the design phase of a project, USA field markings are required prior to potholing, and both the potholes and USA markings should be surveyed to an accuracy of  $\pm$  one inch.

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3. For contract pipeline projects (i.e., not EBMUD staff), to locate high-priority utilities or to provide the necessary accuracy for engineered pipelines, consider using ASCE's quality level attributes for depicting existing utilities on pipeline design drawings (Quality Levels A to D, as defined above and under Article IV). See Attachment B for an example of ASCE quality level delineations on a pipeline drawing.
  
4. The recommendation for whether quality level attributes should be adopted for a particular project and which quality level is warranted should be provided by the pipeline designer or project engineer, with input from the Senior Engineer responsible for stamping and signing the pipeline drawings (requires judgment and may vary on a case-by-case basis). For larger projects and depending on the extent of the potential conflict, final decisions on quality level or attributes shall be made with input from PCE, Construction Division, and/or with the Director of Engineering and Construction.
  
5. For pipeline projects to be done by EBMUD staff, or contract projects for which the ASCE quality level attributes are not being used (i.e., smaller projects), clearly highlight the presence of high-priority utilities by flagging their location as "High-Priority Utility" on all pipeline drawings, using large font, and by verifying their location by potholing. If available, also provide emergency contact information for the owner of the high-priority utility on the drawing. See sample drawing excerpt (Attachment C).
  
6. For pipeline projects to be done by contract (i.e., not EBMUD staff), require that the contractor verify the exact location of all utilities during construction via the contract specifications, even if such utilities have been potholed during design and identified as Quality Level A on EBMUD's pipeline construction drawings.  
  
Consider modifying existing specification or creating new specification to apply ASCE 38-02 on a project-by-project basis. If it is decided that a project needs to reference ASCE 38-02, quality level attributes should be called out on the pipeline design drawings, but also need to be referenced/defined in the specifications.
  
7. Define how high-priority utility data provided by another utility or source in latitude/longitude coordinates can be converted into north/east coordinates to ensure accurate reporting of information on EBMUD's pipeline drawings. Note that common errors can result in a conversion that looks reasonable but is imprecise, so the conversion needs validation; for example, by matching up of converted data versus field-surveyed data, or comparison of relative offsets to known features.
  
8. For pipeline design work done by consultants, check that as-built data from other utilities that is transferred onto EBMUD's base maps is accurately shown, by verifying the utility's location using the same control or reference point.

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Consultant's proposal/scope of services should include the potholing and surveying of these utilities, instead of relying on data from other sources.

### Construction

Some of the construction-phase guidelines presented below, such as items 2 and 4, only apply to contract work, which is typically limited to larger diameter pipeline projects (i.e., pipelines greater or equal to 24 inches in diameter). Other items, however, also apply to projects performed by EBMUD staff. Applicable guidelines that need to be followed on projects performed by EBMUD staff and system extension/applicant projects include pre-construction/tailgate meetings (items 1 and 5) and reviewing pothole data (item 3), if any, that may be collected by PCE or an applicant's contractor prior to start of construction.

The project lead is responsible for ensuring that applicable construction guidelines are followed even though specific tasks may be delegated to subordinates. The project lead during construction phase may vary depending on the type of project, and is defined as follows for the purpose of this ESP:

- Contract Manager, for contract work.
- Lead Construction Inspector, for projects done by PCE or applicants.
- Water Distribution Crew Foreman, for projects constructed by an EBMUD Area Service Center (i.e., Yard).

1. **Pre-Construction Meeting:** The pre-construction meeting agenda should include discussion of:

- Contactor's responsibilities to pothole and submit pothole data.
- Tailgate meetings prior to start of excavation.

A request should be made that the owners of all high-priority utilities located in the project area attend this pre-construction meeting.

2. **Submittals:** Modify specification language to require the contractor to submit pothole data in tabular form (e.g., utility type, vertical and horizontal offset from survey line, depth of cover, vertical and horizontal distance from location of utility as shown on contract drawings, etc.). Submittals should be done before any pipe lay sheets are provided.

3. **Pothole Data Review:**

- **Contract Work:** Review the contractor's pothole submittal to ensure it meets the requirements of the specification and drawings, and to review any discrepancies, as identified by the contractor, between the location of utilities as shown on the contract drawings and as found during the potholing. The results of submittal review will be discussed with the contractor using the

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contractor's marked up contract drawings before the submittal is returned to the contractor.

- **Work Performed by EBMUD Staff or Applicant:** Review PCE's or applicant's pothole data to identify any discrepancies between the location of utilities as shown on the drawings and as found during the potholing. Drawings should be marked up to reflect any discrepancies and should be reviewed/discussed with PCE and the pipeline designer/project engineer, if needed, before start of construction.

4. **Lay Drawings Review:** Review the lay drawings to ensure they reflect the pothole data from the contractor.
5. **Pre-Pipeline Excavation Tailgate Meeting(s):** Meet with the contractor's foreman, supervisor and excavator operator prior to the start of excavation each day. Topics to discuss include: current alignment and alignment changes, pothole data, USA markings, potential conflicts, existing utilities, contract and permit requirements.
6. **As-Built Drawings:** Do not rely entirely on shop lay drawings in the field on a day-to-day basis for recording as-built information. Record the information on a current set of contract documents.
7. **Projects Performed by EBMUD Staff:** Any changes in the pipeline alignment implicating a high-priority utility should be approved by the pipeline designer/project engineer.

**D. ANTICIPATED INVESTIGATION COSTS FOR IDENTIFYING BURIED CONFLICTS**

The existence of buried utilities, identified during the design phase and properly shown on the construction documents, should improve safety and decrease impacts during construction. When used for engineered pipeline designs, the efforts of potholing should result in reduced construction durations due to pipe fit-ups being planned in advance rather than determined in the field. On infrastructure renewal projects, the cost of potholing to prevent the realignment of a smaller pipe during construction may be justifiable because re-sawing and additional paving would not be required (i.e., savings by having less saw-cutting and repaving would offset cost of potholing). Reduced traffic impacts and shorter system outages should also be expected. The benefits of these investigations should be compared to the estimated costs given below. Safety should at all times remain the paramount concern.

An encroachment permit is necessary for methods such as potholing by vacuum extraction that require excavation within the public right-of-way. Encroachment permit fees vary by city and are not included in the cost estimates given below. EBMUD's total direct costs for excavating potholes using a backhoe and hand excavation techniques, including office support, surveying and paving, are approximately \$10,000 per pothole (all costs are estimated in 2005 dollars). In comparison, the cost for vacuum extraction

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services is about \$3,000 per day. Therefore, the cost of potholing using vacuum extraction equipment is significantly lower than conventional potholing techniques using power-operated equipment, and should be used whenever possible. The cost of performing multiple potholes during the design phase may be expensive due to multiple permits required and permits may be difficult to obtain. For comparison purposes, a one-day delay on a large pipeline project, due to a miss-marked utility, can cost about \$8,000 to \$10,000 plus the cost of the design and rework.

The cost for a complete non-destructive survey for an individual street intersection is about \$3,000. The estimated direct costs to investigate a large pipeline project, which may consist of 4,000 to 15,000 feet with multiple intersections, ranges from \$15,000 to \$30,000. Fees imposed by the subject utilities, if any, are not included in these cost estimates. These costs, while significant by themselves, may be relatively low when compared to the costs associated with change orders or construction delays if a contractor is shut down for a day or more due to unforeseen conditions.

It should be noted that these costs are relatively minor in comparison to the costs of delaying a large pipe installation crew while a new design is being developed to address a utility that is in conflict with the designed alignment.



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Director of Engineering and Construction



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ATTACHMENT A

DETERMINING FACTORS  
FOR IDENTIFYING BURIED CONFLICTS

Subject	Factor #	Determination Factor	Project Issue	Recommended Minimum Level of Investigation
Site Conditions	1	High-priority utilities, such as petroleum lines or large-diameter, high-pressure gas pipelines	Presence of a high-priority utility in or near a proposed alignment presents both a safety concern and a risk of delaying the project.	A
	2	Busy road or street intersection	<ul style="list-style-type: none"> <li>Traffic delays impact community; damage to traffic loops may be costly.</li> <li>Crew is at physical risk from traffic (k-rails may be needed for safety in high-speed/traffic volume streets).</li> <li>Ensure selected alignment allows room for people, equipment, and trucks.</li> </ul>	B or C
	3	An old, well-developed, area	Street may have abandoned utilities that impact work (e.g., City of Oakland, which has abandoned lines such as concrete-encased steam lines, fire/police call lines, etc., whose locations are unknown).	B or C
	4	Record drawings from agencies show many utility crossings	Consider a new pipe alignment to best avoid conflicts and minimize cave-ins (includes EBMUD facilities).	A or B
	5	Existing USA markings or patches on pavement show many utility crossings	Recent utilities may not be as shown on the records obtained from owner.	A or B

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Subject	Factor #	Determination Factor	Project Issue	Recommended Minimum Level of Investigation
Site Conditions (continued)	6	Sensitive utilities present, i.e., fiber-optic lines or communication vaults	<ul style="list-style-type: none"> <li>Repairs to these facilities are costly.</li> <li>Working near these utilities increases the likelihood of near-miss, or injury for the crew.</li> </ul>	A
	7	Narrow alignments, with adjacent utilities	<ul style="list-style-type: none"> <li>Locate utilities early to prevent revisions to new pipe alignments.</li> <li>Meet with General Pipe Supervisor before beginning design to discuss the best way to install the pipeline.</li> <li>Meet with Distribution Maintenance &amp; Construction Division to ensure pipeline and services can be maintained.</li> <li>For contract work, meet with Construction Division.</li> </ul>	A
	8	Other facilities, active or abandoned, that cannot be physically moved, i.e., large storm drains and culverts	New pipe alignment and profile must avoid facility, or cost to remove the abandoned utility must be included in the project approval and reflected on drawings.	A or B
New Pipe Information	9	Pipe diameter greater than 16 inches	Alignment and profile revisions on large pipes are difficult to make in field.	A
	10	Installation by micro-tunneling, horizontal directional drilling, or other trenchless technologies	All buried conflicts must be found for safe work and to prevent damage, or to prevent losing or damaging construction equipment.	A

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Subject	Factor #	Determination Factor	Project Issue	Recommended Minimum Level of Investigation
Construction Constraints	11	Limited work hours	Mobilization of crews limits actual time available for pipe tasks.	B or C
	12	Narrow utility system outage window	Delays to return-to-service may not be acceptable to client or customers.	A
	13	Extensive traffic control requirements	<ul style="list-style-type: none"> <li>Mobilization of traffic control limits time available for pipe tasks.</li> <li>Agencies typically reluctant to closing roads/lanes, and common two-person flagging may not be sufficient.</li> </ul>	B or C

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**ATTACHMENT B**

**EXAMPLE OF ASCE QUALITY LEVEL DELINEATION**

*(Source: ASCE Standard 38-02, Figure 6-1, Page 8, March 2002)*

**LEGEND**

<u>COLOR/LINE CODES</u>	<u>SYMBOLS</u>
--- <u>CW</u> ---	○ MANHOLE
--- <u>FP</u> ---	⊕ DROP INLET
--- <u>RW</u> ---	□ UTILITY POLE
--- <u>DI</u> ---	□ LIGHT POLE
--- <u>CW</u> ---	⊗ VALVE
--- <u>GAS</u> ---	* FIRE HYDRANT
--- <u>PROPANE</u> ---	┌ UTILITY END POINT
--- <u>STEAM</u> ---	○ RISER
--- <u>CR</u> ---	⊕ HANDHOLE, BOX
--- <u>CA</u> ---	⊕ PEDESTAL TRANSFORMER
--- <u>N</u> ---	● BOLLARD
--- <u>O</u> ---	■ SIGN
--- <u>CO</u> ---	□ HOUSE TRAP
--- <u>J</u> ---	⊕ "QUALITY LEVEL A" DATA POINT
--- <u>E</u> ---	
--- <u>CS</u> ---	
--- <u>UNK</u> ---	
--- <u>ST</u> ---	
.....	LINE CODE FOR QLC OR QLD INFORMATION

**ABBREVIATIONS**

F.O.	FIBER OPTIC
EOI	END OF SURFACE GEOPHYSICAL INFORMATION
EORI	END OF RECORD INFORMATION
AATUR	UTILITY ABANDONED ACCORDING TO UTILITY RECORDS
AATFI	UTILITY ABANDONED ACCORDING TO FIELD INSPECTION
EATUR	EMPTY ACCORDING TO UTILITY RECORDS
NAP	NO ASSOCIATED PIPING FOUND FROM STRUCTURE
NAC	NO ASSOCIATED CABLES FOUND FROM STRUCTURE

**NOTES**

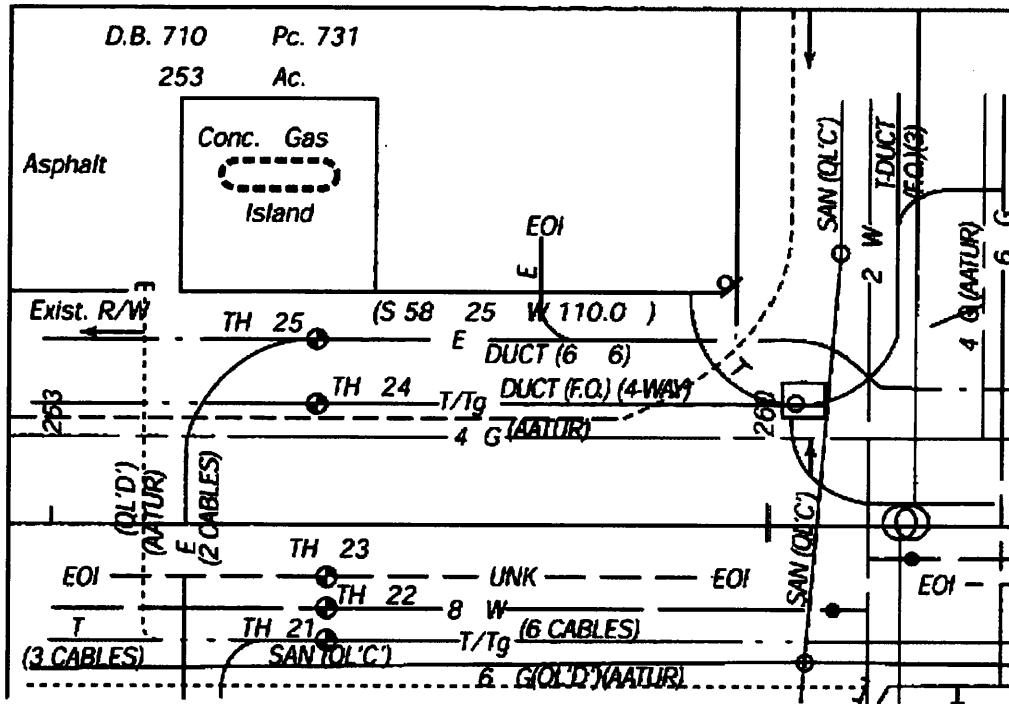
- NOTE 1:** "QUALITY LEVEL A" DATA POINTS INDICATED BY SYMBOL ⊕. SEE QLA SUPPLEMENTAL DATA FORM FOR ADDITIONAL UTILITY INFORMATION.
- NOTE 2:** ALL "QUALITY LEVEL A" ELEVATIONS ARE FOR THE TOP OF THE UTILITY UNLESS OTHERWISE NOTED.
- NOTE 3:** ALL UTILITIES DEPICTED AT "QUALITY LEVEL B" UNLESS INDICATED BY DOTTED LINE CODE (.....) AND LABELED "QLC" OR "QLD".

**FIGURE 6-1. Legend Example.**

**ATTACHMENT B (Cont.)**

**EXAMPLE OF ASCE QUALITY LEVEL DELINEATION**

(Source: ASCE Standard 38-02, Figure 6-2, Page 9, March 2002)



All Utilities depicted QL B unless otherwise noted.

QL A Data Summary (see QL A Supplemental Data Sheets for additional information):

TH 21: 6 non-encased telephone cables

TH 22: 8 3/4 C.I. water

elevation top of cable configuration: 188.15  
 elevation bottom of configuration: 183.43  
 Coords: N 441987.8011  
 E 3640280.1310

elevation top of water line: 184.67  
 Coords: N 441992.7925  
 E 3640280.0092

TH 23: 6 3/4 unknown function steel pipe  
 elevation top of pipe: 181.12  
 Coords: N 441997.3489  
 E 3640280.8993

TH 24: Fiber Optic concrete telephone duct  
 elevation top of duct: 184.41  
 elevation bottom duct: 182.22  
 width of duct: 2.62

TH 25: concrete encased electric duct  
 elevation top of duct: 186.87  
 elevation bottom duct: 183.55  
 width of duct: 4.66  
 Coords: N 442032.1007  
 E 3640281.2238

Coords: N 442022.7934  
 E 3640281.0571

**FIGURE 6-2. An Example of Line Code, Labeling, Symbol Embedding, and Notes.**

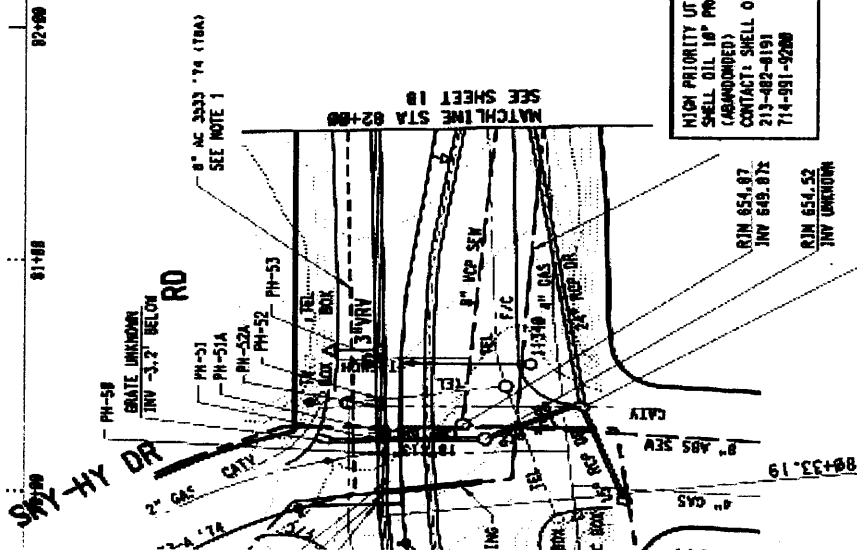
**ATTACHMENT C  
SAMPLE DRAWING/EXCERPT  
HIGHLIGHTING THE PRESENCE OF A HIGH-PRIORITY UTILITY**

POTHOLE DATA TABLE

PH #	UTILITY	DESCRIPTION	IN/PI IN TO TOP	AC/CUMIC THICKNESS
PH-45	STORM DR	24" CMP	2'-2"	11" AC
PH-46	WATER	12" M.L.M.C.S	4'-2"	11" AC
PH-47	GAS	6" STL	4'-8"	11" AC
PH-48	GAS	1 1/2" STL	1'-11"	
PH-49	OIL PRODUCTS LINE	18" W/16" CASTING	NOT FOUND TO 8'	18" AC
PH-50	GAS	2" STL	3'-3"	18" AC
PH-51	STORM DR	18" 113" CMP ARCH		
PH-51A	ELEC	3" STL	3'-11"	18" AC
PH-52	TEL	2" CABLE	1'-10"	9" AC
PH-52A	TEL	1 1/2" CABLE	1'-11"	9" AC
PH-53	TRENCH	6" PVC	2'-11"	

**NOTE:**

1. 8" AC WATER LINE TO BE ABANDONED IN PLACE AND SERVICES RELOCATED PRIOR TO CONSTRUCTION BY OTHERS.
2. 8" AC IN IN SKY-HY DR TO BE RECONNECTED 8'



REQUIRED SAFETY PRACTICE 1100  
EXCAVATIONS, TRENCHING, AND EMPLOYEE PROTECTIVE  
SYSTEMS

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# RSP 1100 – EXCAVATIONS, TRENCHING, AND EMPLOYEE PROTECTIVE SYSTEMS

*CCR Title 8 §1504, §1539-1547; CA Govt. Code §4216; RSP 4400.*

## Safety Requirement

1100. All excavations performed by District forces will strictly conform to this RSP, RSP 4400, *Subsurface Installation Locating and Marking*, all applicable Cal/OSHA *Construction Safety Orders (CSO)*, CA Government Code §4216 ("4216"), and where applicable, to the prerequisites contained in the most recent version of the Common Ground Alliance's (CGA) *Best Practices*.

- a) District employees will not voluntarily enter, or respond to a directive to enter, excavations that do not strictly conform to this RSP, CSO, and 4216.
- b) If a District "owned" excavation is non-compliant, District staff will advise the on-site supervisor (regardless of job-title) that the excavation is non-compliant and what actions need to be taken before District staff will be allowed to enter the excavation. If the on-site supervisor does not make the corrections, their supervisor shall be immediately notified in an attempt to resolve the dispute. The Workplace Health and Safety Section (WHS) may be called for technical assistance to resolve the matter.
- c) If a contractor "owned" excavation is non-compliant, District staff will advise the owner of the specific reason(s) why entry is being refused. District staff will refrain from advising the owner on what corrective action must be performed, or equipment installed, to bring the excavation into strict compliance and entry by District staff will not be made until the excavation conforms to CSO, and 4216.

## General Information

1101. Due to the District's status as a government body (as defined in CCR Title 8 §341(e)1), the District is exempt from Cal/OSHA excavation permit requirements.

1102. For the purposes of this RSP, "excavation" can be defined as any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

1103. Whenever excavation operations are undertaken, the on-site supervisor or foreman will ensure that proper work practices are established prior to, at all times during, and at the conclusion of the excavation operation.





- a) Because of the dynamics and individuality of excavations, it should not be presumed that every possible safety precaution is noted in this RSP, or that unusual circumstances will not require added procedures or equipment.
- b) Decisions affecting worker protection will be made based on actual site conditions existing at the time operations are occurring and in no case will a lesser level of protection than is required by this RSP be allowed to exist.
- c) Employees will cease operations if there is a question regarding a noted hazard, or if a hazard is suspected or discovered.
- d) Any District employee who observes an unsafe act or condition at an excavation site has the authority to stop work in progress until the act or condition is resolved. The on-site supervisor or foreman will be immediately personally notified of any such shutdown.

1104. Trenches 5-feet or more in depth require a protective system, or will be laid back to its angle of incline (stabilized slope).

- a) In hazardous soil conditions (loosely compacted or rocky) trenches less than five-feet deep require protection.
- b) A registered engineer is required to design and sign-off tabulated data for excavations 20 feet or deeper.

### **Excavation on District Property**

1105. When excavation work is to be performed *by District employees* on District property, the work-group conducting the excavation will contact the facility (i.e.; for example, Water Treatment Plant) that will be affected PRIOR to commencing the work.

- a) A Safe Work Permit ( See RSP 1300 - *Safe Work Permit*) will be obtained whenever excavations are to be performed on Water Treatment Plant sites. All excavating activities are prohibited until the Permit has been issued.
- b) District utilities installed and/or located during excavation shall be indicated on applicable drawings and up-dated if required.
- c) Completed drawings shall be sent to Engineering Services for incorporation into District record drawings.



1106. When excavation work occurs on District property *by contract employees*, the Project Manager shall obtain a Safe Work Permit (See RSP 1300 – *Safe Work Permit*) from the Plant Supervisor on duty.

- a) Utilities installed and/or located during excavation shall be indicated on applicable drawings and up-dated if required.
- b) Completed drawings shall be sent to Engineering Services for incorporation into District record drawings.

### **Competent Person**

1107. A “Competent Person” will be present at every excavation and is responsible to the job-site supervisor or foreman for the safety of the excavation including inspections, safety operations, and logistics.

- a) The on-site supervisor or foreman may delegate competent person duties and responsibilities to a qualified individual. No employee shall be deemed qualified unless that individual has received initial competent person training.
- b) A replacement competent person will formally relieve the competent person whenever the assigned competent person must leave the job-site.
- c) The competent person's duties include, but are not limited to identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees.
- d) The competent person has the authority to take prompt corrective measures to eliminate all detected hazards.
- e) The competent person will classify soil and protective systems (shoring, bracing and piling) to be used in accordance with Cal/OSHA Trenching Standards (See Attachment A - D).

1108. The competent person will make daily inspections of excavations, adjacent areas, and protective systems for evidence of circumstances that could result in possible cave-ins, failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be:

- a) Conducted by the competent person prior to the start of work and as needed throughout the shift.



- b) Made after every rainstorm or other hazard-increasing occurrence.
- c) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees will be immediately removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

### **Protection from Water Accumulation**

1109. Employees will not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions as directed by the competent person have been taken to protect employees against the hazards posed by water accumulation.

- a) The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline systems.
- b) Water should not be allowed to accumulate within the excavation. Accumulated water will be removed utilizing proper pumping procedures and safe work practices. Water will be controlled or prevented from accumulating by the use of water removal equipment.
- c) The competent person will continue to monitor the water removal equipment and operations until all employees have completed their work in the trench.
- d) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches or dikes, suitable means will be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will be regularly inspected by a competent person

### **Protection from Superimposed Loads**

1110. Superimposed loads such as cranes, backhoes, spoils, traffic, and other construction equipment working close to the excavation edges may require extra sheet piling, shoring or other bracing to be used to assure the ability of the soil to resist the superimposed load. The use of mobile equipment near the excavation requires proper vehicles barricades and/or stop blocks.



- a) Equipment, materials and trench spoils shall not be stored within 2 feet of the edge of the trench.

1111. Under no circumstances are District employees authorized to work or be present in a trench while the area is covered by a trench plate.

### **Access and Egress from Excavations**

1112. The competent person will design structural ramps that are to be used solely by employees as a means of access or egress from excavations.

- a) Structural ramps used for access or egress of equipment will be designed by the competent person and will be constructed in accordance with acceptable designs.
- b) A stairway, ladder, ramp or other safe means of egress will be located in excavations that are 4-feet or more in depth so as to require no more than 25-feet of lateral travel for employees.
- c) If the excavation is 20 feet or greater in depth, ladders will be equipped with ladder platforms at 20-foot intervals.

1113. Employees may not use protective systems, such as aluminum hydraulic shoring, or subsurface installations to access or egress excavations.

### **Protection from Vehicular Traffic**

1114. A temporary traffic control zone will be created for all jobsites within or adjacent to vehicular traffic lanes to provide the highest possible level of worker protection.

- a) Employees exposed to vehicular, construction, or maintenance equipment traffic will be provided with, and will wear a yellow-green fluorescent vests or other suitable garments equipped with retroreflective material (ANSI/ISEA 107-2010; Class 2 or 3) (see RSP 1000 - PPE).
- b) Traffic cones, signs and barricades in accordance with RSP 4600 - *Temporary Traffic Control* shall be utilized to control the flow of vehicles and provide safe areas for employees working in and around excavations.

### **Protection from Falling Loads**

1115. No employee will be permitted underneath loads handled by lifting or digging equipment.



- a) Employees will be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials.
- b) Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

### **Warning Systems for Mobile Equipment**

1116. When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation and the operator does not have a clear and direct view of the edge of the excavation, a warning system such as barricades, hand or mechanical signals, or stop logs will be used.

### **Hazardous Atmospheres**

1117. To prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements apply:

- a) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in sewer breaks, excavations in landfill areas, or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter the excavation.
- b) Adequate precautions will be taken, such as providing ventilation to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 10 percent of the lower flammable limit (LFL) of the gas.
- c) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing will be conducted as often as necessary to ensure that the atmosphere remains safe.
- d) The District uses 10-ppm hydrocarbon for a period of 1 minute as a stop-work criterion. The supervisor, competent person, or WHS representative will decide whether to ventilate the excavation before work continues, or to stop work and proceed with remediation efforts.
- e) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, will wear a harness with a lifeline securely attached to it. The lifeline will be separate from any line used to handle



materials and will be individually attended at all times while the employee wearing the lifeline is in the excavation.

### **Stability of Adjacent Structures**

1118. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning will be provided to ensure the stability of such structures for the protection of employees.

1119. Excavations below the level of the base or footing of any foundation or retaining wall that could be reasonably expected by the competent person to pose a hazard to employees will not be permitted except when:

- (a) A support system (i.e., underpinning) is provided to ensure the safety of employees and the stability of the structure; or,
- (b) The excavation is in stable rock; or,
- (c) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity.

1120. Sidewalks, pavements and appurtenant structures will not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures. Any undermining occurring during a leak or other emergency activity will be secured to prevent pedestrians, bicyclists or motor vehicles from using the undermined area.

### **Underground Installations**

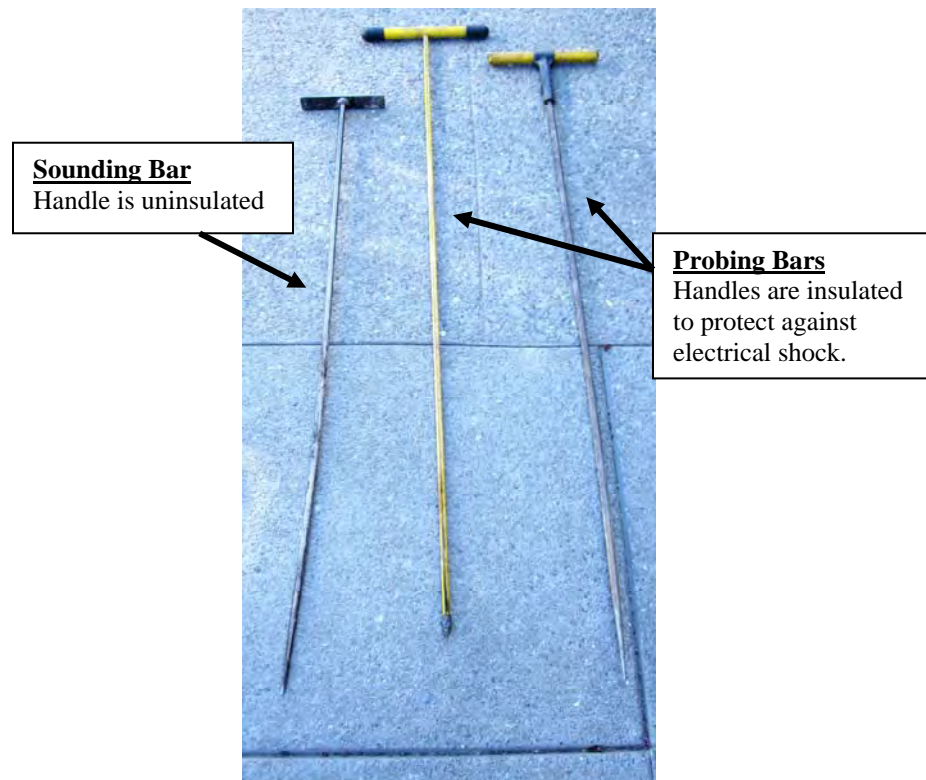
1121. For specific requirements for identification of underground installations PRIOR to the start of work, see RSP 4400 – *Subsurface Installation Locating and Marking*.

1122. Probe and Sound Bars

- a) The District utilizes two types of pin bars in the process of locating water leaks. Each has a separate purpose.
- b) Probe Bars - Probe bars are used to probe for locations of subsurface installations during excavation activities. They shall have an insulated handle to protect the user against electrical shock resulting from incidental

contact with energized subsurface installations. When in use, contact with the un-insulated portions of the probe bar shall be avoided. In order to limit the risk of damaging subsurface installations resulting in employee injury, probe bars shall not be hammered to enable penetration into hard soils.

- c) Sounding Bars - Sounding bars are authorized to be used for sounding leaks once the opening in the pavement and soil has been completed with equipment or tools authorized for that purpose. Sounding bars do not have an insulated handle and are therefore NOT authorized to be used to probe or hammer, which could put employees at risk for electrical shock.
- d) While probe bars may be used for sounding activities, sounding bars may NOT be used for probing activities.
- e) Sounding Bar vs. Probing Bar Visual Example:



### Protection of Employees from Loose Rock or Soil

1123. Adequate protection will be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection will consist of scaling to remove loose material, installation of protective



barricades at intervals as necessary on the face to stop and contain falling material, or other means that provide equivalent protection.

1124. Employees will be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection will be provided by placing and keeping such materials or equipment at least 2 feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

### **Fall Protection**

1125. Where employees or equipment are required or permitted to cross over excavations greater than 6-feet deep or 30-inches wide), walkways or bridges with standard guardrails will be provided. Employees shall not climb upon or over shoring devices to traverse an excavation.

- a) Adequate barrier physical protection will be provided at all remotely located excavations. This includes when the excavation is not readily seen because of plant growth or other visual barrier.
- b) All wells, pits, shafts, etc., will be barricaded or covered.
- c) Upon completion of exploration and other similar operations, temporary wells, pits, shafts, etc., will be backfilled.

### **Protection of Employees in Excavations**

1126. Each employee in an excavation will be protected from cave-ins by an adequately designed protective system except when excavations are made entirely in stable rock; or the excavation is less than 5-feet deep AND examination of the soil by the competent person provides no indication of a potential cave-in.

1127. Protective systems will have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

1128. Soil must be classified prior to determining appropriate protective system. Soil classifications and acceptable tests are located in Appendix A and B, respectively.

### **Design of Sloping and Benching Systems**

1129. The slopes and configurations of sloping and benching systems will be properly selected and constructed as follows. For each option, at least one copy of the tabulated data and/or design must remain at the jobsite during construction of the protective





system. After that time, the data may be stored away from the jobsite, but a copy of the data must be made available to WHS or Cal/OSHA upon request.

- a) *Option 1* - Excavations will be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless one of the other options listed below is used.
- b) *Option 2* - Determination of slopes and configurations is made using both the table below, and allowable configurations for sloping and benching systems.

<u>Soil or Rock Type</u>	<u>Maximum Allowable Slopes (H:V) for Excavations Less Than 20 feet Deep</u>
<u>Stable Rock</u>	<u>Vertical (90 degrees)</u>
<u>A</u>	<u>3/4 : 1 (53 degrees)</u>
<u>B</u>	<u>1 : 1 (45 degrees)</u>
<u>C</u>	<u>1 1/2 : 1 (34 degrees)</u>

- c) *Option 3* - Designs of sloping or benching systems will be selected from and in accordance with tabulated data provided by the shoring manufacturer, such as approved tables and charts. The tabulated data will be in written form and will include:
  - 1. Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;
  - 2. Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;
  - 3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
- d) *Option 4* - Designed by a registered professional engineer. Designs will be in written form and will include at least the following:
  - 1. The magnitude of the slopes that were determined safe for the particular project;
  - 2. The configurations that were determined to be safe for the particular project;



3. The identity of the registered professional engineer approving the design

1130. Employees will not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

### **Design of Support and Shield Systems, and Other Protective Systems**

1131. Designs of support systems, shield systems, and other protective systems will be selected and constructed in accordance with the following options. For each option, at least one copy of the tabulated data and/or design must remain at the jobsite during construction of the protective system. After that time, the data may be stored away from the jobsite, but a copy of the data must be made available to WHS or Cal/OSHA upon request.

- a) Option 1 - Designs using Attachments A, C, and D of CCR Title 8 §1541.1.
  1. Designs for *timber shoring* in trenches will be determined in accordance with the conditions and requirements set forth in CCR Title 8 §1541.1 Attachments A and C.
  2. Designs for *aluminum hydraulic* designs will be in accordance with CCR Title 8 §1541.1 Attachment D.
- b) Option 2 - Designs using Manufacturer's Tabulated Data. Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data will be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.
  1. Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer will only be allowed after the manufacturer issues specific written approval.
- c) Option 3 - Designs using other Tabulated Data. Designs of support systems, shield systems, or other protective systems will be selected from and be in accordance with tabulated data, such as tables and charts. The tabulated data will be in written form and include all of the following:



1. Identification of the parameters that affect the selection of a protective system drawn from such data;
  2. Identification of the limits of use of the data;
  3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
- d) Option 4 - Design by a Registered Professional Engineer. A registered professional engineer will approve support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above. Designs will be in written form and will include the following:
1. A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and
  2. The identity of the registered professional engineer approving the design.

## Shield Systems

1132. Shield systems will not be subjected to loads exceeding those that the system was designed to withstand.

- (a) Shields will be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
- (b) Employees will be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
- (c) Employees will not be allowed in shields when shields are being installed, removed, or moved vertically.

1133. Excavations of a level not greater than 2 feet below the bottom of a shield will be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

1134. Portable trench boxes or sliding trench boxes used in place of shoring and sloping shall be designed, constructed, and maintained to provide protection at least



equal to the required sheeting and shoring. Shields shall be designed by a registered professional engineer and will meet the standards contained in CCR Title 8 §1539-1547.

1135. Shields shall extend to the bottom of the trench and no less than 18-inches above the vertical top of the trench or excavation face.

1136. Excavation to a level not greater than 2-feet below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

1137. No employee shall be allowed within the shield, or trench box during the installation, removal or relocation. If at anytime trench boxes are stacked, means shall be provided to prevent separation.

### **Maintenance of Protective Systems**

1138. Materials and equipment used for protective systems will be free from damage or defects that might impair their proper function.

1139. Manufactured materials and equipment used for protective systems will be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards. For aluminum hydraulic shoring this typically includes annual maintenance by the manufacturer or authorized servicer.

1140. When material or equipment that is used for protective systems is damaged, a competent person will examine the material or equipment and evaluate its suitability for continued use.

- (a) If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, the material or equipment will be removed from service, and will be evaluated and approved by a registered professional engineer before being returned to service.
- (b) Any support system or support system part that requires maintenance shall be removed from service by clearly marking the equipment. Damaged protective systems shall be stored separately from in-service protective systems.



## **Installation and Removal of Protective Systems**

1141. Members of protective systems will be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

1142. Protective systems will be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

1143. Before temporary removal of individual members begins, additional precautions will be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

- a) Removal will begin at, and progress from, the bottom of the excavation. Members will be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.
- b) Backfilling will progress together with the removal of support systems from excavations.

1144. Excavation of material to a level no greater than 2 feet below the bottom of the members of a support system will be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

## **Safety Procedures for Pulling Service Renewals**

1145. When field crews are renewing water service laterals by use of the cable pull method, safe work practices shall be followed to minimize the chance of electrical shock.

- a) Underground electric cables can be encountered when such utilities are located near the service lateral, especially where the service bends upward to the meter location.
- b) When pulling the new copper pipe with the cable, either the cable or the new pipe can come in contact with the buried electric line creating an electrical shock hazard.
- c) The crew foreman must assess the need to conduct a proper cable pull operation or to excavate in order to safely access the renewal location.



1146. Do not touch the copper pipe until the pull is complete. A PVC pipe stand should be used where practical to uncoil copper pipe as it is pulled.

1147. Employees performing the copper pulls must wear ASTM approved (or equivalently recognized standard) 20KV high voltage insulating gloves with leather over-gloves when handling the cable or pipe. ASTM approved leather over-gloves must not exceed the protective length of the high voltage insulating gloves.

1148. Employees must not be in the trench or excavation while the pipe is being pulled. Leaning against or touching the backhoe or equipment during the pulling process is prohibited.

1149. Employees must remain clear of the cable ends during the pulling process.

1150. Observations must be made to identify a condition, such as unusual percussive noises, discontinuous pull of the pipe, or jerking, that may cause other in-place utilities to be inadvertently damaged.

1151. If observed possible or actual damage occurs, the pulling operation must cease until it is determined by a competent person or agency that no safety hazard exists. This may require notification of PG&E, or other utilities to assess and de-energize potentially hazardous utilities in-place before work continues.

1152. Leather over-gloves must be in good condition and capable of protecting the high voltage gloves worn. Leather over-gloves should be clean and dry for use.

1153. High voltage gloves must be field air-tested prior to each use to ensure there are no leaks.

- a) Visually examine over their entire inner and outer surface for any defects, i.e., burns, cuts, cracks, punctures and weak spots; and
- b) Have the cuff stretched to detect abrasions and weak spots.
- c) Allow air to fill the glove, pinch-off the cuff and roll twice or thrice to capture air, then squeeze the glove while it has air in it. Air will seep from small cracks or holes if damaged.



1154. High voltage gloves must be kept clean and stored in a protective container or bag to prevent chemical and physical damage. High voltage gloves must be stored separately from leather over-gloves.

1155. High voltage gloves must be either discarded or sent to a qualified testing laboratory each six months.

1156. A record of purchase and testing of high voltage gloves shall be maintained by each yard or crew assigned gloves.

1157. No high voltage gloves shall be worn unless they are in safe condition and have met the required 6-month testing protocol. In lieu of testing, high voltage gloves can be discarded after every 6 months and replaced by new ones.

### **Training Requirements**

1158. Employees who are involved in the excavation operations and exposed to excavation operation hazards shall be trained in the excavator notification and excavation practices required by this RSP and RSP 4400 - *Locating and Marking of Subsurface Installations*.

1159. Employees who may be designated as the competent person for an excavation site shall be trained to identify existing and predicable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees. In addition they shall understand:

- a) The recognition of applicable hazards associated with trenching and excavation operations.
- b) The purpose and use of this RSP.
- c) Soil classification
- d) Acceptable visual and manual soil tests

1160. Competent person training will be accomplished through District sponsored or approved Competent Person training course.



## Attachment A SOILS CLASSIFICATION

This Appendix describes a method of classifying soil and rock deposits based on site conditions, and on the structure and composition of the earth deposits.

1. This appendix applies when:

- ◆ *A sloping or benching system* is designed in accordance with the requirements set forth in CCR Title 8 §1541.1 (b)(2) as a method of protection for employees from cave-ins.
- ◆ *Timber shoring* for excavations is designed as a method of protection from cave-ins in accordance with (CCR Title 8 §1541), and when *aluminum hydraulic shoring* is designed in accordance with §1541.
- ◆ *Other protective systems* are designed and selected for use from data prepared in accordance with the requirements set forth in CCR Title 8 §1541.1(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

### Soil Types

**Stable Rock** - natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed.

**Type A** - Cohesive soils are soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

- ◆ The soil is fissured; or
- ◆ The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
- ◆ The soil has been previously disturbed; or





- ◆ The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater;
- ◆ The material is subject to other factors that would require it to be classified as a less stable material.

**Type B** - Cohesive soil has an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; or

- ◆ Granular cohesion-less soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam; or
- ◆ Previously disturbed soils except those that would otherwise be classed as Type C soil; or
- ◆ Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
- ◆ Dry rock that is not stable; or
- ◆ Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H: 1 V), but only if the material would otherwise be classified as Type B.

**Type C** - Cohesive soil has an unconfined compressive strength of 0.5 tsf or less; or

- ◆ Granular soils including gravel, sand, and loamy sand; or
- ◆ Submerged soil or soil from which water is freely seeping; or
- ◆ Submerged rock that is not stable, or
- ◆ Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H: 1V) or steeper.

## Other Considerations

2. Soil and rock deposits will be specifically classified by a competent person as either Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in this appendix and the determination will be communicated to all affected workers.



3. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis.

- ◆ Such analyses shall be conducted by a competent person using tests described in Attachment B, or in other approved methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

4. The visual and manual analyses noted as being acceptable in this appendix shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

- ◆ In a layered system, the system shall be classified in accordance with its *weakest* layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.
- ◆ If, after classifying a deposit, the conditions affecting its classification change in any way, a competent person shall evaluate the changes. The deposit shall be reclassified as necessary to reflect the changed circumstances.



## Attachment B ACCEPTABLE VISUAL AND MANUAL TESTS

**Visual Analysis:** *Visual analysis* is conducted to determine *qualitative* information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

- ◆ Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.
- ◆ Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breads up easily and does not stay in clumps is granular.
- ◆ Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.
- ◆ Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.
- ◆ Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.
- ◆ Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

**Manual Analysis:** Manual analysis of soil samples is conducted to determine *quantitative* as well as qualitative properties of soil and to provide more information in order to classify soil properly.



- ◆ Plasticity. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling.
- ◆ Dry strength. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps that break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.
- ◆ Thumb penetration. Thumb penetration can be used to estimate the unconfined compressive strength of cohesive soils.
  - Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort.
  - Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences.
- ◆ Other strength tests. Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.
- ◆ Drying test. The purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material.
  - The procedure for the drying test involves drying a sample of soil that is approximately one inch thick and six inches in diameter until it is thoroughly dry. If the sample develops cracks as it dries, significant fissures are indicated. Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an



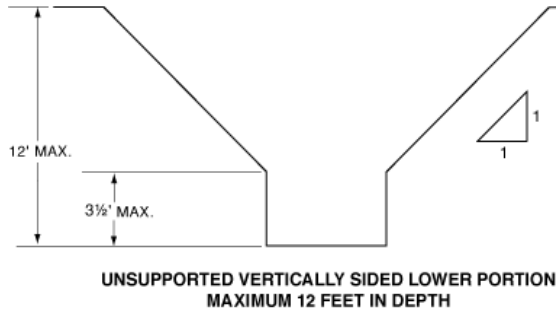
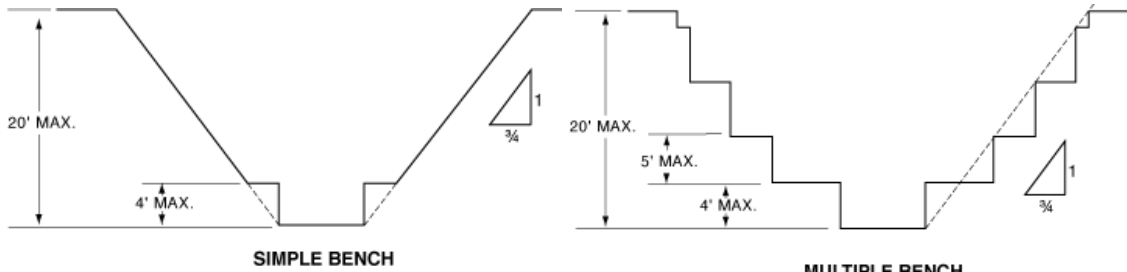
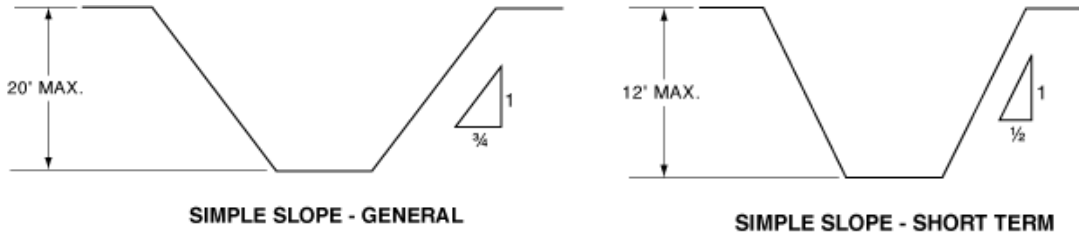
RSP1100  
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SUPERSEDES: 7/10  
LAST REVIEW: 3/13

unfissured cohesive material and the unconfined compressive strength should be determined.

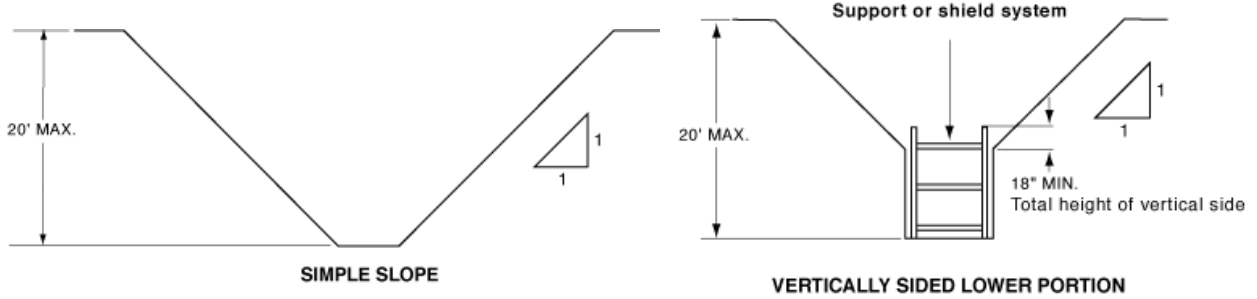
- If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

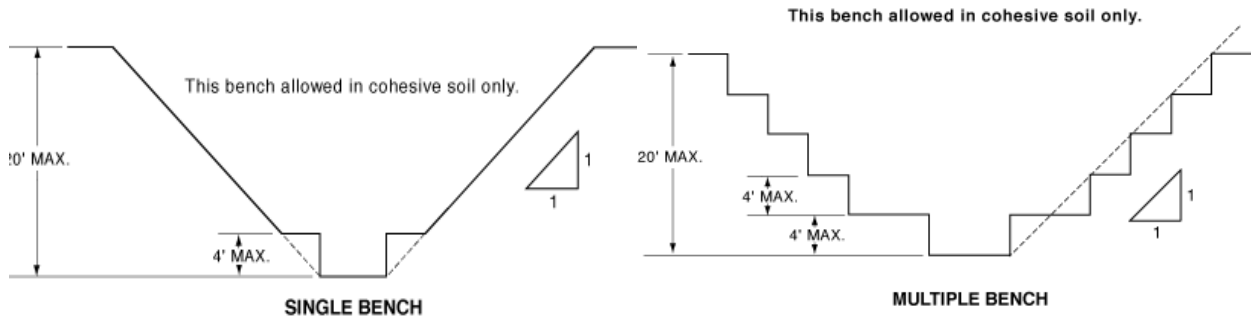
**Attachment C**  
**SLOPING AND BENCHING PARAMETERS**

**TYPE A SOIL**

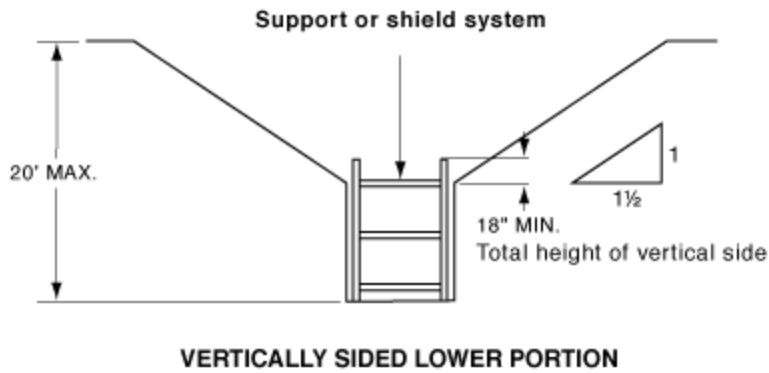
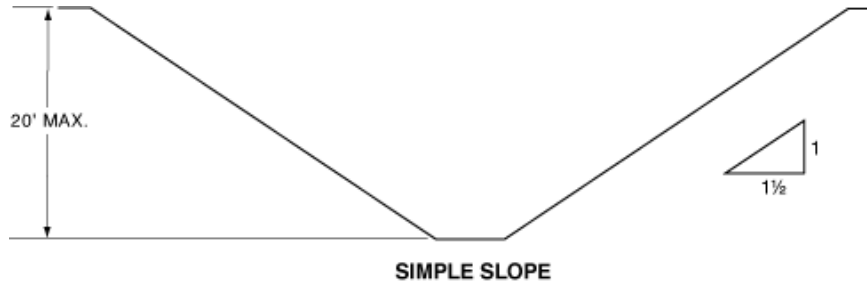


**TYPE B SOIL**

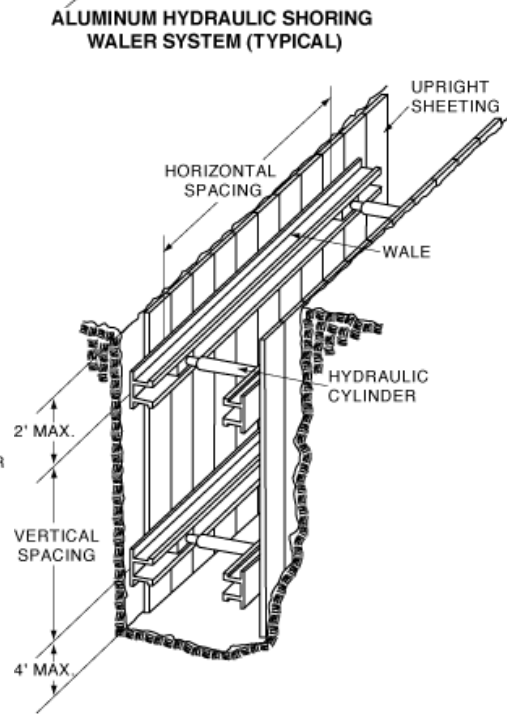
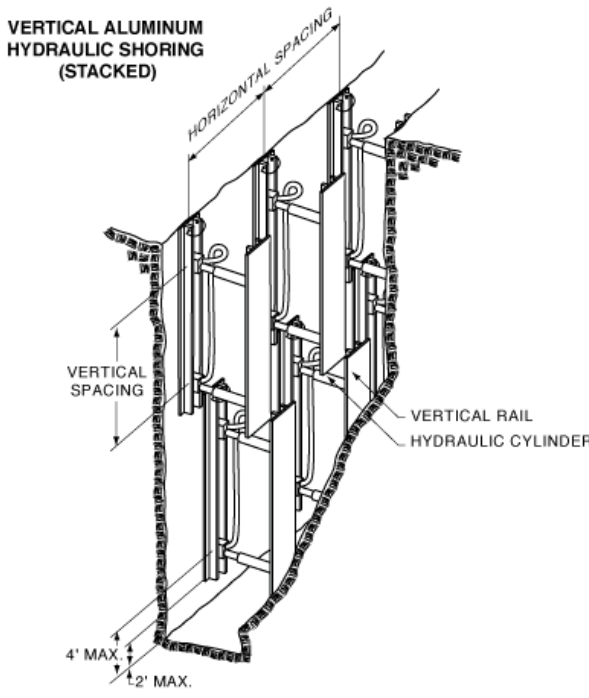
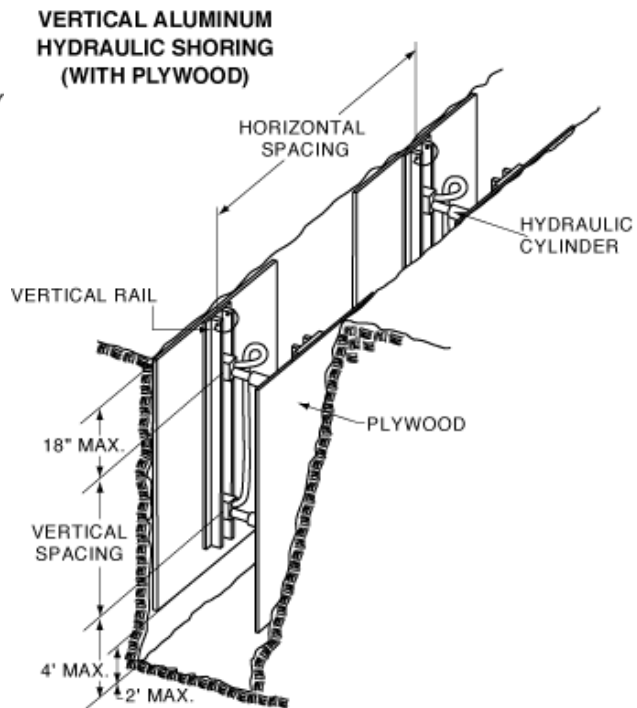
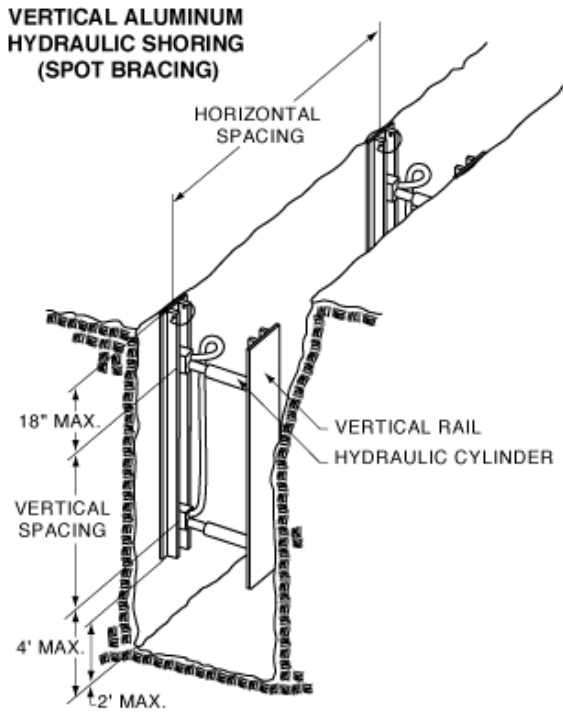




### TYPE C SOIL



**Attachment D**  
**HYDRAULIC SHORING TYPICAL APPLICATIONS**





APPENDIX E:  
AIR QUALITY AND GREENHOUSE GAS EMISSIONS  
TECHNICAL REPORT

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ALAMEDA-NORTH BAY FARM ISLAND PIPELINE CROSSINGS PROJECT

# *AIR QUALITY AND GHG EMISSIONS ASSESSMENT*

*OAKLAND AND ALAMEDA, CALIFORNIA*

May 13, 2016

**Prepared for:**

East Bay Municipal Utility District  
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Project: 15-149

## 1.0 INTRODUCTION

This technical report evaluates the potential air quality and greenhouse gas (GHG) emission impacts associated with the construction and operation of the Alameda–North Bay Farm Island Pipeline Crossings Project (proposed project). This analysis of air quality impacts was conducted following guidance provided by the Bay Area Air Quality Management District (BAAQMD).

The proposed project involves the construction and operation of three transmission pipelines (24-inch inner diameter) in Alameda County within the cities of Oakland and Alameda. The proposed pipelines would be installed within Oakland and Alameda city streets, a business park parking lot, Estuary Park, and Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel surrounding Alameda Island. The project location is shown in Figure 1. The locations of Crossings #1, #2, and #3 are shown in Figures 2 to 4.

Construction of the three crossings would involve the following construction methods: open trench, jack and bore, and horizontal directional drilling (HDD). Construction of the three crossings would also involve the following activities: geotechnical investigation, connection of the new pipelines to existing water transmission pipelines, in-street pipeline abandonment, abandonment of seven existing underwater crossings, and distribution pipeline replacements. A description of the three crossings and the construction methods and activities that would take place is described below.

### 1.1 Crossings

Each pipeline crossing is described below.

- Crossing #1. Crossing #1, known as the Estuary Park–Marina Village Crossing, is approximately 2.3 miles long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Oakland Inner Harbor, and continue through Alameda to its connection point. One alternate route option for the replacement of an existing pipeline in Oakland is being considered (see Figure 2). Construction activities would occur within city streets, one business park parking lot (the Telecare Corporation), and Estuary Park.
- Crossing #2. Crossing #2, known as the Alameda–North Bay Farm Island Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines on Alameda Island, cross under the San Leandro Bay Channel, and continue on North Bay Farm Island to its connection point (see Figure 3). Construction activities would occur within city streets and Towata Park.
- Crossing #3. Crossing #3, known as the Derby Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Tidal Canal, and continue in Alameda to its connection point. Project activities associated with Crossing #3 would include replacing an existing pipeline (see Figure 4). One alternate route option for open trench construction in Alameda is being considered. Construction activities would occur within city streets.

## 1.2 Alternative Alignment Options

This technical report analyzes two alternate transmission pipeline trenching options and one alternate location for a distribution pipeline replacement. The locations of these alternate alignment options are shown in Figures 2 and 4 and described below.

- ***Crossing #1 alternate trench option.*** Instead of using 2nd Street, the open trench construction and pipeline installation would occur along 3rd Street for one block, then along Oak Street for one block, and then would continue along the proposed alignment.
- ***Crossing #1 alternate pipeline replacement option.*** Instead of replacing the existing pipeline on 2nd Street between Madison Street and Oak Street, the pipeline on 3rd Street between Madison Street and Oak Street would be replaced.
- ***Crossing #3 alternate trench option.*** Instead of using Clement Avenue and a portion of Everett Street, open trench construction would occur on Broadway and then along Eagle Avenue until Everett Street, where pipeline installation would continue along the proposed alignment.

## 1.3 Project Construction

Table 1 includes a summary of the construction activities for the proposed project, including the equipment that would be used, the location where the activity would occur, and the dimensions of the construction activity.

Construction hours would typically be between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) might be required when the proposed pipelines are connected to existing pipelines as well as to minimize service disruptions for water customers. Forty-eight-hour construction for one weekend would also be necessary for each HDD underwater pipeline crossing. Additional nighttime construction work could occur at traffic intersections if required by encroachment permit conditions to minimize traffic impacts. If required, it is expected that nighttime intersection work would only occur at arterial streets such as High Street, Tilden Way, 5th Street, 6th Street, 7th Street, and 8th Street.

## 1.4 Operation and Maintenance

The proposed project would require routine operation and maintenance after construction, which is conducted under existing operations and maintenance procedures and protocols.

# AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Figure 1: Project Location



# AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Figure 2: Crossing #1 Alignment



Figure 3: Crossing #2 Alignment



Figure 4: Crossing #3 Alignment





## AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Table 1: Summary of Construction Activities

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Transmission Pipeline Open Trench Construction	<p>Open trench construction consists of the following activities:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Saw-cutting the pavement</li> <li>• Excavating a trench</li> <li>• Removing and stockpiling soils</li> <li>• Installing the pipeline</li> <li>• Backfilling the trench and applying temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Pavement saws &amp; jack hammers</li> <li>• Excavators, backhoes, front-end loaders</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Dewatering pumps</li> <li>• Soil-cement mixing machines</li> <li>• Paving equipment (asphalt and/or concrete trucks, vibratory compactors, pavers, and rollers)</li> <li>• Water trucks</li> </ul>	Throughout project roads for Crossing #1, #2, and #3 (see Figures 2, 3, and 4)	<p>Construction corridor: 25 feet</p> <p>Maximum depth of trench: 8 feet</p> <p>Width of trench: 4 feet</p>
Transmission Pipeline Jack and Bore	The jack and bore method would be used twice during project implementation: at Crossing #1 to install pipeline beneath a segment of railroad track on Oak Street, and at Crossing #2 to install pipeline beneath Otis Drive so that Otis Drive could remain open during construction. The jack and bore	<ul style="list-style-type: none"> <li>• Horizontal boring machine or auger &amp; hydraulic jack</li> <li>• Excavators</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Backhoes &amp; front-end loaders</li> <li>• Dewatering pumps</li> </ul>	<b>Crossing #1:</b> The pits are located on (1) Oak Street, north of Embarcadero West, just north of the railroad crossing and on (2) Oak Street, south of Embarcadero West, just south of the railroad crossing (see Figure 2)	<p>Pit Area: 500 square feet</p> <p>Depth: 10–15 feet</p> <p>Length: 150 feet at Crossing #1 and 300 feet at Crossing #2</p>

## AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<p>method would consist of the following activities:</p> <ul style="list-style-type: none"> <li>• Excavating a temporary jacking and receiving pit</li> <li>• Constructing a temporary jacking platform in the jacking pit</li> <li>• Drilling or jacking a casing through the earth under the road or railroad to be avoided</li> <li>• Installing the new pipeline in the casing</li> <li>• Connecting the new pipeline-to-pipeline segments on either end of the jacking pit</li> <li>• Backfilling the jacking and receiving pit and temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>		<p><b>Crossing #2:</b> The pits are located on (1) Peach Street, which divides Towata Park in half, south of Otis Drive and on (2) Peach Street north of Otis Drive, on a part of Peach Street that has been closed to vehicle access (see Figure 3)</p>	
Geotechnical Investigation	A geologic review and geotechnical investigation would be conducted for the HDD Crossings and jack	<ul style="list-style-type: none"> <li>• Geotechnical drilling rig (truck-mounted and barge-mounted)</li> </ul>	HDD entry and insertion pits for all crossings; The	Depth: 125 feet

AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<p>and bore locations. Exploratory borings would be made at the HDD entry and insertion pit locations and along the underwater alignment as well as at each jack and bore pit. The subsurface soils investigation would originate on the land or water surface and would consist of the following steps:</p> <ul style="list-style-type: none"> <li>• Locate/pothole for utilities</li> <li>• Mobilize land based and barge- or ship-mounted geotechnical drilling equipment</li> <li>• Drill exploratory soils borings at the following locations                             <ul style="list-style-type: none"> <li>- HDD entry and insertion pits for all crossings</li> <li>- The underwater alignments for Crossing #1 and #2 at intervals of approximately 300 feet and depths of 125 feet</li> <li>- Jack and bore pits</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Turbidity curtains for drilling</li> <li>• Barge</li> </ul>	<p>underwater alignments for Crossings #1 and #2; and jack and bore pits</p>	

AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Collect soils samples for classification and laboratory analysis (geophysical investigation methods may also be used)</li> <li>• Abandon exploratory borings (backfill land-based borings only)</li> </ul>			
Transmission Pipeline Horizontal Directional Drilling	<p>HDD will be used to install the three underwater pipelines under the Oakland Inner Harbor, Tidal Canal, and the San Leandro Bay Channel. HDD is a process that originates on the surface and typically consists of the following steps:</p> <ul style="list-style-type: none"> <li>• Ramming a steel conductor casing approximately 200 feet long into the ground on both sides of the drilling operation to support the pipeline until the pipeline reaches deeper and more stable soil and to prevent hydraulic fracturing (“frac out”) at the surface.</li> </ul>	<ul style="list-style-type: none"> <li>• HDD rig with control cab for the HDD operator (potentially one for each side)<sup>2</sup></li> <li>• Slurry separation plants (potentially one for each side)<sup>2</sup></li> <li>• Small pick-cranes (one for each side)</li> <li>• Pipeline rollers</li> <li>• Slurry and grout pumps (one for each side)</li> <li>• Welders (at insertion pit)</li> <li>• Soil-cement mixing machines (one for each side)</li> <li>• Jet grouting rig (one for each side)</li> <li>• Excavators (one for each side)</li> </ul>	<p><b>Crossing #1, entry pit:</b> Adjacent to the parking spaces next to Estuary Park (Oakland) – located approximately 500 feet south of the intersection of Embarcadero West and the road that provides access to the parking lot for Estuary Park</p> <p><b>Crossing #1, insertion pit:</b> Telecare Corporation parking lot (Alameda) – located in the middle of Telecare Corporation parking lot,</p>	<p>Entry and exit angles: 15 degrees</p> <p>Depth: 50–100 feet</p> <p>Dimensions of entry and insertion pits: 10 by 20 feet</p> <p>Depth of entry and insertion pits: 5 feet</p> <p>Total staging area around entry and insertion pits: 2,000–2,500 square feet</p> <p>HDD length at Crossing #1: 1,800 feet</p>

AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Drilling a pilot hole from the entry pit across the water to the insertion pit; drilling could potentially occur at both the entry and insertion pit.</li> <li>• Enlarging the pilot hole through a reaming process</li> <li>• Laying down, fusing together, and pressure testing the pipeline</li> <li>• Pulling the pipeline into the insertion pit, through the enlarged pilot hole, and to the receiving pit</li> <li>• Injecting grout between the pipeline and casing</li> <li>• Injecting jet grouted columns to provide additional support to the casing, between the entry pit and the shoreline</li> <li>• Backfilling the HDD pit and temporary paving</li> <li>• Disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Tractors/ loaders/ backhoes (one for each side)</li> </ul>	<p>approximately 250 feet north of the intersection of Marina Village Parkway and Tynan Avenue</p> <p><b>Crossing #2, entry pit:</b> Towata Park (Alameda) – located within Towata Park, east of the portion of Peach Street, which divides Towata Park</p> <p><b>Crossing #2, insertion pit:</b> Veterans Court (North Bay Farm Island) – located approximately 275 feet north of the intersection of Veterans Court and Island Drive</p> <p><b>Crossing #3, entry pit:</b> Derby Avenue (Oakland) – located on Derby Avenue, between Ford Street and Glascock Street, approximately 50 feet</p>	<p>HDD length at Crossing #2: 1,400 feet</p> <p>HDD length at Crossing #3: 1,400 feet</p>

AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
			north of the intersection of Derby Avenue and Glascock Street  <b>Crossing #3, insertion pit:</b> Broadway (Alameda) – located on Broadway, between Blanding Avenue and Clement Avenue, approximately 160 feet south of the intersection of Broadway and Blanding Avenue	
Connections	The proposed project would connect the new water pipelines to existing EBMUD water transmission pipelines. The work to connect the new pipelines to existing pipelines would require the excavation of a trench or pit at each connection location. Temporary shoring would be required to ensure the stability of the excavation, which may include the use of vibratory sheet piles. The	<ul style="list-style-type: none"> <li>• Excavators</li> <li>• Generator Sets for night lighting</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering pumps</li> <li>• Hot tap machine</li> </ul>	Connections would be located where open trench construction would occur (See Figure 2, 3, and 4)	The connections would be in the open trench construction corridor and would have similar dimensions as open trench construction.

AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<p>proposed tie-ins would be located within street rights-of-way and sited to minimize disruptions to traffic and homeowner access. Construction of the connections would generally be completed within a 12-hour period. For connections that require a new tee, construction could require a full 24-hour period, and night work might be necessary.</p>			
In-Street Pipeline Abandonment	<p>Pipeline abandonment would require three construction pits in 5th Street to move service connections and fire hydrants and to install two endcaps, one at 5th Street and another at Oak Street. The abandoned pipeline would be filled with cellular concrete between the two endcaps, and an existing valve near the intersection of Madison Street and 5th Street would be abandoned in place after opening the valve.</p>	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> </ul>	<p><b>Oakland side of Crossing #1:</b> On 5th Street, between Oak Street and Jackson Street</p>	<p>Length: 800 feet. Width of Pit: 10 feet Length of Pit: 10 feet Depth: 4–10 feet</p>

## AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
		<ul style="list-style-type: none"> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> </ul>		
Underwater Pipeline Crossings Abandonment	The seven existing underwater pipeline crossings would be abandoned. Abandonment includes filling onshore sections of pipelines with cellular concrete and abandoning submarine sections of pipelines in place. Bumped heads or blind flanges will be constructed at the demarcation between the onshore and submarine sections and at the end of the onshore sections to be abandoned. To install the bumped heads or blind flanges, a pit would be excavated down to the pipeline. The bumped head at the two abandonment locations at Crossing #2 would be installed in existing vaults and would not require pit excavation (see Figure 3). Additional pits may be necessary to remove valves, hydrants, move service laterals, and at low points along the onshore	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> <li>• Vibratory pile driving may be used to install sheet pile walls for the abandonment pits</li> </ul>	See Figures 2, 3, and 4	<p>Width of Pit: 10 feet</p> <p>Length of Pit: 10 feet</p> <p>Depth: 4–10 feet</p>



AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<p>pipeline alignment to facilitate concrete pumping; the location of these additional pits would be determined during detailed design.</p>			
Distribution Pipeline Replacement	<p>The proposed project would replace existing small-diameter distribution pipelines at two locations along Crossing #1 and Crossing #3. Open trench construction methods (see above) would be used to install the new pipeline and the existing pipeline would be abandoned in place. Pipeline replacement would occur during open trenching activities, before the new transmission pipeline is installed. The following pipelines would be replaced:</p> <ul style="list-style-type: none"> <li>• <b>Crossing #1:</b> On 2nd Street (see Figure 2), approximately 400 feet of existing 10-inch cast-iron pipeline constructed in 1908 would be replaced with a 12-inch steel pipeline.</li> </ul>	<p>Distribution pipeline replacement would require the same equipment used for open trench construction.</p>	<p><b>Crossing #1, Oakland:</b> On 2nd Street (see Figure 2).</p> <p><b>Crossing #3, Alameda:</b> On Everett Street (see Figure 4).</p>	<p>The distribution pipeline replacement would be in the open trench construction corridor and would have similar dimensions as open trench construction. Length of pipeline replacement at Crossing #1: 400 feet Length of pipeline replacement at Crossing #3: 750 feet</p>

## AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• <b>Crossing #3:</b> On Everett Street (see Figure 4), approximately 750 feet of existing 4-inch cast-iron pipeline constructed in 1895 would be replaced with a 6-inch steel pipeline.</li> </ul>			

Notes:

<sup>1</sup> The air quality analysis in this technical report was conducted under the assumption that the drill rig and the slurry separation plant would be located on the entry pit side. The proposed project would potentially require drilling at both ends of the underwater crossings. A separate technical memorandum was prepared, which qualitatively evaluates the air quality impacts from having drill rigs and slurry separation plants at both ends of the underwater crossings (see Air Quality Memorandum).

### 1.5 Approach to Data Collection

Construction emissions from the proposed project were modeled using information contained in the Project Description for the EIR and data provided by EBMUD. Construction schedule, proposed equipment for use, hauling volumes, and anticipated workers were entered into the California Emissions Estimator Model Version 2013.2.2 (CalEEMod), as recommended by BAAQMD. To determine community risk impacts from construction of the proposed project, a screening level health risk assessment was conducted using the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) air quality dispersion model.

## 2.0 ENVIRONMENTAL SETTING

### 2.1 Climate and Meteorology

Along Alameda County's western coast, temperatures are moderated by the San Francisco Bay (bay), which can act as a heat source during cold weather, or cool the air by evaporation during warm weather. It is generally sunnier farther from the coast, although partly cloudy skies are common throughout the summer. Average summer temperatures are mild overnight and moderate during the day. Winter temperatures are cool overnight and mild during the day. Highest temperatures are more common inland. Wind speeds vary throughout the county, with the strongest gusts along the western coast, often aided by dominant westerly winds and a bay-breeze effect. Rainfall totals average about 14 to 23 inches per year, with the highest totals in the northern end of the county and atop the Oakland-Berkeley hills.

### 2.2 Existing Air Quality Conditions

The project area is located in the western portion of Alameda County, which is in the San Francisco Bay Area Air Basin. Ambient air quality standards have been established at both the state and federal level. The San Francisco Bay Area Air Basin meets all ambient air quality standards with the exception of ground-level ozone (ozone), respirable particulate matter (PM<sub>10</sub>) and fine particulate matter (PM<sub>2.5</sub>).

Ozone and fine particle pollution (PM<sub>2.5</sub>) are the major regional air pollutants of concern in the San Francisco Bay Area Basin. Ozone is primarily a problem in the summer, and fine particle pollution in the winter.

In Alameda County west of the East Bay hills, ozone rarely exceeds health standards because the area is adjacent to San Francisco Bay, which tends to keep temperatures well below prime levels for ozone formation. Fine particle pollution is a more significant issue in this region due to cool winter nights with light winds, wood smoke, and occasional pollution transport from the Livermore Valley to the east.

### 2.3 Criteria Air Pollutants

High ozone levels are caused by the cumulative emissions of precursor pollutants including reactive organic gases (ROG) and nitrogen oxides (NO<sub>x</sub>) that react under certain meteorological

conditions. Controlling the emissions of these precursor pollutants is the focus of the Bay Area Air Quality Management District's (BAAQMD) attempts to reduce ozone levels. The highest ozone levels in the Bay Area occur in the eastern and southern inland valleys that are downwind of air pollutant sources. High ozone levels aggravate respiratory and cardiovascular diseases, reduce lung function, and increase coughing and chest discomfort.

Particulate matter is another constituent that exceeds State Air Quality Standards in the Bay Area. Particulate matter is assessed and measured in terms of respirable particulate matter or particles that have a diameter of 10 micrometers or less (PM<sub>10</sub>) and fine particulate matter where particles have a diameter of 2.5 micrometers or less (PM<sub>2.5</sub>). Elevated concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> are the result of both region-wide (or cumulative) emissions and localized emissions. High particulate matter levels aggravate respiratory and cardiovascular diseases, reduce lung function, increase mortality (e.g., lung cancer), and result in reduced lung function growth in children.

#### 2.4 Toxic Air Contaminants

Toxic air contaminants (TAC) are a broad class of compounds known to have the potential to cause morbidity or mortality (e.g., carcinogenic quality) and include, but are not limited to, the criteria air pollutants listed above. TACs are commonly found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter near a freeway). Because chronic exposure can result in adverse health effects, TACs are regulated at the regional, state, and federal level.

Diesel exhaust is the predominant TAC in urban air and is estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average). According to the California Air Resources Board (CARB), diesel exhaust is a complex mixture of gases, vapors and fine particles, which makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some of the chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by the CARB, and are listed as carcinogens either under the state's Proposition 65 or under the Federal Hazardous Air Pollutants programs.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of diesel particulate matter (DPM). Several of these regulatory programs affect medium and heavy duty diesel trucks that represent the bulk of DPM emissions from California highways and include the solid waste collection vehicle (SWCV) rule, in-use public and utility fleets, and the heavy-duty diesel truck and bus regulations. In 2008, CARB approved a new regulation to reduce emissions of DPM and nitrogen oxides from existing on-road heavy-duty diesel fueled vehicles,<sup>1</sup> which requires affected vehicles to meet specific performance requirements between 2014 and 2023, with all affected diesel vehicles required to have 2010 model-year engines or equivalent by 2023. These requirements are phased in over the compliance period and depend on the model year of the vehicle.

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<sup>1</sup> Available online: <http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm>. Accessed: April 30, 2014.

2.5 Sensitive Receptors

There are groups of people more affected by air pollution than others. CARB has identified the following persons who are most likely to be affected by air pollution and are classified as sensitive receptors: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. Locations that may contain a high concentration of these sensitive receptors include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks. The closest sensitive receptors to project construction activities are residences living on streets adjacent to where construction will occur. For the purposes of the air quality and greenhouse gas emissions analysis, all residential locations in the vicinity of project construction activities are assumed to include infants, children, and adults. Table 2 summarizes the sensitive receptors located within the vicinity of the proposed project. Figures 7 through 9 show the location of sensitive receptors.

Table 2: Sensitive Receptors within the Vicinity of the Proposed Project

<b>Crossing</b>	<b>Sensitive Receptor</b>	<b>Distance from Crossing</b>
Crossing #1	Sugar and Spice Center for Children	Within 400 feet of Crossing #1
	Residences	Between 10 and 500 feet
Crossing #2	Earhart Elementary School	Adjacent to HDD pipeline laydown area next to Island Drive
	Small Size Big Mind Preschool	Adjacent to HDD entry pit
	Residences	Between 10 and 500 feet
Crossing #3	Edison Elementary School	Within 500 feet from the HDD pipeline laydown area
	Residences	Between 10 and 500 feet

2.6 Greenhouse Gases

Gases that trap heat in the atmosphere, GHGs, regulate the earth’s temperature. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate. The most common GHGs are carbon dioxide (CO<sub>2</sub>) and water vapor but there are also several others, most importantly methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>), which are released into the earth’s atmosphere through a variety of natural processes and human activities.

Sources of GHGs are generally as follows:

- Fuel Combustion: CO<sub>2</sub> and N<sub>2</sub>O
- Agricultural Operations: N<sub>2</sub>O from crop fertilization; CH<sub>4</sub> from off-gassing from livestock and landfill operations
- Refrigeration and Cooling: HFCs
- Industry Processes: PFCs and sulfur hexafluoride .

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Each GHG has its own potency and effect upon the earth’s energy balance and is expressed in terms of a global warming potential (GWP). CO<sub>2</sub> is assigned a value of 1 and sulfur hexafluoride is several orders of magnitude stronger with a GWP of 23,900. In GHG emission inventories, the weight of each gas is multiplied by its GWP and is measured in units of equivalent CO<sub>2</sub> (CO<sub>2</sub>e).

An expanding body of scientific research supports the theory that global warming is currently affecting changes in weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates, and that it will increasingly do so in the future. The climate and several naturally occurring resources within California could be adversely affected by the global warming trend. Increased precipitation and sea level rise could increase coastal flooding, saltwater intrusion, and degradation of wetlands. Mass migration and/or loss of plant and animal species could also occur. Potential effects of global warming that could adversely affect human health include more extreme heat waves and heat-related stress; an increase in climate-sensitive diseases; more frequent and intense natural disasters such as flooding, hurricanes and drought; and increased levels of air pollution.

### 2.7 Air Quality Significance Thresholds

BAAQMD is the regional agency tasked with managing air quality in the region. At the state level, CARB (a part of the California Environmental Protection Agency) oversees regional air district activities and regulates air quality at the state level. The BAAQMD has published California Environmental Quality Act (CEQA) Air Quality Guidelines that are used in this assessment to evaluate air quality impacts of the project.<sup>2</sup> The significance thresholds identified by BAAQMD and used in the air quality and greenhouse gas emissions analysis are summarized in Table 3.

Table 3: Air Quality Significance Thresholds

Pollutant	Construction Thresholds	Operational Thresholds	
	Average Daily Emissions (pounds per day)	Average Daily Emissions (pounds per day)	Annual Average Emissions (tons per year)
<b>Criteria Air Pollutants</b>			
ROG	54	54	10
NO <sub>x</sub>	54	54	10
PM <sub>10</sub>	82	82	15
PM <sub>2.5</sub>	54	54	10
CO	Not Applicable	9.0 ppm (8-hour average) or 20.0 ppm (1-hour average)	
Fugitive Dust	Construction Dust Ordinance or other Best Management Practices	Not Applicable	
<b>Health Risks and Hazards for New Sources</b>			
Excess Cancer Risk	> 10.0 per one million		

<sup>2</sup> Bay Area Air Quality Management District. 2011. BAAQMD CEQA Air Quality Guidelines. May.

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Pollutant	Construction Thresholds	Operational Thresholds	
	Average Daily Emissions (pounds per day)	Average Daily Emissions (pounds per day)	Annual Average Emissions (tons per year)
Chronic or Acute Hazard Index	> 1.0		
Incremental annual average PM <sub>2.5</sub>	> 0.3 µg/m <sup>3</sup>		
<b>Health Risks and Hazards for Sensitive Receptors (Cumulative from all sources within 1,000 foot zone of influence) and Cumulative Thresholds for New Sources</b>			
Excess Cancer Risk	> 100 per one million		
Chronic Hazard Index	>10.0		
Annual Average PM <sub>2.5</sub>	> 0.8 µg/m <sup>3</sup>		
<b>Greenhouse Gas Emissions</b>			
GHG Annual Emissions	Compliance with a Qualified GHG Reduction Strategy OR 1,100 metric tons or 4.6 metric tons per capita		

Source: BAAQMD CEQA Air Quality Guidelines, May 2011

*Note: ROG = reactive organic gases, NO<sub>x</sub> = nitrogen oxides, PM<sub>10</sub> = coarse particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, PM<sub>2.5</sub> = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less; and GHG = greenhouse gas.*

### 3.0 ASSESSMENT OF IMPACTS

#### 3.1 Emissions

For each of the three crossings, CalEEMod was used as recommended by BAAQMD for analyzing construction emissions to predict emissions from construction of the proposed project.

#### ***Pre-Construction Geotechnical Investigation Emissions***

Pre-construction geotechnical investigation borings would be conducted in 2017 prior to construction of Crossing #1 and in 2020 prior to construction of Crossings #2 and #3. The boring activities would be conducted in less than a week. Borings for Crossings #1 and #2 would be conducted on land and in the channel. Borings for Crossings #3 would be conducted only on land due to the smaller width of the channel. The emissions that would be generated by the pre-construction geotechnical borings are provided in Table 4. For the purposes of this analysis, the borings required for the jack and bore proposed by Recommended Mitigation Measure Traffic-4 in the EIR have been included in the Crossing #3 emissions estimated below. The emissions generated by the geotechnical borings would be minimal and substantially below BAAQMD significance thresholds.

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Table 4: Pre-Construction Geotechnical Borings Emissions

Crossing	Pollutant	Average Daily Emissions (pounds per day)	Threshold (pounds per day)	Exceeds Threshold
Crossing #1	ROG	0.009	54	No
	NOx	0.13	54	No
	PM <sub>10</sub> Exhaust	0.004	82	No
	PM <sub>2.5</sub> Exhaust	0.004	54	No
Crossing #2	ROG	0.009	54	No
	NOx	0.13	54	No
	PM <sub>10</sub> Exhaust	0.004	82	No
	PM <sub>2.5</sub> Exhaust	0.004	54	No
Crossing #3	ROG	0.004	54	No
	NOx	0.05	54	No
	PM <sub>10</sub> Exhaust	0.002	82	No
	PM <sub>2.5</sub> Exhaust	0.001	54	No

### **Construction Emissions**

CalEEMod was used to calculate the project’s emissions for both on-site and off-site construction activities. On-site activities are primarily made up of construction equipment emissions, while off-site activity includes worker, vendor, and haul truck traffic to and from the site. A construction schedule and equipment usage worksheet was provided by EBMUD for each crossing that included the duration for various construction activities (i.e., demolition-open trench, grading/excavation-open trench, HDD/drilling, jack and bore drilling, pipeline abandonment, and paving-open trench). For each activity, construction equipment usage was provided by specifying the type, quantity, days of use on site, and average hours of use per day and was input to the CalEEMod model. A land use type of “User Defined Industrial” was chosen, which is the category in the model that includes activities and emissions most similar to a pipeline construction project.

CalEEMod also predicts emissions from worker and hauling trips. Worker trips, which include autos and light-duty trucks, were based on estimates provided by EBMUD. CalEEMod was used to model truck hauling trips based on the amount of material to be imported or exported for open trenching and HDD/drilling phases. Project quantities of materials and personnel used for the model can be found in Appendix C of the Draft EIR.



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Construction of Crossing #1 is anticipated to begin in 2018 and last between 13 to 22 months. Construction of Crossings #2 and #3 would not occur until after 2020. Construction of Crossing #2 would last between 9 and 18 months, and Crossing #3 would last between 9 to 19 months. Because the exact timeframe for construction of Crossing #2 or #3 is not known, both were conservatively modeled with construction start dates of 2021, since emissions associated with construction equipment are expected to reduce in future years. The pipelines would not be constructed at the same time, but modeling them as simultaneous construction is a more conservative approach. Crossing #2 would be constructed before Crossing #3. CalEEMod provided the total construction emissions in tons. Average daily emissions were computed by dividing the total construction emissions by the number of construction days.<sup>3</sup> For purposes of the criteria pollutant analysis and averaging, construction of Crossing #1 was assumed to begin early 2018 and last for 13 months as the shortest construction timeframe conservatively estimates the highest average daily emissions. For purposes of this analysis, construction of Crossing #2 and #3 were each conservatively assumed to last for 9 months. Table 5 shows average daily construction emissions of ROG, NO<sub>x</sub>, PM<sub>10</sub> exhaust, and PM<sub>2.5</sub> exhaust during construction of each crossing. As indicated in Table 5, predicted project emissions are below the BAAQMD significance thresholds. *Attachment 1* includes the CalEEMod input and output values for construction emissions and the construction schedule and equipment list.

Table 5: Construction Period Emissions

Crossing	Pollutant	Total Emissions (tons)	Average Daily Emissions (pounds per day)	Threshold (pounds per day)	Exceeds Threshold
Crossing #1	ROG	0.66	5	54	No
	NO <sub>x</sub>	5.30	37	54	No
	PM <sub>10</sub> Exhaust	0.26	2	82	No
	PM <sub>2.5</sub> Exhaust	0.27	2	54	No
Crossing #2	ROG	0.39	4	54	No
	NO <sub>x</sub>	3.35	34	54	No
	PM <sub>10</sub> Exhaust	0.15	2	82	No
	PM <sub>2.5</sub> Exhaust	0.16	2	54	No
Crossing #3	ROG	0.41	4	54	No
	NO <sub>x</sub>	3.46	35	54	No
	PM <sub>10</sub> Exhaust	0.16	2	82	No
	PM <sub>2.5</sub> Exhaust	0.16	2	54	No

Construction activities, particularly during site preparation and grading would temporarily generate fugitive dust in the form of PM<sub>10</sub> and PM<sub>2.5</sub>, which would be controlled. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit dust or mud on local streets, which could be an additional source of airborne dust after it dries. Fugitive dust emissions would vary from day to day, depending on the nature and magnitude

<sup>3</sup> Assumes an average of 22 construction days per month.

of construction activity and local weather conditions. Fugitive dust emissions would also depend on soil moisture, silt content of soil, wind speed, and the amount of equipment operating. Larger dust particles would settle near the source, while fine particles would be dispersed over greater distances from the construction site. The BAAQMD CEQA Air Quality Guidelines consider these impacts to be less than significant if controlled through best management practices to reduce these emissions.

***Recommended Mitigation Measure AQ-1. Best Management Practices***

The construction crew shall implement the following Best Management Practices that are required of all construction projects:

- When moisture content is low enough to create dust. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible and feasible. Building pads shall be laid as soon as possible and feasible, as well, after grading unless seeding or soil binders are used.
- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.
- All construction equipment shall be maintained and properly tuned in accordance with manufacturer’s specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- A publicly visible sign with the telephone number and email address to contact EBMUD regarding dust complaints will be posted at the site. If dust exceeds specified limits, EBMUD shall respond and take corrective action within 48 hours.

3.2 Pollutants and Risks Considered

Project construction would utilize diesel-powered equipment such as excavators, dozers, loaders, backhoes, and cranes. Operation of such equipment would generate diesel exhaust emissions. Diesel exhaust is a complex mixture of gases and fine particles and includes over 40 substances that are listed by the U.S. EPA as hazardous air pollutants and by the ARB as TACs. Some of these gaseous components such as benzene, formaldehyde, and 1,3-butadiene are suspected or known to cause cancer in humans. The particle portion of diesel exhaust is mainly comprised of aggregates of spherical carbon particles coated with inorganic and organic substances. The inorganic fraction primarily consists of small solid carbon. The organic fraction consists of soluble organic compounds (soluble organic fraction) such as aldehydes, alkanes,

and alkenes, and high-molecular weight PAH and PAH-derivatives. Many of these PAH and PAH-derivatives have been found to be potent mutagens and carcinogens.

A community risk assessment of the project construction activities was conducted. The methods used to conduct the community risk assessment followed the guidelines of BAAQMD. BAAQMD also requires that PM<sub>2.5</sub> be modeled and evaluated because of its potential to cause chronic health impacts. There are two types of PM<sub>2.5</sub> considered; particulate matter from fugitive dust and particulate matter from diesel exhaust.

In their review of the health effects from exposure to diesel exhaust and in developing the health effects criteria for diesel particulate matter (reference exposure level and cancer potency factor) OEHHA examined the overall toxicity of diesel exhaust. Most of the human exposure studies are based on exposure to the whole exhaust and are consistent with the scientific studies to assess health effects from exposure to diesel exhaust. DPM is used as a surrogate for all components of diesel exhaust when modeling the dispersion of diesel exhaust. The potential cumulative and synergistic effects of all the toxic compounds that comprise diesel exhaust are reflected in the OEHHA specified reference exposure level and cancer potency factor for DPM. A dispersion model was used to predict the off-site DPM and PM<sub>2.5</sub> concentrations resulting from project construction at sensitive receptors so that potential health effects could be predicted.

Non-cancer risks were also assessed using the BAAQMDs recommended methodology utilizing the calculation of a hazard index (HI). The closest sensitive receptors to project construction activities are residents living along or adjacent to the streets where construction would occur. Table 2 summarizes sensitive receptors within the vicinity of the proposed project. Figures 7 to 9 show the modeled construction areas for Crossings #1 through #3, respectively, and the sensitive receptor locations used in the air quality dispersion modeling analysis where potential health impacts were evaluated.

## ***Modeling***

### **Activities Modeled**

Modeling of the potential community health risks from construction activities focused on emissions from the HDD/drilling work and HDD pipeline laydown, as these activities have the greatest emissions and are concentrated in relatively small areas. Other smaller emission sources (e.g., jack and bore drilling, abandonment pits, and standard open trenching work) that are located within about 1,000 feet from the location of the HDD sites were included in the evaluation. Health risks from standard pipeline/trenching work alone was not modeled, even though receptors are located as close as approximately 10 feet away.

Construction equipment and vehicles for standard pipeline/trenching work would remain in a particular area for a short duration (around a week) while completing each segment, limiting nearby receptors exposure to diesel exhaust and PM<sub>2.5</sub>; therefore, the health risk from these activities would be minimal, supported by the fact that the trenching portions within 1,000 feet

of the HDD sites contributed only 2 to 3 percent of the total concentration of DPM and PM<sub>2.5</sub>, and were way below thresholds.

**Emissions Modeling**

Total localized construction emissions generated over the construction period were modeled using CalEEMod. The CalEEMod model provided emissions data for DPM and fugitive dust PM<sub>2.5</sub> for the off-road construction equipment and for exhaust emissions from on-road vehicles (haul trucks and worker vehicles). A trip length of one mile was conservatively used to represent vehicle travel while at or near the construction areas. Emissions from on-road vehicles traveling at or near the construction sites were modeled as occurring at the construction sites. Tables 6 and 7 summarize the DPM and PM<sub>2.5</sub> emissions, respectively, for construction activities at each crossing. These emissions were then used in the dispersion modeling of DPM and PM<sub>2.5</sub> concentrations at residences and sensitive receptors.

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Table 6: Construction Period DPM Emissions (tons)

Scenario	HDD Entry Pit Work Area	HDD Insertion Pit Work Area	HDD Pipeline Laydown Area	Pipeline Trenching	Jack and Bore Drilling Areas	Pipeline Abandon Pit Areas
Crossing #1	0.0840	0.0786	0.0141	0.0192	0.0076	-
Crossing #2	0.0579	0.0539	0.0066	0.0038	0.0051	0.0108
Crossing #3	0.0568	0.0529	0.0082	0.0108	-	0.0054

Table 7: Construction Period Fugitive PM<sub>2.5</sub> Emissions (tons)

Scenario	HDD Entry Pit Work Area	HDD Insertion Pit Work Area	HDD Pipeline Laydown Area	Pipeline Trenching	Jack and Bore Drilling Areas	Pipeline Abandon Pit Areas
Crossing #1	0.0005	0.0005	0.0003	0.0004	0.0000	-
Crossing #2	0.0004	0.0004	0.0002	0.0001	0.0000	0.0000
Crossing #3	0.0005	0.0005	0.0003	0.0003	-	0.0000

### Dispersion Modeling

The U.S. EPA AERMOD dispersion model was used to predict DPM and PM<sub>2.5</sub> concentrations at residential and sensitive receptor locations near the project construction areas. The AERMOD dispersion model is a BAAQMD-recommended model for use in modeling these types of emission activities for CEQA projects.<sup>4</sup> Emission sources for the construction site were grouped into two categories, exhaust emissions of DPM and fugitive PM<sub>2.5</sub> dust emissions. The AERMOD modeling utilized area sources to represent the crossing area HDD entry pit areas, HDD pipeline laydown areas, jack and bore pit areas, abandonment pit areas, and pipeline trenching. Half of the area sources used were for modeling DPM exhaust emissions and the other half were used for modeling fugitive PM<sub>2.5</sub> dust emissions. For the HDD pipeline laydown areas and pipeline trenching areas, the line source option in AERMOD was used, which uses a series of consecutive area sources to represent emissions that are distributed along a line, such as a roadway, or in this case the pipeline laydown and trenching areas.

For exhaust emissions from construction equipment, an emission release height of 6 meters (20 feet) was used for the area sources. The elevated source height reflects the height of the

<sup>4</sup> Bay Area Air Quality Management District (BAAQMD), 2012. Recommended Methods for Screening and Modeling Local Risks and Hazards, Version 3.0. May.

equipment exhaust pipes plus an additional distance for the height of the exhaust plume above the exhaust pipes to account for plume rise of the exhaust gases. For modeling fugitive PM<sub>2.5</sub> from dust, a near-ground level release height of 2 meters (6.6 feet) was used for the area sources. Emissions from vehicle travel around the project sites were included in the modeled area sources. Construction emissions were modeled as occurring daily between 7 a.m. and 7 p.m., when the majority of the construction activity involving equipment usage would occur. The modeling used a five-year data set (2009 to 2013) of hourly meteorological data from the Oakland Airport that was prepared for use in AERMOD by CARB. The airport is about two to five miles south-southeast from the three crossings. Annual DPM and PM<sub>2.5</sub> concentrations from construction activities during the 2018 through 2019 period were calculated for Crossing #1 and for the 2021 through 2022 period for Crossings #2 and #3 using the model. DPM and PM<sub>2.5</sub> concentrations were calculated at residential receptors near the project work areas at a receptor height of 1.5 meters (4.9 feet). Concentrations were also calculated at the preschool near Crossing #1, the Earhart Elementary School and Small Size Big Mind Preschool near Crossing #2, and the Edison Elementary School near Crossing #3.

### 3.3 Cancer Risks

The maximum modeled DPM and PM<sub>2.5</sub> concentrations occurred at the same receptor location for each of the crossing site areas. The locations where the maximum concentrations, and TAC impacts, occurred are shown in Figures 7 to 9 for Crossings #1 through #3, respectively. Increased cancer risks were calculated using the modeled DPM concentrations and BAAQMD-recommended risk assessment methods for both a child exposure (3rd trimester through 2 years of age) and adult exposure.<sup>5</sup> The cancer risk calculations were based on applying the BAAQMD-recommended age sensitivity factors to the DPM exposures. Age-sensitivity factors reflect the greater sensitivity of infants and small children to cancer-causing TACs. BAAQMD-recommended exposure parameters were used for the cancer risk calculations.<sup>6</sup> Adult and child exposures were assumed to occur at all residences during the entire construction period and child exposures were assumed to occur at the preschools and elementary schools near the construction sites.

Results of this community risk assessment, without mitigation measures outlined below, are summarized in Table 8. The maximum health impacts at Crossing #2 are below BAAQMD significance thresholds. For Crossing #1 the maximum cancer risk impact is above BAAQMD significance threshold, and for Crossing #3, the maximum impacts for cancer risk and PM<sub>2.5</sub> concentration are above the BAAQMD significance thresholds.

### 3.4 Non-Cancer Risks

Potential non-cancer health effects due to chronic exposure to diesel exhaust were evaluated. Non-cancer health hazards from TAC exposure are expressed in terms of a HI, which is the ratio of the TAC concentration to a reference exposure level (REL). California's Office of

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<sup>5</sup> Bay Area Air Quality Management District (BAAQMD), 2012. *Recommended Methods for Screening and Modeling Local Risks and Hazards*. May.

<sup>6</sup> Bay Area Air Quality Management District (BAAQMD), 2010. *Air Toxics NSR Program Health Risk Screening Analysis Guidelines*. January.

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Environmental Health and Hazards (OEHHA) has defined acceptable concentration levels for contaminants that pose non-cancer health hazards. TAC concentrations below the REL are not expected to cause adverse health impacts, even for sensitive individuals. The chronic inhalation REL for DPM is an annual average concentration of 5 µg/m<sup>3</sup>. BAAQMD significance criterion for non-cancer health is a hazard index greater than 1.0. Table 8 summarizes the HI for each crossing. The HI would not exceed BAAQMD thresholds for any crossing.

Table 8: Maximum Community Risks from Project Construction Activities

Location and Exposure Type	Cancer Risk		Non-Cancer Risk
	Cancer Risk (per million)	Annual PM <sub>2.5</sub> (µg/m <sup>3</sup> ) <sup>1</sup>	Hazard Index (HI)
<b><u>Crossing #1</u></b>			
<i>Maximum Residential</i>			
Child	16.1	0.19	<0.1
Adult	0.8	0.19	<0.1
<i>Maximum Preschool Child<sup>2</sup></i>	0.1	<0.01	<0.1
<i>BAAQMD Significance Threshold</i>	10	0.3	1.0
<i>Exceed Threshold?</i>	<b>Yes</b>	<b>No</b>	<b>No</b>
<b><u>Crossing #2</u></b>			
<i>Maximum Residential</i>			
Child	7.7	0.09	<0.1
Adult	0.4	0.09	<0.1
<i>Maximum School Child<sup>3</sup></i>	0.2	<0.01	<0.1
<i>Maximum Preschool Child<sup>4</sup></i>	0.6	0.02	<0.1
<i>BAAQMD Significance Threshold</i>	10	0.3	1.0
<i>Exceed Threshold?</i>	<b>No</b>	<b>No</b>	<b>No</b>
<b><u>Crossing #3</u></b>			
<i>Maximum Residential</i>			
Child	64.7	0.74	0.1
Adult	3.4	0.74	0.1
<i>Maximum School Child<sup>5</sup></i>	0.1	<0.01	<0.1
<i>BAAQMD Significance Threshold</i>	10	0.3	1.0
<i>Exceed Threshold?</i>	<b>Yes</b>	<b>Yes</b>	<b>No</b>

<sup>1</sup>The annual PM<sub>2.5</sub> concentration is the sum of the DPM and fugitive PM<sub>2.5</sub> concentrations.

<sup>2</sup> Sugar & Spice Preschool

<sup>3</sup> Earhart Elementary School

<sup>4</sup> Small Size Big Mind Preschool

<sup>5</sup> Edison Elementary School

*Attachment 1* includes the emission calculations used for the modeling, summary of dispersion model inputs and outputs, and the cancer risk calculations. Without mitigation, the proposed project would exceed BAAQMD thresholds with respect to community risk caused by construction activities. Implementation of Recommended Mitigation Measures AQ-1 and AQ-2 would reduce this community risk to below BAAQMD thresholds.

### ***Pre-Construction Geotechnical Investigation***

Pre-construction geotechnical investigation borings would use drill rigs, barge or drill ships, and trucks for hauling and workers. The use of this equipment would be limited to less than a week and a limited number of hours per day for each crossing. Due to the short term use of the equipment and minimal number of equipment, the generated diesel exhaust emissions generated by the use of the equipment associated with geotechnical borings would be minimal. EBMUD would also implement's Environmental Requirements that includes several measures for emissions reductions.

### ***Recommended Mitigation Measure AQ-2. Selection of equipment during demolition, grading and trenching construction phases to minimize emissions***

1. All diesel-powered off-road equipment larger than 50 horsepower and operating during construction for more than two days continuously shall, at a minimum, meet U.S. EPA particulate matter emissions standards for Tier 4 engines or equivalent; and
2. Minimize the number of hours that equipment will operate.

Note that other measures may be used to minimize construction period DPM emissions to reduce the predicted cancer risk below the thresholds. Such measures may be the use of alternative powered equipment (e.g., LPG-powered lifts), alternative fuels (e.g., biofuels), added exhaust devices, or a combination of measures, provided that these measures are approved by the lead agency and demonstrated to reduce community risk impacts to less than significant.

Fugitive dust will be controlled through the use of BAAQMD's Recommended BMPs for construction, and would reduce exhaust emissions by 5 percent and fugitive dust emissions by over 50 percent. Implementation of Recommended Mitigation Measure AQ-2 would further reduce on-site diesel exhaust emissions for Crossings #1 and #3. The computed maximum excess residential cancer risks and PM<sub>2.5</sub> concentrations for Crossings #1 and #3 construction activities with implementation of Recommended Mitigation Measures AQ-1 and AQ-2 are shown in Table 9 and would be below the BAAQMD threshold for cancer risk and PM<sub>2.5</sub>.



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Table 9: Maximum Community Risks from Project Construction Activities after Implementation of Recommended Mitigation

Location and Exposure Type	Cancer Risk (per million)	Annual PM <sub>2.5</sub> (µg/m <sup>3</sup> )
<b><u>Crossing #1</u></b>		
<i>Maximum Residential</i>		
Child	0.7	0.01
Adult	0.0	0.01
<i>BAAQMD Significance Threshold</i>	10	0.3
<i>Exceed Threshold?</i>	<b>No</b>	<b>No</b>
<b><u>Crossing #3</u></b>		
<i>Maximum Residential</i>		
Child	3.9	0.06
Adult	0.2	0.06
<i>BAAQMD Significance Threshold</i>	10	0.3
<i>Exceed Threshold?</i>	<b>No</b>	<b>No</b>

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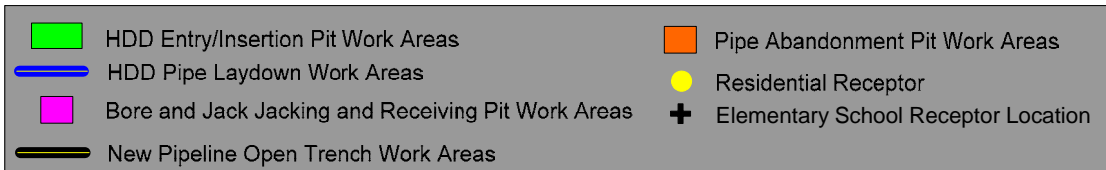
Figure 7: Crossing #1 - Project Areas, Residential Receptor Locations, and Location of Maximally Exposed Individual



Figure 8: Crossing #2 - Project Areas, Sensitive Receptor Locations, and Location of Maximally Exposed Individual



Figure 9: Crossing #3 - Project Areas, Residential Receptor Locations, and Location of Maximally Exposed Individual



### 3.5 Odors

The proposed project would generate localized emissions of diesel exhaust during construction equipment operation and truck activity, which may be noticeable from time to time by adjacent receptors; however, emissions would be localized and would not adversely affect a substantial number of people. The proposed project would not include any sources of significant odors that would cause complaints from surrounding uses.

## 4.0 GREENHOUSE GAS EMISSIONS

GHG emissions associated with implementation of the proposed project would occur over the short-term from construction activities, consisting primarily of emissions from equipment exhaust and worker and hauling trips. There would also be negligible long-term operational emissions associated with vehicular maintenance trips. Emissions for the proposed project are discussed below and were analyzed using the methodology recommended in the BAAQMD CEQA Air Quality Guidelines.<sup>7</sup>

### 4.1 GHG CalEEMod Modeling

CalEEMod was used to predict GHG emissions from construction of the project. Project-specific construction information was input to the model, as described above. The use of CalEEMod for evaluating emissions from land use projects is recommended by BAAQMD. Unless otherwise noted below, the CalEEMod model defaults for Alameda County were used. CalEEMod output worksheets are included in *Attachment 1*.

### ***Pre-Construction Geotechnical Investigation***

Pre-construction geotechnical investigation borings would be conducted in 2017 prior to construction of Crossing #1 and in 2020 prior to construction of Crossings #2 and #3. The boring activities would be conducted in less than a week. Borings for Crossings #1 and #2 would be conducted on land and in the channel. Borings for Crossings #3 would be conducted only on land due to the smaller width of the channel. The GHG emissions generated during the borings are shown in Table 10. The GHG emissions generated during borings would be minimal.

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<sup>7</sup> BAAQMD, 2011. *Op cit.*

AIR QUALITY – GREENHOUSE GAS EMISSIONS TECHNICAL REPORT

Table 10: GHG Emissions Generated by Each Crossing

Location/Year	GHG Emissions (MT of CO <sub>2</sub> e)
<b>Crossing #1</b>	
2017	4.5
<b>Crossing #2</b>	
2020	4.5
<b>Crossing #3</b>	
2020	1.9

**Construction**

The maximum annual GHG emissions associated with construction were computed to be 677 MT of CO<sub>2</sub>e<sup>8</sup> per year, generated by all construction activities occurring in one year (Table 11). A breakdown of GHG emissions per year and totals for each crossing are provided in Table 11. GHG emissions are generated from on-site operation of construction equipment, hauling truck trips, and worker trips. Neither the Cities of Alameda and Oakland, nor EBMUD, nor BAAQMD have an adopted threshold of significance for construction-related GHG emissions, though BAAQMD recommends quantifying emissions and disclosing that GHG emissions would occur during construction. BAAQMD also encourages the incorporation of best management practices to reduce GHG emissions during construction, where feasible and applicable. For reference, the operational-related threshold is 1,100 MT of CO<sub>2</sub>e per year. A conservative, maximum annual construction emission of 677 MT of CO<sub>2</sub>e from the proposed project would be below the operation-related threshold.

Table 11: GHG Emissions Generated by the Proposed Project (MT of CO<sub>2</sub>e)

Year	Crossing #1	Crossing #2	Crossing #3	Total GHG Emissions
2018	285	–	–	285
2019	471	–	–	471
2021	–	279	250	529
2022	–	312	365	<b>677</b>
Note:				
<b>Bold</b> indicates greatest emissions in any one year.				

<sup>8</sup> The maximum GHG emissions would occur in 2022, should Crossing #2 and #3 be constructed at the same time.

## **ATTACHMENT 1**

**Attachment 1: CalEEMod Input and Output Worksheets, Construction Schedule, and Risk Calculations**

# ATTACHMENT 1

## Alameda Pipeline - TAC Emissions Summary

### Unmitigated Emissions

Crossing/Construction Year	Total Pipeline Trenching Length (ft)	Exhaust DPM Emissions									
		HDD Entry Pit Area Emissions (tons)	HDD Insertion Pit Area Emissions (tons)	Existing Line Abandonment Pit Area Emissions (tons per pit)	Bore and Jack Emissions (tons)	Trench/HDD Laydown Emissions (tons)	Trenching Emissions (ton/ft)	Modeled HDD Laydown Length (ft)	Modeled HDD Laydown Emissions (tons)	Modeled Pipeline Trenching Length (ft)	Modeled Pipeline Trenching Emissions (tons)
<u>Crossing 1</u>											
2018-2019	10,890	0.0840	0.0786	-	0.0076	0.0732	6.72E-06	2,099	0.0141	2,863	0.0192
<u>Crossing 2</u>											
2021-2022	4,220	0.0579	0.0539	0.0027	0.0051	0.0192	4.55E-06	1,445	0.0066	835	0.0038
<u>Crossing 3</u>											
2021-2022	4,495	0.0568	0.0529	0.0029	-	0.0197	4.38E-06	1,865	0.0082	2,469	0.0108
Crossing/Construction Year	Total Pipeline Trenching Length (ft)	Fugitive PM2.5 Emissions									
		HDD Entry Pit Area Emissions (tons)	HDD Insertion Pit Area Emissions (tons)	Existing Line Abandonment Pit Area Emissions (tons per pit)	Bore and Jack Emissions (tons)	Trench/HDD Laydown Emissions (tons)	Trenching Emissions (ton/ft)	Modeled HDD Laydown Length (ft)	Modeled HDD Laydown Emissions (tons)	Modeled Pipeline Trenching Length (ft)	Modeled Pipeline Trenching Emissions (tons)
<u>Crossing 1</u>											
2018-2019	10,890	0.0005	0.0005	-	0.0000	0.0017	1.56E-07	2,099	0.000328	2,863	0.000447
<u>Crossing 2</u>											
2021-2022	4,220	0.0004	0.0004	0.0000	0.0000	0.0006	1.42E-07	1,445	0.000205	835	0.000119
<u>Crossing 3</u>											
2021-2022	4,495	0.0005	0.0005	0.0000	-	0.0007	1.56E-07	1,865	0.000290	2,469	0.000384

### Mitigated Emissions

Crossing/Construction Year	Total Pipeline Trenching Length (ft)	Exhaust DPM Emissions									
		HDD Entry Pit Area Emissions (tons)	HDD Insertion Pit Area Emissions (tons)	Existing Line Abandonment Pit Area Emissions (tons per pit)	Bore and Jack Emissions (tons)	Trench/HDD Laydown Emissions (tons)	Trenching Emissions (ton/ft)	Modeled HDD Laydown Length (ft)	Modeled HDD Laydown Emissions (tons)	Modeled Pipeline Trenching Length (ft)	Modeled Pipeline Trenching Emissions (tons)
<u>Crossing 1</u>											
2018-2019	10,890	0.0039	0.0050	-	0.0004	0.0029	2.66E-07	2,099	0.0006	2,863	0.0008
<u>Crossing 2</u>											
2021-2022	4,220	0.0000	0.0000	0.0000	0.0000	0.0000	0.00E+00	1,445	0.0000	835	0.0000
<u>Crossing 3</u>											
2021-2022	4,495	0.0039	0.0032	0.0002	-	0.0013	2.89E-07	1,865	0.0005	2,469	0.0007
Crossing/Construction Year	Total Pipeline Trenching Length (ft)	Fugitive PM2.5 Emissions									
		HDD Entry Pit Area Emissions (tons)	HDD Insertion Pit Area Emissions (tons)	Existing Line Abandonment Pit Area Emissions (tons per pit)	Bore and Jack Emissions (tons)	Trench/HDD Laydown Emissions (tons)	Trenching Emissions (ton/ft)	Modeled HDD Laydown Length (ft)	Modeled HDD Laydown Emissions (tons)	Modeled Pipeline Trenching Length (ft)	Modeled Pipeline Trenching Emissions (tons)
<u>Crossing 1</u>											
2018-2019	10,890	0.0005	0.0005	-	0.0000	0.0013	1.19E-07	2,099	0.000251	2,863	0.000342
<u>Crossing 3</u>											
2021-2022	4,495	0.0005	0.0005	0.0000	-	0.0006	1.33E-07	1,865	0.000249	2,469	0.000330



# ATTACHMENT 1

## Alameda Pipeline - Crossing 1

### DPM Construction Emissions and Modeling Emission Rates

Construction Year	Activity	DPM (tons)	Area Source	DPM Emissions			Modeled Area (m <sup>2</sup> )	DPM Emission Rate (g/s/m <sup>2</sup> )
				(lb/yr)	(lb/hr)	(g/s)		
<b>2018-2019</b>	HDD Laydown	0.0141	PIPE_DPM	28.2	0.00644	8.12E-04	6,396	1.27E-07
	HDD Insert Pit	0.0786	PIT_I_DPM	157.2	0.03589	4.52E-03	222	2.04E-05
	Trench-South	0.0100	T_S_DPM	19.9	0.00455	5.73E-04	4,520	1.27E-07
	HDD Entry Pit	0.0840	PIT_E_DPM	168.0	0.03836	4.83E-03	222	2.18E-05
	Trench 1-North	0.0067	T1_N_DPM	13.4	0.00306	3.86E-04	3,039	1.27E-07
	B&J Jacking Pit	0.0038	BJ_J_DPM	7.6	0.00174	2.19E-04	100	2.18E-06
	B&J Receive Pit	0.0038	BJ_R_DPM	7.6	0.00174	2.19E-04	99	2.20E-06
	Trench 2-North	0.0026	T2_N_DPM	5.2	0.00118	1.48E-04	1,170	1.27E-07
<b>Total</b>		<b>0.2036</b>		<b>407</b>	<b>0.0929</b>	<b>0.0117</b>		

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

### PM2.5 Fugitive Dust Construction Emissions for Modeling

Construction Year	Activity	Area Source	PM2.5 Emissions (tons)	PM2.5 Emissions			Modeled Area (m <sup>2</sup> )	PM2.5 Emission Rate g/s/m <sup>2</sup>
				(lb/yr)	(lb/hr)	(g/s)		
<b>2018-2019</b>	HDD Laydown	PIPE_FUG	0.00033	0.7	0.00015	1.88E-05	6,396	2.95E-09
	HDD Insert Pit	PIT_I_FUG	0.00050	1.0	0.00023	2.88E-05	222	1.30E-07
	Trench-South	T_S_FUG	0.00023	0.5	0.00011	1.33E-05	4,520	2.95E-09
	HDD Entry Pit	PIT_E_FUG	0.00050	1.0	0.00023	2.88E-05	222	1.30E-07
	Trench 1-North	T1_N_FUG	0.00016	0.3	0.00007	8.95E-06	3,039	2.95E-09
	B&J Jacking Pit	BJ_J_FUG	0.00000	0.0	0.00000	0.00E+00	100	0.00E+00
	B&J Receive Pit	BJ_R_FUG	0.00000	0.0	0.00000	0.00E+00	99	0.00E+00
	Trench 2-North	T2_N_FUG	0.00006	0.1	0.00003	3.45E-06	1,170	2.95E-09
<b>Total</b>			<b>0.00083</b>	<b>3.5</b>	<b>0.0008</b>	<b>0.0001</b>		

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

# ATTACHMENT 1

## DPM Construction Emissions and Modeling Emission Rates - Mitigated Emissions

Construction Year	Activity	DPM (ton/year)	Area Source	DPM Emissions			Modeled Area (m <sup>2</sup> )	DPM Emission Rate (g/s/m <sup>2</sup> )
				(lb/yr)	(lb/hr)	(g/s)		
2018-2019	HDD Laydown	0.0006	PIPE_DPM	1.1	0.00026	3.22E-05	6,396	5.03E-09
	HDD Insert Pit	0.0050	PIT_I_DPM	10.0	0.00228	2.88E-04	222	1.30E-06
	Trench-South	0.0004	T_S_DPM	0.8	0.00018	2.27E-05	4,520	5.03E-09
	HDD Entry Pit	0.0039	PIT_E_DPM	7.8	0.00178	2.24E-04	222	1.01E-06
	Trench 1-North	0.0003	T1_N_DPM	0.5	0.00012	1.53E-05	3,039	5.03E-09
	B&J Jacking Pit	0.0002	BJ_J_DPM	0.4	0.00009	1.15E-05	100	1.15E-07
	B&J Receive Pit	0.0002	BJ_R_DPM	0.4	0.00009	1.15E-05	99	1.16E-07
	Trench 2-North	0.0001	T2_N_DPM	0.2	0.00005	5.88E-06	1,170	5.03E-09
	<b>Total</b>		<b>0.0106</b>		<b>21</b>	<b>0.0048</b>	<b>0.0006</b>	

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

## PM2.5 Fugitive Dust Construction Emissions for Modeling - Mitigated Emissions

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	PM2.5 Emissions			Modeled Area (m <sup>2</sup> )	PM2.5 Emission Rate g/s/m <sup>2</sup>
				(lb/yr)	(lb/hr)	(g/s)		
2018-2019	HDD Laydown	PIPE_FUG	0.00025	0.5	0.00011	1.44E-05	6,396	2.25E-09
	HDD Insert Pit	PIT_I_FUG	0.00050	1.0	0.00023	2.88E-05	222	1.30E-07
	Trench-South	T_S_FUG	0.00018	0.4	0.00008	1.02E-05	4,520	2.25E-09
	HDD Entry Pit	PIT_E_FUG	0.00050	1.0	0.00023	2.88E-05	222	1.30E-07
	Trench 1-North	T1_N_FUG	0.00012	0.2	0.00005	6.85E-06	3,039	2.25E-09
	B&J Jacking Pit	BJ_J_FUG	0.00000	0.0	0.00000	0.00E+00	100	0.00E+00
	B&J Receive Pit	BJ_R_FUG	0.00000	0.0	0.00000	0.00E+00	99	0.00E+00
	Trench 2-North	T2_N_FUG	0.00005	0.1	0.00002	2.64E-06	1,170	2.25E-09
	<b>Total</b>			<b>0.00075</b>	<b>3.2</b>	<b>0.0007</b>	<b>0.0001</b>	

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

# ATTACHMENT 1

**Alameda Pipeline - Crossing 1 - North Area Construction Impacts  
Maximum DPM Cancer Risk Calculations From Construction  
Off-Site Residential Receptor Locations - 1.5 meters**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Maximum Impact Receptor Location**

Exposure Year	Exposure Duration (years)	Child - Exposure Information			Child Cancer Risk (per million)	Adult - Exposure Information			Adult Cancer Risk (per million)	Fugitive PM2.5	Total PM2.5
		DPM Conc (ug/m3)		Exposure Adjust Factor		Modeled		Exposure Adjust Factor			
		Year	Annual			Year	Annual				
1	1	2018-2019	0.1840	10	16.11	2018-2019	0.1840	1	0.84	0.0018	0.186
2	1		0.0000	10	0.00		0.0000	1	0.00		
3	1		0.0000	4.75	0.00		0.0000	1	0.00		
4	1		0.0000	3	0.00		0.0000	1	0.00		
5	1		0.0000	3	0.00		0.0000	1	0.00		
6	1		0.0000	3	0.00		0.0000	1	0.00		
7	1		0.0000	3	0.00		0.0000	1	0.00		
8	1		0.0000	3	0.00		0.0000	1	0.00		
9	1		0.0000	3	0.00		0.0000	1	0.00		
10	1		0.0000	3	0.00		0.0000	1	0.00		
11	1		0.0000	3	0.00		0.0000	1	0.00		
12	1		0.0000	3	0.00		0.0000	1	0.00		
13	1		0.0000	3	0.00		0.0000	1	0.00		
14	1		0.0000	3	0.00		0.0000	1	0.00		
15	1		0.0000	3	0.00		0.0000	1	0.00		
16	1		0.0000	3	0.00		0.0000	1	0.00		
17	1		0.0000	1.5	0.00		0.0000	1	0.00		
18	1		0.0000	1	0.00		0.0000	1	0.00		
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65	1		0.0000	1	0.00		0.0000	1	0.00		
66	1		0.0000	1	0.00		0.0000	1	0.00		
67	1		0.0000	1	0.00		0.0000	1	0.00		
68	1		0.0000	1	0.00		0.0000	1	0.00		
69	1		0.0000	1	0.00		0.0000	1	0.00		
70	1		0.0000	1	0.00		0.0000	1	0.00		
<b>Total Increased Cancer Risk</b>					<b>16.11</b>				<b>0.84</b>		

# ATTACHMENT 1

**Alameda Pipeline - Crossing 1 South Area- Construction Impacts - Mitigated Emissions  
Maximum DPM Cancer Risk Calculations From Construction  
Off-Site Residential Receptor Locations - 1.5 meters**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Maximum Impact Receptor Location**

Exposure Year	Exposure Duration (years)	Child - Exposure Information			Child Cancer Risk (per million)	Adult - Exposure Information			Adult Cancer Risk (per million)	Mitigated Fugitive PM2.5	Total PM2.5
		DPM Conc (ug/m3)		Exposure Adjust Factor		Modeled		Exposure Adjust Factor			
		Year	Annual			Year	Annual				
1	1	2018-2019	0.0085	10	0.75	2018-2019	0.0085	1	0.04	0.0018	0.010
2	1		0.0000	10	0.00		0.0000	1	0.00		
3	1		0.0000	4.75	0.00		0.0000	1	0.00		
4	1		0.0000	3	0.00		0.0000	1	0.00		
5	1		0.0000	3	0.00		0.0000	1	0.00		
6	1		0.0000	3	0.00		0.0000	1	0.00		
7	1		0.0000	3	0.00		0.0000	1	0.00		
8	1		0.0000	3	0.00		0.0000	1	0.00		
9	1		0.0000	3	0.00		0.0000	1	0.00		
10	1		0.0000	3	0.00		0.0000	1	0.00		
11	1		0.0000	3	0.00		0.0000	1	0.00		
12	1		0.0000	3	0.00		0.0000	1	0.00		
13	1		0.0000	3	0.00		0.0000	1	0.00		
14	1		0.0000	3	0.00		0.0000	1	0.00		
15	1		0.0000	3	0.00		0.0000	1	0.00		
16	1		0.0000	3	0.00		0.0000	1	0.00		
17	1		0.0000	1.5	0.00		0.0000	1	0.00		
18	1		0.0000	1	0.00		0.0000	1	0.00		
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.	.	.	.	.	.	.	.	.	.		
.	.	.	.	.	.	.	.	.	.		
65	1		0.0000	1	0.00		0.0000	1	0.00		
66	1		0.0000	1	0.00		0.0000	1	0.00		
67	1		0.0000	1	0.00		0.0000	1	0.00		
68	1		0.0000	1	0.00		0.0000	1	0.00		
69	1		0.0000	1	0.00		0.0000	1	0.00		
70	1		0.0000	1	0.00		0.0000	1	0.00		
<b>Total Increased Cancer Risk</b>					<b>0.7</b>				<b>0.0</b>		

# ATTACHMENT 1

**Alameda Pipeline - Crossing 1 - Construction Impacts  
Maximum DPM Cancer Risk Calculations From Construction  
Preschool Child Receptor Locations  
Sugar & Spice Preschool**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Child Exposure**

Year	Exposure Duration (years)	Child - Exposure Information		Exposure Adjust Factor*	Child Cancer Risk (per million)	Fugitive PM2.5	Total PM2.5
		DPM Conc (ug/m3)					
		Year	Conc				
1	1	2020-2021	0.0034	3	0.09	0.0001	0.0034
2	1		0.0000	3	0.00		
3	1		0.0000	3	0.00		
4	1		0.000	3	0.00		
5	1		0.000	3	0.00		
6	1		0.000	3	0.00		
7	1		0.000	1	0.00		
8	1		0.000	1	0.00		
9	1		0.000	1	0.00		
10	1		0.000	1	0.00		
11	1		0.000	1	0.00		
12	1		0.000	1	0.00		
13	1		0.000	1	0.00		
14	1		0.000	1	0.00		
15	1		0.000	1	0.00		
16	1		0.000	1	0.00		
17	1		0.000	1	0.00		
18	1		0.000	1	0.00		
.	.	.	.	.	.		
.	.	.	.	.	.		
.	.	.	.	.	.		
65	1		0.000	1	0.00		
66	1		0.000	1	0.00		
67	1		0.000	1	0.00		
68	1		0.000	1	0.00		
69	1		0.000	1	0.00		
70	1		0.000	1	0.00		
<b>Total Increased Cancer Risk</b>					<b>0.1</b>		

# ATTACHMENT 1

## Alameda Pipeline - Crossing 2

### DPM Construction Emissions and Modeling Emission Rates

Construction Year	Activity	DPM (tons)	Area Source	DPM Emissions			Modeled Area (m <sup>2</sup> )	DPM Emission Rate (g/s/m <sup>2</sup> )	
				(lb/yr)	(lb/hr)	(g/s)			
2021-2022	HDD Laydown	0.0066	PIPE_DPM	13.2	0.00300	3.78E-04	4,405	8.59E-08	
	HDD Insert Pit	0.0539	PIT_I_DPM	107.8	0.02461	3.10E-03	215	1.44E-05	
	Abandon Pit 1-S	0.0027	A_S1_DPM	5.4	0.00123	1.55E-04	98	1.59E-06	
	Abandon Pit 2-S	0.0027	A_S2_DPM	5.4	0.00123	1.55E-04	103	1.51E-06	
	HDD Entry Pit	0.0579	PIT_E_DPM	115.8	0.02644	3.33E-03	214	1.56E-05	
	Trench 1-North	0.0009	T1_N_DPM	1.9	0.00042	5.33E-05	620	8.59E-08	
	B&J Jacking Pit	0.0026	BJ_J_DPM	5.1	0.00116	1.47E-04	100	1.47E-06	
	B&J Receive Pit	0.0026	BJ_R_DPM	5.1	0.00116	1.47E-04	97	1.51E-06	
	Trench 2-North	0.0029	T2_N_DPM	5.7	0.00131	1.65E-04	1,925	8.59E-08	
	Abandon Pits (2)-N	0.0054	A_N_DPM	10.8	0.00247	3.11E-04	99	3.14E-06	
	<b>Total</b>		<b>0.1327</b>		<b>265</b>	<b>0.0606</b>	<b>0.0076</b>		

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

### PM2.5 Fugitive Dust Construction Emissions for Modeling

Construction Year	Activity	Area Source	PM2.5 Emissions			Modeled Area (m <sup>2</sup> )	PM2.5 Emission Rate (g/s/m <sup>2</sup> )	
			(tons)	(lb/yr)	(lb/hr)			(g/s)
2021-2022	HDD Laydown	PIPE_FUG	0.00021	0.4	0.00009	1.18E-05	4,405	2.68E-09
	HDD Insert Pit	PITI_FUG	0.00040	0.8	0.00018	2.30E-05	215	1.07E-07
	Abandon Pit 1-S	A_S1_FUG	0.00000	0.0	0.00000	0.00E+00	98	0.00E+00
	Abandon Pit 2-S	A_S2_FUG	0.00000	0.0	0.00000	0.00E+00	103	0.00E+00
	HDD Entry Pit	PIT_E_FUG	0.00040	0.8	0.00018	2.30E-05	214	1.07E-07
	Trench 1-North	T1_N_FUG	0.00003	0.1	0.00001	1.66E-06	620	2.68E-09
	B&J Jacking Pit	BJ_J_FUG	0.00000	0.0	0.00000	0.00E+00	100	0.00E+00
	B&J Receive Pit	BJ_R_FUG	0.00000	0.0	0.00000	0.00E+00	97	0.00E+00
	Trench 2-North	T2_N_FUG	0.00009	0.2	0.00004	5.17E-06	1,925	2.68E-09
	Abandon Pits (2)-N	A_N_Fug	0.00000	0.0	0.00000	0.00E+00	99	0.00E+00
	<b>Total</b>		<b>0.0011</b>	<b>2.2</b>	<b>0.0005</b>	<b>0.0001</b>		

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

# ATTACHMENT 1

**Alameda Pipeline - Crossing 2 - Construction Impacts  
Maximum DPM Cancer Risk Calculations From Construction  
Off-Site Residential Receptor Locations - 1.5 meters**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Maximum Impact Receptor Location**

Exposure Year	Exposure Duration (years)	Child - Exposure Information			Child Cancer Risk (per million)	Adult - Exposure Information			Adult Cancer Risk (per million)	Fugitive PM2.5	Total PM2.5
		DPM Conc (ug/m3)		Exposure Adjust Factor		Modeled		Exposure Adjust Factor			
		Year	Annual			Year	Annual				
1	1	2018-2019	0.0880	10	7.71	2018-2019	0.0880	1	0.40	0.0008	0.089
2	1		0.0000	10	0.00		0.0000	1	0.00		
3	1		0.0000	4.75	0.00		0.0000	1	0.00		
4	1		0.0000	3	0.00		0.0000	1	0.00		
5	1		0.0000	3	0.00		0.0000	1	0.00		
6	1		0.0000	3	0.00		0.0000	1	0.00		
7	1		0.0000	3	0.00		0.0000	1	0.00		
8	1		0.0000	3	0.00		0.0000	1	0.00		
9	1		0.0000	3	0.00		0.0000	1	0.00		
10	1		0.0000	3	0.00		0.0000	1	0.00		
11	1		0.0000	3	0.00		0.0000	1	0.00		
12	1		0.0000	3	0.00		0.0000	1	0.00		
13	1		0.0000	3	0.00		0.0000	1	0.00		
14	1		0.0000	3	0.00		0.0000	1	0.00		
15	1		0.0000	3	0.00		0.0000	1	0.00		
16	1		0.0000	3	0.00		0.0000	1	0.00		
17	1		0.0000	1.5	0.00		0.0000	1	0.00		
18	1		0.0000	1	0.00		0.0000	1	0.00		
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65	1		0.0000	1	0.00		0.0000	1	0.00		
66	1		0.0000	1	0.00		0.0000	1	0.00		
67	1		0.0000	1	0.00		0.0000	1	0.00		
68	1		0.0000	1	0.00		0.0000	1	0.00		
69	1		0.0000	1	0.00		0.0000	1	0.00		
70	1		0.0000	1	0.00		0.0000	1	0.00		
<b>Total Increased Cancer Risk</b>					<b>7.7</b>				<b>0.4</b>		

# ATTACHMENT 1

**Alameda Pipeline - Crossing 2 - Construction Impacts  
Maximum DPM Cancer Risk Calculations From Construction  
School Child Receptor Locations  
Earhart Elementary School**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Student Exposure**

Year	Exposure Duration (years)	Student - Exposure Information		Exposure Adjust Factor*	Student Cancer Risk (per million)
		DPM Conc (ug/m3)			
		Year	Conc		
1	1	2020-2021	0.0066	3	0.17
2	1		0.0000	3	0.00
3	1		0.0000	3	0.00
4	1		0.0000	3	0.00
5	1		0.0000	3	0.00
6	1		0.0000	3	0.00
7	1		0.0000	1	0.00
8	1		0.0000	1	0.00
9	1		0.0000	1	0.00
10	1		0.0000	1	0.00
11	1		0.0000	1	0.00
12	1		0.0000	1	0.00
13	1		0.0000	1	0.00
14	1		0.0000	1	0.00
15	1		0.0000	1	0.00
16	1		0.0000	1	0.00
17	1		0.0000	1	0.00
18	1		0.0000	1	0.00
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
65	1		0.0000	1	0.00
66	1		0.0000	1	0.00
67	1		0.0000	1	0.00
68	1		0.0000	1	0.00
69	1		0.0000	1	0.00
70	1		0.0000	1	0.00
<b>Total Increased Cancer Risk</b>					<b>0.2</b>

Fugitive PM2.5: 0.0002  
Total PM2.5: 0.007

\* Assumes that students at school are 16 years of age or younger for entire construction period



# ATTACHMENT 1

**Alameda Pipeline - Crossing 2 - Construction Impacts  
Maximum DPM Cancer Risk Calculations From Construction  
Preschool Child Receptor Locations  
Small Size Big mind Preschool**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Child Exposure**

Year	Exposure Duration (years)	Child - Exposure Information		Exposure Adjust Factor*	Child Cancer Risk (per million)
		DPM Conc (ug/m3)			
		Year	Conc		
1	1	2020-2021	0.0214	3	0.56
2	1		0.0000	3	0.00
3	1		0.0000	3	0.00
4	1		0.0000	3	0.00
5	1		0.0000	3	0.00
6	1		0.0000	3	0.00
7	1		0.0000	1	0.00
8	1		0.0000	1	0.00
9	1		0.0000	1	0.00
10	1		0.0000	1	0.00
11	1		0.0000	1	0.00
12	1		0.0000	1	0.00
13	1		0.0000	1	0.00
14	1		0.0000	1	0.00
15	1		0.0000	1	0.00
16	1		0.0000	1	0.00
17	1		0.0000	1	0.00
18	1		0.0000	1	0.00
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
65	1		0.0000	1	0.00
66	1		0.0000	1	0.00
67	1		0.0000	1	0.00
68	1		0.0000	1	0.00
69	1		0.0000	1	0.00
70	1		0.0000	1	0.00
<b>Total Increased Cancer Risk</b>					<b>0.6</b>

Fugitive PM2.5    Total PM2.5  
0.0002    0.022

\* Assumes that children are 2 years of age or older

# ATTACHMENT 1

## Alameda Pipeline - Crossing 3

### DPM Construction Emissions and Modeling Emission Rates

Construction Year	Activity	DPM (ton/year)	Area Source	DPM Emissions			Modeled Area (m <sup>2</sup> )	DPM Emission Rate (g/s/m <sup>2</sup> )	
				(lb/yr)	(lb/hr)	(g/s)			
<b>2021-2022</b>	HDD Laydown	0.0082	PIPE_DPM	16.3	0.00373	4.70E-04	5,685	8.27E-08	
	HDD Insert Pit	0.0529	PITI_DPM	105.8	0.02416	3.04E-03	218	1.40E-05	
	Trench-South	0.0058	T_S_DPM	11.5	0.00263	3.31E-04	4,005	8.27E-08	
	Abandon Pit-S	0.0029	A_S_DPM	5.8	0.00132	1.67E-04	97	1.72E-06	
	HDD Entry Pit	0.0568	PITE_DPM	113.6	0.02594	3.27E-03	216	1.51E-05	
	Trench-North	0.0051	T_N_DPM	10.1	0.00231	2.91E-04	3,520	8.27E-08	
	Abandon Pit-N	0.0029	A_N_DPM	5.8	0.00132	1.67E-04	96	1.74E-06	
	<b>Total</b>		<b>0.1345</b>		<b>269</b>	<b>0.0614</b>	<b>0.0077</b>		

hr/day = 12 (7am - 7pm)  
 days/yr = 365  
 hours/year = 4380

### PM2.5 Fugitive Dust Construction Emissions for Modeling

Construction Year	Activity	Area Source	Area (ton/year)	PM2.5 Emissions			Modeled Area (m <sup>2</sup> )	PM2.5 Emission Rate g/s/m <sup>2</sup>	
				(lb/yr)	(lb/hr)	(g/s)			
<b>2021-2022</b>	HDD Laydown	PIPE_FUG	0.00029	0.6	0.00013	1.67E-05	5,685	2.94E-09	
	HDD Insert Pit	PITI_FUG	0.00050	1.0	0.00023	2.88E-05	218	1.32E-07	
	Trench-South	T_S_FUG	0.00020	0.4	0.00009	1.18E-05	4,005	2.94E-09	
	Abandon Pit-S	A_S_FUG	0	0.0	0.00000	0.00E+00	97	0.00E+00	
	HDD Entry Pit	PITE_FUG	0.00050	1.0	0.00023	2.88E-05	216	1.33E-07	
	Trench-North	T-N-FUG	0.00018	0.4	0.00008	1.03E-05	3,520	2.94E-09	
	Abandon Pit-N	A-N-FUG	0	0.0	0.00000	0.00E+00	96	0.00E+00	
	<b>Total</b>			<b>0.00167</b>	<b>3.3</b>	<b>0.0008</b>	<b>0.0001</b>		

hr/day = 12 (7am - 7pm)  
 days/yr = 365  
 hours/year = 4380

# ATTACHMENT 1

## DPM Construction Emissions and Modeling Emission Rates - Mitigated Emissions

Construction Year	Activity	DPM (ton/year)	Area Source	DPM Emissions			Modeled Area (m <sup>2</sup> )	DPM Emission Rate (g/s/m <sup>2</sup> )	
				(lb/yr)	(lb/hr)	(g/s)			
2021-2022	HDD Laydown	0.0005	PIPE_DPM	1.1	0.00025	3.10E-05	5,685	5.46E-09	
	HDD Insert Pit	0.0032	PITI_DPM	6.4	0.00146	1.84E-04	218	8.46E-07	
	Trench-South	0.0004	T_S_DPM	0.8	0.00017	2.19E-05	4,005	5.46E-09	
	Abandon Pit-S	0.0002	A_S_DPM	0.4	0.00009	1.15E-05	97	1.18E-07	
	HDD Entry Pit	0.0039	PITE_DPM	7.8	0.00178	2.24E-04	216	1.04E-06	
	Trench-North	0.0003	T_N_DPM	0.7	0.00015	1.92E-05	3,520	5.46E-09	
	Abandon Pit-N	0.0002	A_N_DPM	0.4	0.00009	1.15E-05	96	1.20E-07	
	<b>Total</b>		<b>0.0088</b>		<b>18</b>	<b>0.0040</b>	<b>0.0005</b>		

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

## PM2.5 Fugitive Dust Construction Emissions for Modeling - Mitigated Emissions

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	PM2.5 Emissions			Modeled Area (m <sup>2</sup> )	PM2.5 Emission Rate g/s/m <sup>2</sup>	
				(lb/yr)	(lb/hr)	(g/s)			
2021-2022	HDD Laydown	PIPE_FUG	0.00025	0.5	0.00011	1.43E-05	5,685	2.52E-09	
	HDD Insert Pit	PITI_FUG	0.00050	1.0	0.00023	2.88E-05	218	1.32E-07	
	Trench-South	T_S_FUG	0.00018	0.4	0.00008	1.01E-05	4,005	2.52E-09	
	Abandon Pit-S	A_S_FUG	0	0.0	0.00000	0.00E+00	97	0.00E+00	
	HDD Entry Pit	PITE_FUG	0.00050	1.0	0.00023	2.88E-05	216	1.33E-07	
	Trench-North	T-S-FUG	0.00015	0.3	0.00007	8.87E-06	3,520	2.52E-09	
	Abandon Pit-N	A-S-FUG	0	0.0	0.00000	0.00E+00	96	0.00E+00	
	<b>Total</b>			<b>0.00158</b>	<b>3.2</b>	<b>0.0007</b>	<b>0.0001</b>		

hr/day = 12 (7am - 7pm)  
days/yr = 365  
hours/year = 4380

# ATTACHMENT 1

**Alameda Pipeline - Crossing 3 - Construction Impacts  
Maximum DPM Cancer Risk Calculations From Construction  
Off-Site Residential Receptor Locations - 1.5 meters**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Maximum Impact Receptor Location**

Exposure Year	Exposure Duration (years)	Child - Exposure Information			Child Cancer Risk (per million)	Adult - Exposure Information			Adult Cancer Risk (per million)	Fugitive PM2.5	Total PM2.5
		DPM Conc (ug/m3)		Exposure Adjust Factor		Modeled		Exposure Adjust Factor			
		Year	Annual			Year	Annual				
1	1	2021-2022	0.7391	10	64.70	2021-2022	0.7391	1	3.36	0.0039	0.743
2	1		0.0000	10	0.00		0.0000	1	0.00		
3	1		0.0000	4.75	0.00		0.0000	1	0.00		
4	1		0.0000	3	0.00		0.0000	1	0.00		
5	1		0.0000	3	0.00		0.0000	1	0.00		
6	1		0.0000	3	0.00		0.0000	1	0.00		
7	1		0.0000	3	0.00		0.0000	1	0.00		
8	1		0.0000	3	0.00		0.0000	1	0.00		
9	1		0.0000	3	0.00		0.0000	1	0.00		
10	1		0.0000	3	0.00		0.0000	1	0.00		
11	1		0.0000	3	0.00		0.0000	1	0.00		
12	1		0.0000	3	0.00		0.0000	1	0.00		
13	1		0.0000	3	0.00		0.0000	1	0.00		
14	1		0.0000	3	0.00		0.0000	1	0.00		
15	1		0.0000	3	0.00		0.0000	1	0.00		
16	1		0.0000	3	0.00		0.0000	1	0.00		
17	1		0.0000	1.5	0.00		0.0000	1	0.00		
18	1		0.0000	1	0.00		0.0000	1	0.00		
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.	.	.	.	.	.	.	.	.	.		
65	1		0.0000	1	0.00		0.0000	1	0.00		
66	1		0.0000	1	0.00		0.0000	1	0.00		
67	1		0.0000	1	0.00		0.0000	1	0.00		
68	1		0.0000	1	0.00		0.0000	1	0.00		
69	1		0.0000	1	0.00		0.0000	1	0.00		
70	1		0.0000	1	0.00		0.0000	1	0.00		
<b>Total Increased Cancer Risk</b>					<b>64.7</b>				<b>3.4</b>		

# ATTACHMENT 1

**Alameda Pipeline - Crossing 3 - Construction Impacts - Mitigated Emissions  
Maximum DPM Cancer Risk Calculations From Construction  
Off-Site Residential Receptor Locations - 1.5 meters**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

Values

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Maximum Impact Receptor Location**

Exposure Year	Exposure Duration (years)	Child - Exposure Information			Child Cancer Risk (per million)	Adult - Exposure Information			Adult Cancer Risk (per million)
		DPM Conc (ug/m3)		Exposure Adjust Factor		Modeled		Exposure Adjust Factor	
		Year	Annual			Year	Annual		
1	1	2021-2022	0.0447	10	3.92	2021-2022	0.0447	1	0.20
2	1		0.0000	10	0.00		0.0000	1	0.00
3	1		0.0000	4.75	0.00		0.0000	1	0.00
4	1		0.0000	3	0.00		0.0000	1	0.00
5	1		0.0000	3	0.00		0.0000	1	0.00
6	1		0.0000	3	0.00		0.0000	1	0.00
7	1		0.0000	3	0.00		0.0000	1	0.00
8	1		0.0000	3	0.00		0.0000	1	0.00
9	1		0.0000	3	0.00		0.0000	1	0.00
10	1		0.0000	3	0.00		0.0000	1	0.00
11	1		0.0000	3	0.00		0.0000	1	0.00
12	1		0.0000	3	0.00		0.0000	1	0.00
13	1		0.0000	3	0.00		0.0000	1	0.00
14	1		0.0000	3	0.00		0.0000	1	0.00
15	1		0.0000	3	0.00		0.0000	1	0.00
16	1		0.0000	3	0.00		0.0000	1	0.00
17	1		0.0000	1.5	0.00		0.0000	1	0.00
18	1		0.0000	1	0.00		0.0000	1	0.00
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
65	1		0.0000	1	0.00		0.0000	1	0.00
66	1		0.0000	1	0.00		0.0000	1	0.00
67	1		0.0000	1	0.00		0.0000	1	0.00
68	1		0.0000	1	0.00		0.0000	1	0.00
69	1		0.0000	1	0.00		0.0000	1	0.00
70	1		0.0000	1	0.00		0.0000	1	0.00
<b>Total Increased Cancer Risk</b>					<b>3.9</b>				<b>0.2</b>

Mitigated Fugitive PM2.5 0.0153  
Total PM2.5 0.060

# ATTACHMENT 1

**Alameda Pipeline - Crossing 3 - Construction Impacts  
Maximum DPM Cancer Risk Calculations From Construction  
School Child Receptor Locations  
Edison Elementary School**

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6

Where: CPF = Cancer potency factor (mg/kg-day)<sup>-1</sup>

Inhalation Dose = C<sub>air</sub> x DBR x A x EF x ED x 10<sup>-6</sup> / AT

Where: C<sub>air</sub> = concentration in air (µg/m<sup>3</sup>)

DBR = daily breathing rate (L/kg body weight-day)

A = Inhalation absorption factor

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time period over which exposure is averaged.

10<sup>-6</sup> = Conversion factor

**Values**

Parameter	Child	Adult
CPF =	1.10E+00	1.10E+00
DBR =	581	302
A =	1	1
EF =	350	350
AT =	25,550	25,550

**Construction Cancer Risk by Year - Student Exposure**

Year	Exposure Duration (years)	Student - Exposure Information		Exposure Adjust Factor*	Student Cancer Risk (per million)	Fugitive PM2.5	Total PM2.5
		DPM Conc (ug/m3)					
		Year	Conc				
1	1	2021-2022	0.0046	3	0.12	0.0001	0.0047
2	1		0.0000	3	0.00		
3	1		0.0000	3	0.00		
4	1		0.000	3	0.00		
5	1		0.000	3	0.00		
6	1		0.000	3	0.00		
7	1		0.000	1	0.00		
8	1		0.000	1	0.00		
9	1		0.000	1	0.00		
10	1		0.000	1	0.00		
11	1		0.000	1	0.00		
12	1		0.000	1	0.00		
13	1		0.000	1	0.00		
14	1		0.000	1	0.00		
15	1		0.000	1	0.00		
16	1		0.000	1	0.00		
17	1		0.000	1	0.00		
18	1		0.000	1	0.00		
.	.	.	.	.	.		
.	.	.	.	.	.		
.	.	.	.	.	.		
65	1		0.000	1	0.00		
66	1		0.000	1	0.00		
67	1		0.000	1	0.00		
68	1		0.000	1	0.00		
69	1		0.000	1	0.00		
70	1		0.000	1	0.00		
<b>Total Increased Cancer Risk</b>					<b>0.1</b>		

Project Name:		Alameda North Bay Island Pipeline - Alternative 1D (Alice Webster)							
	<b>Project Size</b>	1.1 total project acres disturbed							
	<b>Construction Hours</b>	7 am to 7 pm							
	<b>Open Trench Operation</b>								
	Total Length	10,890	Feet						
	Production Rate	80	Feet/Day						
	Days	136	Days						
		% of Time	Total Days						
	Pavement Cutting	14%	19						
	Excavation	43%	58						
	Pipe Installation	29%	39						
	Repaving	14%	19						
	Note: % Times estimated based on West of Hills EIR								
Qty	Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours	Avg Hrs Per Day	Comments	
	<b>Demolition - Open Trench</b>	<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>19</b>				
		<b>End Date:</b>	<b>Unknown</b>						
1	Concrete/Industrial Saws	81	0.73	8	19	152	8.0		
2	Tractors/Loaders/Backhoes x2	97	0.37	16	19	304	16.0		
	<b>Grading / Excavation - Open Trench</b>	<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>270</b>				
		<b>End Date:</b>	<b>Unknown</b>						
1	Excavators	162	0.38	8	58	464	1.7		
1	Tractors/Loaders/Backhoes	97	0.37	8	58	464	1.7		
2	Dewatering Pumps x2	50	0.74	24	97	2328	8.6	For Stormwater and for pipe dewatering	
	<b>Drilling/Casing - HDD</b>	<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>176</b>				
		<b>End Date:</b>	<b>Unknown</b>						
2	Excavators x2	162	0.38	16	40	640	3.6	Location Insertion/Entry One for each side, used at the same time.	
2	Tractors/Loaders/Backhoes x2	97	0.37	16	40	640	3.6	Insertion/Entry One for each side, used at the same time.	
1	Bore/Drill Rig-x2	205	0.50	8	20	160	0.9	Entry Entry side only	
1	Slurry Plant x2	150	0.50	8	42	336	1.9	Entry Entry side only	
2	Pick-Crane x2	226	0.29	16	122	1952	11.1	For moving pipe during pullback and for picking up drilling equipment Insertion/Entry One for each side, used at the same time.	
2	Generator Sets x2	84	0.74	16	82	1312	7.5	Insertion/Entry One for each side, used at the same time.	
2	Pumps x2	84	0.74	16	82	1312	7.5	For pressure grouting Insertion/Entry One for each side, used at the same time.	
1	Welders	85	0.50	8	20	160	0.9	For HDPE welding Insertion Just used on the insertion side.	
1	Cement and Mortar Mixers (Grouting)	9	0.56	8	60	480	2.7	For pressure grouting Entry Entry side only	
	<b>Paving - Open Trench</b>	<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>19</b>				
		<b>Start Date:</b>	<b>Unknown</b>						
1	Cement and Mortar Mixers	9	0.56	8	19	152	8.0		
1	Pavers	125	0.42	8	19	152	8.0		
1	Paving Equipment	130	0.36	8	19	152	8.0		
1	Rollers	80	0.38	8	19	152	8.0		
1	Tractors/Loaders/Backhoes	97	0.37	8	19	152	8.0		

Project Name:		Alameda North Bay Island Pipeline - Alternative 2A (Bay Farm)							Complete ALL Portions in Yellow	
See Equipment Type TAB for type, horsepower and load factor										
Project Size		0.5 total project acres disturbed								
Construction Hours		7 am to 7 pm								
<b>Open Trench Operation</b>										
Total Length		4,220 Feet								
Production Rate		80 Feet/Day								
Days		53 Days								
		% of Time Total Days								
Pavement Cutting		14% 8								
Excavation		43% 23								
Pipe Installation		29% 15								
Repaving		14% 8								
Note: % Times estimated based on West of Hills EIR										
Qty	Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours	Avg Hrs Per Day	Comments		
<b>Demolition - Open Trench</b>		<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>8</b>					
		<b>End Date:</b>	<b>Unknown</b>							
1	Concrete/Industrial Saws	81	0.73	8	8	64	8.0			
2	Tractors/Loaders/Backhoes x2	97	0.3685	16	8	128	16.0			
<b>Grading / Excavation - Open Trench</b>		<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>204</b>					
		<b>End Date:</b>	<b>Unknown</b>							
1	Excavators	162	0.3819	8	23	184	0.9			
1	Tractors/Loaders/Backhoes	97	0.3685	8	23	184	0.9			
2	Dewatering Pumps x2	50	0.74	24	38	912	4.5	For Stormwater and for pipe dewatering		
<b>Drilling/Casing - HDD</b>		<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>176</b>					
		<b>End Date:</b>	<b>Unknown</b>							
2	Excavators x2	162	0.3819	16	40	640	3.6		Location Clarification	
2	Tractors/Loaders/Backhoes x2	97	0.3685	16	40	640	3.6		Insertion/Entry One for each side, used at the same time.	
1	Bore/Drill Rig x2	205	0.5	8	20	160	0.9		Entry Entry side only	
1	Slurry Plant x2	150	0.5	8	42	336	1.9		Entry Entry side only	
2	Pick-Crane x2	226	0.29	16	122	1952	11.1	For moving pipe during pu	Insertion/Entry One for each side, used at the same time.	
2	Generator Sets x2	84	0.74	16	82	1312	7.5		Insertion/Entry One for each side, used at the same time.	
2	Pumps x2	84	0.74	16	82	1312	7.5	For pressure grouting	Insertion/Entry One for each side, used at the same time.	
1	Welders	85	0.50	8	20	160	0.9	For HDPE welding	Insertion Just used on the insertion side.	
1	Cement and Mortar Mixers (Grouting)	9	0.56	8	60	480	2.7	For pressure grouting	Entry Entry side only	
<b>Paving - Open Trench</b>		<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	<b>8</b>					
		<b>Start Date:</b>	<b>Unknown</b>							
1	Cement and Mortar Mixers	9	0.56	8	8	64	8.0			
1	Pavers	125	0.42	8	8	64	8.0			
1	Paving Equipment	130	0.3551	8	8	64	8.0			
1	Rollers	80	0.3752	8	8	64	8.0			
1	Tractors/Loaders/Backhoes	97	0.3685	8	8	64	8.0			



Project Name:		Alameda North Bay Island Pipeline - Alternative 3A							Complete ALL Portions in Yellow	
See Equipment Type TAB for type, horsepower and load factor										
Project Size		0.5 total project acres disturbed								
Construction Hours		7 am to 7 pm								
<b>Open Trench Operation</b>										
Total Length		4,495 Feet								
Production Rate		80 Feet/Day								
Days		56 Days								
		% of Time Total Days								
Pavement Cutting		14% 8								
Excavation		43% 24								
Pipe Installation		29% 16								
Repaving		14% 8								
Note: % Times estimated based on West of Hills EIR										
Qty	Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours	Avg Hrs Per Day	Comments		
<b>Demolition - Open Trench</b>		<b>Start Date:</b>		<b>Unknown</b>		<b>Total work c</b>		<b>8</b>		
		<b>End Date:</b>		<b>Unknown</b>						
1	Concrete/Industrial Saws	81	0.73	8	8	64	8.0			
2	Tractors/Loaders/Backhoes x2	97	0.3685	16	8	128	16.0			
<b>Grading / Excavation - Open Trench</b>		<b>Start Date:</b>		<b>Unknown</b>		<b>Total work c</b>		<b>226</b>		
		<b>End Date:</b>		<b>Unknown</b>						
1	Excavators	162	0.3819	8	24	192	0.8			
1	Tractors/Loaders/Backhoes	97	0.3685	8	24	192	0.8			
2	Dewatering Pumps x2	50	0.74	24	40	960	4.2	For Stormwater and for pipe dewatering		
<b>Drilling/Casing - HDD</b>		<b>Start Date:</b>		<b>Unknown</b>		<b>Total work c</b>		<b>176</b>		
		<b>End Date:</b>		<b>Unknown</b>						
2	Excavators x2	162	0.3819	16	40	640	3.6		Location Clarification	
2	Tractors/Loaders/Backhoes x2	97	0.3685	16	40	640	3.6		Insertion/Entry One for each side, used at the same time.	
1	Bore/Drill Rig-x2	205	0.5	8	20	160	0.9		Entry side only	
1	Slurry Plant x2	150	0.5	8	42	336	1.9		Entry side only	
2	Pick-Crane x2	226	0.29	16	122	1952	11.1	For moving pipe during pullback and for pick	Insertion/Entry One for each side, used at the same time.	
2	Generator Sets x2	84	0.74	16	82	1312	7.5		Insertion/Entry One for each side, used at the same time.	
2	Pumps x2	84	0.74	16	82	1312	7.5	For pressure grouting	Insertion/Entry One for each side, used at the same time.	
1	Welders	85	0.50	8	20	160	0.9	For HDPE welding	Insertion Just used on the insertion side.	
1	Cement and Mortar Mixers (Grouting)	9	0.56	8	60	480	2.7	For pressure grouting	Entry Entry side only	
<b>Paving - Open Trench</b>		<b>Start Date:</b>		<b>Unknown</b>		<b>Total work c</b>		<b>8</b>		
		<b>Start Date:</b>		<b>Unknown</b>						
1	Cement and Mortar Mixers	9	0.56	8	8	64	8.0			
1	Pavers	125	0.42	8	8	64	8.0			
1	Paving Equipment	130	0.3551	8	8	64	8.0			
1	Rollers	80	0.3752	8	8	64	8.0			
1	Tractors/Loaders/Backhoes	97	0.3685	8	8	64	8.0			

**Project Name:** Alameda North Bay Island Pipeline - Abandoning the Cross

See Equipment Type TAB for type, horsepower and load factor

**Project Size** \_\_\_\_\_ **total project acres disturbed**  
**Construction Hours** \_\_\_\_\_ **am to** \_\_\_\_\_ **pm**

**Open Trench Operation**

Total Length NA Feet  
 Production Rate NA Feet/Day  
 Days NA Days

Information below is for abandoning 1 crossing

Qty	Description	HP	Load Factor	Hours/day	Total Work Days	Total Project Hours
	<b>Construction of Pits and Filling With Concrete</b>					
		<b>Start Date:</b>	<b>Unknown</b>	<b>Total work days:</b>	Varies	
		<b>End Date:</b>	<b>Unknown</b>			
1	Concrete/Industrial Saws	81	0.73	8	5	40
1	Excavators	162	0.38	8	5	40
1	Tractors/Loaders/Backhoes	97	0.37	8	5	40
2	Dewatering Pumps x2	50	0.74	16	5	80
1	Generator Set	84	0.74	8	5	40
1	Welders	85	0.50	8	5	40
1	Cement and Mortar Mixers	9	0.56	8	5	40

## Alameda Pipeline, Crossing 1 Alameda County, Annual

### 1.0 Project Characteristics

#### 1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	1.10	0.00	0

#### 1.2 Other Project Characteristics

<b>Urbanization</b>	Urban	<b>Wind Speed (m/s)</b>	2.2	<b>Precipitation Freq (Days)</b>	63
<b>Climate Zone</b>	5			<b>Operational Year</b>	2014
<b>Utility Company</b>	Pacific Gas & Electric Company				
<b>CO2 Intensity (lb/MWhr)</b>	641.35	<b>CH4 Intensity (lb/MWhr)</b>	0.029	<b>N2O Intensity (lb/MWhr)</b>	0.006

#### 1.3 User Entered Comments & Non-Default Data

Land Use - Lot acreage from construction data request sheet

Construction Phase - Schedule based on 2018 start date, up to 22 months construction, and anticipated work days provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - HDD: 765cy hauling @ 16cy/truck = 96 one-way trips. 19 trench workers, 25 HDD workers, 11 abandonment.

Grading - 10,250cy import, 13,728 cy export during Open Trench, 133 cy during Abandonment.

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	200.00	176.00
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tblConstructionPhase	NumDays	4.00	20.00
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tblConstructionPhase	NumDays	4.00	10.00
tblConstructionPhase	PhaseEndDate	10/12/2018	10/11/2019
tblConstructionPhase	PhaseEndDate	6/15/2020	10/11/2019
tblConstructionPhase	PhaseEndDate	3/7/2019	2/22/2018
tblConstructionPhase	PhaseEndDate	3/1/2018	2/1/2018
tblConstructionPhase	PhaseEndDate	2/15/2018	2/8/2018
tblConstructionPhase	PhaseStartDate	2/9/2018	2/8/2019
tblConstructionPhase	PhaseStartDate	10/12/2019	2/8/2019
tblConstructionPhase	PhaseStartDate	2/8/2019	1/26/2018
tblConstructionPhase	PhaseStartDate	2/23/2018	1/26/2018
tblConstructionPhase	PhaseStartDate	2/2/2018	1/26/2018
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tblGrading	MaterialExported	0.00	67.00
tblGrading	MaterialExported	0.00	67.00
tblGrading	MaterialImported	0.00	10,250.00
tblLandUse	LotAcreage	0.00	1.10
tblOffRoadEquipment	HorsePower	171.00	150.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	46.00	85.00

tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
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tblOffRoadEquipment	OffRoadEquipmentType		Concrete/Industrial Saws
tblOffRoadEquipment	OffRoadEquipmentType		Excavators
tblOffRoadEquipment	OffRoadEquipmentType		Pumps
tblOffRoadEquipment	OffRoadEquipmentType		Generator Sets
tblOffRoadEquipment	OffRoadEquipmentType		Welders
tblOffRoadEquipment	OffRoadEquipmentType		Cement and Mortar Mixers
tblOffRoadEquipment	OffRoadEquipmentType		Concrete/Industrial Saws
tblOffRoadEquipment	OffRoadEquipmentType		Excavators
tblOffRoadEquipment	OffRoadEquipmentType		Pumps
tblOffRoadEquipment	OffRoadEquipmentType		Generator Sets
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tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
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tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
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tblTripsAndVMT	WorkerTripNumber	8.00	19.00
tblTripsAndVMT	WorkerTripNumber	10.00	19.00

tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00
tblTripsAndVMT	WorkerTripNumber	20.00	11.00
tblTripsAndVMT	WorkerTripNumber	20.00	11.00

## 2.0 Emissions Summary

### 2.1 Overall Construction

#### Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.2867	1.7500	1.7910	3.5000e-003	0.0517	0.0900	0.1417	0.0137	0.0878	0.1014	0.0000	283.9472	283.9472	0.0352	0.0000	284.6860
2019	0.3752	3.5499	2.8080	5.4800e-003	0.0664	0.1819	0.2482	0.0171	0.1740	0.1911	0.0000	469.0619	469.0619	0.0847	0.0000	470.8416
<b>Total</b>	<b>0.6619</b>	<b>5.2999</b>	<b>4.5990</b>	<b>8.9800e-003</b>	<b>0.1180</b>	<b>0.2719</b>	<b>0.3899</b>	<b>0.0307</b>	<b>0.2618</b>	<b>0.2925</b>	<b>0.0000</b>	<b>753.0092</b>	<b>753.0092</b>	<b>0.1199</b>	<b>0.0000</b>	<b>755.5276</b>

#### Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.2867	1.7500	1.7910	3.5000e-003	0.0517	0.0900	0.1417	0.0137	0.0878	0.1014	0.0000	283.9470	283.9470	0.0352	0.0000	284.6858
2019	0.3752	3.5499	2.8080	5.4800e-003	0.0664	0.1819	0.2482	0.0171	0.1740	0.1911	0.0000	469.0614	469.0614	0.0847	0.0000	470.8411

Total	0.6619	5.2999	4.5990	8.9800e-003	0.1180	0.2719	0.3899	0.0307	0.2618	0.2925	0.0000	753.0085	753.0085	0.1199	0.0000	755.5269
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	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

### 3.0 Construction Detail

#### Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition - Open Trench	Demolition	1/1/2018	1/25/2018	5	19	
2	Grading/Excavation - Open Trench	Grading	1/26/2018	2/7/2019	5	270	
3	Bore and Jack	Grading	1/26/2018	2/22/2018	5	20	
4	5th St Abandonment	Grading	1/26/2018	2/1/2018	5	5	
5	Alice Webster Abandonment	Grading	1/26/2018	2/8/2018	5	10	
6	HDD - Entry	Building Construction	2/8/2019	10/11/2019	5	176	
7	HDD - Insertion	Building Construction	2/8/2019	10/11/2019	5	176	
8	Paving - Open Trench	Paving	10/12/2019	11/7/2019	5	19	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

#### OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition - Open Trench	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition - Open Trench	Rubber Tired Dozers	0	8.00	255	0.40
Demolition - Open Trench	Tractors/Loaders/Backhoes	2	16.00	97	0.37
Grading/Excavation - Open Trench	Excavators	1	1.70	162	0.38



Grading/Excavation - Open Trench	Graders	0	6.00	174	0.41
Grading/Excavation - Open Trench	Pumps	2	8.60	50	0.74
Grading/Excavation - Open Trench	Rubber Tired Dozers	0	6.00	255	0.40
Grading/Excavation - Open Trench	Tractors/Loaders/Backhoes	1	1.70	97	0.37
HDD - Entry	Bore/Drill Rigs	1	0.90	205	0.50
HDD - Entry	Cement and Mortar Mixers	1	2.70	9	0.56
HDD - Entry	Cranes	1	11.10	226	0.29
HDD - Entry	Excavators	1	3.60	162	0.38
HDD - Entry	Forklifts	0	6.00	89	0.20
HDD - Entry	Generator Sets	1	7.50	84	0.74
HDD - Entry	Other Construction Equipment	1	1.90	150	0.50
HDD - Entry	Pumps	1	7.50	84	0.74
HDD - Entry	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Excavators	1	3.60	162	0.38
Paving - Open Trench	Cement and Mortar Mixers	1	8.00	9	0.56
Paving - Open Trench	Pavers	1	8.00	125	0.42
Paving - Open Trench	Paving Equipment	1	8.00	130	0.36
Paving - Open Trench	Rollers	1	8.00	80	0.38
Paving - Open Trench	Tractors/Loaders/Backhoes	1	8.00	97	0.37
HDD- Insertion	Cranes	1	11.10	226	0.29
HDD- Insertion	Forklifts	0	6.00	89	0.20
HDD- Insertion	Generator Sets	1	7.50	84	0.74
HDD- Insertion	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Welders	1	0.90	85	0.50
HDD- Insertion	Pumps	1	7.50	84	0.74
HDD - Entry	Welders	0	8.00	46	0.45
Bore and Jack	Graders	0	6.00	174	0.41
5th St Abandonment	Graders	0	6.00	174	0.41
Alice Webster Abandonment	Graders	0	6.00	174	0.41
Bore and Jack	Rubber Tired Dozers	0	6.00	255	0.40

5th St Abandonment	Rubber Tired Dozers	0	6.00	255	0.40
Alice Webster Abandonment	Rubber Tired Dozers	0	6.00	255	0.40
Bore and Jack	Tractors/Loaders/Backhoes	1	8.00	97	0.37
5th St Abandonment	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Alice Webster Abandonment	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Bore and Jack	Excavators	1	8.00	162	0.38
Bore and Jack	Pumps	2	8.00	50	0.74
Bore and Jack	Bore/Drill Rigs	1	8.00	205	0.50
5th St Abandonment	Concrete/Industrial Saws	1	8.00	81	0.73
5th St Abandonment	Excavators	1	8.00	162	0.38
5th St Abandonment	Pumps	2	16.00	50	0.74
5th St Abandonment	Generator Sets	1	8.00	84	0.74
5th St Abandonment	Welders	1	8.00	85	0.50
5th St Abandonment	Cement and Mortar Mixers	1	8.00	9	0.56
Alice Webster Abandonment	Concrete/Industrial Saws	1	8.00	81	0.73
Alice Webster Abandonment	Excavators	1	8.00	162	0.38
Alice Webster Abandonment	Pumps	2	16.00	50	0.74
Alice Webster Abandonment	Generator Sets	1	8.00	84	0.74
Alice Webster Abandonment	Welders	1	8.00	85	0.50
Alice Webster Abandonment	Cement and Mortar Mixers	1	8.00	9	0.56

### Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition - Open Trench	3	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading/Excavation - Open Trench	4	19.00	0.00	2,997.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
HDD - Entry	8	25.00	0.00	48.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving - Open Trench	5	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
HDD- Insertion	6	25.00	0.00	48.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Bore and Jack	5	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

5th St Abandonment	8	11.00	0.00	8.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Alice Webster Abandonment	8	11.00	0.00	8.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

### 3.1 Mitigation Measures Construction

### 3.2 Demolition - Open Trench - 2018

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0151	0.1371	0.1242	1.8000e-004		9.6200e-003	9.6200e-003		9.0500e-003	9.0500e-003	0.0000	15.8901	15.8901	3.7500e-003	0.0000	15.9689
<b>Total</b>	<b>0.0151</b>	<b>0.1371</b>	<b>0.1242</b>	<b>1.8000e-004</b>		<b>9.6200e-003</b>	<b>9.6200e-003</b>		<b>9.0500e-003</b>	<b>9.0500e-003</b>	<b>0.0000</b>	<b>15.8901</b>	<b>15.8901</b>	<b>3.7500e-003</b>	<b>0.0000</b>	<b>15.9689</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.4000e-004	8.2000e-004	7.8200e-003	2.0000e-005	1.6400e-003	1.0000e-005	1.6500e-003	4.4000e-004	1.0000e-005	4.5000e-004	0.0000	1.3803	1.3803	7.0000e-005	0.0000	1.3818
<b>Total</b>	<b>5.4000e-004</b>	<b>8.2000e-004</b>	<b>7.8200e-003</b>	<b>2.0000e-005</b>	<b>1.6400e-003</b>	<b>1.0000e-005</b>	<b>1.6500e-003</b>	<b>4.4000e-004</b>	<b>1.0000e-005</b>	<b>4.5000e-004</b>	<b>0.0000</b>	<b>1.3803</b>	<b>1.3803</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.3818</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0151	0.1371	0.1242	1.8000e-004		9.6200e-003	9.6200e-003		9.0500e-003	9.0500e-003	0.0000	15.8901	15.8901	3.7500e-003	0.0000	15.9688
<b>Total</b>	<b>0.0151</b>	<b>0.1371</b>	<b>0.1242</b>	<b>1.8000e-004</b>		<b>9.6200e-003</b>	<b>9.6200e-003</b>		<b>9.0500e-003</b>	<b>9.0500e-003</b>	<b>0.0000</b>	<b>15.8901</b>	<b>15.8901</b>	<b>3.7500e-003</b>	<b>0.0000</b>	<b>15.9688</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.4000e-004	8.2000e-004	7.8200e-003	2.0000e-005	1.6400e-003	1.0000e-005	1.6500e-003	4.4000e-004	1.0000e-005	4.5000e-004	0.0000	1.3803	1.3803	7.0000e-005	0.0000	1.3818
<b>Total</b>	<b>5.4000e-004</b>	<b>8.2000e-004</b>	<b>7.8200e-003</b>	<b>2.0000e-005</b>	<b>1.6400e-003</b>	<b>1.0000e-005</b>	<b>1.6500e-003</b>	<b>4.4000e-004</b>	<b>1.0000e-005</b>	<b>4.5000e-004</b>	<b>0.0000</b>	<b>1.3803</b>	<b>1.3803</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.3818</b>

**3.3 Grading/Excavation - Open Trench - 2018**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
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Category	tons/yr										MT/yr					
Fugitive Dust					1.9400e-003	0.0000	1.9400e-003	2.7000e-004	0.0000	2.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1797	0.8999	0.8929	1.4000e-003		0.0541	0.0541		0.0534	0.0534	0.0000	107.2455	107.2455	0.0195	0.0000	107.6558
<b>Total</b>	<b>0.1797</b>	<b>0.8999</b>	<b>0.8929</b>	<b>1.4000e-003</b>	<b>1.9400e-003</b>	<b>0.0541</b>	<b>0.0560</b>	<b>2.7000e-004</b>	<b>0.0534</b>	<b>0.0537</b>	<b>0.0000</b>	<b>107.2455</b>	<b>107.2455</b>	<b>0.0195</b>	<b>0.0000</b>	<b>107.6558</b>

**Unmitigated Construction Off-Site**

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0278	0.3282	0.3114	1.0100e-003	0.0246	4.6000e-003	0.0292	6.7100e-003	4.2300e-003	0.0110	0.0000	89.5169	89.5169	6.7000e-004	0.0000	89.5309
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.9100e-003	0.0105	0.0996	2.5000e-004	0.0209	1.6000e-004	0.0210	5.5500e-003	1.5000e-004	5.7000e-003	0.0000	17.5803	17.5803	9.0000e-004	0.0000	17.5992
<b>Total</b>	<b>0.0348</b>	<b>0.3387</b>	<b>0.4110</b>	<b>1.2600e-003</b>	<b>0.0455</b>	<b>4.7600e-003</b>	<b>0.0503</b>	<b>0.0123</b>	<b>4.3800e-003</b>	<b>0.0167</b>	<b>0.0000</b>	<b>107.0972</b>	<b>107.0972</b>	<b>1.5700e-003</b>	<b>0.0000</b>	<b>107.1301</b>

**Mitigated Construction On-Site**

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.9400e-003	0.0000	1.9400e-003	2.7000e-004	0.0000	2.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1797	0.8999	0.8929	1.4000e-003		0.0541	0.0541		0.0534	0.0534	0.0000	107.2454	107.2454	0.0195	0.0000	107.6557

<b>Total</b>	<b>0.1797</b>	<b>0.8999</b>	<b>0.8929</b>	<b>1.4000e-003</b>	<b>1.9400e-003</b>	<b>0.0541</b>	<b>0.0560</b>	<b>2.7000e-004</b>	<b>0.0534</b>	<b>0.0537</b>	<b>0.0000</b>	<b>107.2454</b>	<b>107.2454</b>	<b>0.0195</b>	<b>0.0000</b>	<b>107.6557</b>
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### Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0278	0.3282	0.3114	1.0100e-003	0.0246	4.6000e-003	0.0292	6.7100e-003	4.2300e-003	0.0110	0.0000	89.5169	89.5169	6.7000e-004	0.0000	89.5309
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.9100e-003	0.0105	0.0996	2.5000e-004	0.0209	1.6000e-004	0.0210	5.5500e-003	1.5000e-004	5.7000e-003	0.0000	17.5803	17.5803	9.0000e-004	0.0000	17.5992
<b>Total</b>	<b>0.0348</b>	<b>0.3387</b>	<b>0.4110</b>	<b>1.2600e-003</b>	<b>0.0455</b>	<b>4.7600e-003</b>	<b>0.0503</b>	<b>0.0123</b>	<b>4.3800e-003</b>	<b>0.0167</b>	<b>0.0000</b>	<b>107.0972</b>	<b>107.0972</b>	<b>1.5700e-003</b>	<b>0.0000</b>	<b>107.1301</b>

### **3.3 Grading/Excavation - Open Trench - 2019**

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.9400e-003	0.0000	1.9400e-003	2.7000e-004	0.0000	2.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0182	0.0990	0.1010	1.6000e-004		5.4700e-003	5.4700e-003		5.4100e-003	5.4100e-003	0.0000	12.3710	12.3710	2.0600e-003	0.0000	12.4144
<b>Total</b>	<b>0.0182</b>	<b>0.0990</b>	<b>0.1010</b>	<b>1.6000e-004</b>	<b>1.9400e-003</b>	<b>5.4700e-003</b>	<b>7.4100e-003</b>	<b>2.7000e-004</b>	<b>5.4100e-003</b>	<b>5.6800e-003</b>	<b>0.0000</b>	<b>12.3710</b>	<b>12.3710</b>	<b>2.0600e-003</b>	<b>0.0000</b>	<b>12.4144</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.0200e-003	0.0349	0.0345	1.2000e-004	0.0196	5.3000e-004	0.0201	4.8900e-003	4.8000e-004	5.3700e-003	0.0000	10.1782	10.1782	8.0000e-005	0.0000	10.1798
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.3000e-004	1.1000e-003	0.0105	3.0000e-005	2.4100e-003	2.0000e-005	2.4300e-003	6.4000e-004	2.0000e-005	6.6000e-004	0.0000	1.9611	1.9611	1.0000e-004	0.0000	1.9631
<b>Total</b>	<b>3.7500e-003</b>	<b>0.0360</b>	<b>0.0449</b>	<b>1.5000e-004</b>	<b>0.0220</b>	<b>5.5000e-004</b>	<b>0.0226</b>	<b>5.5300e-003</b>	<b>5.0000e-004</b>	<b>6.0300e-003</b>	<b>0.0000</b>	<b>12.1392</b>	<b>12.1392</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>12.1429</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.9400e-003	0.0000	1.9400e-003	2.7000e-004	0.0000	2.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0182	0.0990	0.1010	1.6000e-004		5.4700e-003	5.4700e-003		5.4100e-003	5.4100e-003	0.0000	12.3710	12.3710	2.0600e-003	0.0000	12.4144
<b>Total</b>	<b>0.0182</b>	<b>0.0990</b>	<b>0.1010</b>	<b>1.6000e-004</b>	<b>1.9400e-003</b>	<b>5.4700e-003</b>	<b>7.4100e-003</b>	<b>2.7000e-004</b>	<b>5.4100e-003</b>	<b>5.6800e-003</b>	<b>0.0000</b>	<b>12.3710</b>	<b>12.3710</b>	<b>2.0600e-003</b>	<b>0.0000</b>	<b>12.4144</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	3.0200e-003	0.0349	0.0345	1.2000e-004	0.0196	5.3000e-004	0.0201	4.8900e-003	4.8000e-004	5.3700e-003	0.0000	10.1782	10.1782	8.0000e-005	0.0000	10.1798
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.3000e-004	1.1000e-003	0.0105	3.0000e-005	2.4100e-003	2.0000e-005	2.4300e-003	6.4000e-004	2.0000e-005	6.6000e-004	0.0000	1.9611	1.9611	1.0000e-004	0.0000	1.9631
<b>Total</b>	<b>3.7500e-003</b>	<b>0.0360</b>	<b>0.0449</b>	<b>1.5000e-004</b>	<b>0.0220</b>	<b>5.5000e-004</b>	<b>0.0226</b>	<b>5.5300e-003</b>	<b>5.0000e-004</b>	<b>6.0300e-003</b>	<b>0.0000</b>	<b>12.1392</b>	<b>12.1392</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>12.1429</b>

### 3.4 Bore and Jack - 2018

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0211	0.1547	0.1337	2.6000e-004	7.9900e-003	7.9900e-003		7.6300e-003	7.6300e-003		0.0000	22.3458	22.3458	5.8900e-003	0.0000	22.4696
<b>Total</b>	<b>0.0211</b>	<b>0.1547</b>	<b>0.1337</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>7.9900e-003</b>	<b>7.9900e-003</b>	<b>0.0000</b>	<b>7.6300e-003</b>	<b>7.6300e-003</b>	<b>0.0000</b>	<b>22.3458</b>	<b>22.3458</b>	<b>5.8900e-003</b>	<b>0.0000</b>	<b>22.4696</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.7000e-004	8.6000e-004	8.2300e-003	2.0000e-005	1.7200e-003	1.0000e-005	1.7400e-003	4.6000e-004	1.0000e-005	4.7000e-004	0.0000	1.4529	1.4529	7.0000e-005	0.0000	1.4545
<b>Total</b>	<b>5.7000e-004</b>	<b>8.6000e-004</b>	<b>8.2300e-003</b>	<b>2.0000e-005</b>	<b>1.7200e-003</b>	<b>1.0000e-005</b>	<b>1.7400e-003</b>	<b>4.6000e-004</b>	<b>1.0000e-005</b>	<b>4.7000e-004</b>	<b>0.0000</b>	<b>1.4529</b>	<b>1.4529</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.4545</b>



**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0211	0.1547	0.1337	2.6000e-004		7.9900e-003	7.9900e-003		7.6300e-003	7.6300e-003	0.0000	22.3458	22.3458	5.8900e-003	0.0000	22.4695
<b>Total</b>	<b>0.0211</b>	<b>0.1547</b>	<b>0.1337</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>7.9900e-003</b>	<b>7.9900e-003</b>	<b>0.0000</b>	<b>7.6300e-003</b>	<b>7.6300e-003</b>	<b>0.0000</b>	<b>22.3458</b>	<b>22.3458</b>	<b>5.8900e-003</b>	<b>0.0000</b>	<b>22.4695</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.7000e-004	8.6000e-004	8.2300e-003	2.0000e-005	1.7200e-003	1.0000e-005	1.7400e-003	4.6000e-004	1.0000e-005	4.7000e-004	0.0000	1.4529	1.4529	7.0000e-005	0.0000	1.4545
<b>Total</b>	<b>5.7000e-004</b>	<b>8.6000e-004</b>	<b>8.2300e-003</b>	<b>2.0000e-005</b>	<b>1.7200e-003</b>	<b>1.0000e-005</b>	<b>1.7400e-003</b>	<b>4.6000e-004</b>	<b>1.0000e-005</b>	<b>4.7000e-004</b>	<b>0.0000</b>	<b>1.4529</b>	<b>1.4529</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.4545</b>

**3.5 5th St Abandonment - 2018**

**Unmitigated Construction On-Site**



Off-Road	0.0115	0.0718	0.0692	1.1000e-004		4.5000e-003	4.5000e-003		4.4300e-003	4.4300e-003	0.0000	9.1198	9.1198	1.4100e-003	0.0000	9.1495
<b>Total</b>	<b>0.0115</b>	<b>0.0718</b>	<b>0.0692</b>	<b>1.1000e-004</b>	<b>0.0000</b>	<b>4.5000e-003</b>	<b>4.5000e-003</b>	<b>0.0000</b>	<b>4.4300e-003</b>	<b>4.4300e-003</b>	<b>0.0000</b>	<b>9.1198</b>	<b>9.1198</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>9.1495</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.0000e-005	9.8000e-004	9.3000e-004	0.0000	7.0000e-005	1.0000e-005	8.0000e-005	2.0000e-005	1.0000e-005	3.0000e-005	0.0000	0.2666	0.2666	0.0000	0.0000	0.2666
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.0000e-005	1.3000e-004	1.1900e-003	0.0000	2.5000e-004	0.0000	2.5000e-004	7.0000e-005	0.0000	7.0000e-005	0.0000	0.2103	0.2103	1.0000e-005	0.0000	0.2105
<b>Total</b>	<b>1.6000e-004</b>	<b>1.1100e-003</b>	<b>2.1200e-003</b>	<b>0.0000</b>	<b>3.2000e-004</b>	<b>1.0000e-005</b>	<b>3.3000e-004</b>	<b>9.0000e-005</b>	<b>1.0000e-005</b>	<b>1.0000e-004</b>	<b>0.0000</b>	<b>0.4769</b>	<b>0.4769</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.4772</b>

**3.6 Alice Webster Abandonment - 2018**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0231	0.1437	0.1385	2.2000e-004		8.9900e-003	8.9900e-003		8.8600e-003	8.8600e-003	0.0000	18.2516	18.2516	2.8300e-003	0.0000	18.3111
<b>Total</b>	<b>0.0231</b>	<b>0.1437</b>	<b>0.1385</b>	<b>2.2000e-004</b>	<b>0.0000</b>	<b>8.9900e-003</b>	<b>8.9900e-003</b>	<b>0.0000</b>	<b>8.8600e-003</b>	<b>8.8600e-003</b>	<b>0.0000</b>	<b>18.2516</b>	<b>18.2516</b>	<b>2.8300e-003</b>	<b>0.0000</b>	<b>18.3111</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.0000e-005	9.8000e-004	9.3000e-004	0.0000	7.0000e-005	1.0000e-005	8.0000e-005	2.0000e-005	1.0000e-005	3.0000e-005	0.0000	0.2666	0.2666	0.0000	0.0000	0.2666
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	2.5000e-004	2.3800e-003	1.0000e-005	5.0000e-004	0.0000	5.0000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.4206	0.4206	2.0000e-005	0.0000	0.4210
<b>Total</b>	<b>2.5000e-004</b>	<b>1.2300e-003</b>	<b>3.3100e-003</b>	<b>1.0000e-005</b>	<b>5.7000e-004</b>	<b>1.0000e-005</b>	<b>5.8000e-004</b>	<b>1.5000e-004</b>	<b>1.0000e-005</b>	<b>1.7000e-004</b>	<b>0.0000</b>	<b>0.6872</b>	<b>0.6872</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.6877</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0231	0.1437	0.1385	2.2000e-004		8.9900e-003	8.9900e-003		8.8600e-003	8.8600e-003	0.0000	18.2516	18.2516	2.8300e-003	0.0000	18.3111
<b>Total</b>	<b>0.0231</b>	<b>0.1437</b>	<b>0.1385</b>	<b>2.2000e-004</b>	<b>0.0000</b>	<b>8.9900e-003</b>	<b>8.9900e-003</b>	<b>0.0000</b>	<b>8.8600e-003</b>	<b>8.8600e-003</b>	<b>0.0000</b>	<b>18.2516</b>	<b>18.2516</b>	<b>2.8300e-003</b>	<b>0.0000</b>	<b>18.3111</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	8.0000e-005	9.8000e-004	9.3000e-004	0.0000	7.0000e-005	1.0000e-005	8.0000e-005	2.0000e-005	1.0000e-005	3.0000e-005	0.0000	0.2666	0.2666	0.0000	0.0000	0.2666
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	2.5000e-004	2.3800e-003	1.0000e-005	5.0000e-004	0.0000	5.0000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.4206	0.4206	2.0000e-005	0.0000	0.4210
<b>Total</b>	<b>2.5000e-004</b>	<b>1.2300e-003</b>	<b>3.3100e-003</b>	<b>1.0000e-005</b>	<b>5.7000e-004</b>	<b>1.0000e-005</b>	<b>5.8000e-004</b>	<b>1.5000e-004</b>	<b>1.0000e-005</b>	<b>1.7000e-004</b>	<b>0.0000</b>	<b>0.6872</b>	<b>0.6872</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.6877</b>

### 3.7 HDD - Entry - 2019

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1712	1.7144	1.2349	2.3500e-003		0.0880	0.0880		0.0840	0.0840	0.0000	206.1720	206.1720	0.0415	0.0000	207.0436
<b>Total</b>	<b>0.1712</b>	<b>1.7144</b>	<b>1.2349</b>	<b>2.3500e-003</b>		<b>0.0880</b>	<b>0.0880</b>		<b>0.0840</b>	<b>0.0840</b>	<b>0.0000</b>	<b>206.1720</b>	<b>206.1720</b>	<b>0.0415</b>	<b>0.0000</b>	<b>207.0436</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.7000e-004	5.3900e-003	5.3300e-003	2.0000e-005	4.0000e-004	8.0000e-005	4.9000e-004	1.1000e-004	7.0000e-005	1.9000e-004	0.0000	1.5719	1.5719	1.0000e-005	0.0000	1.5722
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0100e-003	9.1200e-003	0.0865	2.4000e-004	0.0200	1.5000e-004	0.0201	5.3100e-003	1.4000e-004	5.4500e-003	0.0000	16.2193	16.2193	8.0000e-004	0.0000	16.2361
<b>Total</b>	<b>6.4800e-003</b>	<b>0.0145</b>	<b>0.0918</b>	<b>2.6000e-004</b>	<b>0.0204</b>	<b>2.3000e-004</b>	<b>0.0206</b>	<b>5.4200e-003</b>	<b>2.1000e-004</b>	<b>5.6400e-003</b>	<b>0.0000</b>	<b>17.7912</b>	<b>17.7912</b>	<b>8.1000e-004</b>	<b>0.0000</b>	<b>17.8083</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1712	1.7144	1.2349	2.3500e-003		0.0880	0.0880		0.0840	0.0840	0.0000	206.1717	206.1717	0.0415	0.0000	207.0434
<b>Total</b>	<b>0.1712</b>	<b>1.7144</b>	<b>1.2349</b>	<b>2.3500e-003</b>		<b>0.0880</b>	<b>0.0880</b>		<b>0.0840</b>	<b>0.0840</b>	<b>0.0000</b>	<b>206.1717</b>	<b>206.1717</b>	<b>0.0415</b>	<b>0.0000</b>	<b>207.0434</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.7000e-004	5.3900e-003	5.3300e-003	2.0000e-005	4.0000e-004	8.0000e-005	4.9000e-004	1.1000e-004	7.0000e-005	1.9000e-004	0.0000	1.5719	1.5719	1.0000e-005	0.0000	1.5722
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0100e-003	9.1200e-003	0.0865	2.4000e-004	0.0200	1.5000e-004	0.0201	5.3100e-003	1.4000e-004	5.4500e-003	0.0000	16.2193	16.2193	8.0000e-004	0.0000	16.2361
<b>Total</b>	<b>6.4800e-003</b>	<b>0.0145</b>	<b>0.0918</b>	<b>2.6000e-004</b>	<b>0.0204</b>	<b>2.3000e-004</b>	<b>0.0206</b>	<b>5.4200e-003</b>	<b>2.1000e-004</b>	<b>5.6400e-003</b>	<b>0.0000</b>	<b>17.7912</b>	<b>17.7912</b>	<b>8.1000e-004</b>	<b>0.0000</b>	<b>17.8083</b>

**3.8 HDD- Insertion - 2019**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1592	1.5741	1.1436	2.1500e-003		0.0820	0.0820		0.0786	0.0786	0.0000	188.8620	188.8620	0.0354	0.0000	189.6057
<b>Total</b>	<b>0.1592</b>	<b>1.5741</b>	<b>1.1436</b>	<b>2.1500e-003</b>		<b>0.0820</b>	<b>0.0820</b>		<b>0.0786</b>	<b>0.0786</b>	<b>0.0000</b>	<b>188.8620</b>	<b>188.8620</b>	<b>0.0354</b>	<b>0.0000</b>	<b>189.6057</b>

### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.7000e-004	5.3900e-003	5.3300e-003	2.0000e-005	4.0000e-004	8.0000e-005	4.9000e-004	1.1000e-004	7.0000e-005	1.9000e-004	0.0000	1.5719	1.5719	1.0000e-005	0.0000	1.5722
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0100e-003	9.1200e-003	0.0865	2.4000e-004	0.0200	1.5000e-004	0.0201	5.3100e-003	1.4000e-004	5.4500e-003	0.0000	16.2193	16.2193	8.0000e-004	0.0000	16.2361
<b>Total</b>	<b>6.4800e-003</b>	<b>0.0145</b>	<b>0.0918</b>	<b>2.6000e-004</b>	<b>0.0204</b>	<b>2.3000e-004</b>	<b>0.0206</b>	<b>5.4200e-003</b>	<b>2.1000e-004</b>	<b>5.6400e-003</b>	<b>0.0000</b>	<b>17.7912</b>	<b>17.7912</b>	<b>8.1000e-004</b>	<b>0.0000</b>	<b>17.8083</b>

### Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1592	1.5741	1.1436	2.1500e-003		0.0820	0.0820		0.0786	0.0786	0.0000	188.8618	188.8618	0.0354	0.0000	189.6055

<b>Total</b>	<b>0.1592</b>	<b>1.5741</b>	<b>1.1436</b>	<b>2.1500e-003</b>		<b>0.0820</b>	<b>0.0820</b>		<b>0.0786</b>	<b>0.0786</b>	<b>0.0000</b>	<b>188.8618</b>	<b>188.8618</b>	<b>0.0354</b>	<b>0.0000</b>	<b>189.6055</b>
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**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.7000e-004	5.3900e-003	5.3300e-003	2.0000e-005	4.0000e-004	8.0000e-005	4.9000e-004	1.1000e-004	7.0000e-005	1.9000e-004	0.0000	1.5719	1.5719	1.0000e-005	0.0000	1.5722
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0100e-003	9.1200e-003	0.0865	2.4000e-004	0.0200	1.5000e-004	0.0201	5.3100e-003	1.4000e-004	5.4500e-003	0.0000	16.2193	16.2193	8.0000e-004	0.0000	16.2361
<b>Total</b>	<b>6.4800e-003</b>	<b>0.0145</b>	<b>0.0918</b>	<b>2.6000e-004</b>	<b>0.0204</b>	<b>2.3000e-004</b>	<b>0.0206</b>	<b>5.4200e-003</b>	<b>2.1000e-004</b>	<b>5.6400e-003</b>	<b>0.0000</b>	<b>17.7912</b>	<b>17.7912</b>	<b>8.1000e-004</b>	<b>0.0000</b>	<b>17.8083</b>

**3.9 Paving - Open Trench - 2019**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.5400e-003	0.0967	0.0930	1.4000e-004		5.4600e-003	5.4600e-003		5.0400e-003	5.0400e-003	0.0000	12.6046	12.6046	3.9000e-003	0.0000	12.6864
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>9.5400e-003</b>	<b>0.0967</b>	<b>0.0930</b>	<b>1.4000e-004</b>		<b>5.4600e-003</b>	<b>5.4600e-003</b>		<b>5.0400e-003</b>	<b>5.0400e-003</b>	<b>0.0000</b>	<b>12.6046</b>	<b>12.6046</b>	<b>3.9000e-003</b>	<b>0.0000</b>	<b>12.6864</b>

**Unmitigated Construction Off-Site**



	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.9000e-004	7.5000e-004	7.0900e-003	2.0000e-005	1.6400e-003	1.0000e-005	1.6500e-003	4.4000e-004	1.0000e-005	4.5000e-004	0.0000	1.3307	1.3307	7.0000e-005	0.0000	1.3321
<b>Total</b>	<b>4.9000e-004</b>	<b>7.5000e-004</b>	<b>7.0900e-003</b>	<b>2.0000e-005</b>	<b>1.6400e-003</b>	<b>1.0000e-005</b>	<b>1.6500e-003</b>	<b>4.4000e-004</b>	<b>1.0000e-005</b>	<b>4.5000e-004</b>	<b>0.0000</b>	<b>1.3307</b>	<b>1.3307</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.3321</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.5400e-003	0.0967	0.0930	1.4000e-004		5.4600e-003	5.4600e-003		5.0400e-003	5.0400e-003	0.0000	12.6046	12.6046	3.9000e-003	0.0000	12.6864
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>9.5400e-003</b>	<b>0.0967</b>	<b>0.0930</b>	<b>1.4000e-004</b>		<b>5.4600e-003</b>	<b>5.4600e-003</b>		<b>5.0400e-003</b>	<b>5.0400e-003</b>	<b>0.0000</b>	<b>12.6046</b>	<b>12.6046</b>	<b>3.9000e-003</b>	<b>0.0000</b>	<b>12.6864</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.9000e-004	7.5000e-004	7.0900e-003	2.0000e-005	1.6400e-003	1.0000e-005	1.6500e-003	4.4000e-004	1.0000e-005	4.5000e-004	0.0000	1.3307	1.3307	7.0000e-005	0.0000	1.3321
<b>Total</b>	<b>4.9000e-004</b>	<b>7.5000e-004</b>	<b>7.0900e-003</b>	<b>2.0000e-005</b>	<b>1.6400e-003</b>	<b>1.0000e-005</b>	<b>1.6500e-003</b>	<b>4.4000e-004</b>	<b>1.0000e-005</b>	<b>4.5000e-004</b>	<b>0.0000</b>	<b>1.3307</b>	<b>1.3307</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.3321</b>

## Alameda Pipeline, Crossing 2 Alameda County, Annual

### 1.0 Project Characteristics

#### 1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	0.50	0.00	0

#### 1.2 Other Project Characteristics

<b>Urbanization</b>	Urban	<b>Wind Speed (m/s)</b>	2.2	<b>Precipitation Freq (Days)</b>	63
<b>Climate Zone</b>	5			<b>Operational Year</b>	2014
<b>Utility Company</b>	Pacific Gas & Electric Company				
<b>CO2 Intensity (lb/MWhr)</b>	641.35	<b>CH4 Intensity (lb/MWhr)</b>	0.029	<b>N2O Intensity (lb/MWhr)</b>	0.006

#### 1.3 User Entered Comments & Non-Default Data

Land Use - Lot acreage from construction data request sheet

Construction Phase - Schedule based on 2021 start date, up to 18 months construction, and anticipated work days provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - HDD: 615cy hauling @ 16cy/truck = 78 one-way trips. 19 trench workers, 25 HDD workers, 11 abandonment.

Grading - 3,692 cy import, 5,064 cy export during Open Trench, 178 cy during Abandonment.

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	10.00	8.00
tblConstructionPhase	NumDays	2.00	204.00
tblConstructionPhase	NumDays	2.00	20.00
tblConstructionPhase	NumDays	2.00	10.00
tblConstructionPhase	NumDays	5.00	8.00
tblConstructionPhase	PhaseEndDate	9/29/2021	6/28/2022
tblConstructionPhase	PhaseEndDate	3/1/2023	6/28/2022
tblConstructionPhase	PhaseEndDate	11/22/2021	2/9/2021
tblConstructionPhase	PhaseEndDate	2/23/2021	1/26/2021
tblConstructionPhase	PhaseStartDate	1/27/2021	10/26/2021
tblConstructionPhase	PhaseStartDate	6/29/2022	10/26/2021
tblConstructionPhase	PhaseStartDate	10/26/2021	1/13/2021
tblConstructionPhase	PhaseStartDate	2/10/2021	1/13/2021
tblGrading	AcresOfGrading	0.00	0.50
tblGrading	MaterialExported	0.00	5,064.00
tblGrading	MaterialExported	0.00	178.00
tblGrading	MaterialImported	0.00	3,692.00
tblLandUse	LotAcreage	0.00	0.50
tblOffRoadEquipment	HorsePower	171.00	150.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	LoadFactor	0.42	0.50
tblOffRoadEquipment	LoadFactor	0.45	0.50

tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	6.00	16.00
tblOffRoadEquipment	UsageHours	6.00	0.90
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblTripsAndVMT	HaulingTripNumber	0.00	39.00
tblTripsAndVMT	HaulingTripNumber	0.00	39.00
tblTripsAndVMT	WorkerTripNumber	8.00	19.00
tblTripsAndVMT	WorkerTripNumber	10.00	19.00

tblTripsAndVMT	WorkerTripNumber	13.00	19.00
tblTripsAndVMT	WorkerTripNumber	38.00	11.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00

## 2.0 Emissions Summary

### 2.1 Overall Construction

#### Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.1998	1.5790	1.6746	3.4300e-003	0.0424	0.0723	0.1146	0.0112	0.0698	0.0810	0.0000	278.2365	278.2365	0.0407	0.0000	279.0905
2022	0.1884	1.7658	1.7764	3.6800e-003	0.0301	0.0828	0.1129	8.0100e-003	0.0791	0.0871	0.0000	311.1475	311.1475	0.0560	0.0000	312.3235
<b>Total</b>	<b>0.3882</b>	<b>3.3448</b>	<b>3.4510</b>	<b>7.1100e-003</b>	<b>0.0725</b>	<b>0.1550</b>	<b>0.2275</b>	<b>0.0193</b>	<b>0.1489</b>	<b>0.1681</b>	<b>0.0000</b>	<b>589.3840</b>	<b>589.3840</b>	<b>0.0967</b>	<b>0.0000</b>	<b>591.4140</b>

#### Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.1998	1.5790	1.6746	3.4300e-003	0.0424	0.0723	0.1146	0.0112	0.0698	0.0810	0.0000	278.2362	278.2362	0.0407	0.0000	279.0902
2022	0.1884	1.7658	1.7764	3.6800e-003	0.0301	0.0828	0.1129	8.0100e-003	0.0791	0.0871	0.0000	311.1472	311.1472	0.0560	0.0000	312.3232

Total	0.3882	3.3448	3.4510	7.1100e-003	0.0725	0.1550	0.2275	0.0193	0.1489	0.1681	0.0000	589.3834	589.3834	0.0967	0.0000	591.4134
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	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

### 3.0 Construction Detail

#### Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition - Open Trench	Demolition	1/1/2021	1/12/2021	5	8	
2	Grading/Excavation - Open Trench	Grading	1/13/2021	10/25/2021	5	204	
3	Bore and Jack	Grading	1/13/2021	2/9/2021	5	20	
4	2 Abandonments - BF11 and 2	Grading	1/13/2021	1/26/2021	5	10	
5	HDD - Entry	Building Construction	10/26/2021	6/28/2022	5	176	
6	HDD- Insertion	Building Construction	10/26/2021	6/28/2022	5	176	
7	Paving - Open Trench	Paving	6/29/2022	7/8/2022	5	8	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

#### OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition - Open Trench	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40
Demolition - Open Trench	Tractors/Loaders/Backhoes	2	16.00	97	0.37
Grading/Excavation - Open Trench	Concrete/Industrial Saws	0	8.00	81	0.73
Grading/Excavation - Open Trench	Excavators	1	0.90	162	0.38

Grading/Excavation - Open Trench	Pumps	2	4.50	50	0.74
Grading/Excavation - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40
Grading/Excavation - Open Trench	Tractors/Loaders/Backhoes	1	0.90	97	0.37
Bore and Jack	Bore/Drill Rigs	1	8.00	205	0.50
Bore and Jack	Concrete/Industrial Saws	0	8.00	81	0.73
Bore and Jack	Excavators	1	8.00	162	0.38
Bore and Jack	Pumps	2	8.00	50	0.74
Bore and Jack	Rubber Tired Dozers	0	1.00	255	0.40
Bore and Jack	Tractors/Loaders/Backhoes	1	8.00	97	0.37
2 Abandonments - BF11 and 2	Cement and Mortar Mixers	2	8.00	9	0.56
2 Abandonments - BF11 and 2	Concrete/Industrial Saws	1	8.00	81	0.73
2 Abandonments - BF11 and 2	Excavators	2	8.00	162	0.38
2 Abandonments - BF11 and 2	Generator Sets	2	8.00	84	0.74
2 Abandonments - BF11 and 2	Pumps	4	16.00	50	0.74
2 Abandonments - BF11 and 2	Rubber Tired Dozers	0	1.00	255	0.40
2 Abandonments - BF11 and 2	Tractors/Loaders/Backhoes	2	8.00	97	0.37
2 Abandonments - BF11 and 2	Welders	2	8.00	85	0.50
HDD - Entry	Bore/Drill Rigs	1	0.90	205	0.50
HDD - Entry	Cement and Mortar Mixers	1	2.70	9	0.56
HDD - Entry	Cranes	1	11.10	226	0.29
HDD - Entry	Excavators	1	3.60	162	0.38
HDD - Entry	Forklifts	0	6.00	89	0.20
HDD - Entry	Generator Sets	1	7.50	84	0.74
HDD - Entry	Other Construction Equipment	1	1.90	150	0.50
HDD - Entry	Pumps	1	7.50	84	0.74
HDD - Entry	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Cranes	1	11.10	226	0.29
HDD- Insertion	Excavators	1	3.60	162	0.38
HDD- Insertion	Forklifts	0	6.00	89	0.20
HDD- Insertion	Generator Sets	1	7.50	84	0.74



HDD- Insertion	Pumps	1	7.50	84	0.74
HDD- Insertion	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Welders	1	0.90	85	0.50
Paving - Open Trench	Cement and Mortar Mixers	1	8.00	9	0.56
Paving - Open Trench	Pavers	1	8.00	125	0.42
Paving - Open Trench	Paving Equipment	1	8.00	130	0.36
Paving - Open Trench	Rollers	1	8.00	80	0.38
Paving - Open Trench	Tractors/Loaders/Backhoes	1	8.00	97	0.37

### Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition - Open Trench	3	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading/Excavation - Open Trench	4	19.00	0.00	1,095.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Bore and Jack	5	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
2 Abandonments - RE1 and 2	15	11.00	0.00	22.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
HDD - Entry	8	25.00	0.00	39.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
HDD- Insertion	6	25.00	0.00	39.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving - Open Trench	5	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

### 3.1 Mitigation Measures Construction

### 3.2 Demolition - Open Trench - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.5400e-003	0.0425	0.0509	7.0000e-005		2.4800e-003	2.4800e-003		2.3400e-003	2.3400e-003	0.0000	6.5182	6.5182	1.5400e-003	0.0000	6.5505

<b>Total</b>	<b>4.5400e-003</b>	<b>0.0425</b>	<b>0.0509</b>	<b>7.0000e-005</b>		<b>2.4800e-003</b>	<b>2.4800e-003</b>		<b>2.3400e-003</b>	<b>2.3400e-003</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>
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**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.8000e-004	2.7000e-004	2.5700e-003	1.0000e-005	6.9000e-004	1.0000e-005	7.0000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5284	0.5284	2.0000e-005	0.0000	0.5289
<b>Total</b>	<b>1.8000e-004</b>	<b>2.7000e-004</b>	<b>2.5700e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>7.0000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5284</b>	<b>0.5284</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5289</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.5400e-003	0.0425	0.0509	7.0000e-005		2.4800e-003	2.4800e-003		2.3400e-003	2.3400e-003	0.0000	6.5182	6.5182	1.5400e-003	0.0000	6.5505
<b>Total</b>	<b>4.5400e-003</b>	<b>0.0425</b>	<b>0.0509</b>	<b>7.0000e-005</b>		<b>2.4800e-003</b>	<b>2.4800e-003</b>		<b>2.3400e-003</b>	<b>2.3400e-003</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.8000e-004	2.7000e-004	2.5700e-003	1.0000e-005	6.9000e-004	1.0000e-005	7.0000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5284	0.5284	2.0000e-005	0.0000	0.5289
<b>Total</b>	<b>1.8000e-004</b>	<b>2.7000e-004</b>	<b>2.5700e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>7.0000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5284</b>	<b>0.5284</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5289</b>

### 3.3 Grading/Excavation - Open Trench - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					7.6000e-004	0.0000	7.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0551	0.3441	0.3714	6.2000e-004		0.0156	0.0156		0.0154	0.0154	0.0000	47.0768	47.0768	6.8200e-003	0.0000	47.2200
<b>Total</b>	<b>0.0551</b>	<b>0.3441</b>	<b>0.3714</b>	<b>6.2000e-004</b>	<b>7.6000e-004</b>	<b>0.0156</b>	<b>0.0164</b>	<b>1.0000e-004</b>	<b>0.0154</b>	<b>0.0155</b>	<b>0.0000</b>	<b>47.0768</b>	<b>47.0768</b>	<b>6.8200e-003</b>	<b>0.0000</b>	<b>47.2200</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	9.9500e-003	0.0883	0.1162	4.1000e-004	9.2400e-003	1.7900e-003	0.0110	2.5400e-003	1.6500e-003	4.1900e-003	0.0000	34.9716	34.9716	2.8000e-004	0.0000	34.9773
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.6500e-003	6.8900e-003	0.0655	2.1000e-004	0.0176	1.3000e-004	0.0177	4.6800e-003	1.2000e-004	4.8000e-003	0.0000	13.4745	13.4745	6.3000e-004	0.0000	13.4878
<b>Total</b>	<b>0.0146</b>	<b>0.0952</b>	<b>0.1817</b>	<b>6.2000e-004</b>	<b>0.0268</b>	<b>1.9200e-003</b>	<b>0.0288</b>	<b>7.2200e-003</b>	<b>1.7700e-003</b>	<b>8.9900e-003</b>	<b>0.0000</b>	<b>48.4461</b>	<b>48.4461</b>	<b>9.1000e-004</b>	<b>0.0000</b>	<b>48.4651</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					7.6000e-004	0.0000	7.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0551	0.3441	0.3714	6.2000e-004		0.0156	0.0156		0.0154	0.0154	0.0000	47.0768	47.0768	6.8200e-003	0.0000	47.2199
<b>Total</b>	<b>0.0551</b>	<b>0.3441</b>	<b>0.3714</b>	<b>6.2000e-004</b>	<b>7.6000e-004</b>	<b>0.0156</b>	<b>0.0164</b>	<b>1.0000e-004</b>	<b>0.0154</b>	<b>0.0155</b>	<b>0.0000</b>	<b>47.0768</b>	<b>47.0768</b>	<b>6.8200e-003</b>	<b>0.0000</b>	<b>47.2199</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.9500e-003	0.0883	0.1162	4.1000e-004	9.2400e-003	1.7900e-003	0.0110	2.5400e-003	1.6500e-003	4.1900e-003	0.0000	34.9716	34.9716	2.8000e-004	0.0000	34.9773
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.6500e-003	6.8900e-003	0.0655	2.1000e-004	0.0176	1.3000e-004	0.0177	4.6800e-003	1.2000e-004	4.8000e-003	0.0000	13.4745	13.4745	6.3000e-004	0.0000	13.4878
<b>Total</b>	<b>0.0146</b>	<b>0.0952</b>	<b>0.1817</b>	<b>6.2000e-004</b>	<b>0.0268</b>	<b>1.9200e-003</b>	<b>0.0288</b>	<b>7.2200e-003</b>	<b>1.7700e-003</b>	<b>8.9900e-003</b>	<b>0.0000</b>	<b>48.4461</b>	<b>48.4461</b>	<b>9.1000e-004</b>	<b>0.0000</b>	<b>48.4651</b>

### 3.4 Bore and Jack - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0154	0.1208	0.1289	2.6000e-004		5.3200e-003	5.3200e-003		5.0800e-003	5.0800e-003	0.0000	21.7860	21.7860	5.5800e-003	0.0000	21.9032
<b>Total</b>	<b>0.0154</b>	<b>0.1208</b>	<b>0.1289</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>5.3200e-003</b>	<b>5.3200e-003</b>	<b>0.0000</b>	<b>5.0800e-003</b>	<b>5.0800e-003</b>	<b>0.0000</b>	<b>21.7860</b>	<b>21.7860</b>	<b>5.5800e-003</b>	<b>0.0000</b>	<b>21.9032</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.6000e-004	6.8000e-004	6.4300e-003	2.0000e-005	1.7200e-003	1.0000e-005	1.7400e-003	4.6000e-004	1.0000e-005	4.7000e-004	0.0000	1.3210	1.3210	6.0000e-005	0.0000	1.3223
<b>Total</b>	<b>4.6000e-004</b>	<b>6.8000e-004</b>	<b>6.4300e-003</b>	<b>2.0000e-005</b>	<b>1.7200e-003</b>	<b>1.0000e-005</b>	<b>1.7400e-003</b>	<b>4.6000e-004</b>	<b>1.0000e-005</b>	<b>4.7000e-004</b>	<b>0.0000</b>	<b>1.3210</b>	<b>1.3210</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>1.3223</b>

#### Mitigated Construction On-Site



Off-Road	0.0309	0.2179	0.2483	4.2000e-004		0.0108	0.0108		0.0107	0.0107	0.0000	33.5027	33.5027	4.5500e-003	0.0000	33.5982
<b>Total</b>	<b>0.0309</b>	<b>0.2179</b>	<b>0.2483</b>	<b>4.2000e-004</b>	<b>1.0000e-005</b>	<b>0.0108</b>	<b>0.0108</b>	<b>0.0000</b>	<b>0.0107</b>	<b>0.0107</b>	<b>0.0000</b>	<b>33.5027</b>	<b>33.5027</b>	<b>4.5500e-003</b>	<b>0.0000</b>	<b>33.5982</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-004	1.7700e-003	2.3300e-003	1.0000e-005	1.9000e-004	4.0000e-005	2.2000e-004	5.0000e-005	3.0000e-005	8.0000e-005	0.0000	0.7026	0.7026	1.0000e-005	0.0000	0.7027
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	2.0000e-004	1.8600e-003	1.0000e-005	5.0000e-004	0.0000	5.0000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.3824	0.3824	2.0000e-005	0.0000	0.3828
<b>Total</b>	<b>3.3000e-004</b>	<b>1.9700e-003</b>	<b>4.1900e-003</b>	<b>2.0000e-005</b>	<b>6.9000e-004</b>	<b>4.0000e-005</b>	<b>7.2000e-004</b>	<b>1.8000e-004</b>	<b>3.0000e-005</b>	<b>2.2000e-004</b>	<b>0.0000</b>	<b>1.0850</b>	<b>1.0850</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>1.0855</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0309	0.2179	0.2483	4.2000e-004		0.0108	0.0108		0.0107	0.0107	0.0000	33.5026	33.5026	4.5500e-003	0.0000	33.5982
<b>Total</b>	<b>0.0309</b>	<b>0.2179</b>	<b>0.2483</b>	<b>4.2000e-004</b>	<b>1.0000e-005</b>	<b>0.0108</b>	<b>0.0108</b>	<b>0.0000</b>	<b>0.0107</b>	<b>0.0107</b>	<b>0.0000</b>	<b>33.5026</b>	<b>33.5026</b>	<b>4.5500e-003</b>	<b>0.0000</b>	<b>33.5982</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-004	1.7700e-003	2.3300e-003	1.0000e-005	1.9000e-004	4.0000e-005	2.2000e-004	5.0000e-005	3.0000e-005	8.0000e-005	0.0000	0.7026	0.7026	1.0000e-005	0.0000	0.7027
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	2.0000e-004	1.8600e-003	1.0000e-005	5.0000e-004	0.0000	5.0000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.3824	0.3824	2.0000e-005	0.0000	0.3828
<b>Total</b>	<b>3.3000e-004</b>	<b>1.9700e-003</b>	<b>4.1900e-003</b>	<b>2.0000e-005</b>	<b>6.9000e-004</b>	<b>4.0000e-005</b>	<b>7.2000e-004</b>	<b>1.8000e-004</b>	<b>3.0000e-005</b>	<b>2.2000e-004</b>	<b>0.0000</b>	<b>1.0850</b>	<b>1.0850</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>1.0855</b>

### 3.6 HDD - Entry - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0390	0.3902	0.3308	6.5000e-004		0.0186	0.0186		0.0178	0.0178	0.0000	56.7355	56.7355	0.0112	0.0000	56.9715
<b>Total</b>	<b>0.0390</b>	<b>0.3902</b>	<b>0.3308</b>	<b>6.5000e-004</b>		<b>0.0186</b>	<b>0.0186</b>		<b>0.0178</b>	<b>0.0178</b>	<b>0.0000</b>	<b>56.7355</b>	<b>56.7355</b>	<b>0.0112</b>	<b>0.0000</b>	<b>56.9715</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					



Hauling	1.0000e-004	8.8000e-004	1.1500e-003	0.0000	2.7000e-004	2.0000e-005	2.9000e-004	7.0000e-005	2.0000e-005	9.0000e-005	0.0000	0.3468	0.3468	0.0000	0.0000	0.3468
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4700e-003	2.1800e-003	0.0207	7.0000e-005	5.5600e-003	4.0000e-005	5.6000e-003	1.4800e-003	4.0000e-005	1.5200e-003	0.0000	4.2586	4.2586	2.0000e-004	0.0000	4.2628
<b>Total</b>	<b>1.5700e-003</b>	<b>3.0600e-003</b>	<b>0.0219</b>	<b>7.0000e-005</b>	<b>5.8300e-003</b>	<b>6.0000e-005</b>	<b>5.8900e-003</b>	<b>1.5500e-003</b>	<b>6.0000e-005</b>	<b>1.6100e-003</b>	<b>0.0000</b>	<b>4.6054</b>	<b>4.6054</b>	<b>2.0000e-004</b>	<b>0.0000</b>	<b>4.6096</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0390	0.3902	0.3308	6.5000e-004		0.0186	0.0186		0.0178	0.0178	0.0000	56.7354	56.7354	0.0112	0.0000	56.9714
<b>Total</b>	<b>0.0390</b>	<b>0.3902</b>	<b>0.3308</b>	<b>6.5000e-004</b>		<b>0.0186</b>	<b>0.0186</b>		<b>0.0178</b>	<b>0.0178</b>	<b>0.0000</b>	<b>56.7354</b>	<b>56.7354</b>	<b>0.0112</b>	<b>0.0000</b>	<b>56.9714</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-004	8.8000e-004	1.1500e-003	0.0000	2.7000e-004	2.0000e-005	2.9000e-004	7.0000e-005	2.0000e-005	9.0000e-005	0.0000	0.3468	0.3468	0.0000	0.0000	0.3468
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4700e-003	2.1800e-003	0.0207	7.0000e-005	5.5600e-003	4.0000e-005	5.6000e-003	1.4800e-003	4.0000e-005	1.5200e-003	0.0000	4.2586	4.2586	2.0000e-004	0.0000	4.2628
<b>Total</b>	<b>1.5700e-003</b>	<b>3.0600e-003</b>	<b>0.0219</b>	<b>7.0000e-005</b>	<b>5.8300e-003</b>	<b>6.0000e-005</b>	<b>5.8900e-003</b>	<b>1.5500e-003</b>	<b>6.0000e-005</b>	<b>1.6100e-003</b>	<b>0.0000</b>	<b>4.6054</b>	<b>4.6054</b>	<b>2.0000e-004</b>	<b>0.0000</b>	<b>4.6096</b>

### 3.6 HDD - Entry - 2022

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0920	0.8943	0.8465	1.7000e-003		0.0420	0.0420		0.0401	0.0401	0.0000	147.0665	147.0665	0.0289	0.0000	147.6734
<b>Total</b>	<b>0.0920</b>	<b>0.8943</b>	<b>0.8465</b>	<b>1.7000e-003</b>		<b>0.0420</b>	<b>0.0420</b>		<b>0.0401</b>	<b>0.0401</b>	<b>0.0000</b>	<b>147.0665</b>	<b>147.0665</b>	<b>0.0289</b>	<b>0.0000</b>	<b>147.6734</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.5000e-004	1.9800e-003	2.8800e-003	1.0000e-005	3.1000e-004	5.0000e-005	3.5000e-004	8.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8976	0.8976	1.0000e-005	0.0000	0.8978
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-003	5.2700e-003	0.0502	1.7000e-004	0.0144	1.1000e-004	0.0145	3.8300e-003	1.0000e-004	3.9300e-003	0.0000	10.8575	10.8575	4.9000e-004	0.0000	10.8678
<b>Total</b>	<b>3.8500e-003</b>	<b>7.2500e-003</b>	<b>0.0531</b>	<b>1.8000e-004</b>	<b>0.0147</b>	<b>1.6000e-004</b>	<b>0.0149</b>	<b>3.9100e-003</b>	<b>1.4000e-004</b>	<b>4.0500e-003</b>	<b>0.0000</b>	<b>11.7551</b>	<b>11.7551</b>	<b>5.0000e-004</b>	<b>0.0000</b>	<b>11.7656</b>

#### Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0920	0.8943	0.8465	1.7000e-003		0.0420	0.0420		0.0401	0.0401	0.0000	147.0663	147.0663	0.0289	0.0000	147.6732
<b>Total</b>	<b>0.0920</b>	<b>0.8943</b>	<b>0.8465</b>	<b>1.7000e-003</b>		<b>0.0420</b>	<b>0.0420</b>		<b>0.0401</b>	<b>0.0401</b>	<b>0.0000</b>	<b>147.0663</b>	<b>147.0663</b>	<b>0.0289</b>	<b>0.0000</b>	<b>147.6732</b>

### Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.5000e-004	1.9800e-003	2.8800e-003	1.0000e-005	3.1000e-004	5.0000e-005	3.5000e-004	8.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8976	0.8976	1.0000e-005	0.0000	0.8978
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-003	5.2700e-003	0.0502	1.7000e-004	0.0144	1.1000e-004	0.0145	3.8300e-003	1.0000e-004	3.9300e-003	0.0000	10.8575	10.8575	4.9000e-004	0.0000	10.8678
<b>Total</b>	<b>3.8500e-003</b>	<b>7.2500e-003</b>	<b>0.0531</b>	<b>1.8000e-004</b>	<b>0.0147</b>	<b>1.6000e-004</b>	<b>0.0149</b>	<b>3.9100e-003</b>	<b>1.4000e-004</b>	<b>4.0500e-003</b>	<b>0.0000</b>	<b>11.7551</b>	<b>11.7551</b>	<b>5.0000e-004</b>	<b>0.0000</b>	<b>11.7656</b>

### **3.7 HDD- Insertion - 2021**

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0362	0.3593	0.3058	6.0000e-004		0.0173	0.0173		0.0166	0.0166	0.0000	52.0261	52.0261	9.5200e-003	0.0000	52.2261

<b>Total</b>	<b>0.0362</b>	<b>0.3593</b>	<b>0.3058</b>	<b>6.0000e-004</b>		<b>0.0173</b>	<b>0.0173</b>		<b>0.0166</b>	<b>0.0166</b>	<b>0.0000</b>	<b>52.0261</b>	<b>52.0261</b>	<b>9.5200e-003</b>	<b>0.0000</b>	<b>52.2261</b>
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**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-004	8.8000e-004	1.1500e-003	0.0000	2.7000e-004	2.0000e-005	2.9000e-004	7.0000e-005	2.0000e-005	9.0000e-005	0.0000	0.3468	0.3468	0.0000	0.0000	0.3468
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4700e-003	2.1800e-003	0.0207	7.0000e-005	5.5600e-003	4.0000e-005	5.6000e-003	1.4800e-003	4.0000e-005	1.5200e-003	0.0000	4.2586	4.2586	2.0000e-004	0.0000	4.2628
<b>Total</b>	<b>1.5700e-003</b>	<b>3.0600e-003</b>	<b>0.0219</b>	<b>7.0000e-005</b>	<b>5.8300e-003</b>	<b>6.0000e-005</b>	<b>5.8900e-003</b>	<b>1.5500e-003</b>	<b>6.0000e-005</b>	<b>1.6100e-003</b>	<b>0.0000</b>	<b>4.6054</b>	<b>4.6054</b>	<b>2.0000e-004</b>	<b>0.0000</b>	<b>4.6096</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0362	0.3593	0.3058	6.0000e-004		0.0173	0.0173		0.0166	0.0166	0.0000	52.0260	52.0260	9.5200e-003	0.0000	52.2260
<b>Total</b>	<b>0.0362</b>	<b>0.3593</b>	<b>0.3058</b>	<b>6.0000e-004</b>		<b>0.0173</b>	<b>0.0173</b>		<b>0.0166</b>	<b>0.0166</b>	<b>0.0000</b>	<b>52.0260</b>	<b>52.0260</b>	<b>9.5200e-003</b>	<b>0.0000</b>	<b>52.2260</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-004	8.8000e-004	1.1500e-003	0.0000	2.7000e-004	2.0000e-005	2.9000e-004	7.0000e-005	2.0000e-005	9.0000e-005	0.0000	0.3468	0.3468	0.0000	0.0000	0.3468
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4700e-003	2.1800e-003	0.0207	7.0000e-005	5.5600e-003	4.0000e-005	5.6000e-003	1.4800e-003	4.0000e-005	1.5200e-003	0.0000	4.2586	4.2586	2.0000e-004	0.0000	4.2628
<b>Total</b>	<b>1.5700e-003</b>	<b>3.0600e-003</b>	<b>0.0219</b>	<b>7.0000e-005</b>	<b>5.8300e-003</b>	<b>6.0000e-005</b>	<b>5.8900e-003</b>	<b>1.5500e-003</b>	<b>6.0000e-005</b>	<b>1.6100e-003</b>	<b>0.0000</b>	<b>4.6054</b>	<b>4.6054</b>	<b>2.0000e-004</b>	<b>0.0000</b>	<b>4.6096</b>

### 3.7 HDD- Insertion - 2022

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0854	0.8267	0.7826	1.5500e-003		0.0389	0.0389		0.0373	0.0373	0.0000	134.8543	134.8543	0.0244	0.0000	135.3675
<b>Total</b>	<b>0.0854</b>	<b>0.8267</b>	<b>0.7826</b>	<b>1.5500e-003</b>		<b>0.0389</b>	<b>0.0389</b>		<b>0.0373</b>	<b>0.0373</b>	<b>0.0000</b>	<b>134.8543</b>	<b>134.8543</b>	<b>0.0244</b>	<b>0.0000</b>	<b>135.3675</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	2.5000e-004	1.9800e-003	2.8800e-003	1.0000e-005	3.1000e-004	5.0000e-005	3.5000e-004	8.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8976	0.8976	1.0000e-005	0.0000	0.8978
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-003	5.2700e-003	0.0502	1.7000e-004	0.0144	1.1000e-004	0.0145	3.8300e-003	1.0000e-004	3.9300e-003	0.0000	10.8575	10.8575	4.9000e-004	0.0000	10.8678
<b>Total</b>	<b>3.8500e-003</b>	<b>7.2500e-003</b>	<b>0.0531</b>	<b>1.8000e-004</b>	<b>0.0147</b>	<b>1.6000e-004</b>	<b>0.0149</b>	<b>3.9100e-003</b>	<b>1.4000e-004</b>	<b>4.0500e-003</b>	<b>0.0000</b>	<b>11.7551</b>	<b>11.7551</b>	<b>5.0000e-004</b>	<b>0.0000</b>	<b>11.7656</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0854	0.8267	0.7826	1.5500e-003		0.0389	0.0389		0.0373	0.0373	0.0000	134.8542	134.8542	0.0244	0.0000	135.3674
<b>Total</b>	<b>0.0854</b>	<b>0.8267</b>	<b>0.7826</b>	<b>1.5500e-003</b>		<b>0.0389</b>	<b>0.0389</b>		<b>0.0373</b>	<b>0.0373</b>	<b>0.0000</b>	<b>134.8542</b>	<b>134.8542</b>	<b>0.0244</b>	<b>0.0000</b>	<b>135.3674</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.5000e-004	1.9800e-003	2.8800e-003	1.0000e-005	3.1000e-004	5.0000e-005	3.5000e-004	8.0000e-005	4.0000e-005	1.2000e-004	0.0000	0.8976	0.8976	1.0000e-005	0.0000	0.8978
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-003	5.2700e-003	0.0502	1.7000e-004	0.0144	1.1000e-004	0.0145	3.8300e-003	1.0000e-004	3.9300e-003	0.0000	10.8575	10.8575	4.9000e-004	0.0000	10.8678
<b>Total</b>	<b>3.8500e-003</b>	<b>7.2500e-003</b>	<b>0.0531</b>	<b>1.8000e-004</b>	<b>0.0147</b>	<b>1.6000e-004</b>	<b>0.0149</b>	<b>3.9100e-003</b>	<b>1.4000e-004</b>	<b>4.0500e-003</b>	<b>0.0000</b>	<b>11.7551</b>	<b>11.7551</b>	<b>5.0000e-004</b>	<b>0.0000</b>	<b>11.7656</b>

### 3.8 Paving - Open Trench - 2022

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.0600e-003	0.0300	0.0388	6.0000e-005		1.5300e-003	1.5300e-003		1.4100e-003	1.4100e-003	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>3.0600e-003</b>	<b>0.0300</b>	<b>0.0388</b>	<b>6.0000e-005</b>		<b>1.5300e-003</b>	<b>1.5300e-003</b>		<b>1.4100e-003</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	2.5000e-004	2.4000e-003	1.0000e-005	6.9000e-004	1.0000e-005	6.9000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5198	0.5198	2.0000e-005	0.0000	0.5203
<b>Total</b>	<b>1.7000e-004</b>	<b>2.5000e-004</b>	<b>2.4000e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5198</b>	<b>0.5198</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5203</b>

#### Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.0600e-003	0.0300	0.0388	6.0000e-005		1.5300e-003	1.5300e-003		1.4100e-003	1.4100e-003	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>3.0600e-003</b>	<b>0.0300</b>	<b>0.0388</b>	<b>6.0000e-005</b>		<b>1.5300e-003</b>	<b>1.5300e-003</b>		<b>1.4100e-003</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	2.5000e-004	2.4000e-003	1.0000e-005	6.9000e-004	1.0000e-005	6.9000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5198	0.5198	2.0000e-005	0.0000	0.5203
<b>Total</b>	<b>1.7000e-004</b>	<b>2.5000e-004</b>	<b>2.4000e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5198</b>	<b>0.5198</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5203</b>



## Alameda Pipeline, Crossing 3 Alameda County, Annual

### 1.0 Project Characteristics

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#### 1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	0.50	0.00	0

#### 1.2 Other Project Characteristics

<b>Urbanization</b>	Urban	<b>Wind Speed (m/s)</b>	2.2	<b>Precipitation Freq (Days)</b>	63
<b>Climate Zone</b>	5			<b>Operational Year</b>	2014
<b>Utility Company</b>	Pacific Gas & Electric Company				
<b>CO2 Intensity (lb/MW hr)</b>	641.35	<b>CH4 Intensity (lb/MW hr)</b>	0.029	<b>N2O Intensity (lb/MW hr)</b>	0.006

#### 1.3 User Entered Comments & Non-Default Data

Land Use - Lot acreage from construction data request sheet

Construction Phase - Schedule based on 2021 start date, up to 19 months construction, and anticipated work days provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

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Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - HDD: 585cy hauling @ 16cy/truck = 74 one-way trips. 19 trench workers, 25 HDD workers, 11 abandonment.

Grading - 3,997 cy import, 6,001 cy export during Open Trench, 311 cy during Abandonment.

Construction Off-road Equipment Mitigation - Tier 4 engines for equip > 50hp/ BAAQMD BMPs.

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	8.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	14.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	11.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	10.00	8.00
tblConstructionPhase	NumDays	2.00	226.00

tblConstructionPhase	NumDays	2.00	10.00
tblConstructionPhase	NumDays	5.00	8.00
tblConstructionPhase	PhaseEndDate	9/29/2021	7/28/2022
tblConstructionPhase	PhaseEndDate	3/31/2023	7/28/2022
tblConstructionPhase	PhaseEndDate	12/8/2021	1/26/2021
tblConstructionPhase	PhaseStartDate	1/27/2021	11/25/2021
tblConstructionPhase	PhaseStartDate	7/29/2022	11/25/2021
tblConstructionPhase	PhaseStartDate	11/25/2021	1/13/2021
tblGrading	AcresOfGrading	0.00	0.50
tblGrading	MaterialExported	0.00	6,001.00
tblGrading	MaterialExported	0.00	311.00
tblGrading	MaterialImported	0.00	3,997.00
tblLandUse	LotAcreage	0.00	0.50
tblOffRoadEquipment	HorsePower	171.00	150.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	LoadFactor	0.42	0.50
tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	6.00	16.00
tblOffRoadEquipment	UsageHours	6.00	0.80
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblTripsAndVMT	HaulingTripNumber	0.00	37.00
tblTripsAndVMT	HaulingTripNumber	0.00	37.00
tblTripsAndVMT	WorkerTripNumber	8.00	19.00
tblTripsAndVMT	WorkerTripNumber	10.00	19.00
tblTripsAndVMT	WorkerTripNumber	80.00	11.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00

## 2.0 Emissions Summary

### 2.1 Overall Construction

#### Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
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Year	tons/yr										MT/yr					
2021	0.1873	1.3905	1.5536	3.1000e-003	0.0390	0.0640	0.1030	0.0104	0.0623	0.0726	0.0000	249.1512	249.1512	0.0306	0.0000	249.7937
2022	0.2204	2.0662	2.0766	4.3100e-003	0.0351	0.0968	0.1319	9.3400e-003	0.0926	0.1019	0.0000	363.9488	363.9488	0.0654	0.0000	365.3225
<b>Total</b>	<b>0.4077</b>	<b>3.4567</b>	<b>3.6302</b>	<b>7.4100e-003</b>	<b>0.0741</b>	<b>0.1608</b>	<b>0.2350</b>	<b>0.0197</b>	<b>0.1549</b>	<b>0.1746</b>	<b>0.0000</b>	<b>613.1000</b>	<b>613.1000</b>	<b>0.0960</b>	<b>0.0000</b>	<b>615.1162</b>

### Mitigated Construction

Year	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
tons/yr											MT/yr					
2021	0.0363	0.4828	1.5952	3.1000e-003	0.0386	2.6000e-004	0.0388	0.0103	1.9000e-004	0.0105	0.0000	249.1510	249.1510	0.0306	0.0000	249.7935
2022	0.0444	0.1153	2.4392	4.3100e-003	0.0351	1.4400e-003	0.0365	9.3400e-003	1.5700e-003	0.0109	0.0000	363.9484	363.9484	0.0654	0.0000	365.3221
<b>Total</b>	<b>0.0807</b>	<b>0.5981</b>	<b>4.0344</b>	<b>7.4100e-003</b>	<b>0.0737</b>	<b>1.7000e-003</b>	<b>0.0754</b>	<b>0.0196</b>	<b>1.7600e-003</b>	<b>0.0214</b>	<b>0.0000</b>	<b>613.0994</b>	<b>613.0994</b>	<b>0.0960</b>	<b>0.0000</b>	<b>615.1155</b>

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
<b>Percent Reduction</b>	<b>80.20</b>	<b>82.70</b>	<b>-11.14</b>	<b>0.00</b>	<b>0.63</b>	<b>98.94</b>	<b>67.93</b>	<b>0.46</b>	<b>98.86</b>	<b>87.76</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

### 3.0 Construction Detail

#### Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition - Open Trench	Demolition	1/1/2021	1/12/2021	5	8	
2	Grading/Excavation - Open Trench	Grading	1/13/2021	11/24/2021	5	226	
3	4 Abandonments	Grading	1/13/2021	1/26/2021	5	10	
4	HDD - Entry	Building Construction	11/25/2021	7/28/2022	5	176	

5	HDD- Insertion	Building Construction	11/25/2021	7/28/2022	5	176
6	Paving - Open Trench	Paving	7/29/2022	8/9/2022	5	8

**Acres of Grading (Site Preparation Phase): 0**

**Acres of Grading (Grading Phase): 0**

**Acres of Paving: 0**

**Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)**

**OffRoad Equipment**

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition - Open Trench	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40
Demolition - Open Trench	Tractors/Loaders/Backhoes	2	16.00	97	0.37
Grading/Excavation - Open Trench	Concrete/Industrial Saws	0	8.00	81	0.73
Grading/Excavation - Open Trench	Excavators	1	0.80	162	0.38
Grading/Excavation - Open Trench	Pumps	2	4.20	50	0.74
Grading/Excavation - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40
Grading/Excavation - Open Trench	Tractors/Loaders/Backhoes	1	0.80	97	0.37
4 Abandonments	Cement and Mortar Mixers	4	8.00	9	0.56
4 Abandonments	Concrete/Industrial Saws	4	8.00	81	0.73
4 Abandonments	Excavators	4	8.00	162	0.38
4 Abandonments	Generator Sets	4	8.00	84	0.74
4 Abandonments	Pumps	8	16.00	50	0.74
4 Abandonments	Rubber Tired Dozers	0	1.00	255	0.40
4 Abandonments	Tractors/Loaders/Backhoes	4	8.00	97	0.37
4 Abandonments	Welders	4	8.00	85	0.50
HDD - Entry	Bore/Drill Rigs	1	0.90	205	0.50
HDD - Entry	Cement and Mortar Mixers	1	2.70	9	0.56
HDD - Entry	Cranes	1	11.10	226	0.29
HDD - Entry	Excavators	1	3.60	162	0.38

HDD - Entry	Forklifts	0	6.00	89	0.20
HDD - Entry	Generator Sets	1	7.50	84	0.74
HDD - Entry	Other Construction Equipment	1	1.90	150	0.50
HDD - Entry	Pumps	1	7.50	84	0.74
HDD - Entry	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Cranes	1	11.10	226	0.29
HDD- Insertion	Excavators	1	3.60	162	0.38
HDD- Insertion	Forklifts	0	6.00	89	0.20
HDD- Insertion	Generator Sets	1	7.50	84	0.74
HDD- Insertion	Pumps	1	7.50	84	0.74
HDD- Insertion	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Welders	1	0.90	85	0.50
Paving - Open Trench	Cement and Mortar Mixers	1	8.00	9	0.56
Paving - Open Trench	Pavers	1	8.00	125	0.42
Paving - Open Trench	Paving Equipment	1	8.00	130	0.36
Paving - Open Trench	Rollers	1	8.00	80	0.38
Paving - Open Trench	Tractors/Loaders/Backhoes	1	8.00	97	0.37

### Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition - Open Trench	3	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading/Excavation - Open Trench	4	19.00	0.00	1,250.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
4 Abandonments	32	11.00	0.00	39.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
HDD - Entry	8	25.00	0.00	37.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
HDD- Insertion	6	25.00	0.00	37.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving - Open Trench	5	19.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

### 3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

### 3.2 Demolition - Open Trench - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.5400e-003	0.0425	0.0509	7.0000e-005		2.4800e-003	2.4800e-003		2.3400e-003	2.3400e-003	0.0000	6.5182	6.5182	1.5400e-003	0.0000	6.5505
<b>Total</b>	<b>4.5400e-003</b>	<b>0.0425</b>	<b>0.0509</b>	<b>7.0000e-005</b>		<b>2.4800e-003</b>	<b>2.4800e-003</b>		<b>2.3400e-003</b>	<b>2.3400e-003</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.8000e-004	2.7000e-004	2.5700e-003	1.0000e-005	6.9000e-004	1.0000e-005	7.0000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5284	0.5284	2.0000e-005	0.0000	0.5289
<b>Total</b>	<b>1.8000e-004</b>	<b>2.7000e-004</b>	<b>2.5700e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>7.0000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5284</b>	<b>0.5284</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5289</b>



**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.2000e-004	9.5000e-004	0.0530	7.0000e-005		-0.0001	-0.0001		0.0000	0.0000	0.0000	6.5182	6.5182	1.5400e-003	0.0000	6.5505
<b>Total</b>	<b>6.2000e-004</b>	<b>9.5000e-004</b>	<b>0.0530</b>	<b>7.0000e-005</b>		<b>-0.0001</b>	<b>-0.0001</b>		<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.8000e-004	2.7000e-004	2.5700e-003	1.0000e-005	6.9000e-004	1.0000e-005	7.0000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5284	0.5284	2.0000e-005	0.0000	0.5289
<b>Total</b>	<b>1.8000e-004</b>	<b>2.7000e-004</b>	<b>2.5700e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>7.0000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5284</b>	<b>0.5284</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5289</b>

**3.3 Grading/Excavation - Open Trench - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
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Category	tons/yr										MT/yr					
	Fugitive Dust					8.3000e-004	0.0000	8.3000e-004	1.1000e-004	0.0000	1.1000e-004	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0567	0.3535	0.3808	6.4000e-004		0.0160	0.0160		0.0158	0.0158	0.0000	48.2597	48.2597	6.9100e-003	0.0000	48.4049
<b>Total</b>	<b>0.0567</b>	<b>0.3535</b>	<b>0.3808</b>	<b>6.4000e-004</b>	<b>8.3000e-004</b>	<b>0.0160</b>	<b>0.0169</b>	<b>1.1000e-004</b>	<b>0.0158</b>	<b>0.0159</b>	<b>0.0000</b>	<b>48.2597</b>	<b>48.2597</b>	<b>6.9100e-003</b>	<b>0.0000</b>	<b>48.4049</b>

**Unmitigated Construction Off-Site**

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0114	0.1008	0.1326	4.7000e-004	0.0106	2.0500e-003	0.0126	2.9000e-003	1.8800e-003	4.7800e-003	0.0000	39.9219	39.9219	3.1000e-004	0.0000	39.9285
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.1500e-003	7.6300e-003	0.0726	2.3000e-004	0.0195	1.5000e-004	0.0196	5.1800e-003	1.4000e-004	5.3200e-003	0.0000	14.9277	14.9277	7.0000e-004	0.0000	14.9423
<b>Total</b>	<b>0.0165</b>	<b>0.1085</b>	<b>0.2052</b>	<b>7.0000e-004</b>	<b>0.0300</b>	<b>2.2000e-003</b>	<b>0.0322</b>	<b>8.0800e-003</b>	<b>2.0200e-003</b>	<b>0.0101</b>	<b>0.0000</b>	<b>54.8495</b>	<b>54.8495</b>	<b>1.0100e-003</b>	<b>0.0000</b>	<b>54.8708</b>

**Mitigated Construction On-Site**

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Fugitive Dust					3.7000e-004	0.0000	3.7000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.1900e-003	0.1970	0.3545	6.4000e-004		-0.0016	-0.0016		-0.0016	-0.0016	0.0000	48.2597	48.2597	6.9100e-003	0.0000	48.4048

<b>Total</b>	<b>3.1900e-003</b>	<b>0.1970</b>	<b>0.3545</b>	<b>6.4000e-004</b>	<b>3.7000e-004</b>	<b>-0.0016</b>	<b>-0.0012</b>	<b>3.0000e-005</b>	<b>-0.0016</b>	<b>-0.0015</b>	<b>0.0000</b>	<b>48.2597</b>	<b>48.2597</b>	<b>6.9100e-003</b>	<b>0.0000</b>	<b>48.4048</b>
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**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0114	0.1008	0.1326	4.7000e-004	0.0106	2.0500e-003	0.0126	2.9000e-003	1.8800e-003	4.7800e-003	0.0000	39.9219	39.9219	3.1000e-004	0.0000	39.9285
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.1500e-003	7.6300e-003	0.0726	2.3000e-004	0.0195	1.5000e-004	0.0196	5.1800e-003	1.4000e-004	5.3200e-003	0.0000	14.9277	14.9277	7.0000e-004	0.0000	14.9423
<b>Total</b>	<b>0.0165</b>	<b>0.1085</b>	<b>0.2052</b>	<b>7.0000e-004</b>	<b>0.0300</b>	<b>2.2000e-003</b>	<b>0.0322</b>	<b>8.0800e-003</b>	<b>2.0200e-003</b>	<b>0.0101</b>	<b>0.0000</b>	<b>54.8495</b>	<b>54.8495</b>	<b>1.0100e-003</b>	<b>0.0000</b>	<b>54.8708</b>

**3.4 4 Abandonments - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0657	0.4662	0.5333	8.9000e-004		0.0234	0.0234		0.0230	0.0230	0.0000	72.3819	72.3819	9.4200e-003	0.0000	72.5796
<b>Total</b>	<b>0.0657</b>	<b>0.4662</b>	<b>0.5333</b>	<b>8.9000e-004</b>	<b>2.0000e-005</b>	<b>0.0234</b>	<b>0.0234</b>	<b>0.0000</b>	<b>0.0230</b>	<b>0.0230</b>	<b>0.0000</b>	<b>72.3819</b>	<b>72.3819</b>	<b>9.4200e-003</b>	<b>0.0000</b>	<b>72.5796</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.5000e-004	3.1500e-003	4.1400e-003	1.0000e-005	3.3000e-004	6.0000e-005	3.9000e-004	9.0000e-005	6.0000e-005	1.5000e-004	0.0000	1.2456	1.2456	1.0000e-005	0.0000	1.2458
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	2.0000e-004	1.8600e-003	1.0000e-005	5.0000e-004	0.0000	5.0000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.3824	0.3824	2.0000e-005	0.0000	0.3828
<b>Total</b>	<b>4.8000e-004</b>	<b>3.3500e-003</b>	<b>6.0000e-003</b>	<b>2.0000e-005</b>	<b>8.3000e-004</b>	<b>6.0000e-005</b>	<b>8.9000e-004</b>	<b>2.2000e-004</b>	<b>6.0000e-005</b>	<b>2.9000e-004</b>	<b>0.0000</b>	<b>1.6280</b>	<b>1.6280</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>1.6286</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	7.5900e-003	0.1553	0.5390	8.9000e-004		-0.0004	-0.0004		-0.0004	-0.0004	0.0000	72.3818	72.3818	9.4200e-003	0.0000	72.5795
<b>Total</b>	<b>7.5900e-003</b>	<b>0.1553</b>	<b>0.5390</b>	<b>8.9000e-004</b>	<b>1.0000e-005</b>	<b>-0.0004</b>	<b>-0.0004</b>	<b>0.0000</b>	<b>-0.0004</b>	<b>-0.0004</b>	<b>0.0000</b>	<b>72.3818</b>	<b>72.3818</b>	<b>9.4200e-003</b>	<b>0.0000</b>	<b>72.5795</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	3.5000e-004	3.1500e-003	4.1400e-003	1.0000e-005	3.3000e-004	6.0000e-005	3.9000e-004	9.0000e-005	6.0000e-005	1.5000e-004	0.0000	1.2456	1.2456	1.0000e-005	0.0000	1.2458
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	2.0000e-004	1.8600e-003	1.0000e-005	5.0000e-004	0.0000	5.0000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.3824	0.3824	2.0000e-005	0.0000	0.3828
<b>Total</b>	<b>4.8000e-004</b>	<b>3.3500e-003</b>	<b>6.0000e-003</b>	<b>2.0000e-005</b>	<b>8.3000e-004</b>	<b>6.0000e-005</b>	<b>8.9000e-004</b>	<b>2.2000e-004</b>	<b>6.0000e-005</b>	<b>2.9000e-004</b>	<b>0.0000</b>	<b>1.6280</b>	<b>1.6280</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>1.6286</b>

### 3.5 HDD - Entry - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0215	0.2150	0.1823	3.6000e-004		0.0103	0.0103		9.8000e-003	9.8000e-003	0.0000	31.2624	31.2624	6.1900e-003	0.0000	31.3925
<b>Total</b>	<b>0.0215</b>	<b>0.2150</b>	<b>0.1823</b>	<b>3.6000e-004</b>		<b>0.0103</b>	<b>0.0103</b>		<b>9.8000e-003</b>	<b>9.8000e-003</b>	<b>0.0000</b>	<b>31.2624</b>	<b>31.2624</b>	<b>6.1900e-003</b>	<b>0.0000</b>	<b>31.3925</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.0000e-005	4.6000e-004	6.0000e-004	0.0000	2.5000e-004	1.0000e-005	2.6000e-004	6.0000e-005	1.0000e-005	7.0000e-005	0.0000	0.1813	0.1813	0.0000	0.0000	0.1813
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.1000e-004	1.2000e-003	0.0114	4.0000e-005	3.0600e-003	2.0000e-005	3.0900e-003	8.1000e-004	2.0000e-005	8.4000e-004	0.0000	2.3466	2.3466	1.1000e-004	0.0000	2.3489
<b>Total</b>	<b>8.6000e-004</b>	<b>1.6600e-003</b>	<b>0.0120</b>	<b>4.0000e-005</b>	<b>3.3100e-003</b>	<b>3.0000e-005</b>	<b>3.3500e-003</b>	<b>8.7000e-004</b>	<b>3.0000e-005</b>	<b>9.1000e-004</b>	<b>0.0000</b>	<b>2.5279</b>	<b>2.5279</b>	<b>1.1000e-004</b>	<b>0.0000</b>	<b>2.5302</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.2100e-003	6.9000e-003	0.2165	3.6000e-004		0.0000	0.0000		3.0000e-005	3.0000e-005	0.0000	31.2624	31.2624	6.1900e-003	0.0000	31.3924
<b>Total</b>	<b>3.2100e-003</b>	<b>6.9000e-003</b>	<b>0.2165</b>	<b>3.6000e-004</b>		<b>0.0000</b>	<b>0.0000</b>		<b>3.0000e-005</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>31.2624</b>	<b>31.2624</b>	<b>6.1900e-003</b>	<b>0.0000</b>	<b>31.3924</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.0000e-005	4.6000e-004	6.0000e-004	0.0000	2.5000e-004	1.0000e-005	2.6000e-004	6.0000e-005	1.0000e-005	7.0000e-005	0.0000	0.1813	0.1813	0.0000	0.0000	0.1813
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.1000e-004	1.2000e-003	0.0114	4.0000e-005	3.0600e-003	2.0000e-005	3.0900e-003	8.1000e-004	2.0000e-005	8.4000e-004	0.0000	2.3466	2.3466	1.1000e-004	0.0000	2.3489
<b>Total</b>	<b>8.6000e-004</b>	<b>1.6600e-003</b>	<b>0.0120</b>	<b>4.0000e-005</b>	<b>3.3100e-003</b>	<b>3.0000e-005</b>	<b>3.3500e-003</b>	<b>8.7000e-004</b>	<b>3.0000e-005</b>	<b>9.1000e-004</b>	<b>0.0000</b>	<b>2.5279</b>	<b>2.5279</b>	<b>1.1000e-004</b>	<b>0.0000</b>	<b>2.5302</b>

**3.5 HDD - Entry - 2022**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1080	1.0493	0.9932	1.9900e-003		0.0493	0.0493		0.0470	0.0470	0.0000	172.5426	172.5426	0.0339	0.0000	173.2546
<b>Total</b>	<b>0.1080</b>	<b>1.0493</b>	<b>0.9932</b>	<b>1.9900e-003</b>		<b>0.0493</b>	<b>0.0493</b>		<b>0.0470</b>	<b>0.0470</b>	<b>0.0000</b>	<b>172.5426</b>	<b>172.5426</b>	<b>0.0339</b>	<b>0.0000</b>	<b>173.2546</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.8000e-004	2.2000e-003	3.2100e-003	1.0000e-005	3.0000e-004	5.0000e-005	3.5000e-004	8.0000e-005	5.0000e-005	1.3000e-004	0.0000	0.9991	0.9991	1.0000e-005	0.0000	0.9993
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2200e-003	6.1800e-003	0.0589	2.0000e-004	0.0169	1.3000e-004	0.0170	4.5000e-003	1.2000e-004	4.6100e-003	0.0000	12.7383	12.7383	5.8000e-004	0.0000	12.7504
<b>Total</b>	<b>4.5000e-003</b>	<b>8.3800e-003</b>	<b>0.0621</b>	<b>2.1000e-004</b>	<b>0.0172</b>	<b>1.8000e-004</b>	<b>0.0174</b>	<b>4.5800e-003</b>	<b>1.7000e-004</b>	<b>4.7400e-003</b>	<b>0.0000</b>	<b>13.7374</b>	<b>13.7374</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>13.7497</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0185	0.0492	1.1950	1.9900e-003		5.7000e-004	5.7000e-004		6.7000e-004	6.7000e-004	0.0000	172.5424	172.5424	0.0339	0.0000	173.2544

<b>Total</b>	<b>0.0185</b>	<b>0.0492</b>	<b>1.1950</b>	<b>1.9900e-003</b>		<b>5.7000e-004</b>	<b>5.7000e-004</b>		<b>6.7000e-004</b>	<b>6.7000e-004</b>	<b>0.0000</b>	<b>172.5424</b>	<b>172.5424</b>	<b>0.0339</b>	<b>0.0000</b>	<b>173.2544</b>
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**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.8000e-004	2.2000e-003	3.2100e-003	1.0000e-005	3.0000e-004	5.0000e-005	3.5000e-004	8.0000e-005	5.0000e-005	1.3000e-004	0.0000	0.9991	0.9991	1.0000e-005	0.0000	0.9993
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2200e-003	6.1800e-003	0.0589	2.0000e-004	0.0169	1.3000e-004	0.0170	4.5000e-003	1.2000e-004	4.6100e-003	0.0000	12.7383	12.7383	5.8000e-004	0.0000	12.7504
<b>Total</b>	<b>4.5000e-003</b>	<b>8.3800e-003</b>	<b>0.0621</b>	<b>2.1000e-004</b>	<b>0.0172</b>	<b>1.8000e-004</b>	<b>0.0174</b>	<b>4.5800e-003</b>	<b>1.7000e-004</b>	<b>4.7400e-003</b>	<b>0.0000</b>	<b>13.7374</b>	<b>13.7374</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>13.7497</b>

**3.6 HDD- Insertion - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0199	0.1980	0.1685	3.3000e-004		9.5200e-003	9.5200e-003		9.1200e-003	9.1200e-003	0.0000	28.6674	28.6674	5.2500e-003	0.0000	28.7777
<b>Total</b>	<b>0.0199</b>	<b>0.1980</b>	<b>0.1685</b>	<b>3.3000e-004</b>		<b>9.5200e-003</b>	<b>9.5200e-003</b>		<b>9.1200e-003</b>	<b>9.1200e-003</b>	<b>0.0000</b>	<b>28.6674</b>	<b>28.6674</b>	<b>5.2500e-003</b>	<b>0.0000</b>	<b>28.7777</b>

**Unmitigated Construction Off-Site**



	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.0000e-005	4.6000e-004	6.0000e-004	0.0000	2.5000e-004	1.0000e-005	2.6000e-004	6.0000e-005	1.0000e-005	7.0000e-005	0.0000	0.1813	0.1813	0.0000	0.0000	0.1813
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.1000e-004	1.2000e-003	0.0114	4.0000e-005	3.0600e-003	2.0000e-005	3.0900e-003	8.1000e-004	2.0000e-005	8.4000e-004	0.0000	2.3466	2.3466	1.1000e-004	0.0000	2.3489
<b>Total</b>	<b>8.6000e-004</b>	<b>1.6600e-003</b>	<b>0.0120</b>	<b>4.0000e-005</b>	<b>3.3100e-003</b>	<b>3.0000e-005</b>	<b>3.3500e-003</b>	<b>8.7000e-004</b>	<b>3.0000e-005</b>	<b>9.1000e-004</b>	<b>0.0000</b>	<b>2.5279</b>	<b>2.5279</b>	<b>1.1000e-004</b>	<b>0.0000</b>	<b>2.5302</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.7900e-003	7.2400e-003	0.1944	3.3000e-004		0.0000	0.0000		1.0000e-005	1.0000e-005	0.0000	28.6674	28.6674	5.2500e-003	0.0000	28.7776
<b>Total</b>	<b>2.7900e-003</b>	<b>7.2400e-003</b>	<b>0.1944</b>	<b>3.3000e-004</b>		<b>0.0000</b>	<b>0.0000</b>		<b>1.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>28.6674</b>	<b>28.6674</b>	<b>5.2500e-003</b>	<b>0.0000</b>	<b>28.7776</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	5.0000e-005	4.6000e-004	6.0000e-004	0.0000	2.5000e-004	1.0000e-005	2.6000e-004	6.0000e-005	1.0000e-005	7.0000e-005	0.0000	0.1813	0.1813	0.0000	0.0000	0.1813
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.1000e-004	1.2000e-003	0.0114	4.0000e-005	3.0600e-003	2.0000e-005	3.0900e-003	8.1000e-004	2.0000e-005	8.4000e-004	0.0000	2.3466	2.3466	1.1000e-004	0.0000	2.3489
<b>Total</b>	<b>8.6000e-004</b>	<b>1.6600e-003</b>	<b>0.0120</b>	<b>4.0000e-005</b>	<b>3.3100e-003</b>	<b>3.0000e-005</b>	<b>3.3500e-003</b>	<b>8.7000e-004</b>	<b>3.0000e-005</b>	<b>9.1000e-004</b>	<b>0.0000</b>	<b>2.5279</b>	<b>2.5279</b>	<b>1.1000e-004</b>	<b>0.0000</b>	<b>2.5302</b>

### 3.6 HDD- Insertion - 2022

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1002	0.9699	0.9181	1.8200e-003		0.0457	0.0457		0.0438	0.0438	0.0000	158.2149	158.2149	0.0287	0.0000	158.8170
<b>Total</b>	<b>0.1002</b>	<b>0.9699</b>	<b>0.9181</b>	<b>1.8200e-003</b>		<b>0.0457</b>	<b>0.0457</b>		<b>0.0438</b>	<b>0.0438</b>	<b>0.0000</b>	<b>158.2149</b>	<b>158.2149</b>	<b>0.0287</b>	<b>0.0000</b>	<b>158.8170</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.8000e-004	2.2000e-003	3.2100e-003	1.0000e-005	3.0000e-004	5.0000e-005	3.5000e-004	8.0000e-005	5.0000e-005	1.3000e-004	0.0000	0.9991	0.9991	1.0000e-005	0.0000	0.9993
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2200e-003	6.1800e-003	0.0589	2.0000e-004	0.0169	1.3000e-004	0.0170	4.5000e-003	1.2000e-004	4.6100e-003	0.0000	12.7383	12.7383	5.8000e-004	0.0000	12.7504
<b>Total</b>	<b>4.5000e-003</b>	<b>8.3800e-003</b>	<b>0.0621</b>	<b>2.1000e-004</b>	<b>0.0172</b>	<b>1.8000e-004</b>	<b>0.0174</b>	<b>4.5800e-003</b>	<b>1.7000e-004</b>	<b>4.7400e-003</b>	<b>0.0000</b>	<b>13.7374</b>	<b>13.7374</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>13.7497</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0159	0.0452	1.0731	1.8200e-003		3.9000e-004	3.9000e-004		4.5000e-004	4.5000e-004	0.0000	158.2147	158.2147	0.0287	0.0000	158.8168
<b>Total</b>	<b>0.0159</b>	<b>0.0452</b>	<b>1.0731</b>	<b>1.8200e-003</b>		<b>3.9000e-004</b>	<b>3.9000e-004</b>		<b>4.5000e-004</b>	<b>4.5000e-004</b>	<b>0.0000</b>	<b>158.2147</b>	<b>158.2147</b>	<b>0.0287</b>	<b>0.0000</b>	<b>158.8168</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.8000e-004	2.2000e-003	3.2100e-003	1.0000e-005	3.0000e-004	5.0000e-005	3.5000e-004	8.0000e-005	5.0000e-005	1.3000e-004	0.0000	0.9991	0.9991	1.0000e-005	0.0000	0.9993
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2200e-003	6.1800e-003	0.0589	2.0000e-004	0.0169	1.3000e-004	0.0170	4.5000e-003	1.2000e-004	4.6100e-003	0.0000	12.7383	12.7383	5.8000e-004	0.0000	12.7504
<b>Total</b>	<b>4.5000e-003</b>	<b>8.3800e-003</b>	<b>0.0621</b>	<b>2.1000e-004</b>	<b>0.0172</b>	<b>1.8000e-004</b>	<b>0.0174</b>	<b>4.5800e-003</b>	<b>1.7000e-004</b>	<b>4.7400e-003</b>	<b>0.0000</b>	<b>13.7374</b>	<b>13.7374</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>13.7497</b>

**3.7 Paving - Open Trench - 2022**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.0600e-003	0.0300	0.0388	6.0000e-005		1.5300e-003	1.5300e-003		1.4100e-003	1.4100e-003	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>3.0600e-003</b>	<b>0.0300</b>	<b>0.0388</b>	<b>6.0000e-005</b>		<b>1.5300e-003</b>	<b>1.5300e-003</b>		<b>1.4100e-003</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	2.5000e-004	2.4000e-003	1.0000e-005	6.9000e-004	1.0000e-005	6.9000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5198	0.5198	2.0000e-005	0.0000	0.5203
<b>Total</b>	<b>1.7000e-004</b>	<b>2.5000e-004</b>	<b>2.4000e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5198</b>	<b>0.5198</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5203</b>

### Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	8.9000e-004	3.9100e-003	0.0445	6.0000e-005		1.2000e-004	1.2000e-004		1.2000e-004	1.2000e-004	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312

Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
<b>Total</b>	<b>8.9000e-004</b>	<b>3.9100e-003</b>	<b>0.0445</b>	<b>6.0000e-005</b>		<b>1.2000e-004</b>	<b>1.2000e-004</b>		<b>1.2000e-004</b>	<b>1.2000e-004</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	2.5000e-004	2.4000e-003	1.0000e-005	6.9000e-004	1.0000e-005	6.9000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5198	0.5198	2.0000e-005	0.0000	0.5203
<b>Total</b>	<b>1.7000e-004</b>	<b>2.5000e-004</b>	<b>2.4000e-003</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.0000e-005</b>	<b>6.9000e-004</b>	<b>1.8000e-004</b>	<b>0.0000</b>	<b>1.9000e-004</b>	<b>0.0000</b>	<b>0.5198</b>	<b>0.5198</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.5203</b>

## Alameda Pipeline, Crossing 1 - Construction TAC Alameda County, Annual

### 1.0 Project Characteristics

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#### 1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	1.10	0.00	0

#### 1.2 Other Project Characteristics

<b>Urbanization</b>	Urban	<b>Wind Speed (m/s)</b>	2.2	<b>Precipitation Freq (Days)</b>	63
<b>Climate Zone</b>	5			<b>Operational Year</b>	2014
<b>Utility Company</b>	Pacific Gas & Electric Company				
<b>CO2 Intensity (lb/MWhr)</b>	641.35	<b>CH4 Intensity (lb/MWhr)</b>	0.029	<b>N2O Intensity (lb/MWhr)</b>	0.006

#### 1.3 User Entered Comments & Non-Default Data

Land Use - Lot acreage from construction data request sheet

Construction Phase - Schedule based on 2018 start date, up to 22 months construction, and anticipated work days provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - HDD: 765cy hauling @ 16cy/truck = 96 one-way trips. 19 trench workers, 25 HDD workers, 11 abandonment. 1 mile trip lengths.

Grading - 10,250cy import, 13,728 cy export during Open Trench, 133 cy during Abandonment.

Construction Off-road Equipment Mitigation - Tier 4 engines for equip > 50hp. BAAQMD BMPs.

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	9.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	200.00	176.00
tblConstructionPhase	NumDays	200.00	176.00
tblConstructionPhase	NumDays	20.00	19.00
tblConstructionPhase	NumDays	4.00	270.00

tblConstructionPhase	NumDays	4.00	20.00
tblConstructionPhase	NumDays	4.00	5.00
tblConstructionPhase	NumDays	4.00	10.00
tblConstructionPhase	NumDays	10.00	19.00
tblConstructionPhase	PhaseEndDate	10/12/2018	10/11/2019
tblConstructionPhase	PhaseEndDate	6/15/2020	10/11/2019
tblConstructionPhase	PhaseEndDate	3/7/2019	2/22/2018
tblConstructionPhase	PhaseEndDate	3/1/2018	2/1/2018
tblConstructionPhase	PhaseEndDate	2/15/2018	2/8/2018
tblConstructionPhase	PhaseStartDate	2/9/2018	2/8/2019
tblConstructionPhase	PhaseStartDate	10/12/2019	2/8/2019
tblConstructionPhase	PhaseStartDate	2/8/2019	1/26/2018
tblConstructionPhase	PhaseStartDate	2/23/2018	1/26/2018
tblConstructionPhase	PhaseStartDate	2/2/2018	1/26/2018
tblGrading	AcresOfGrading	0.00	1.10
tblGrading	MaterialExported	0.00	13,728.00
tblGrading	MaterialExported	0.00	67.00
tblGrading	MaterialExported	0.00	67.00
tblGrading	MaterialImported	0.00	10,250.00
tblLandUse	LotAcreage	0.00	1.10
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	HorsePower	171.00	150.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	LoadFactor	0.42	0.50



tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
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tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
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tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	UsageHours	6.00	8.00
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tblOffRoadEquipment	UsageHours	6.00	11.10
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tblOffRoadEquipment	UsageHours	8.00	7.50
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
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tblOffRoadEquipment	UsageHours	6.00	3.60
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tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00

tblOffRoadEquipment	UsageHours	8.00	0.90
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
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tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripNumber	0.00	48.00
tblTripsAndVMT	HaulingTripNumber	0.00	48.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
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tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
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tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripNumber	8.00	19.00
tblTripsAndVMT	WorkerTripNumber	10.00	19.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00

tblTripsAndVMT	WorkerTripNumber	20.00	11.00
tblTripsAndVMT	WorkerTripNumber	20.00	11.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00

## 2.0 Emissions Summary

### 2.1 Overall Construction

#### Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.2707	1.4530	1.6312	2.2900e-003	5.2500e-003	0.0855	0.0908	1.1600e-003	0.0836	0.0848	0.0000	181.5009	181.5009	0.0337	0.0000	182.2083
2019	0.3700	3.4938	2.6517	4.8700e-003	6.5600e-003	0.1810	0.1875	1.4900e-003	0.1732	0.1747	0.0000	424.6762	424.6762	0.0832	0.0000	426.4223
<b>Total</b>	<b>0.6407</b>	<b>4.9468</b>	<b>4.2829</b>	<b>7.1600e-003</b>	<b>0.0118</b>	<b>0.2665</b>	<b>0.2783</b>	<b>2.6500e-003</b>	<b>0.2568</b>	<b>0.2595</b>	<b>0.0000</b>	<b>606.1771</b>	<b>606.1771</b>	<b>0.1168</b>	<b>0.0000</b>	<b>608.6306</b>

#### Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.0568	0.6625	1.5440	2.2900e-003	4.1800e-003	4.8300e-003	9.0100e-003	9.5000e-004	4.8000e-003	5.7500e-003	0.0000	181.5007	181.5007	0.0337	0.0000	182.2081
2019	0.0719	0.3282	2.9174	4.8700e-003	5.4900e-003	9.5500e-003	0.0150	1.2800e-003	9.5500e-003	0.0108	0.0000	424.6757	424.6757	0.0832	0.0000	426.4218

Total	0.1287	0.9908	4.4615	7.1600e-003	9.6700e-003	0.0144	0.0241	2.2300e-003	0.0144	0.0166	0.0000	606.1764	606.1764	0.1168	0.0000	608.6299
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	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Percent Reduction	79.92	79.97	-4.17	0.00	18.12	94.60	91.36	15.85	94.41	93.61	0.00	0.00	0.00	0.00	0.00	0.00

### 3.0 Construction Detail

#### Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition - Open Trench	Demolition	1/1/2018	1/25/2018	5	19	
2	Grading/Excavation - Open Trench	Grading	1/26/2018	2/7/2019	5	270	
3	Bore and Jack	Grading	1/26/2018	2/22/2018	5	20	
4	5th St Abandonment	Grading	1/26/2018	2/1/2018	5	5	
5	Alice Webster Abandonment	Grading	1/26/2018	2/8/2018	5	10	
6	HDD - Entry	Building Construction	2/8/2019	10/11/2019	5	176	
7	HDD - Insertion	Building Construction	2/8/2019	10/11/2019	5	176	
8	Paving - Open Trench	Paving	10/12/2019	11/7/2019	5	19	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

#### OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition - Open Trench	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition - Open Trench	Rubber Tired Dozers	0	8.00	255	0.40
Demolition - Open Trench	Tractors/Loaders/Backhoes	2	16.00	97	0.37
Grading/Excavation - Open Trench	Excavators	1	1.70	162	0.38

Grading/Excavation - Open Trench	Graders	0	6.00	174	0.41
Grading/Excavation - Open Trench	Pumps	2	8.60	50	0.74
Grading/Excavation - Open Trench	Rubber Tired Dozers	0	6.00	255	0.40
Grading/Excavation - Open Trench	Tractors/Loaders/Backhoes	1	1.70	97	0.37
Bore and Jack	Bore/Drill Rigs	1	8.00	205	0.50
Bore and Jack	Excavators	1	8.00	162	0.38
Bore and Jack	Graders	0	6.00	174	0.41
Bore and Jack	Pumps	2	8.00	50	0.74
Bore and Jack	Rubber Tired Dozers	0	6.00	255	0.40
Bore and Jack	Tractors/Loaders/Backhoes	1	8.00	97	0.37
5th St Abandonment	Cement and Mortar Mixers	1	8.00	9	0.56
5th St Abandonment	Concrete/Industrial Saws	1	8.00	81	0.73
5th St Abandonment	Excavators	1	8.00	162	0.38
5th St Abandonment	Generator Sets	1	8.00	84	0.74
5th St Abandonment	Graders	0	6.00	174	0.41
5th St Abandonment	Pumps	2	16.00	50	0.74
5th St Abandonment	Rubber Tired Dozers	0	6.00	255	0.40
5th St Abandonment	Tractors/Loaders/Backhoes	1	8.00	97	0.37
5th St Abandonment	Welders	1	8.00	85	0.50
Alice Webster Abandonment	Cement and Mortar Mixers	1	8.00	9	0.56
Alice Webster Abandonment	Concrete/Industrial Saws	1	8.00	81	0.73
Alice Webster Abandonment	Excavators	1	8.00	162	0.38
Alice Webster Abandonment	Generator Sets	1	8.00	84	0.74
Alice Webster Abandonment	Graders	0	6.00	174	0.41
Alice Webster Abandonment	Pumps	2	16.00	50	0.74
Alice Webster Abandonment	Rubber Tired Dozers	0	6.00	255	0.40
Alice Webster Abandonment	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Alice Webster Abandonment	Welders	1	8.00	85	0.50
HDD - Entry	Bore/Drill Rigs	1	0.90	205	0.50
HDD - Entry	Cement and Mortar Mixers	1	2.70	9	0.56

HDD - Entry	Cranes	1	11.10	226	0.29
HDD - Entry	Excavators	1	3.60	162	0.38
HDD - Entry	Forklifts	0	6.00	89	0.20
HDD - Entry	Generator Sets	1	7.50	84	0.74
HDD - Entry	Other Construction Equipment	1	1.90	150	0.50
HDD - Entry	Pumps	1	7.50	84	0.74
HDD - Entry	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD - Entry	Welders	0	8.00	46	0.45
HDD- Insertion	Cranes	1	11.10	226	0.29
HDD- Insertion	Excavators	1	3.60	162	0.38
HDD- Insertion	Forklifts	0	6.00	89	0.20
HDD- Insertion	Generator Sets	1	7.50	84	0.74
HDD- Insertion	Pumps	1	7.50	84	0.74
HDD- Insertion	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Welders	1	0.90	85	0.50
Paving - Open Trench	Cement and Mortar Mixers	1	8.00	9	0.56
Paving - Open Trench	Pavers	1	8.00	125	0.42
Paving - Open Trench	Paving Equipment	1	8.00	130	0.36
Paving - Open Trench	Rollers	1	8.00	80	0.38
Paving - Open Trench	Tractors/Loaders/Backhoes	1	8.00	97	0.37

### Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition - Open Trench	3	19.00	0.00	0.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
Grading/Excavation - Open Trench	4	19.00	0.00	2,997.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
Bore and Jack	5	19.00	0.00	0.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
5th St Abandonment	8	11.00	0.00	8.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
Alice Webster Abandonment	8	11.00	0.00	8.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
HDD - Entry	8	25.00	0.00	48.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT

HDD- Insertion	6	25.00	0.00	48.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
Paving - Open Trench	5	19.00	0.00	0.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT

### 3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

### 3.2 Demolition - Open Trench - 2018

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0151	0.1371	0.1242	1.8000e-004		9.6200e-003	9.6200e-003		9.0500e-003	9.0500e-003	0.0000	15.8901	15.8901	3.7500e-003	0.0000	15.9689
<b>Total</b>	<b>0.0151</b>	<b>0.1371</b>	<b>0.1242</b>	<b>1.8000e-004</b>		<b>9.6200e-003</b>	<b>9.6200e-003</b>		<b>9.0500e-003</b>	<b>9.0500e-003</b>	<b>0.0000</b>	<b>15.8901</b>	<b>15.8901</b>	<b>3.7500e-003</b>	<b>0.0000</b>	<b>15.9689</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-004	1.4000e-004	1.8100e-003	0.0000	1.3000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1433	0.1433	1.0000e-005	0.0000	0.1435
<b>Total</b>	<b>4.0000e-004</b>	<b>1.4000e-004</b>	<b>1.8100e-003</b>	<b>0.0000</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1433</b>	<b>0.1433</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1435</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.0400e-003	8.8300e-003	0.1257	1.8000e-004		2.7000e-004	2.7000e-004		2.7000e-004	2.7000e-004	0.0000	15.8901	15.8901	3.7500e-003	0.0000	15.9688
<b>Total</b>	<b>2.0400e-003</b>	<b>8.8300e-003</b>	<b>0.1257</b>	<b>1.8000e-004</b>		<b>2.7000e-004</b>	<b>2.7000e-004</b>		<b>2.7000e-004</b>	<b>2.7000e-004</b>	<b>0.0000</b>	<b>15.8901</b>	<b>15.8901</b>	<b>3.7500e-003</b>	<b>0.0000</b>	<b>15.9688</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-004	1.4000e-004	1.8100e-003	0.0000	1.3000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1433	0.1433	1.0000e-005	0.0000	0.1435
<b>Total</b>	<b>4.0000e-004</b>	<b>1.4000e-004</b>	<b>1.8100e-003</b>	<b>0.0000</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1433</b>	<b>0.1433</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1435</b>



### 3.3 Grading/Excavation - Open Trench - 2018

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.9400e-003	0.0000	1.9400e-003	2.7000e-004	0.0000	2.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1797	0.8999	0.8929	1.4000e-003		0.0541	0.0541		0.0534	0.0534	0.0000	107.2455	107.2455	0.0195	0.0000	107.6558
<b>Total</b>	<b>0.1797</b>	<b>0.8999</b>	<b>0.8929</b>	<b>1.4000e-003</b>	<b>1.9400e-003</b>	<b>0.0541</b>	<b>0.0560</b>	<b>2.7000e-004</b>	<b>0.0534</b>	<b>0.0537</b>	<b>0.0000</b>	<b>107.2455</b>	<b>107.2455</b>	<b>0.0195</b>	<b>0.0000</b>	<b>107.6558</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0142	0.0434	0.2436	8.0000e-005	1.2600e-003	2.9000e-004	1.5500e-003	3.5000e-004	2.7000e-004	6.1000e-004	0.0000	6.4371	6.4371	1.0000e-004	0.0000	6.4392
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.1200e-003	1.8200e-003	0.0231	3.0000e-005	1.7000e-003	3.0000e-005	1.7300e-003	4.6000e-004	3.0000e-005	4.8000e-004	0.0000	1.8251	1.8251	1.3000e-004	0.0000	1.8279
<b>Total</b>	<b>0.0193</b>	<b>0.0452</b>	<b>0.2667</b>	<b>1.1000e-004</b>	<b>2.9600e-003</b>	<b>3.2000e-004</b>	<b>3.2800e-003</b>	<b>8.1000e-004</b>	<b>3.0000e-004</b>	<b>1.0900e-003</b>	<b>0.0000</b>	<b>8.2622</b>	<b>8.2622</b>	<b>2.3000e-004</b>	<b>0.0000</b>	<b>8.2670</b>

#### Mitigated Construction On-Site



Off-Road	0.0182	0.0990	0.1010	1.6000e-004		5.4700e-003	5.4700e-003		5.4100e-003	5.4100e-003	0.0000	12.3710	12.3710	2.0600e-003	0.0000	12.4144
<b>Total</b>	<b>0.0182</b>	<b>0.0990</b>	<b>0.1010</b>	<b>1.6000e-004</b>	<b>1.9400e-003</b>	<b>5.4700e-003</b>	<b>7.4100e-003</b>	<b>2.7000e-004</b>	<b>5.4100e-003</b>	<b>5.6800e-003</b>	<b>0.0000</b>	<b>12.3710</b>	<b>12.3710</b>	<b>2.0600e-003</b>	<b>0.0000</b>	<b>12.4144</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.4500e-003	4.7500e-003	0.0267	1.0000e-005	9.8000e-004	3.0000e-005	1.0200e-003	2.5000e-004	3.0000e-005	2.8000e-004	0.0000	0.7312	0.7312	1.0000e-005	0.0000	0.7315
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.5000e-004	1.9000e-004	2.4300e-003	0.0000	2.0000e-004	0.0000	2.0000e-004	5.0000e-005	0.0000	6.0000e-005	0.0000	0.2036	0.2036	1.0000e-005	0.0000	0.2039
<b>Total</b>	<b>2.0000e-003</b>	<b>4.9400e-003</b>	<b>0.0292</b>	<b>1.0000e-005</b>	<b>1.1800e-003</b>	<b>3.0000e-005</b>	<b>1.2200e-003</b>	<b>3.0000e-004</b>	<b>3.0000e-005</b>	<b>3.4000e-004</b>	<b>0.0000</b>	<b>0.9348</b>	<b>0.9348</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.9354</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					8.7000e-004	0.0000	8.7000e-004	6.0000e-005	0.0000	6.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.6600e-003	0.0552	0.0916	1.6000e-004		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	12.3710	12.3710	2.0600e-003	0.0000	12.4144
<b>Total</b>	<b>2.6600e-003</b>	<b>0.0552</b>	<b>0.0916</b>	<b>1.6000e-004</b>	<b>8.7000e-004</b>	<b>2.0000e-004</b>	<b>1.0700e-003</b>	<b>6.0000e-005</b>	<b>2.0000e-004</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>12.3710</b>	<b>12.3710</b>	<b>2.0600e-003</b>	<b>0.0000</b>	<b>12.4144</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.4500e-003	4.7500e-003	0.0267	1.0000e-005	9.8000e-004	3.0000e-005	1.0200e-003	2.5000e-004	3.0000e-005	2.8000e-004	0.0000	0.7312	0.7312	1.0000e-005	0.0000	0.7315
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.5000e-004	1.9000e-004	2.4300e-003	0.0000	2.0000e-004	0.0000	2.0000e-004	5.0000e-005	0.0000	6.0000e-005	0.0000	0.2036	0.2036	1.0000e-005	0.0000	0.2039
<b>Total</b>	<b>2.0000e-003</b>	<b>4.9400e-003</b>	<b>0.0292</b>	<b>1.0000e-005</b>	<b>1.1800e-003</b>	<b>3.0000e-005</b>	<b>1.2200e-003</b>	<b>3.0000e-004</b>	<b>3.0000e-005</b>	<b>3.4000e-004</b>	<b>0.0000</b>	<b>0.9348</b>	<b>0.9348</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.9354</b>

### 3.4 Bore and Jack - 2018

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0211	0.1547	0.1337	2.6000e-004		7.9900e-003	7.9900e-003		7.6300e-003	7.6300e-003	0.0000	22.3458	22.3458	5.8900e-003	0.0000	22.4696
<b>Total</b>	<b>0.0211</b>	<b>0.1547</b>	<b>0.1337</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>7.9900e-003</b>	<b>7.9900e-003</b>	<b>0.0000</b>	<b>7.6300e-003</b>	<b>7.6300e-003</b>	<b>0.0000</b>	<b>22.3458</b>	<b>22.3458</b>	<b>5.8900e-003</b>	<b>0.0000</b>	<b>22.4696</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2000e-004	1.5000e-004	1.9100e-003	0.0000	1.4000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1508	0.1508	1.0000e-005	0.0000	0.1511
<b>Total</b>	<b>4.2000e-004</b>	<b>1.5000e-004</b>	<b>1.9100e-003</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1508</b>	<b>0.1508</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1511</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6800e-003	0.0449	0.1517	2.6000e-004		3.9000e-004	3.9000e-004		3.9000e-004	3.9000e-004	0.0000	22.3458	22.3458	5.8900e-003	0.0000	22.4695
<b>Total</b>	<b>3.6800e-003</b>	<b>0.0449</b>	<b>0.1517</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>3.9000e-004</b>	<b>3.9000e-004</b>	<b>0.0000</b>	<b>3.9000e-004</b>	<b>3.9000e-004</b>	<b>0.0000</b>	<b>22.3458</b>	<b>22.3458</b>	<b>5.8900e-003</b>	<b>0.0000</b>	<b>22.4695</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2000e-004	1.5000e-004	1.9100e-003	0.0000	1.4000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1508	0.1508	1.0000e-005	0.0000	0.1511
<b>Total</b>	<b>4.2000e-004</b>	<b>1.5000e-004</b>	<b>1.9100e-003</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1508</b>	<b>0.1508</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1511</b>

### 3.5 5th St Abandonment - 2018

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0115	0.0718	0.0692	1.1000e-004		4.5000e-003	4.5000e-003		4.4300e-003	4.4300e-003	0.0000	9.1198	9.1198	1.4100e-003	0.0000	9.1495
<b>Total</b>	<b>0.0115</b>	<b>0.0718</b>	<b>0.0692</b>	<b>1.1000e-004</b>	<b>0.0000</b>	<b>4.5000e-003</b>	<b>4.5000e-003</b>	<b>0.0000</b>	<b>4.4300e-003</b>	<b>4.4300e-003</b>	<b>0.0000</b>	<b>9.1198</b>	<b>9.1198</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>9.1495</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.0000e-005	1.3000e-004	7.3000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0192	0.0192	0.0000	0.0000	0.0192
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0000e-005	2.0000e-005	2.8000e-004	0.0000	2.0000e-005	0.0000	2.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0218	0.0218	0.0000	0.0000	0.0219
<b>Total</b>	<b>1.0000e-004</b>	<b>1.5000e-004</b>	<b>1.0100e-003</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.0410</b>	<b>0.0410</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0410</b>

#### Mitigated Construction On-Site



Off-Road	0.0230	0.1436	0.1384	2.2000e-004		8.9900e-003	8.9900e-003		8.8500e-003	8.8500e-003	0.0000	18.2395	18.2395	2.8300e-003	0.0000	18.2990
<b>Total</b>	<b>0.0230</b>	<b>0.1436</b>	<b>0.1384</b>	<b>2.2000e-004</b>	<b>0.0000</b>	<b>8.9900e-003</b>	<b>8.9900e-003</b>	<b>0.0000</b>	<b>8.8500e-003</b>	<b>8.8500e-003</b>	<b>0.0000</b>	<b>18.2395</b>	<b>18.2395</b>	<b>2.8300e-003</b>	<b>0.0000</b>	<b>18.2990</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.0000e-005	1.3000e-004	7.3000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0192	0.0192	0.0000	0.0000	0.0192
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2000e-004	4.0000e-005	5.5000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0437	0.0437	0.0000	0.0000	0.0437
<b>Total</b>	<b>1.6000e-004</b>	<b>1.7000e-004</b>	<b>1.2800e-003</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.0628</b>	<b>0.0628</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0629</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.1300e-003	0.0575	0.1349	2.2000e-004		1.4200e-003	1.4200e-003		1.4200e-003	1.4200e-003	0.0000	18.2395	18.2395	2.8300e-003	0.0000	18.2989
<b>Total</b>	<b>5.1300e-003</b>	<b>0.0575</b>	<b>0.1349</b>	<b>2.2000e-004</b>	<b>0.0000</b>	<b>1.4200e-003</b>	<b>1.4200e-003</b>	<b>0.0000</b>	<b>1.4200e-003</b>	<b>1.4200e-003</b>	<b>0.0000</b>	<b>18.2395</b>	<b>18.2395</b>	<b>2.8300e-003</b>	<b>0.0000</b>	<b>18.2989</b>

**Mitigated Construction Off-Site**



	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.0000e-005	1.3000e-004	7.3000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0192	0.0192	0.0000	0.0000	0.0192
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2000e-004	4.0000e-005	5.5000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0437	0.0437	0.0000	0.0000	0.0437
<b>Total</b>	<b>1.6000e-004</b>	<b>1.7000e-004</b>	<b>1.2800e-003</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.0628</b>	<b>0.0628</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0629</b>

### 3.7 HDD - Entry - 2019

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1712	1.7144	1.2349	2.3500e-003		0.0880	0.0880		0.0840	0.0840	0.0000	206.1720	206.1720	0.0415	0.0000	207.0436
<b>Total</b>	<b>0.1712</b>	<b>1.7144</b>	<b>1.2349</b>	<b>2.3500e-003</b>		<b>0.0880</b>	<b>0.0880</b>		<b>0.0840</b>	<b>0.0840</b>	<b>0.0000</b>	<b>206.1720</b>	<b>206.1720</b>	<b>0.0415</b>	<b>0.0000</b>	<b>207.0436</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	2.2000e-004	7.3000e-004	4.1300e-003	0.0000	2.0000e-005	1.0000e-005	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1129	0.1129	0.0000	0.0000	0.1130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.5700e-003	1.5700e-003	0.0201	2.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.4000e-004	3.0000e-005	4.6000e-004	0.0000	1.6839	1.6839	1.2000e-004	0.0000	1.6863
<b>Total</b>	<b>4.7900e-003</b>	<b>2.3000e-003</b>	<b>0.0242</b>	<b>2.0000e-005</b>	<b>1.6500e-003</b>	<b>4.0000e-005</b>	<b>1.6900e-003</b>	<b>4.5000e-004</b>	<b>3.0000e-005</b>	<b>4.7000e-004</b>	<b>0.0000</b>	<b>1.7968</b>	<b>1.7968</b>	<b>1.2000e-004</b>	<b>0.0000</b>	<b>1.7993</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0279	0.1242	1.3825	2.3500e-003		3.9100e-003	3.9100e-003		3.9100e-003	3.9100e-003	0.0000	206.1717	206.1717	0.0415	0.0000	207.0434
<b>Total</b>	<b>0.0279</b>	<b>0.1242</b>	<b>1.3825</b>	<b>2.3500e-003</b>		<b>3.9100e-003</b>	<b>3.9100e-003</b>		<b>3.9100e-003</b>	<b>3.9100e-003</b>	<b>0.0000</b>	<b>206.1717</b>	<b>206.1717</b>	<b>0.0415</b>	<b>0.0000</b>	<b>207.0434</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.2000e-004	7.3000e-004	4.1300e-003	0.0000	2.0000e-005	1.0000e-005	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1129	0.1129	0.0000	0.0000	0.1130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.5700e-003	1.5700e-003	0.0201	2.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.4000e-004	3.0000e-005	4.6000e-004	0.0000	1.6839	1.6839	1.2000e-004	0.0000	1.6863
<b>Total</b>	<b>4.7900e-003</b>	<b>2.3000e-003</b>	<b>0.0242</b>	<b>2.0000e-005</b>	<b>1.6500e-003</b>	<b>4.0000e-005</b>	<b>1.6900e-003</b>	<b>4.5000e-004</b>	<b>3.0000e-005</b>	<b>4.7000e-004</b>	<b>0.0000</b>	<b>1.7968</b>	<b>1.7968</b>	<b>1.2000e-004</b>	<b>0.0000</b>	<b>1.7993</b>

### 3.8 HDD- Insertion - 2019

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1592	1.5741	1.1436	2.1500e-003		0.0820	0.0820		0.0786	0.0786	0.0000	188.8620	188.8620	0.0354	0.0000	189.6057
<b>Total</b>	<b>0.1592</b>	<b>1.5741</b>	<b>1.1436</b>	<b>2.1500e-003</b>		<b>0.0820</b>	<b>0.0820</b>		<b>0.0786</b>	<b>0.0786</b>	<b>0.0000</b>	<b>188.8620</b>	<b>188.8620</b>	<b>0.0354</b>	<b>0.0000</b>	<b>189.6057</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.2000e-004	7.3000e-004	4.1300e-003	0.0000	2.0000e-005	1.0000e-005	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1129	0.1129	0.0000	0.0000	0.1130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.5700e-003	1.5700e-003	0.0201	2.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.4000e-004	3.0000e-005	4.6000e-004	0.0000	1.6839	1.6839	1.2000e-004	0.0000	1.6863
<b>Total</b>	<b>4.7900e-003</b>	<b>2.3000e-003</b>	<b>0.0242</b>	<b>2.0000e-005</b>	<b>1.6500e-003</b>	<b>4.0000e-005</b>	<b>1.6900e-003</b>	<b>4.5000e-004</b>	<b>3.0000e-005</b>	<b>4.7000e-004</b>	<b>0.0000</b>	<b>1.7968</b>	<b>1.7968</b>	<b>1.2000e-004</b>	<b>0.0000</b>	<b>1.7993</b>

#### Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0271	0.1285	1.2585	2.1500e-003		4.9800e-003	4.9800e-003		4.9800e-003	4.9800e-003	0.0000	188.8618	188.8618	0.0354	0.0000	189.6055
<b>Total</b>	<b>0.0271</b>	<b>0.1285</b>	<b>1.2585</b>	<b>2.1500e-003</b>		<b>4.9800e-003</b>	<b>4.9800e-003</b>		<b>4.9800e-003</b>	<b>4.9800e-003</b>	<b>0.0000</b>	<b>188.8618</b>	<b>188.8618</b>	<b>0.0354</b>	<b>0.0000</b>	<b>189.6055</b>

### Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.2000e-004	7.3000e-004	4.1300e-003	0.0000	2.0000e-005	1.0000e-005	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1129	0.1129	0.0000	0.0000	0.1130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.5700e-003	1.5700e-003	0.0201	2.0000e-005	1.6300e-003	3.0000e-005	1.6600e-003	4.4000e-004	3.0000e-005	4.6000e-004	0.0000	1.6839	1.6839	1.2000e-004	0.0000	1.6863
<b>Total</b>	<b>4.7900e-003</b>	<b>2.3000e-003</b>	<b>0.0242</b>	<b>2.0000e-005</b>	<b>1.6500e-003</b>	<b>4.0000e-005</b>	<b>1.6900e-003</b>	<b>4.5000e-004</b>	<b>3.0000e-005</b>	<b>4.7000e-004</b>	<b>0.0000</b>	<b>1.7968</b>	<b>1.7968</b>	<b>1.2000e-004</b>	<b>0.0000</b>	<b>1.7993</b>

### **3.9 Paving - Open Trench - 2019**

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.5400e-003	0.0967	0.0930	1.4000e-004		5.4600e-003	5.4600e-003		5.0400e-003	5.0400e-003	0.0000	12.6046	12.6046	3.9000e-003	0.0000	12.6864

Paving	0.0000					0.0000	0.0000			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
<b>Total</b>	<b>9.5400e-003</b>	<b>0.0967</b>	<b>0.0930</b>	<b>1.4000e-004</b>		<b>5.4600e-003</b>	<b>5.4600e-003</b>			<b>5.0400e-003</b>	<b>5.0400e-003</b>	<b>0.0000</b>	<b>12.6046</b>	<b>12.6046</b>	<b>3.9000e-003</b>	<b>0.0000</b>	<b>12.6864</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.7000e-004	1.3000e-004	1.6500e-003	0.0000	1.3000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1382	0.1382	1.0000e-005	0.0000	0.1384
<b>Total</b>	<b>3.7000e-004</b>	<b>1.3000e-004</b>	<b>1.6500e-003</b>	<b>0.0000</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1382</b>	<b>0.1382</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1384</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.2200e-003	0.0107	0.1056	1.4000e-004		3.6000e-004	3.6000e-004		3.6000e-004	3.6000e-004	0.0000	12.6046	12.6046	3.9000e-003	0.0000	12.6864
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>2.2200e-003</b>	<b>0.0107</b>	<b>0.1056</b>	<b>1.4000e-004</b>		<b>3.6000e-004</b>	<b>3.6000e-004</b>		<b>3.6000e-004</b>	<b>3.6000e-004</b>	<b>0.0000</b>	<b>12.6046</b>	<b>12.6046</b>	<b>3.9000e-003</b>	<b>0.0000</b>	<b>12.6864</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.7000e-004	1.3000e-004	1.6500e-003	0.0000	1.3000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1382	0.1382	1.0000e-005	0.0000	0.1384
<b>Total</b>	<b>3.7000e-004</b>	<b>1.3000e-004</b>	<b>1.6500e-003</b>	<b>0.0000</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1382</b>	<b>0.1382</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1384</b>

## Alameda Pipeline, Crossing 2 - Construction TAC

### Alameda County, Annual

### 1.0 Project Characteristics

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#### 1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	0.50	0.00	0

#### 1.2 Other Project Characteristics

<b>Urbanization</b>	Urban	<b>Wind Speed (m/s)</b>	2.2	<b>Precipitation Freq (Days)</b>	63
<b>Climate Zone</b>	5			<b>Operational Year</b>	2014
<b>Utility Company</b>	Pacific Gas & Electric Company				
<b>CO2 Intensity (lb/MWhr)</b>	641.35	<b>CH4 Intensity (lb/MWhr)</b>	0.029	<b>N2O Intensity (lb/MWhr)</b>	0.006

#### 1.3 User Entered Comments & Non-Default Data

Land Use - Lot acreage from construction data request sheet

Construction Phase - Schedule based on 2021 start date, up to 18 months construction, and anticipated work days provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

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Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - HDD: 615cy hauling @ 16cy/truck = 78 one-way trips. 19 trench workers, 25 HDD workers, 11 abandonment. 1 mile trip lengths.

Grading - 3,692 cy import, 5,064 cy export during Open Trench, 178 cy during Abandonment.

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	10.00	8.00
tblConstructionPhase	NumDays	2.00	204.00
tblConstructionPhase	NumDays	2.00	20.00
tblConstructionPhase	NumDays	2.00	10.00
tblConstructionPhase	NumDays	5.00	8.00
tblConstructionPhase	PhaseEndDate	9/29/2021	6/28/2022
tblConstructionPhase	PhaseEndDate	3/1/2023	6/28/2022
tblConstructionPhase	PhaseEndDate	11/22/2021	2/9/2021
tblConstructionPhase	PhaseEndDate	2/23/2021	1/26/2021
tblConstructionPhase	PhaseStartDate	1/27/2021	10/26/2021
tblConstructionPhase	PhaseStartDate	6/29/2022	10/26/2021
tblConstructionPhase	PhaseStartDate	10/26/2021	1/13/2021
tblConstructionPhase	PhaseStartDate	2/10/2021	1/13/2021
tblGrading	AcresOfGrading	0.00	0.50
tblGrading	MaterialExported	0.00	5,064.00
tblGrading	MaterialExported	0.00	178.00
tblGrading	MaterialImported	0.00	3,692.00
tblLandUse	LotAcreage	0.00	0.50
tblOffRoadEquipment	HorsePower	171.00	150.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	LoadFactor	0.42	0.50
tblOffRoadEquipment	LoadFactor	0.45	0.50



tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	6.00	16.00
tblOffRoadEquipment	UsageHours	6.00	0.90
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00

tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripNumber	0.00	39.00
tblTripsAndVMT	HaulingTripNumber	0.00	39.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripNumber	8.00	19.00
tblTripsAndVMT	WorkerTripNumber	10.00	19.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00
tblTripsAndVMT	WorkerTripNumber	38.00	11.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00

## 2.0 Emissions Summary

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### 2.1 Overall Construction

#### Unmitigated Construction



1	Demolition - Open Trench	Demolition	1/1/2021	1/12/2021	5	8
2	Grading/Excavation - Open Trench	Grading	1/13/2021	10/25/2021	5	204
3	Bore and Jack	Grading	1/13/2021	2/9/2021	5	20
4	2 Abandonments - BF11 and 2	Grading	1/13/2021	1/26/2021	5	10
5	HDD - Entry	Building Construction	10/26/2021	6/28/2022	5	176
6	HDD- Insertion	Building Construction	10/26/2021	6/28/2022	5	176
7	Paving - Open Trench	Paving	6/29/2022	7/8/2022	5	8

**Acres of Grading (Site Preparation Phase): 0**

**Acres of Grading (Grading Phase): 0**

**Acres of Paving: 0**

**Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)**

**OffRoad Equipment**

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition - Open Trench	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40
Demolition - Open Trench	Tractors/Loaders/Backhoes	2	16.00	97	0.37
Grading/Excavation - Open Trench	Concrete/Industrial Saws	0	8.00	81	0.73
Grading/Excavation - Open Trench	Excavators	1	0.90	162	0.38
Grading/Excavation - Open Trench	Pumps	2	4.50	50	0.74
Grading/Excavation - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40
Grading/Excavation - Open Trench	Tractors/Loaders/Backhoes	1	0.90	97	0.37
Bore and Jack	Bore/Drill Rigs	1	8.00	205	0.50
Bore and Jack	Concrete/Industrial Saws	0	8.00	81	0.73
Bore and Jack	Excavators	1	8.00	162	0.38
Bore and Jack	Pumps	2	8.00	50	0.74
Bore and Jack	Rubber Tired Dozers	0	1.00	255	0.40
Bore and Jack	Tractors/Loaders/Backhoes	1	8.00	97	0.37
2 Abandonments - BF11 and 2	Cement and Mortar Mixers	2	8.00	9	0.56

2 Abandonments - BF11 and 2	Concrete/Industrial Saws	1	8.00	81	0.73
2 Abandonments - BF11 and 2	Excavators	2	8.00	162	0.38
2 Abandonments - BF11 and 2	Generator Sets	2	8.00	84	0.74
2 Abandonments - BF11 and 2	Pumps	4	16.00	50	0.74
2 Abandonments - BF11 and 2	Rubber Tired Dozers	0	1.00	255	0.40
2 Abandonments - BF11 and 2	Tractors/Loaders/Backhoes	2	8.00	97	0.37
2 Abandonments - BF11 and 2	Welders	2	8.00	85	0.50
HDD - Entry	Bore/Drill Rigs	1	0.90	205	0.50
HDD - Entry	Cement and Mortar Mixers	1	2.70	9	0.56
HDD - Entry	Cranes	1	11.10	226	0.29
HDD - Entry	Excavators	1	3.60	162	0.38
HDD - Entry	Forklifts	0	6.00	89	0.20
HDD - Entry	Generator Sets	1	7.50	84	0.74
HDD - Entry	Other Construction Equipment	1	1.90	150	0.50
HDD - Entry	Pumps	1	7.50	84	0.74
HDD - Entry	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Cranes	1	11.10	226	0.29
HDD- Insertion	Excavators	1	3.60	162	0.38
HDD- Insertion	Forklifts	0	6.00	89	0.20
HDD- Insertion	Generator Sets	1	7.50	84	0.74
HDD- Insertion	Pumps	1	7.50	84	0.74
HDD- Insertion	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Welders	1	0.90	85	0.50
Paving - Open Trench	Cement and Mortar Mixers	1	8.00	9	0.56
Paving - Open Trench	Pavers	1	8.00	125	0.42
Paving - Open Trench	Paving Equipment	1	8.00	130	0.36
Paving - Open Trench	Rollers	1	8.00	80	0.38
Paving - Open Trench	Tractors/Loaders/Backhoes	1	8.00	97	0.37

**Trips and VMT**

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition - Open Trench	3	19.00	0.00	0.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
Grading/Excavation - Open Trench	4	19.00	0.00	1,095.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
Bore and Jack	5	19.00	0.00	0.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
2 Abandonments - BE11 and 2	15	11.00	0.00	22.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
HDD - Entry	8	25.00	0.00	39.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
HDD- Insertion	6	25.00	0.00	39.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT
Paving - Open Trench	5	19.00	0.00	0.00	1.00	1.00	1.00	LD_Mix	HDT_Mix	HHDT

### 3.1 Mitigation Measures Construction

### 3.2 Demolition - Open Trench - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.5400e-003	0.0425	0.0509	7.0000e-005		2.4800e-003	2.4800e-003		2.3400e-003	2.3400e-003	0.0000	6.5182	6.5182	1.5400e-003	0.0000	6.5505
<b>Total</b>	<b>4.5400e-003</b>	<b>0.0425</b>	<b>0.0509</b>	<b>7.0000e-005</b>		<b>2.4800e-003</b>	<b>2.4800e-003</b>		<b>2.3400e-003</b>	<b>2.3400e-003</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
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Category	tons/yr										MT/yr					
	Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-004	5.0000e-005	5.9000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0549	0.0549	0.0000	0.0000	0.0549
<b>Total</b>	<b>1.4000e-004</b>	<b>5.0000e-005</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0549</b>	<b>0.0549</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0549</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.5400e-003	0.0425	0.0509	7.0000e-005		2.4800e-003	2.4800e-003		2.3400e-003	2.3400e-003	0.0000	6.5182	6.5182	1.5400e-003	0.0000	6.5505
<b>Total</b>	<b>4.5400e-003</b>	<b>0.0425</b>	<b>0.0509</b>	<b>7.0000e-005</b>		<b>2.4800e-003</b>	<b>2.4800e-003</b>		<b>2.3400e-003</b>	<b>2.3400e-003</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-004	5.0000e-005	5.9000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0549	0.0549	0.0000	0.0000	0.0549

<b>Total</b>	<b>1.4000e-004</b>	<b>5.0000e-005</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0549</b>	<b>0.0549</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0549</b>
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### 3.3 Grading/Excavation - Open Trench - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					7.6000e-004	0.0000	7.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0551	0.3441	0.3714	6.2000e-004		0.0156	0.0156		0.0154	0.0154	0.0000	47.0768	47.0768	6.8200e-003	0.0000	47.2200
<b>Total</b>	<b>0.0551</b>	<b>0.3441</b>	<b>0.3714</b>	<b>6.2000e-004</b>	<b>7.6000e-004</b>	<b>0.0156</b>	<b>0.0164</b>	<b>1.0000e-004</b>	<b>0.0154</b>	<b>0.0155</b>	<b>0.0000</b>	<b>47.0768</b>	<b>47.0768</b>	<b>6.8200e-003</b>	<b>0.0000</b>	<b>47.2200</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.3900e-003	0.0139	0.0889	3.0000e-005	4.7000e-004	1.1000e-004	5.8000e-004	1.3000e-004	1.0000e-004	2.3000e-004	0.0000	2.5114	2.5114	4.0000e-005	0.0000	2.5124
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.5900e-003	1.1600e-003	0.0150	2.0000e-005	1.4400e-003	3.0000e-005	1.4600e-003	3.8000e-004	2.0000e-005	4.1000e-004	0.0000	1.3989	1.3989	9.0000e-005	0.0000	1.4007
<b>Total</b>	<b>7.9800e-003</b>	<b>0.0150</b>	<b>0.1039</b>	<b>5.0000e-005</b>	<b>1.9100e-003</b>	<b>1.4000e-004</b>	<b>2.0400e-003</b>	<b>5.1000e-004</b>	<b>1.2000e-004</b>	<b>6.4000e-004</b>	<b>0.0000</b>	<b>3.9103</b>	<b>3.9103</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>3.9131</b>

#### Mitigated Construction On-Site



	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					7.6000e-004	0.0000	7.6000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0551	0.3441	0.3714	6.2000e-004		0.0156	0.0156		0.0154	0.0154	0.0000	47.0768	47.0768	6.8200e-003	0.0000	47.2199
<b>Total</b>	<b>0.0551</b>	<b>0.3441</b>	<b>0.3714</b>	<b>6.2000e-004</b>	<b>7.6000e-004</b>	<b>0.0156</b>	<b>0.0164</b>	<b>1.0000e-004</b>	<b>0.0154</b>	<b>0.0155</b>	<b>0.0000</b>	<b>47.0768</b>	<b>47.0768</b>	<b>6.8200e-003</b>	<b>0.0000</b>	<b>47.2199</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.3900e-003	0.0139	0.0889	3.0000e-005	4.7000e-004	1.1000e-004	5.8000e-004	1.3000e-004	1.0000e-004	2.3000e-004	0.0000	2.5114	2.5114	4.0000e-005	0.0000	2.5124
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.5900e-003	1.1600e-003	0.0150	2.0000e-005	1.4400e-003	3.0000e-005	1.4600e-003	3.8000e-004	2.0000e-005	4.1000e-004	0.0000	1.3989	1.3989	9.0000e-005	0.0000	1.4007
<b>Total</b>	<b>7.9800e-003</b>	<b>0.0150</b>	<b>0.1039</b>	<b>5.0000e-005</b>	<b>1.9100e-003</b>	<b>1.4000e-004</b>	<b>2.0400e-003</b>	<b>5.1000e-004</b>	<b>1.2000e-004</b>	<b>6.4000e-004</b>	<b>0.0000</b>	<b>3.9103</b>	<b>3.9103</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>3.9131</b>

**3.4 Bore and Jack - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0154	0.1208	0.1289	2.6000e-004		5.3200e-003	5.3200e-003		5.0800e-003	5.0800e-003	0.0000	21.7860	21.7860	5.5800e-003	0.0000	21.9032
<b>Total</b>	<b>0.0154</b>	<b>0.1208</b>	<b>0.1289</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>5.3200e-003</b>	<b>5.3200e-003</b>	<b>0.0000</b>	<b>5.0800e-003</b>	<b>5.0800e-003</b>	<b>0.0000</b>	<b>21.7860</b>	<b>21.7860</b>	<b>5.5800e-003</b>	<b>0.0000</b>	<b>21.9032</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.5000e-004	1.1000e-004	1.4700e-003	0.0000	1.4000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1372	0.1372	1.0000e-005	0.0000	0.1373
<b>Total</b>	<b>3.5000e-004</b>	<b>1.1000e-004</b>	<b>1.4700e-003</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1372</b>	<b>0.1372</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1373</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0154	0.1208	0.1289	2.6000e-004		5.3200e-003	5.3200e-003		5.0800e-003	5.0800e-003	0.0000	21.7860	21.7860	5.5800e-003	0.0000	21.9031
<b>Total</b>	<b>0.0154</b>	<b>0.1208</b>	<b>0.1289</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>5.3200e-003</b>	<b>5.3200e-003</b>	<b>0.0000</b>	<b>5.0800e-003</b>	<b>5.0800e-003</b>	<b>0.0000</b>	<b>21.7860</b>	<b>21.7860</b>	<b>5.5800e-003</b>	<b>0.0000</b>	<b>21.9031</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.5000e-004	1.1000e-004	1.4700e-003	0.0000	1.4000e-004	0.0000	1.4000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.1372	0.1372	1.0000e-005	0.0000	0.1373
<b>Total</b>	<b>3.5000e-004</b>	<b>1.1000e-004</b>	<b>1.4700e-003</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>0.0000</b>	<b>1.4000e-004</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>4.0000e-005</b>	<b>0.0000</b>	<b>0.1372</b>	<b>0.1372</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.1373</b>

**3.5 2 Abandonments - BF11 and 2 - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0309	0.2179	0.2483	4.2000e-004		0.0108	0.0108		0.0107	0.0107	0.0000	33.5027	33.5027	4.5500e-003	0.0000	33.5982
<b>Total</b>	<b>0.0309</b>	<b>0.2179</b>	<b>0.2483</b>	<b>4.2000e-004</b>	<b>1.0000e-005</b>	<b>0.0108</b>	<b>0.0108</b>	<b>0.0000</b>	<b>0.0107</b>	<b>0.0107</b>	<b>0.0000</b>	<b>33.5027</b>	<b>33.5027</b>	<b>4.5500e-003</b>	<b>0.0000</b>	<b>33.5982</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
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Category	tons/yr										MT/yr					
	Hauling	9.0000e-005	2.8000e-004	1.7900e-003	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0505	0.0505	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	3.0000e-005	4.3000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0397	0.0397	0.0000	0.0000	0.0398
<b>Total</b>	<b>1.9000e-004</b>	<b>3.1000e-004</b>	<b>2.2200e-003</b>	<b>0.0000</b>	<b>5.0000e-005</b>	<b>0.0000</b>	<b>5.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.0902</b>	<b>0.0902</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0902</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0309	0.2179	0.2483	4.2000e-004		0.0108	0.0108		0.0107	0.0107	0.0000	33.5026	33.5026	4.5500e-003	0.0000	33.5982
<b>Total</b>	<b>0.0309</b>	<b>0.2179</b>	<b>0.2483</b>	<b>4.2000e-004</b>	<b>1.0000e-005</b>	<b>0.0108</b>	<b>0.0108</b>	<b>0.0000</b>	<b>0.0107</b>	<b>0.0107</b>	<b>0.0000</b>	<b>33.5026</b>	<b>33.5026</b>	<b>4.5500e-003</b>	<b>0.0000</b>	<b>33.5982</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.0000e-005	2.8000e-004	1.7900e-003	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0505	0.0505	0.0000	0.0000	0.0505
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	3.0000e-005	4.3000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0397	0.0397	0.0000	0.0000	0.0398

<b>Total</b>	<b>1.9000e-004</b>	<b>3.1000e-004</b>	<b>2.2200e-003</b>	<b>0.0000</b>	<b>5.0000e-005</b>	<b>0.0000</b>	<b>5.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>0.0902</b>	<b>0.0902</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0902</b>
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### 3.6 HDD - Entry - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0390	0.3902	0.3308	6.5000e-004		0.0186	0.0186		0.0178	0.0178	0.0000	56.7355	56.7355	0.0112	0.0000	56.9715
<b>Total</b>	<b>0.0390</b>	<b>0.3902</b>	<b>0.3308</b>	<b>6.5000e-004</b>		<b>0.0186</b>	<b>0.0186</b>		<b>0.0178</b>	<b>0.0178</b>	<b>0.0000</b>	<b>56.7355</b>	<b>56.7355</b>	<b>0.0112</b>	<b>0.0000</b>	<b>56.9715</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.0000e-005	1.4000e-004	8.8000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0249	0.0249	0.0000	0.0000	0.0249
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	3.7000e-004	4.7500e-003	1.0000e-005	4.5000e-004	1.0000e-005	4.6000e-004	1.2000e-004	1.0000e-005	1.3000e-004	0.0000	0.4421	0.4421	3.0000e-005	0.0000	0.4427
<b>Total</b>	<b>1.1800e-003</b>	<b>5.1000e-004</b>	<b>5.6300e-003</b>	<b>1.0000e-005</b>	<b>4.6000e-004</b>	<b>1.0000e-005</b>	<b>4.7000e-004</b>	<b>1.2000e-004</b>	<b>1.0000e-005</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>0.4670</b>	<b>0.4670</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>0.4676</b>

#### Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0390	0.3902	0.3308	6.5000e-004		0.0186	0.0186		0.0178	0.0178	0.0000	56.7354	56.7354	0.0112	0.0000	56.9714
<b>Total</b>	<b>0.0390</b>	<b>0.3902</b>	<b>0.3308</b>	<b>6.5000e-004</b>		<b>0.0186</b>	<b>0.0186</b>		<b>0.0178</b>	<b>0.0178</b>	<b>0.0000</b>	<b>56.7354</b>	<b>56.7354</b>	<b>0.0112</b>	<b>0.0000</b>	<b>56.9714</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.0000e-005	1.4000e-004	8.8000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0249	0.0249	0.0000	0.0000	0.0249
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	3.7000e-004	4.7500e-003	1.0000e-005	4.5000e-004	1.0000e-005	4.6000e-004	1.2000e-004	1.0000e-005	1.3000e-004	0.0000	0.4421	0.4421	3.0000e-005	0.0000	0.4427
<b>Total</b>	<b>1.1800e-003</b>	<b>5.1000e-004</b>	<b>5.6300e-003</b>	<b>1.0000e-005</b>	<b>4.6000e-004</b>	<b>1.0000e-005</b>	<b>4.7000e-004</b>	<b>1.2000e-004</b>	<b>1.0000e-005</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>0.4670</b>	<b>0.4670</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>0.4676</b>

**3.6 HDD - Entry - 2022**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	0.0920	0.8943	0.8465	1.7000e-003		0.0420	0.0420		0.0401	0.0401	0.0000	147.0665	147.0665	0.0289	0.0000	147.6734
<b>Total</b>	<b>0.0920</b>	<b>0.8943</b>	<b>0.8465</b>	<b>1.7000e-003</b>		<b>0.0420</b>	<b>0.0420</b>		<b>0.0401</b>	<b>0.0401</b>	<b>0.0000</b>	<b>147.0665</b>	<b>147.0665</b>	<b>0.0289</b>	<b>0.0000</b>	<b>147.6734</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-004	3.3000e-004	2.1700e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0645	0.0645	0.0000	0.0000	0.0645
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.8000e-003	8.8000e-004	0.0114	2.0000e-005	1.1800e-003	2.0000e-005	1.2000e-003	3.1000e-004	2.0000e-005	3.4000e-004	0.0000	1.1271	1.1271	7.0000e-005	0.0000	1.1285
<b>Total</b>	<b>2.9000e-003</b>	<b>1.2100e-003</b>	<b>0.0136</b>	<b>2.0000e-005</b>	<b>1.2000e-003</b>	<b>2.0000e-005</b>	<b>1.2200e-003</b>	<b>3.1000e-004</b>	<b>2.0000e-005</b>	<b>3.5000e-004</b>	<b>0.0000</b>	<b>1.1916</b>	<b>1.1916</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.1930</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0920	0.8943	0.8465	1.7000e-003		0.0420	0.0420		0.0401	0.0401	0.0000	147.0663	147.0663	0.0289	0.0000	147.6732
<b>Total</b>	<b>0.0920</b>	<b>0.8943</b>	<b>0.8465</b>	<b>1.7000e-003</b>		<b>0.0420</b>	<b>0.0420</b>		<b>0.0401</b>	<b>0.0401</b>	<b>0.0000</b>	<b>147.0663</b>	<b>147.0663</b>	<b>0.0289</b>	<b>0.0000</b>	<b>147.6732</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-004	3.3000e-004	2.1700e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0645	0.0645	0.0000	0.0000	0.0645
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.8000e-003	8.8000e-004	0.0114	2.0000e-005	1.1800e-003	2.0000e-005	1.2000e-003	3.1000e-004	2.0000e-005	3.4000e-004	0.0000	1.1271	1.1271	7.0000e-005	0.0000	1.1285
<b>Total</b>	<b>2.9000e-003</b>	<b>1.2100e-003</b>	<b>0.0136</b>	<b>2.0000e-005</b>	<b>1.2000e-003</b>	<b>2.0000e-005</b>	<b>1.2200e-003</b>	<b>3.1000e-004</b>	<b>2.0000e-005</b>	<b>3.5000e-004</b>	<b>0.0000</b>	<b>1.1916</b>	<b>1.1916</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.1930</b>

**3.7 HDD- Insertion - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0362	0.3593	0.3058	6.0000e-004		0.0173	0.0173		0.0166	0.0166	0.0000	52.0261	52.0261	9.5200e-003	0.0000	52.2261
<b>Total</b>	<b>0.0362</b>	<b>0.3593</b>	<b>0.3058</b>	<b>6.0000e-004</b>		<b>0.0173</b>	<b>0.0173</b>		<b>0.0166</b>	<b>0.0166</b>	<b>0.0000</b>	<b>52.0261</b>	<b>52.0261</b>	<b>9.5200e-003</b>	<b>0.0000</b>	<b>52.2261</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
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Category	tons/yr										MT/yr					
	Hauling	4.0000e-005	1.4000e-004	8.8000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0249	0.0249	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	3.7000e-004	4.7500e-003	1.0000e-005	4.5000e-004	1.0000e-005	4.6000e-004	1.2000e-004	1.0000e-005	1.3000e-004	0.0000	0.4421	0.4421	3.0000e-005	0.0000	0.4427
<b>Total</b>	<b>1.1800e-003</b>	<b>5.1000e-004</b>	<b>5.6300e-003</b>	<b>1.0000e-005</b>	<b>4.6000e-004</b>	<b>1.0000e-005</b>	<b>4.7000e-004</b>	<b>1.2000e-004</b>	<b>1.0000e-005</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>0.4670</b>	<b>0.4670</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>0.4676</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0362	0.3593	0.3058	6.0000e-004		0.0173	0.0173		0.0166	0.0166	0.0000	52.0260	52.0260	9.5200e-003	0.0000	52.2260
<b>Total</b>	<b>0.0362</b>	<b>0.3593</b>	<b>0.3058</b>	<b>6.0000e-004</b>		<b>0.0173</b>	<b>0.0173</b>		<b>0.0166</b>	<b>0.0166</b>	<b>0.0000</b>	<b>52.0260</b>	<b>52.0260</b>	<b>9.5200e-003</b>	<b>0.0000</b>	<b>52.2260</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.0000e-005	1.4000e-004	8.8000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0249	0.0249	0.0000	0.0000	0.0249
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	3.7000e-004	4.7500e-003	1.0000e-005	4.5000e-004	1.0000e-005	4.6000e-004	1.2000e-004	1.0000e-005	1.3000e-004	0.0000	0.4421	0.4421	3.0000e-005	0.0000	0.4427

<b>Total</b>	<b>1.1800e-003</b>	<b>5.1000e-004</b>	<b>5.6300e-003</b>	<b>1.0000e-005</b>	<b>4.6000e-004</b>	<b>1.0000e-005</b>	<b>4.7000e-004</b>	<b>1.2000e-004</b>	<b>1.0000e-005</b>	<b>1.3000e-004</b>	<b>0.0000</b>	<b>0.4670</b>	<b>0.4670</b>	<b>3.0000e-005</b>	<b>0.0000</b>	<b>0.4676</b>
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### 3.7 HDD- Insertion - 2022

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0854	0.8267	0.7826	1.5500e-003		0.0389	0.0389		0.0373	0.0373	0.0000	134.8543	134.8543	0.0244	0.0000	135.3675
<b>Total</b>	<b>0.0854</b>	<b>0.8267</b>	<b>0.7826</b>	<b>1.5500e-003</b>		<b>0.0389</b>	<b>0.0389</b>		<b>0.0373</b>	<b>0.0373</b>	<b>0.0000</b>	<b>134.8543</b>	<b>134.8543</b>	<b>0.0244</b>	<b>0.0000</b>	<b>135.3675</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-004	3.3000e-004	2.1700e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0645	0.0645	0.0000	0.0000	0.0645
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.8000e-003	8.8000e-004	0.0114	2.0000e-005	1.1800e-003	2.0000e-005	1.2000e-003	3.1000e-004	2.0000e-005	3.4000e-004	0.0000	1.1271	1.1271	7.0000e-005	0.0000	1.1285
<b>Total</b>	<b>2.9000e-003</b>	<b>1.2100e-003</b>	<b>0.0136</b>	<b>2.0000e-005</b>	<b>1.2000e-003</b>	<b>2.0000e-005</b>	<b>1.2200e-003</b>	<b>3.1000e-004</b>	<b>2.0000e-005</b>	<b>3.5000e-004</b>	<b>0.0000</b>	<b>1.1916</b>	<b>1.1916</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.1930</b>

#### Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0854	0.8267	0.7826	1.5500e-003		0.0389	0.0389		0.0373	0.0373	0.0000	134.8542	134.8542	0.0244	0.0000	135.3674
<b>Total</b>	<b>0.0854</b>	<b>0.8267</b>	<b>0.7826</b>	<b>1.5500e-003</b>		<b>0.0389</b>	<b>0.0389</b>		<b>0.0373</b>	<b>0.0373</b>	<b>0.0000</b>	<b>134.8542</b>	<b>134.8542</b>	<b>0.0244</b>	<b>0.0000</b>	<b>135.3674</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-004	3.3000e-004	2.1700e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0645	0.0645	0.0000	0.0000	0.0645
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.8000e-003	8.8000e-004	0.0114	2.0000e-005	1.1800e-003	2.0000e-005	1.2000e-003	3.1000e-004	2.0000e-005	3.4000e-004	0.0000	1.1271	1.1271	7.0000e-005	0.0000	1.1285
<b>Total</b>	<b>2.9000e-003</b>	<b>1.2100e-003</b>	<b>0.0136</b>	<b>2.0000e-005</b>	<b>1.2000e-003</b>	<b>2.0000e-005</b>	<b>1.2200e-003</b>	<b>3.1000e-004</b>	<b>2.0000e-005</b>	<b>3.5000e-004</b>	<b>0.0000</b>	<b>1.1916</b>	<b>1.1916</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>1.1930</b>

**3.8 Paving - Open Trench - 2022**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	3.0600e-003	0.0300	0.0388	6.0000e-005		1.5300e-003	1.5300e-003		1.4100e-003	1.4100e-003	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>3.0600e-003</b>	<b>0.0300</b>	<b>0.0388</b>	<b>6.0000e-005</b>		<b>1.5300e-003</b>	<b>1.5300e-003</b>		<b>1.4100e-003</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	4.0000e-005	5.5000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0540	0.0540	0.0000	0.0000	0.0540
<b>Total</b>	<b>1.3000e-004</b>	<b>4.0000e-005</b>	<b>5.5000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0540</b>	<b>0.0540</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0540</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.0600e-003	0.0300	0.0388	6.0000e-005		1.5300e-003	1.5300e-003		1.4100e-003	1.4100e-003	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>3.0600e-003</b>	<b>0.0300</b>	<b>0.0388</b>	<b>6.0000e-005</b>		<b>1.5300e-003</b>	<b>1.5300e-003</b>		<b>1.4100e-003</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	4.0000e-005	5.5000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0540	0.0540	0.0000	0.0000	0.0540
<b>Total</b>	<b>1.3000e-004</b>	<b>4.0000e-005</b>	<b>5.5000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0540</b>	<b>0.0540</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0540</b>

## Alameda Pipeline, Crossing 3 - Construction TAC

### Alameda County, Annual

### 1.0 Project Characteristics

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#### 1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	0.50	0.00	0

#### 1.2 Other Project Characteristics

<b>Urbanization</b>	Urban	<b>Wind Speed (m/s)</b>	2.2	<b>Precipitation Freq (Days)</b>	63
<b>Climate Zone</b>	5			<b>Operational Year</b>	2014
<b>Utility Company</b>	Pacific Gas & Electric Company				
<b>CO2 Intensity (lb/MW hr)</b>	641.35	<b>CH4 Intensity (lb/MW hr)</b>	0.029	<b>N2O Intensity (lb/MW hr)</b>	0.006

#### 1.3 User Entered Comments & Non-Default Data

Land Use - Lot acreage from construction data request sheet

Construction Phase - Schedule based on 2021 start date, up to 19 months construction, and anticipated work days provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - HDD: 585cy hauling @ 16cy/truck = 74 one-way trips. 19 trench workers, 25 HDD workers, 11 abandonment. 1 mile trip lengths.

Grading - 3,997 cy import, 6,001 cy export during Open Trench, 311 cy during Abandonment.

Construction Off-road Equipment Mitigation - Tier 4 engines for equip > 50hp/ BAAQMD BMPs.

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	12.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	100.00	176.00
tblConstructionPhase	NumDays	10.00	8.00
tblConstructionPhase	NumDays	2.00	226.00

tblConstructionPhase	NumDays	2.00	10.00
tblConstructionPhase	NumDays	5.00	8.00
tblConstructionPhase	PhaseEndDate	9/29/2021	7/28/2022
tblConstructionPhase	PhaseEndDate	3/31/2023	7/28/2022
tblConstructionPhase	PhaseEndDate	12/8/2021	1/26/2021
tblConstructionPhase	PhaseStartDate	1/27/2021	11/25/2021
tblConstructionPhase	PhaseStartDate	7/29/2022	11/25/2021
tblConstructionPhase	PhaseStartDate	11/25/2021	1/13/2021
tblGrading	AcresOfGrading	0.00	0.50
tblGrading	MaterialExported	0.00	6,001.00
tblGrading	MaterialExported	0.00	311.00
tblGrading	MaterialImported	0.00	3,997.00
tblLandUse	LotAcreage	0.00	0.50
tblOffRoadEquipment	HorsePower	171.00	150.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	84.00	50.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	HorsePower	46.00	85.00
tblOffRoadEquipment	LoadFactor	0.42	0.50
tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	LoadFactor	0.45	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00



tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	4.00	11.10
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	8.00	3.60
tblOffRoadEquipment	UsageHours	6.00	16.00
tblOffRoadEquipment	UsageHours	6.00	0.80
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripLength	20.00	1.00
tblTripsAndVMT	HaulingTripNumber	0.00	37.00
tblTripsAndVMT	HaulingTripNumber	0.00	37.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	VendorTripLength	7.30	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00

tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripLength	12.40	1.00
tblTripsAndVMT	WorkerTripNumber	8.00	19.00
tblTripsAndVMT	WorkerTripNumber	10.00	19.00
tblTripsAndVMT	WorkerTripNumber	80.00	11.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	0.00	25.00
tblTripsAndVMT	WorkerTripNumber	13.00	19.00

## 2.0 Emissions Summary

### 2.1 Overall Construction

#### Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.1790	1.2933	1.4441	2.3700e-003	3.6200e-003	0.0618	0.0655	8.6000e-004	0.0603	0.0611	0.0000	192.2036	192.2036	0.0295	0.0000	192.8229
2022	0.2182	2.0520	1.9822	3.9200e-003	2.8500e-003	0.0965	0.0994	7.6000e-004	0.0923	0.0931	0.0000	338.7963	338.7963	0.0644	0.0000	340.1484
<b>Total</b>	<b>0.3972</b>	<b>3.3453</b>	<b>3.4263</b>	<b>6.2900e-003</b>	<b>6.4700e-003</b>	<b>0.1584</b>	<b>0.1648</b>	<b>1.6200e-003</b>	<b>0.1526</b>	<b>0.1542</b>	<b>0.0000</b>	<b>530.9999</b>	<b>530.9999</b>	<b>0.0939</b>	<b>0.0000</b>	<b>532.9713</b>

#### Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
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Year	tons/yr										MT/yr					
	2021	0.0429	0.4484	1.4852	2.3700e-003	3.1500e-003	3.5900e-003	6.7400e-003	7.7000e-004	3.5800e-003	4.3500e-003	0.0000	192.2033	192.2033	0.0295	0.0000
2022	0.0517	0.2000	2.3129	3.9200e-003	2.8500e-003	6.2100e-003	9.0600e-003	7.6000e-004	6.2100e-003	6.9700e-003	0.0000	338.7959	338.7959	0.0644	0.0000	340.1480
<b>Total</b>	<b>0.0946</b>	<b>0.6484</b>	<b>3.7981</b>	<b>6.2900e-003</b>	<b>6.0000e-003</b>	<b>9.8000e-003</b>	<b>0.0158</b>	<b>1.5300e-003</b>	<b>9.7900e-003</b>	<b>0.0113</b>	<b>0.0000</b>	<b>530.9993</b>	<b>530.9993</b>	<b>0.0939</b>	<b>0.0000</b>	<b>532.9706</b>

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
<b>Percent Reduction</b>	<b>76.19</b>	<b>80.62</b>	<b>-10.85</b>	<b>0.00</b>	<b>7.26</b>	<b>93.81</b>	<b>90.41</b>	<b>5.56</b>	<b>93.58</b>	<b>92.66</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

### 3.0 Construction Detail

#### Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition - Open Trench	Demolition	1/1/2021	1/12/2021	5	8	
2	Grading/Excavation - Open Trench	Grading	1/13/2021	11/24/2021	5	226	
3	4 Abandonments	Grading	1/13/2021	1/26/2021	5	10	
4	HDD - Entry	Building Construction	11/25/2021	7/28/2022	5	176	
5	HDD - Insertion	Building Construction	11/25/2021	7/28/2022	5	176	
6	Paving - Open Trench	Paving	7/29/2022	8/9/2022	5	8	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

#### OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition - Open Trench	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40

Demolition - Open Trench	Tractors/Loaders/Backhoes	2	16.00	97	0.37
Grading/Excavation - Open Trench	Concrete/Industrial Saws	0	8.00	81	0.73
Grading/Excavation - Open Trench	Excavators	1	0.80	162	0.38
Grading/Excavation - Open Trench	Pumps	2	4.20	50	0.74
Grading/Excavation - Open Trench	Rubber Tired Dozers	0	1.00	255	0.40
Grading/Excavation - Open Trench	Tractors/Loaders/Backhoes	1	0.80	97	0.37
4 Abandonments	Cement and Mortar Mixers	4	8.00	9	0.56
4 Abandonments	Concrete/Industrial Saws	4	8.00	81	0.73
4 Abandonments	Excavators	4	8.00	162	0.38
4 Abandonments	Generator Sets	4	8.00	84	0.74
4 Abandonments	Pumps	8	16.00	50	0.74
4 Abandonments	Rubber Tired Dozers	0	1.00	255	0.40
4 Abandonments	Tractors/Loaders/Backhoes	4	8.00	97	0.37
4 Abandonments	Welders	4	8.00	85	0.50
HDD - Entry	Bore/Drill Rigs	1	0.90	205	0.50
HDD - Entry	Cement and Mortar Mixers	1	2.70	9	0.56
HDD - Entry	Cranes	1	11.10	226	0.29
HDD - Entry	Excavators	1	3.60	162	0.38
HDD - Entry	Forklifts	0	6.00	89	0.20
HDD - Entry	Generator Sets	1	7.50	84	0.74
HDD - Entry	Other Construction Equipment	1	1.90	150	0.50
HDD - Entry	Pumps	1	7.50	84	0.74
HDD - Entry	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Cranes	1	11.10	226	0.29
HDD- Insertion	Excavators	1	3.60	162	0.38
HDD- Insertion	Forklifts	0	6.00	89	0.20
HDD- Insertion	Generator Sets	1	7.50	84	0.74
HDD- Insertion	Pumps	1	7.50	84	0.74
HDD- Insertion	Tractors/Loaders/Backhoes	1	3.60	97	0.37
HDD- Insertion	Welders	1	0.90	85	0.50



Category	tons/yr										MT/yr					
	Off-Road	4.5400e-003	0.0425	0.0509	7.0000e-005		2.4800e-003	2.4800e-003		2.3400e-003	2.3400e-003	0.0000	6.5182	6.5182	1.5400e-003	0.0000
<b>Total</b>	<b>4.5400e-003</b>	<b>0.0425</b>	<b>0.0509</b>	<b>7.0000e-005</b>		<b>2.4800e-003</b>	<b>2.4800e-003</b>		<b>2.3400e-003</b>	<b>2.3400e-003</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>

**Unmitigated Construction Off-Site**

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-004	5.0000e-005	5.9000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0549	0.0549	0.0000	0.0000	0.0549
<b>Total</b>	<b>1.4000e-004</b>	<b>5.0000e-005</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0549</b>	<b>0.0549</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0549</b>

**Mitigated Construction On-Site**

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Off-Road	8.6000e-004	3.7200e-003	0.0529	7.0000e-005		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	6.5182	6.5182	1.5400e-003	0.0000	6.5505
<b>Total</b>	<b>8.6000e-004</b>	<b>3.7200e-003</b>	<b>0.0529</b>	<b>7.0000e-005</b>		<b>1.1000e-004</b>	<b>1.1000e-004</b>		<b>1.1000e-004</b>	<b>1.1000e-004</b>	<b>0.0000</b>	<b>6.5182</b>	<b>6.5182</b>	<b>1.5400e-003</b>	<b>0.0000</b>	<b>6.5505</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-004	5.0000e-005	5.9000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0549	0.0549	0.0000	0.0000	0.0549
<b>Total</b>	<b>1.4000e-004</b>	<b>5.0000e-005</b>	<b>5.9000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0549</b>	<b>0.0549</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0549</b>

**3.3 Grading/Excavation - Open Trench - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					8.3000e-004	0.0000	8.3000e-004	1.1000e-004	0.0000	1.1000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0567	0.3535	0.3808	6.4000e-004		0.0160	0.0160		0.0158	0.0158	0.0000	48.2597	48.2597	6.9100e-003	0.0000	48.4049
<b>Total</b>	<b>0.0567</b>	<b>0.3535</b>	<b>0.3808</b>	<b>6.4000e-004</b>	<b>8.3000e-004</b>	<b>0.0160</b>	<b>0.0169</b>	<b>1.1000e-004</b>	<b>0.0158</b>	<b>0.0159</b>	<b>0.0000</b>	<b>48.2597</b>	<b>48.2597</b>	<b>6.9100e-003</b>	<b>0.0000</b>	<b>48.4049</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.0100e-003	0.0158	0.1014	4.0000e-005	5.4000e-004	1.3000e-004	6.7000e-004	1.5000e-004	1.2000e-004	2.7000e-004	0.0000	2.8669	2.8669	5.0000e-005	0.0000	2.8680
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.9800e-003	1.2900e-003	0.0166	2.0000e-005	1.5900e-003	3.0000e-005	1.6200e-003	4.3000e-004	3.0000e-005	4.5000e-004	0.0000	1.5498	1.5498	1.0000e-004	0.0000	1.5518
<b>Total</b>	<b>8.9900e-003</b>	<b>0.0171</b>	<b>0.1181</b>	<b>6.0000e-005</b>	<b>2.1300e-003</b>	<b>1.6000e-004</b>	<b>2.2900e-003</b>	<b>5.8000e-004</b>	<b>1.5000e-004</b>	<b>7.2000e-004</b>	<b>0.0000</b>	<b>4.4167</b>	<b>4.4167</b>	<b>1.5000e-004</b>	<b>0.0000</b>	<b>4.4198</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.7000e-004	0.0000	3.7000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0105	0.2172	0.3583	6.4000e-004		7.7000e-004	7.7000e-004		7.7000e-004	7.7000e-004	0.0000	48.2597	48.2597	6.9100e-003	0.0000	48.4048
<b>Total</b>	<b>0.0105</b>	<b>0.2172</b>	<b>0.3583</b>	<b>6.4000e-004</b>	<b>3.7000e-004</b>	<b>7.7000e-004</b>	<b>1.1400e-003</b>	<b>3.0000e-005</b>	<b>7.7000e-004</b>	<b>8.0000e-004</b>	<b>0.0000</b>	<b>48.2597</b>	<b>48.2597</b>	<b>6.9100e-003</b>	<b>0.0000</b>	<b>48.4048</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					



Hauling	5.0100e-003	0.0158	0.1014	4.0000e-005	5.4000e-004	1.3000e-004	6.7000e-004	1.5000e-004	1.2000e-004	2.7000e-004	0.0000	2.8669	2.8669	5.0000e-005	0.0000	2.8680
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.9800e-003	1.2900e-003	0.0166	2.0000e-005	1.5900e-003	3.0000e-005	1.6200e-003	4.3000e-004	3.0000e-005	4.5000e-004	0.0000	1.5498	1.5498	1.0000e-004	0.0000	1.5518
<b>Total</b>	<b>8.9900e-003</b>	<b>0.0171</b>	<b>0.1181</b>	<b>6.0000e-005</b>	<b>2.1300e-003</b>	<b>1.6000e-004</b>	<b>2.2900e-003</b>	<b>5.8000e-004</b>	<b>1.5000e-004</b>	<b>7.2000e-004</b>	<b>0.0000</b>	<b>4.4167</b>	<b>4.4167</b>	<b>1.5000e-004</b>	<b>0.0000</b>	<b>4.4198</b>

### 3.4 4 Abandonments - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0657	0.4662	0.5333	8.9000e-004		0.0234	0.0234		0.0230	0.0230	0.0000	72.3819	72.3819	9.4200e-003	0.0000	72.5796
<b>Total</b>	<b>0.0657</b>	<b>0.4662</b>	<b>0.5333</b>	<b>8.9000e-004</b>	<b>2.0000e-005</b>	<b>0.0234</b>	<b>0.0234</b>	<b>0.0000</b>	<b>0.0230</b>	<b>0.0230</b>	<b>0.0000</b>	<b>72.3819</b>	<b>72.3819</b>	<b>9.4200e-003</b>	<b>0.0000</b>	<b>72.5796</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.6000e-004	4.9000e-004	3.1600e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0895	0.0895	0.0000	0.0000	0.0895
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	3.0000e-005	4.3000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0397	0.0397	0.0000	0.0000	0.0398
<b>Total</b>	<b>2.6000e-004</b>	<b>5.2000e-004</b>	<b>3.5900e-003</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.1292</b>	<b>0.1292</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.1292</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0130	0.1744	0.5403	8.9000e-004		1.4400e-003	1.4400e-003		1.4400e-003	1.4400e-003	0.0000	72.3818	72.3818	9.4200e-003	0.0000	72.5795
<b>Total</b>	<b>0.0130</b>	<b>0.1744</b>	<b>0.5403</b>	<b>8.9000e-004</b>	<b>1.0000e-005</b>	<b>1.4400e-003</b>	<b>1.4500e-003</b>	<b>0.0000</b>	<b>1.4400e-003</b>	<b>1.4400e-003</b>	<b>0.0000</b>	<b>72.3818</b>	<b>72.3818</b>	<b>9.4200e-003</b>	<b>0.0000</b>	<b>72.5795</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.6000e-004	4.9000e-004	3.1600e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0895	0.0895	0.0000	0.0000	0.0895
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	3.0000e-005	4.3000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0397	0.0397	0.0000	0.0000	0.0398
<b>Total</b>	<b>2.6000e-004</b>	<b>5.2000e-004</b>	<b>3.5900e-003</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>1.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.1292</b>	<b>0.1292</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.1292</b>

**3.5 HDD - Entry - 2021**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0215	0.2150	0.1823	3.6000e-004		0.0103	0.0103		9.8000e-003	9.8000e-003	0.0000	31.2624	31.2624	6.1900e-003	0.0000	31.3925
<b>Total</b>	<b>0.0215</b>	<b>0.2150</b>	<b>0.1823</b>	<b>3.6000e-004</b>		<b>0.0103</b>	<b>0.0103</b>		<b>9.8000e-003</b>	<b>9.8000e-003</b>	<b>0.0000</b>	<b>31.2624</b>	<b>31.2624</b>	<b>6.1900e-003</b>	<b>0.0000</b>	<b>31.3925</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	7.0000e-005	4.6000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0130	0.0130	0.0000	0.0000	0.0130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	2.0000e-004	2.6200e-003	0.0000	2.5000e-004	0.0000	2.5000e-004	7.0000e-005	0.0000	7.0000e-005	0.0000	0.2436	0.2436	2.0000e-005	0.0000	0.2439
<b>Total</b>	<b>6.5000e-004</b>	<b>2.7000e-004</b>	<b>3.0800e-003</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>0.2566</b>	<b>0.2566</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.2570</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.2800e-003	0.0191	0.2121	3.6000e-004		6.0000e-004	6.0000e-004		6.0000e-004	6.0000e-004	0.0000	31.2624	31.2624	6.1900e-003	0.0000	31.3924

<b>Total</b>	<b>4.2800e-003</b>	<b>0.0191</b>	<b>0.2121</b>	<b>3.6000e-004</b>		<b>6.0000e-004</b>	<b>6.0000e-004</b>		<b>6.0000e-004</b>	<b>6.0000e-004</b>	<b>0.0000</b>	<b>31.2624</b>	<b>31.2624</b>	<b>6.1900e-003</b>	<b>0.0000</b>	<b>31.3924</b>
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**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	7.0000e-005	4.6000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0130	0.0130	0.0000	0.0000	0.0130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	2.0000e-004	2.6200e-003	0.0000	2.5000e-004	0.0000	2.5000e-004	7.0000e-005	0.0000	7.0000e-005	0.0000	0.2436	0.2436	2.0000e-005	0.0000	0.2439
<b>Total</b>	<b>6.5000e-004</b>	<b>2.7000e-004</b>	<b>3.0800e-003</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>0.2566</b>	<b>0.2566</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.2570</b>

**3.5 HDD - Entry - 2022**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1080	1.0493	0.9932	1.9900e-003		0.0493	0.0493		0.0470	0.0470	0.0000	172.5426	172.5426	0.0339	0.0000	173.2546
<b>Total</b>	<b>0.1080</b>	<b>1.0493</b>	<b>0.9932</b>	<b>1.9900e-003</b>		<b>0.0493</b>	<b>0.0493</b>		<b>0.0470</b>	<b>0.0470</b>	<b>0.0000</b>	<b>172.5426</b>	<b>172.5426</b>	<b>0.0339</b>	<b>0.0000</b>	<b>173.2546</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.2000e-004	3.6000e-004	2.4200e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0718	0.0718	0.0000	0.0000	0.0718
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2900e-003	1.0300e-003	0.0134	2.0000e-005	1.3800e-003	3.0000e-005	1.4100e-003	3.7000e-004	2.0000e-005	3.9000e-004	0.0000	1.3223	1.3223	8.0000e-005	0.0000	1.3240
<b>Total</b>	<b>3.4100e-003</b>	<b>1.3900e-003</b>	<b>0.0158</b>	<b>2.0000e-005</b>	<b>1.4000e-003</b>	<b>3.0000e-005</b>	<b>1.4300e-003</b>	<b>3.7000e-004</b>	<b>2.0000e-005</b>	<b>4.0000e-004</b>	<b>0.0000</b>	<b>1.3941</b>	<b>1.3941</b>	<b>8.0000e-005</b>	<b>0.0000</b>	<b>1.3958</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.1052	1.1704	1.9900e-003		3.3100e-003	3.3100e-003		3.3100e-003	3.3100e-003	0.0000	172.5424	172.5424	0.0339	0.0000	173.2544
<b>Total</b>	<b>0.0236</b>	<b>0.1052</b>	<b>1.1704</b>	<b>1.9900e-003</b>		<b>3.3100e-003</b>	<b>3.3100e-003</b>		<b>3.3100e-003</b>	<b>3.3100e-003</b>	<b>0.0000</b>	<b>172.5424</b>	<b>172.5424</b>	<b>0.0339</b>	<b>0.0000</b>	<b>173.2544</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	1.2000e-004	3.6000e-004	2.4200e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0718	0.0718	0.0000	0.0000	0.0718
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2900e-003	1.0300e-003	0.0134	2.0000e-005	1.3800e-003	3.0000e-005	1.4100e-003	3.7000e-004	2.0000e-005	3.9000e-004	0.0000	1.3223	1.3223	8.0000e-005	0.0000	1.3240
<b>Total</b>	<b>3.4100e-003</b>	<b>1.3900e-003</b>	<b>0.0158</b>	<b>2.0000e-005</b>	<b>1.4000e-003</b>	<b>3.0000e-005</b>	<b>1.4300e-003</b>	<b>3.7000e-004</b>	<b>2.0000e-005</b>	<b>4.0000e-004</b>	<b>0.0000</b>	<b>1.3941</b>	<b>1.3941</b>	<b>8.0000e-005</b>	<b>0.0000</b>	<b>1.3958</b>

### 3.6 HDD- Insertion - 2021

#### Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0199	0.1980	0.1685	3.3000e-004		9.5200e-003	9.5200e-003		9.1200e-003	9.1200e-003	0.0000	28.6674	28.6674	5.2500e-003	0.0000	28.7777
<b>Total</b>	<b>0.0199</b>	<b>0.1980</b>	<b>0.1685</b>	<b>3.3000e-004</b>		<b>9.5200e-003</b>	<b>9.5200e-003</b>		<b>9.1200e-003</b>	<b>9.1200e-003</b>	<b>0.0000</b>	<b>28.6674</b>	<b>28.6674</b>	<b>5.2500e-003</b>	<b>0.0000</b>	<b>28.7777</b>

#### Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	7.0000e-005	4.6000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0130	0.0130	0.0000	0.0000	0.0130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	2.0000e-004	2.6200e-003	0.0000	2.5000e-004	0.0000	2.5000e-004	7.0000e-005	0.0000	7.0000e-005	0.0000	0.2436	0.2436	2.0000e-005	0.0000	0.2439
<b>Total</b>	<b>6.5000e-004</b>	<b>2.7000e-004</b>	<b>3.0800e-003</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>0.2566</b>	<b>0.2566</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.2570</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.6600e-003	0.0159	0.1932	3.3000e-004		4.9000e-004	4.9000e-004		4.9000e-004	4.9000e-004	0.0000	28.6674	28.6674	5.2500e-003	0.0000	28.7776
<b>Total</b>	<b>3.6600e-003</b>	<b>0.0159</b>	<b>0.1932</b>	<b>3.3000e-004</b>		<b>4.9000e-004</b>	<b>4.9000e-004</b>		<b>4.9000e-004</b>	<b>4.9000e-004</b>	<b>0.0000</b>	<b>28.6674</b>	<b>28.6674</b>	<b>5.2500e-003</b>	<b>0.0000</b>	<b>28.7776</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	7.0000e-005	4.6000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0130	0.0130	0.0000	0.0000	0.0130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	2.0000e-004	2.6200e-003	0.0000	2.5000e-004	0.0000	2.5000e-004	7.0000e-005	0.0000	7.0000e-005	0.0000	0.2436	0.2436	2.0000e-005	0.0000	0.2439
<b>Total</b>	<b>6.5000e-004</b>	<b>2.7000e-004</b>	<b>3.0800e-003</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>0.0000</b>	<b>2.6000e-004</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>7.0000e-005</b>	<b>0.0000</b>	<b>0.2566</b>	<b>0.2566</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.2570</b>

**3.6 HDD- Insertion - 2022**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1002	0.9699	0.9181	1.8200e-003		0.0457	0.0457		0.0438	0.0438	0.0000	158.2149	158.2149	0.0287	0.0000	158.8170
<b>Total</b>	<b>0.1002</b>	<b>0.9699</b>	<b>0.9181</b>	<b>1.8200e-003</b>		<b>0.0457</b>	<b>0.0457</b>		<b>0.0438</b>	<b>0.0438</b>	<b>0.0000</b>	<b>158.2149</b>	<b>158.2149</b>	<b>0.0287</b>	<b>0.0000</b>	<b>158.8170</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.2000e-004	3.6000e-004	2.4200e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0718	0.0718	0.0000	0.0000	0.0718
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2900e-003	1.0300e-003	0.0134	2.0000e-005	1.3800e-003	3.0000e-005	1.4100e-003	3.7000e-004	2.0000e-005	3.9000e-004	0.0000	1.3223	1.3223	8.0000e-005	0.0000	1.3240
<b>Total</b>	<b>3.4100e-003</b>	<b>1.3900e-003</b>	<b>0.0158</b>	<b>2.0000e-005</b>	<b>1.4000e-003</b>	<b>3.0000e-005</b>	<b>1.4300e-003</b>	<b>3.7000e-004</b>	<b>2.0000e-005</b>	<b>4.0000e-004</b>	<b>0.0000</b>	<b>1.3941</b>	<b>1.3941</b>	<b>8.0000e-005</b>	<b>0.0000</b>	<b>1.3958</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0202	0.0875	1.0659	1.8200e-003		2.6900e-003	2.6900e-003		2.6900e-003	2.6900e-003	0.0000	158.2147	158.2147	0.0287	0.0000	158.8168



<b>Total</b>	<b>0.0202</b>	<b>0.0875</b>	<b>1.0659</b>	<b>1.8200e-003</b>	<b>2.6900e-003</b>	<b>2.6900e-003</b>	<b>2.6900e-003</b>	<b>2.6900e-003</b>	<b>2.6900e-003</b>	<b>0.0000</b>	<b>158.2147</b>	<b>158.2147</b>	<b>0.0287</b>	<b>0.0000</b>	<b>158.8168</b>
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**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.2000e-004	3.6000e-004	2.4200e-003	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0718	0.0718	0.0000	0.0000	0.0718
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2900e-003	1.0300e-003	0.0134	2.0000e-005	1.3800e-003	3.0000e-005	1.4100e-003	3.7000e-004	2.0000e-005	3.9000e-004	0.0000	1.3223	1.3223	8.0000e-005	0.0000	1.3240
<b>Total</b>	<b>3.4100e-003</b>	<b>1.3900e-003</b>	<b>0.0158</b>	<b>2.0000e-005</b>	<b>1.4000e-003</b>	<b>3.0000e-005</b>	<b>1.4300e-003</b>	<b>3.7000e-004</b>	<b>2.0000e-005</b>	<b>4.0000e-004</b>	<b>0.0000</b>	<b>1.3941</b>	<b>1.3941</b>	<b>8.0000e-005</b>	<b>0.0000</b>	<b>1.3958</b>

**3.7 Paving - Open Trench - 2022**

**Unmitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.0600e-003	0.0300	0.0388	6.0000e-005		1.5300e-003	1.5300e-003		1.4100e-003	1.4100e-003	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>3.0600e-003</b>	<b>0.0300</b>	<b>0.0388</b>	<b>6.0000e-005</b>		<b>1.5300e-003</b>	<b>1.5300e-003</b>		<b>1.4100e-003</b>	<b>1.4100e-003</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

**Unmitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	4.0000e-005	5.5000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0540	0.0540	0.0000	0.0000	0.0540
<b>Total</b>	<b>1.3000e-004</b>	<b>4.0000e-005</b>	<b>5.5000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0540</b>	<b>0.0540</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0540</b>

**Mitigated Construction On-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.4000e-004	4.5100e-003	0.0445	6.0000e-005		1.5000e-004	1.5000e-004		1.5000e-004	1.5000e-004	0.0000	5.1967	5.1967	1.6400e-003	0.0000	5.2312
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>9.4000e-004</b>	<b>4.5100e-003</b>	<b>0.0445</b>	<b>6.0000e-005</b>		<b>1.5000e-004</b>	<b>1.5000e-004</b>		<b>1.5000e-004</b>	<b>1.5000e-004</b>	<b>0.0000</b>	<b>5.1967</b>	<b>5.1967</b>	<b>1.6400e-003</b>	<b>0.0000</b>	<b>5.2312</b>

**Mitigated Construction Off-Site**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	4.0000e-005	5.5000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0540	0.0540	0.0000	0.0000	0.0540
<b>Total</b>	<b>1.3000e-004</b>	<b>4.0000e-005</b>	<b>5.5000e-004</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>0.0000</b>	<b>6.0000e-005</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>2.0000e-005</b>	<b>0.0000</b>	<b>0.0540</b>	<b>0.0540</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0540</b>

## AIR QUALITY IMPLICATIONS MEMORANDUM

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January 27, 2016

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VIA E-mail: [caitlin.gilleran@panoramaenv.com](mailto:caitlin.gilleran@panoramaenv.com)

**SUBJECT: Alameda-North Bay Farm Island Pipeline Crossings Project, Oakland, Alameda, North Bay Farm Island, CA – Air Quality Implications of Proposal to Drill on Both Sides of Crossings**

Dear Caitlin:

Illingworth & Rodkin, Inc. prepared the technical air quality and GHG emissions assessment for the subject project October 30, 2015. The assessment assumed that construction drilling activities for the three proposed crossings would be conducted on the Entry side of all crossings. Since then, we understand that EBMUD wishes to consider drilling on both sides of the crossings. This memorandum qualitatively assesses the potential air quality impacts likely to occur with the change to proposed construction activities. Please refer to the air quality and greenhouse gas technical report for background information and air quality thresholds of significance.

The results of construction risk modeling found that the location of maximum community risk for all three crossings occurred at residential receptors near the HDD Entry Pit. Non-cancer Hazard Index impacts from construction were found to be less than significant and this is not expected to change should drilling occur on both sides of each crossing. Table 1 shows total diesel particulate matter (DPM) emissions at HDD Entry and Insertion Pits from the technical report. As indicated in Table 1, the DPM difference between HDD Entry and Insertion Pit work areas varies by approximately 7 percent.

**Table 1. Construction Period DPM Emissions (tons)**

<b>Scenario</b>	<b>HDD Entry Pit Work Area</b>	<b>HDD Insertion Pit Work Area</b>	<b>Percent Difference</b>
Crossing #1	0.0840	0.0786	6.5%
Crossing #2	0.0579	0.0539	7%
Crossing #3	0.0568	0.0529	7%

Table 2 shows total fugitive PM<sub>2.5</sub> emissions. There would be no effective difference between fugitive dust emissions at HDD Entry and Insertion pits.

Table 2. Construction Period Fugitive PM<sub>2.5</sub> Emissions (tons)

<b>Scenario</b>	<b>HDD Entry Pit Work Area</b>	<b>HDD Insertion Pit Work Area</b>	<b>Percent Difference</b>
Crossing #1	0.0005	0.0005	0%
Crossing #2	0.0004	0.0004	0%
Crossing #3	0.0005	0.0005	0%

As shown in Table 3, the maximum DPM concentrations at receptors on the Insertion side of all three crossings were substantially less than DPM concentrations at receptors on the Entry side.

Table 3. Comparison of Maximum Annual Receptor DPM Concentrations at Receptor on Entry and Insertion Sides

<b>Scenario</b>	<b>Entry Side</b>	<b>Insertion Side</b>
	<b>Max. Annual DPM Concentration at Receptor (µg/m<sup>3</sup>)</b>	<b>Max. Annual DPM Concentration at Receptor (µg/m<sup>3</sup>)</b>
Crossing #1	0.1840	0.0290

Scenario	Entry Side	Insertion Side
	Max. Annual DPM Concentration at Receptor ( $\mu\text{g}/\text{m}^3$ )	Max. Annual DPM Concentration at Receptor ( $\mu\text{g}/\text{m}^3$ )
Crossing #2	0.0880	0.0490
Crossing #3	0.7391	0.0599

For the purposes of this assessment, the difference in DPM emissions shown in Table 1 between Entry and Insertion Pits are conservatively assumed to be due to drilling activity. Therefore, proposing to drill on both sides of the crossings could shift up to 3.5 percent of total DPM emissions from the HDD Entry Pit work area to the HDD Insertion Pit work area. Predicted risk at sensitive receptors is directly proportional to the DPM concentration. Because the maximum risk impacts identified in the technical report occurred on the HDD Entry Pit side for all three crossings, the shift would slightly reduce predicted risk by up to 3.5 percent. This would equate to maximum residential cancer risks of 15.5, 7.4, and 62.4 in one million at Crossings #1, #2, and #3, respectively, as shown in Table 4. The estimated changes in cancer risk due to shifting emissions by 3.5 percent were calculated by scaling cancer risks to the change in DPM emissions. Therefore, Crossings #1 and #3 would still represent a potentially significant impact and mitigation would still be required.

Table 4. Comparison of Maximum Cancer Risk on Entry and Insertion Sides

Scenario	Entry Side		Insertion Side	
	Calculated Max. Cancer Risk (per million) – Drilling on Entry Side Only	Estimated Max. Cancer Risk (per million) <sup>1</sup> – Drilling on Both Sides	Estimated Max. Cancer Risk (per million) <sup>2</sup> – Drilling on entry Side Only	Estimated Max. Cancer Risk (per million) <sup>3</sup> – Drilling on Both Sides
Crossing #1	16.1	15.5	2.5	2.6
Crossing #2	7.7	7.4	4.3	4.5
Crossing #3	64.7	62.4	5.2	5.4

<sup>1</sup> Denotes the estimated result from shifting 3.5 percent of the cancer risk away from the entry side to the insertion side.

<sup>2</sup> Denotes estimated cancer risk on the insertion side with drilling on the entry side only

<sup>3</sup> Denotes the estimated result from shifting 3.5 percent of the cancer risk to the insertion side away from the entry side.

A shift of up to 3.5 percent more DPM emissions to the Insertion side would not be expected to result in a higher predicted cancer risk than already identified on the Entry side. Table 4 includes the estimated cancer risks on the Insertion side due to an increase in DPM emissions by 3.5 percent. Maximum cancer risks were not originally calculated for the Insertion side in the technical report because the modeled DPM concentrations were much lower than those of the Entry side. Insertion side cancer risks were estimated by scaling the Entry Side cancer risks using the relative ratios of the DPM emissions on the Entry side and Insertion side. These estimated values assume that the cancer risk is directly proportional to the DPM concentration. Annual PM<sub>2.5</sub> concentrations would not be expected to substantially change from the previous predictions and the maximum PM<sub>2.5</sub> concentrations would be expected to remain on the Entry sides of all three crossings. Average daily criteria air pollutants from construction activity would not be expected to substantially change.

This concludes our qualitative assessment of the proposal to conduct construction drilling activities on both sides of all three crossings. If you have any questions, please do not hesitate to contact me.

Best regards,

Joshua Carman  
Consultant  
Illingworth & Rodkin, Inc.

Project #15-149



APPENDIX F:  
BIOLOGICAL RESOURCES TECHNICAL REPORT

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# **Alameda–North Bay Farm Island Pipeline Crossings Project Preliminary Biological Resources Assessment**



**East Bay Municipal Utility District  
Natural Resources Department  
Fisheries and Wildlife Division  
Prepared by Michael Carbiener  
May 24, 2016**

**Alameda–North Bay Farm Island Pipeline Crossings Project**  
**PRELIMINARY BIOLOGICAL RESOURCE ASSESSMENT**  
**May 24, 2016**

## **1.0 INTRODUCTION**

This technical assessment evaluates the potential impacts to biological resources associated with the construction and operation of the Alameda–North Bay Farm Island Pipeline Crossings Project (Project). Specifically, this assessment evaluates the potential for the Project to be affected special-status wildlife and plant species and sensitive habitats. Recommended mitigation measures are identified where impacts have been found to remain significant or potentially significant following application and compliance with existing regulations, accepted engineering standards and EBMUD standard practices.

The Project involves the construction and operation of three transmission pipelines (24-inch inner diameter) in Alameda County within the cities of Oakland and Alameda referred to as the three crossings. The proposed pipelines would be installed within Oakland and Alameda city streets, a business park parking lot, Estuary Park, and Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel surrounding Alameda Island. The Project location is shown in Figure 1. Construction of the Project would involve the following construction methods: open trench, jack and bore, and horizontal directional drilling (HDD). Construction of the Project would also involve the following activities: geotechnical investigation, connection of the new pipelines to existing water transmission pipelines, in-street pipeline abandonment, abandonment of seven existing underwater crossings, and distribution pipeline replacements. A description of the three crossings and the construction methods and activities that would take place is described in the following sections.

### **Crossings**

Each pipeline crossing is described below.

- **Crossing #1.** Crossing #1, known as the Estuary Park–Marina Village Crossing, is approximately 2.3 miles long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Oakland Inner Harbor, and continue through Alameda to its connection point. One alternate route option for the replacement of an existing pipeline in Oakland is being considered (see Figure 2). Construction activities would occur within city streets, one business park parking lot (the Telecare Corporation), and Estuary Park.
- **Crossing #2.** Crossing #2, known as the Alameda–North Bay Farm Island Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines on Alameda Island, cross under the San Leandro Bay Channel, and continue on

North Bay Farm Island to its connection point (see Figure 3). Construction activities would occur within city streets and Towata Park.

- **Crossing #3** Crossing #3, known as the Derby Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Tidal Canal, and continue in Alameda to its connection point. Project activities associated with Crossing #3 would include replacing an existing pipeline (see Figure 4). One alternate route option for open trench construction in Alameda is being considered. Construction activities would occur within city streets.

**Figure 1: Project Location**



**Figure 2: Crossing #1 Alignment**



**Figure 3: Crossing #2 Alignment**



**Figure 4: Crossing #3 Alignment**





## Alternative Alignment Options

This technical report analyzes two alternate transmission pipeline trenching options and one alternate location for a distribution pipeline replacement. The locations of these alternate alignment options are shown in Figures 2 and 4 and described below.

- ***Crossing #1 alternate trench option.*** Instead of using 2nd Street, the open trench construction and pipeline installation would occur along 3rd Street for one block, then along Oak Street for one block, and then would continue along the proposed alignment.
- ***Crossing #1 alternate pipeline replacement option.*** Instead of replacing the existing pipeline on 2nd Street between Madison Street and Oak Street, the pipeline on 3rd Street between Madison Street and Oak Street would be replaced.
- ***Crossing #3 alternate trench option.*** Instead of using Clement Avenue and a portion of Everett Street, open trench construction would occur on Broadway and then along Eagle Avenue until Everett Street, where pipeline installation would continue along the proposed alignment.

## Project Construction

Table 1 includes a summary of the construction activities for the proposed Project, including the equipment that would be used, the location where the activity would occur, and the dimensions of the construction activity.

Construction hours would typically be between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) might be required when the proposed pipelines are connected to existing pipelines as well as to minimize service disruptions for water customers. Forty-eight-hour construction for one weekend would also be necessary for each HDD underwater pipeline crossing. Additional nighttime construction work could occur at night at traffic intersections when required by encroachment permit conditions to minimize traffic impacts. If required, it is expected that nighttime intersection work would only occur at arterial streets such as High Street, Tilden Way, 5th Street, 6th Street, 7th Street, and 8th Street.

## Operation and Maintenance

The proposed Project would require routine operation and maintenance after construction, which is conducted under existing operations and maintenance procedures and protocols.

**Table 1: Summary of Construction Activities**

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Transmission Pipeline Open Trench Construction	<p>Open trench construction consists of the following activities:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Saw-cutting the pavement</li> <li>• Excavating a trench</li> <li>• Removing and stockpiling soils</li> <li>• Installing the pipeline</li> <li>• Backfilling the trench and applying temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Pavement saws &amp; jack hammers</li> <li>• Excavators, backhoes, front-end loaders</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Dewatering pumps</li> <li>• Soil-cement mixing machines</li> <li>• Paving equipment (asphalt and/or concrete trucks, vibratory compactors, pavers, and rollers)</li> <li>• Water trucks</li> </ul>	<p>Throughout Project roads for Crossing #1, #2, and #3 (see Figures 2, 3, and 4)</p>	<p>Construction corridor: 25 feet Maximum depth of trench: 8 feet Width of trench: 4 feet</p>
Transmission Pipeline Jack and Bore	<p>The jack and bore method would be used twice during Project implementation: at Crossing #1 to install pipeline beneath a segment of railroad track on Oak Street, and at Crossing #2 to install pipeline beneath Otis Drive so that Otis Drive could remain open during construction. The jack and bore method would consist of the following activities:</p>	<ul style="list-style-type: none"> <li>• Horizontal boring machine or auger &amp; hydraulic jack</li> <li>• Excavators</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Backhoes &amp; front-end loaders</li> <li>• Dewatering pumps</li> </ul>	<p>Crossing #1: The pits are located on (1) Oak Street, north of Embarcadero West, just north of the railroad crossing and on (2) Oak Street, south of Embarcadero West, just south of the railroad crossing (see Figure 2)</p>	<p>Pit Area: 500 square feet Depth: 10–15 feet Length: 150 feet at Crossing #1 and 300 feet at Crossing #2</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Excavating a temporary jacking and receiving pit</li> <li>• Constructing a temporary jacking platform in the jacking pit</li> <li>• Drilling or jacking a casing through the earth under the road or railroad to be avoided</li> <li>• Installing the new pipeline in the casing</li> <li>• Connecting the new pipeline-to-pipeline segments on either end of the jacking pit</li> <li>• Backfilling the jacking and receiving pit and temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>		<p>Crossing #2: The pits are located on (1) Peach Street, which divides Towata Park in half, south of Otis Drive and on (2) Peach Street north of Otis Drive, on a part of Peach Street that has been closed to vehicle access (see Figure 3)</p>	

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Geotechnical Investigation	<p>A geologic review and geotechnical investigation would be conducted for the HDD Crossings and jack and bore locations. Exploratory borings would be made at the HDD entry and insertion pit locations and along the underwater alignment as well as at each jack and bore pit. The subsurface soils investigation would originate on the land or water surface and would consist of the following steps:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Mobilize land based and barge- or ship-mounted geotechnical drilling equipment</li> <li>• Drill exploratory soils borings at the following locations <ul style="list-style-type: none"> <li>- HDD entry and insertion pits for all crossings</li> <li>- The underwater alignments for Crossing #1 and #2 at intervals of approximately 300 feet and depths of 125 feet</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Geotechnical drilling rig (truck-mounted and barge-mounted)</li> <li>• Turbidity curtains for drilling</li> <li>• Barge</li> </ul>	HDD entry and insertion pits for all crossings The underwater alignments for Crossings #1 and #2; and jack and bore pits	Depth: 125 feet

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>- Jack and bore pits</li> <li>• Collect soils samples for classification and laboratory analysis (geophysical investigation methods may also be used)</li> <li>• Abandon exploratory borings (backfill land-based borings only)</li> </ul>			
Transmission Pipeline Horizontal Directional Drilling	<p>HDD will be used to install the three underwater pipelines under the Oakland Inner Harbor, Tidal Canal, and the San Leandro Bay Channel. HDD is a process that originates on the surface and typically consists of the following steps:</p> <ul style="list-style-type: none"> <li>• Ramming a steel conductor casing approximately 200 feet long into the ground on both sides of the drilling operation to support the pipeline until the pipeline reaches deeper and more stable soil and to prevent hydraulic fracturing (“frac out”) at the surface.</li> </ul>	<ul style="list-style-type: none"> <li>• HDD rig with control cab for the HDD operator (potentially one for each side)</li> <li>• Slurry separation plants (one for each side)</li> <li>• Small pick-cranes (one for each side)</li> <li>• Pipeline rollers</li> <li>• Slurry and grout pumps (one for each side)</li> <li>• Welders (at insertion pit)</li> <li>• Soil-cement mixing machines (one for each side)</li> <li>• Jet grouting rig (one for each side)</li> </ul>	<p>Crossing #1, entry pit: Adjacent to the parking spaces next to Estuary Park (Oakland) – located approximately 500 feet south of the intersection of Embarcadero West and the road that provides access to the parking lot for Estuary Park</p> <p>Crossing #1, insertion pit: Telecare Corporation parking lot (Alameda) – located in the middle of Telecare Corporation parking</p>	<p>Entry and exit angles: 15 degrees</p> <p>Depth: 50–100 feet</p> <p>Dimensions of entry and insertion pits: 10 by 20 feet</p> <p>Depth of entry and insertion pits: 5 feet</p> <p>Total staging area around entry and insertion pits: 2,000–2,500 square feet</p> <p>HDD length at Crossing #1: 1,800 feet</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Drilling a pilot hole from the entry pit across the water to the insertion pit; drilling could potentially occur at both the entry and insertion pit.</li> <li>• Enlarging the pilot hole through a reaming process</li> <li>• Laying down, fusing together, and pressure testing the pipeline</li> <li>• Pulling the pipeline into the insertion pit, through the enlarged pilot hole, and to the receiving pit</li> <li>• Injecting grout between the pipeline and casing</li> <li>• Injecting jet grouted columns to provide additional support to the casing, between the entry pit and the shoreline</li> <li>• Backfilling the HDD pit and temporary paving</li> <li>• Disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Excavators (one for each side)</li> <li>• Tractors/ loaders/ backhoes (one for each side)</li> </ul>	<p>lot, approximately 250 feet north of the intersection of Marina Village Parkway and Tynan Avenue</p> <p>Crossing #2, entry pit: Towata Park (Alameda) – located within Towata Park, east of the portion of Peach Street, which divides Towata Park</p> <p>Crossing #2, insertion pit: Veterans Court (North Bay Farm Island) – located approximately 275 feet north of the intersection of Veterans Court and Island Drive</p> <p>Crossing #3, entry pit: Derby Avenue (Oakland) – located on Derby Avenue, between Ford Street and Glascock Street, approximately 50 feet north of the intersection</p>	<p>HDD length at Crossing #2: 1,400 feet</p> <p>HDD length at Crossing #3: 1,400 feet</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
			<p>of Derby Avenue and Glascock Street</p> <p>Crossing #3, insertion pit: Broadway (Alameda) – located on Broadway, between Blanding Avenue and Clement Avenue, approximately 160 feet south of the intersection of Broadway and Blanding Avenue</p>	
Connections	<p>The proposed Project would connect the new water pipelines to existing EBMUD water transmission pipelines. The work to connect the new pipelines to existing pipelines would require the excavation of a trench or pit at each connection location. Temporary shoring would be required to ensure the stability of the excavation, which may include the use of vibratory sheet piles. The proposed tie-ins would be located within street rights-of-way and sited to minimize disruptions to traffic and</p>	<ul style="list-style-type: none"> <li>• Excavators</li> <li>• Generator Sets for night lighting</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering pumps</li> <li>• Hot tap machine</li> </ul>	<p>Connections would be located where open trench construction would occur (See Figure 2, 3, and 4)</p>	<p>The connections would be in the open trench construction corridor and would have similar dimensions as open trench construction.</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<p>homeowner access. Construction of the connections would generally be completed within a 12-hour period. For connections that require a new tee, construction could require a full 24-hour period, and night work might be necessary.</p>			
In-Street Pipeline Abandonment	<p>Pipeline abandonment would require three construction pits in 5th Street to move service connections and fire hydrants and to install two endcaps, one at 5th Street and another at Oak Street. The abandoned pipeline would be filled with cellular concrete between the two endcaps, and an existing valve near the intersection of Madison Street and 5th Street would be abandoned in place after opening the valve.</p>	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> </ul>	Oakland side of Crossing #1: On 5th Street, between Oak Street and Jackson Street	<p>Length: 800 feet.  Width of Pit: 10 feet  Length of Pit: 10 feet  Depth: 4–10 feet</p>



Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Underwater Pipeline Crossings Abandonment	<p>The seven existing underwater pipeline crossings would be abandoned. Abandonment includes filling onshore sections of pipelines with cellular concrete and abandoning submarine sections of pipelines in place. Bumped heads or blind flanges will be constructed at the demarcation between the onshore and submarine sections and at the end of the onshore sections to be abandoned. To install the bumped heads or blind flanges, a pit would be excavated down to the pipeline. The bumped head at the two abandonment locations at Crossing #2 would be installed in existing vaults and would not require pit excavation (see Figure 3). Additional pits may be necessary to remove valves, hydrants, move service laterals, and at low points along the onshore pipeline alignment to facilitate concrete pumping; the location of these additional pits would be determined during detailed design.</p>	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> <li>• Vibratory pile driving may be used to install sheet pile walls for the abandonment pits</li> </ul>	See Figures 2, 3, and 4	<p>Width of Pit: 10 feet  Length of Pit: 10 feet  Depth: 4–10 feet</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Distribution Pipeline Replacement	<p>The proposed Project would replace existing small-diameter distribution pipelines at two locations along Crossing #1 and Crossing #3. Open trench construction methods (see above) would be used to install the new pipeline and the existing pipeline would be abandoned in place. Pipeline replacement would occur during open trenching activities, before the new transmission pipeline is installed. The following pipelines would be replaced:</p> <ul style="list-style-type: none"> <li>• Crossing #1: On 2nd Street (see Figure 2), approximately 400 feet of existing 10-inch cast-iron pipeline constructed in 1908 would be replaced with a 12-inch steel pipeline.</li> <li>• Crossing #3: On Everett Street (see Figure 4), approximately 750 feet of existing 4-inch cast-iron pipeline constructed in 1895 would be replaced with a 6-inch steel pipeline.</li> </ul>	Distribution pipeline replacement would require the same equipment used for open trench construction.	Crossing #1, Oakland: On 2nd Street (see Figure 2). Crossing #3, Alameda: On Everett Street (see Figure 4).	<p>The distribution pipeline replacement would be in the open trench construction corridor and would have similar dimensions as open trench construction. Length of pipeline replacement at Crossing #1: 400 feet Length of pipeline replacement at Crossing #3: 750 feet</p>

## 2.0 Regulatory Background

The following sections explain the regulatory context of the biological assessment, including applicable laws and regulations that were applied to the field investigations and analysis of potential Project impacts.

### 2.1 Sensitive and Special Status Species

Special status species include those plants and wildlife species that have been formally listed, are proposed as endangered or threatened, or are candidates for such listing under the federal Endangered Species Act (ESA) or California Endangered Species Act (CESA). These acts afford protection to both listed and proposed species. In addition, California Department of Fish and Wildlife (CDFW) Species of Special Concern, which are species that face extirpation in California if current population and habitat trends continue; U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern, sensitive species included in USFWS Recovery Plans; and CDFW special status invertebrates are all considered special status species. Although CDFW Species of Special Concern generally have no special legal status, they are given special consideration under the California Environmental Quality Act (CEQA).

In addition to regulations for special status species, the active nests of most common bird species are protected by the Migratory Bird Treaty Act (MBTA) and the California Fish and Game Code (CFGF). While active nests of common bird species are not considered to be of special-status under CEQA, these nests are protected by state and federal law. Under the MBTA and CFGF, destroying active nests, eggs, and young is illegal. Plant species on California Native Plant Society (CNPS) Lists 1 and 2 and locally rare, unusual and significant plants (Lake 2010) are also considered special status plant species. Substantial adverse effects to these species are considered significant according to CEQA. CNPS List 3 and List 4 plants have little or no protection under CEQA, but are included in this analysis for completeness.

**Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801-1884).** The Magnuson-Stevens Act of 1976 (as amended in 1996 and reauthorized in 2006) applies to fisheries resources and fishing activities in federal waters, which extend to 200 miles offshore. The Act is intended to facilitate conservation and management of U.S. fisheries, development of domestic fisheries, and phasing out of foreign fishing activities. Sections 305(b)(2) to (4) of the Magnuson-Stevens Act outline a process for NMFS to comment on activities proposed by federal action agencies that may adversely impact areas designated as Essential Fish Habitat (EFH). Specifically, federal action agencies are required to consult with NMFS on any action authorized, funded, or undertaken that may adversely impact EFH. This consultation process is typically integrated into environmental review procedures in accordance with the National Environmental Policy Act, ESA, or Fish and Wildlife Coordination Act to provide the greatest level of efficiency. NMFS must provide the federal action agency with EFH consultation recommendations for any action that would adversely affect EFH. These recommendations are advisory in nature.

EFH is defined as those waters, aquatic areas, and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH Consultation Guidelines (NMFS 2004) include in their definition of EFH: (1) “Aquatic areas” and their associated physical, chemical, and biological properties are areas that are used by fish and may include aquatic areas historically used by fish, where appropriate; (2) “Substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; (3) “Necessary” means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and (4) “Spawning, breeding, feeding, or growth to maturity” covers a species’ full lifecycle.

**Marine Mammal Protection Act (16 U.S.C. § 1371).** Under the Marine Mammal Protection Act (MMPA) of 1972 (as amended in 2007), it is unlawful to take or import marine mammals and marine mammal products. The MMPA defines “take” as to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” (16 U.S.C. §1362(13).) The MMPA defines harassment as “any act of pursuit, torment or annoyance which has the potential to either: (i) injure a marine mammal or marine mammal stock in the wild, or (ii) disturb a marine mammal or marine mammal stock by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.” Levels of harassment are further defined: “Level A harassment” means harassment which has the potential to injure, and “Level B harassment” means harassment which has the potential to disturb, a marine mammal or marine mammal stock in the wild. (16 U.S.C. §1362(18).)

Under Section 101(a)(5)(D) of the Act, an Incidental Harassment Authorization Permit (IHA) may be issued for activities other than commercial fishing that may impact small numbers of marine mammals. An IHA covers activities that extend for periods of no more than one year and that will have a negligible impact on the impacted species. If the potential for serious injury and/or mortalities exists, and there are no measures that could be taken to prevent this form of “take” from occurring, a Letter of Authorization (LOA) must be obtained.

**National Oceanic and Atmospheric Administration Fisheries/National Marine Fisheries Service Marine Mammal Acoustic Guidelines.** High levels of received underwater sound pressure levels can cause harassment and injury of marine mammals. Marine mammals are considered particularly susceptible to injury and behavioral impacts from anthropogenic noise. NOAA Fisheries/NMFS is currently developing species specific guidelines that would set thresholds for noise impacts on marine mammals (NMFS 2015). Until new guidelines are provided, there are two statutory levels of harassment for marine mammals. NMFS currently provides Interim Sound Threshold Guidance (NMFS 2016), which NMFS uses in its MMPA permitting processes. NMFS has applied these thresholds of received sound pressure levels in MMPA permits and ESA Section 7 consultations for marine mammals as conservative indicators of whether harassment may occur. Level A harassment may cause physical injury, and Level B harassment may cause behavioral disruption.

- The Level A harassment threshold is 180 decibels referenced to 1 micropascal (180 dB re 1  $\mu$ Pa) for cetaceans (harbor porpoises and gray whale) and 190 dB for pinnipeds (Pacific harbor seals and California sea lions).

- The Level B harassment threshold is 160 dB for pulsed noise and 120 dB for continuous noise (NMFS 2016).

**Rivers and Harbors Act (33 U.S.C. § 403)** addresses effects to navigable waters and regulates “excavation, fill, or alterations or modifications to the course, location, condition, or capacity of any port, ...harbor, canal, lake, ...or enclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers.” Under Section 10 of the Rivers and Harbors Act, the U.S. Army Corps of Engineers (USACE) has the authority to regulate the navigable capacity of any of the waters of the United States.

**California Marine Invasive Species Program.** The California State Lands Commission’s Marine Invasive Species Program is intended to prevent the release of nonindigenous species from commercial vessels into California waters. The program began in 1999 with the passage of California’s Ballast Water Management for Control of Nonindigenous Species Act. In 2003, the Marine Invasive Species Act (MISA) was passed, reauthorizing and expanding the 1999 Act. Subsequent amendments to MISA and additional legislation has further expanded the scope of the program to include research, management and policy development related to vessel fouling and ballast water treatment technologies.

## 2.2 Sensitive and Special Status Biological Communities

Special status biological communities include communities and habitats that fulfill special functions or have special values, such as wetlands, streams, and riparian habitat, and sensitive natural plant communities. Special status biological communities and habitats are protected under federal regulations such as the Clean Water Act (CWA), state regulations such as the Porter-Cologne Act, the CDFW Streambed Alteration Program, and CEQA, or local ordinances or policies (City or County Tree Ordinances, Special Habitat Management Areas, and General Plan Elements).

**Waters of the United States.** The USACE regulates “Waters of the United States (U.S.)” under Section 404 of the CWA. “Waters of the U.S.” are defined broadly as waters susceptible to use in commerce, including interstate waters and wetlands, all other waters (intrastate waterbodies, including wetlands), and their tributaries (33 CFR 328.3). Potential wetland areas, according to the three criteria used to delineate wetlands stated in the USACE Wetlands Delineation Manual (Environmental Laboratory 1987), are identified by the presence of (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Areas that are inundated for sufficient duration and depth to exclude growth of hydrophytic vegetation are subject to Section 404 jurisdiction as “other waters” and are often characterized by an ordinary high water mark. Other waters, for example, generally include lakes, rivers, and streams. The placement of fill material into “Waters of the U.S.” (including wetlands) generally requires an individual or nationwide permit from the USACE under Section 404 of the CWA.

**Waters of the State.** The term “Waters of the State” is defined by the Porter-Cologne Act as “any surface water or groundwater, including saline waters, within the boundaries of the state.” The Regional Water Quality Control Board (RWQCB) protects all waters in its regulatory scope, but has special responsibility for wetlands, riparian areas, and headwaters which have high resource value, are vulnerable to filling, and are not

systematically protected by other programs. RWQCB jurisdiction includes “isolated” wetlands and waters that may not be regulated by the USACE under Section 404. “Waters of the State” are regulated by the RWQCB under the State Water Quality Certification Program which regulates discharges of fill and dredged material under Section 401 of the CWA and the Porter-Cologne Water Quality Control Act. Projects that require a USACE permit, or fall under other federal jurisdiction, and have the potential to impact “Waters of the State,” are required to comply with the terms of the Water Quality Certification determination. If a proposed project does not require a federal permit, but does involve dredge or fill activities that may result in a discharge to “Waters of the State,” the RWQCB has the option to regulate the dredge and fill activities under its state authority in the form of Waste Discharge Requirements.

**Streams, Lakes, and Riparian Habitat.** Streams and lakes, as habitat for fish and wildlife species, are subject to jurisdiction by CDFW under Sections 1600-1616 of the State Fish and Game Code. Alterations to or work within or adjacent to streambeds or lakes generally require a Lake and Streambed Alteration Agreement. The term stream, which includes creeks and rivers, is defined in the California Code of Regulations as follows: “a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation” (14 CCR 1.72). In addition, the term stream can include ephemeral streams, dry washes, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife (CDFG ESD 1994). Riparian is defined as, “on, or pertaining to, the banks of a stream;” therefore, riparian vegetation is defined as, “vegetation which occurs in and/or adjacent to a stream and is dependent on, and occurs because of, the stream itself”. Removal of riparian vegetation also requires a Lake and Streambed Alteration Agreement from CDFW.

**Other Sensitive Biological Communities.** Other sensitive biological communities not discussed above include habitats that fulfill special functions or have special values. Natural communities considered sensitive are those identified in local or regional plans, policies, regulations, or by the CDFW. CDFW ranks sensitive communities as “threatened” or “very threatened” and keeps records of their occurrences in its California Natural Diversity Database (CNDDDB). Sensitive plant communities are also identified by CDFW on their List of California Natural Communities Recognized by the CNDDDB. Impacts to sensitive natural communities identified in local or regional plans, policies, and regulations or by the CDFW or the USFWS must be considered and evaluated under CEQA (California Code of Regulations: Title 14, Div. 6, Chap. 3, Appendix G).

Wildlife movement corridors are defined as areas that connect suitable wildlife habitat areas in a region otherwise fragmented by rugged terrain, changes in vegetation, or human disturbance. Natural features such as canyon drainages, ridgelines, or areas with vegetation cover provide corridors for wildlife travel. Wildlife movement corridors are important because they provide access to mates, food, and water; allow the dispersal of individuals away from high population density areas; and facilitate the exchange of genetic traits between populations (Beier and Loe 1992). Wildlife movement corridors are considered sensitive by resource and conservation agencies. In general, any activities

in or adjacent to defined wildlife movement corridors (i.e., riparian corridor, areas that are contiguous with adjacent open space areas, etc.) that could potentially disturb, restrict movement or activity, disrupt natal areas, or facilitate increased predation of wildlife species would be considered a significant adverse impact.

### **2.3 Local Policies and Ordinances**

Pursuant to California Government Code Section 53091, EBMUD, as a local agency and utility district serving a broad regional area is not subject to building and land use zoning ordinances (such as noise ordinances) for projects involving facilities that would produce, generate, store, or transmit water. However, it is the practice of EBMUD to work with local jurisdictions and neighboring communities during project planning, and to consider local environmental protection policies for guidance.

### **2.4 Conservation Plans**

A Habitat Conservation Plan (HCP) is a long-term agreement between an applicant and the USFWS and is designed to offset any harmful effects that a proposed activity might have on federally-listed threatened and endangered species. The HCP process allows development to proceed while providing a conservation basis to conserve the species and provide for incidental take. A “No Surprises” policy provides assurances to landowners participating in HCP efforts.

The Natural Communities Conservation Plan (NCCP) Program, managed by CDFW, is designed to conserve multiple species and their habitats, while also providing for the compatible use of private land. Through local planning, the NCCP planning process protects wildlife and habitat before the landscape becomes so fragmented or degraded by development that listings are required under the federal ESA. Instead of saving small, disconnected units of habitat for just one species at a time, agencies, local jurisdictions, and other interested parties have an opportunity, through the NCCP, to work cooperatively to develop plans that consider broad landscapes, or “ecosystems,” and the needs of many species. Partners enroll in the programs and, by mutual consent, habitat areas with high conservation values are set aside and may not be developed. Partners also agree to study, monitor, and develop management plans for these “reserve” areas. The NCCP provides a process for fostering economic growth by allowing approved development in enrolled areas with lower conservation values.

### **3.0 Methods**

On August 10 and September 30, 2015 the Project areas were traversed on foot to determine (1) plant communities and habitats present within the Project areas, (2) if existing conditions provided suitable habitat for any special status plant or wildlife species, and (3) if sensitive habitats and/or species were present.

## 3.1 Sensitive and Special Status Species

### 3.1.1 Literature Review

Potential occurrence of special status species in the Project area were evaluated by first determining which special status species occur in the vicinity of the Project area through a literature and database search. Due to the level of development in the area, California Natural Diversity Database (CNDDDB) records searches for known occurrences of special status species focused on a 5-mile radius around the entire Project area. The following sources were reviewed to determine which special status plant and wildlife species may occur or have been documented to occur in the vicinity of the Project area:

- CDFW California Natural Diversity Database records (July 2015)
- CDFW Special Vascular Plants, Bryophytes, and Lichens List (July 2015)
- CDFW Special Animals List (October 2014)
- USFWS IPaC Trust Resource Report (August 2015)
- Conservation Biology Institute (CBI) Data Basin

### 3.1.2 Site Assessment

The Project areas were surveyed to search for suitable habitats for species identified in the literature review as occurring in the vicinity. The potential for each special status species to occur within the Project areas was then evaluated according to the following criteria:

- 1) **No Potential.** Habitat on and adjacent to the Project area is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).
- 2) **Low Potential.** Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the Project area is unsuitable or of very poor quality. The species has low potential to be found on the site.
- 3) **Moderate Potential.** Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the Project area is unsuitable. The species has a moderate probability of being found on the site.
- 4) **High Potential.** All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the Project area is highly suitable. The species has a high probability of being found on the site.
- 5) **Present.** Species is observed on the Project area or has been recorded (i.e. CNDDDB, other reports) on the Project area recently.

The site assessment is intended to identify the presence or absence of suitable habitat for each special status species known to occur in the vicinity in order to determine its potential to occur in the Project area. The site assessment does not constitute a protocol-level survey and is not intended to determine the actual presence or absence of a species; however, if a special status species is observed during the site visit, its presence was recorded and discussed.



## 3.2 Sensitive and Special Status Biological Communities

Prior to the site visit, the soils of the site were examined using the Natural Resources Conservation Service Web Soil Survey to determine if any unique soil types (e.g., limestone, serpentine, gabbro) that could support sensitive plant communities and/or aquatic features were present in the Project area.

Sensitive biological communities are defined as those communities that are given special protection under CEQA and other applicable federal, state, and local laws, regulations and ordinances as discussed above in Section 2. Methods used to identify sensitive biological communities are discussed below.

**Wetlands, Waters and Riparian.** The Project areas were surveyed to determine if any wetlands and waters potentially subject to jurisdiction by the USACE, RWQCB, or CDFW were present. The wetland assessment was based primarily on the presence of wetland plant indicators and any observed indicators of wetland hydrology or wetland soils. The preliminary waters and riparian assessment was based primarily on hydrologic indicators.

**Other Sensitive Biological Communities.** The Project areas were surveyed for the presence of other sensitive biological communities, including sensitive plant and wildlife species habitats, sensitive plant communities recognized by CDFW, and wildlife movement/nursery areas.

## 4.0 Results

### 4.1 Soils

The Natural Resources Conservation Service (NRCS) soil survey database lists the soils within the Project area as urban land and water. Project activities will occur in paved parking lots and surrounding landscaping and ruderal habitat at all locations.

### 4.2 Sensitive and Special Status Plant Species

Information on potentially present special-status plant species was compiled from the CDFW's California Natural Diversity Database (CDFW 2015a), and from a USFWS IPaC Trust Resource Report (USFWS 2015) generated for the Project area. Special status species that have been noted within 5-miles of the Project area are shown in Table 2.

The CNDDDB report lists thirty-two (32) sensitive plant species as having potential to occur in the Project area and the USFWS IPaC report lists five (5) sensitive plant species as having potential to occur in the Project area (also listed on CNDDDB). The Project area visits were conducted outside of the blooming period of many plant species and it was not possible to identify all potential plant species that might be present. Therefore, the site visits focused on evaluating the suitability of the onsite habitats to support special-status plant species occurring in the region. No sensitive plants are expected to occur within the Project areas because they do not contain soils or habitat features indicative of sensitive plant species or plant species that may occur in the vicinity are presumed to be extirpated from the area.

The Project areas consist of paved parking lots, landscaping, and ruderal habitat. The Project area is urbanized and consists of pavement, lawn, ornamental landscaping, and riprap. Some small patches of ruderal vegetation occur at locations in the parking lot of Estuary Park and the Alameda side of the pipeline abandonment near High Street Bridge. At Project areas where the land meets water, riprap protects the shore from erosion due to heavy boat traffic. The plant species present within the Project areas are characteristic of disturbed and urban habitats and include mostly planted landscape and many non-native species. The Project areas lack unique substrates, (e.g., alkaline or serpentine soils) micro-habitats (e.g., volcanic rock outcrops, vernal pools, wetlands, etc.). For these reasons, no special-status plant species are expected to occur within the Project areas. No sensitive plant species were observed within the Project areas during the reconnaissance surveys conducted on August 10 and September 30, 2015.

### 4.3 Sensitive and Special Status Wildlife Species

Information on potentially present special-status wildlife species was compiled from the CDFW California Natural Diversity Database (CDFW 2015a), and from a USFWS IPaC Trust Resource Report generated for the Project. Species noted within 5 miles of the Project areas are listed in Table 2.

Thirty-one (31) sensitive wildlife species were found in the CNDDDB within five miles of the Project areas. The USFWS IPaC report listed an additional four (4) sensitive wildlife species with potential to occur in the project area. Of these thirty-five (35) species, fifteen (15) species have some potential to occur at some location within the Project areas. Please see Table 2 for more information on potential occurrences of sensitive species at each location. In addition to the 35 species mentioned above, species protected under Federal EFH guidelines and commercially important fish species managed by CDFW (e.g., Pacific herring) have been included in this document.

#### 4.3.1 Species Descriptions

This report does not contain detailed life histories and descriptions for species with potential to occur. This section describes the portions of the Project area that may affect sensitive species with potential to occur, as listed in Table 2:

**Monarch butterfly (*Danaus plexippus*)**, a California species of concern, is known to overwinter in eucalyptus trees located within Chuck Corica Golf Complex, adjacent to the North Bay Farm Island side of Crossing #2. No eucalyptus trees occur at these locations and the trees onsite are relatively small. Therefore, the likelihood of monarchs using these locations for overwintering is extremely low.

**North American Green Sturgeon Southern DPS (*Acipenser medirostris*)**, is a federally listed threatened species and is known to occur within San Francisco Bay. It may utilize Oakland Inner Harbor, Tidal Canal and San Leandro Bay Channel in the vicinity of project-related in-channel geotechnical borings. All portions of the bay, including Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel, are within critical habitat for this species.

**Central California Coast Distinct Population Segment (DPS) steelhead**

(*Oncorhynchus mykiss*), a federally threatened species, occur within San Francisco Bay and may utilize Oakland Inner Harbor, Tidal Canal and San Leandro Bay Channel during periods of migration in the vicinity of project-related in-channel geotechnical borings. Additionally, Oakland Inner Harbor, Tidal Canal and San Leandro Bay Channel are within designated critical habitat for this species.

**Longfin smelt (*Spirinchus thaleichthys*)**, listed by the State of California as threatened, may occur year-round in San Francisco Bay and are expected to occur within Oakland Inner Harbor, Tidal Canal and San Leandro Bay Channel in the vicinity of project-related in-channel geotechnical borings.

**Pacific herring (*Clupea harengus pallasii*)**, has no special status; however, it is a commercially important species in the San Francisco Bay and therefore is of concern to CDFW. They can be expected to occur within Oakland Inner Harbor, Tidal Canal and San Leandro Bay Channel in the vicinity of project-related in-channel geotechnical borings during their spawning and nursery period in the spring.

**California clapper rail (*Rallus longirostris obsoletus*)**, a federally and state endangered species and a California fully protected species, is known to occur in nearby Arrowhead Marsh within Martin Luther King Jr. Regional Shoreline, approximately 1 mile away from the HDD and abandonment locations at Crossing #2. There are several small patches of suitable habitat within the general area; however, it is unclear if these could support clapper rails as they are not connected and there are fairly large areas of urban and rip-rapped shoreline between these patches of habitat. No suitable habitat exists within the Project area.

**California least tern (*Sterna antillarum browni*)**, a federal and state endangered species as well as a California fully protected species, is known to nest at Alameda Point and is documented as occurring immediately to the east of Highway 61 bridge, near Crossing #2. This migratory species may forage in the Oakland Inland Harbor and other estuary areas between the months of April and August.

**California black rail (*Laterallus jamaicensis*)**, a California threatened and fully protected species, is known to occur in Arrowhead Marsh and other nearby salt marsh habitats. There are some small patches of suitable habitat near the HDD and abandonment project areas at Crossing #2. However, as with clapper rail, it is not likely that these small patches would provide habitat for this species. There is no suitable habitat within the Project area.

**Alameda song sparrow (*Melospiza melodia pusillula*)**, a California species of concern, is known to occur at several areas within the vicinity of the Project areas. It may occur year-round at the Bayview Shoreline Preserve, located approximately ½ mile to the west of the HDD and abandonment project areas at Crossing #2. There is some potential that it may utilize these Project areas for foraging habitat. However, no suitable nesting habitat is present onsite.

**Double-crested cormorant (*Phalacrocorax auritus*)**, a California species of concern, is known to occur around San Francisco Bay. There is no suitable nesting habitat within the Project areas.

**Bat Species.** Several species of bat have some potential to occur in the Project areas (see Table 2). They may utilize crevices on the undersides of bridge for day or night roosts. While habitat suitability is low, there is some potential that individuals may use the bridge at the abandonment project areas at Crossing #2.

**Salt marsh harvest mouse (*Reithrodontomys raviventris*),** a federal and state endangered species and a California fully protected species, is known to occur in nearby Arrowhead Marsh. There is no suitable habitat within the Project areas.

**Alameda Island mole (*Scapanus latimanus*)** is a California species of concern. It is known to occur within Alameda Island. Little is known about this species. Due to exposed soils the HDD and abandonment project areas at Crossing #2, this species has some potential to occur within these Project areas. However, EBMUD conducted a field survey in December 2016 and no evidence of mole activity was observed at either location during the two surveys. Based on the results of these surveys, EBMUD does not expect Alameda Island mole to be present at these locations.

#### **4.4 Marine Mammals**

Pacific harbor seals (*Phoca vitulina*) are known to utilize the Alameda Breakwater as a haul-out site and forage in the vicinity of the breakwater (USFWS 1998). The harbor porpoise (*Phocoena phocoena*) is regularly observed in San Francisco Bay. Most of the observations are near the Golden Gate Bridge, with some observations near Angel Island and Alcatraz (Keener 2011). California sea lions (*Zalophus californianus*) are known to occur in the San Francisco Bay. It is unlikely for any of these species to utilize aquatic habitat within the Project area; however, harbor seals and California sea lions have been observed in Oakland Inner Harbor (U.S. Department of Navy 1997).

#### **4.5 Essential Fish Habitat**

EFH for managed species on the West Coast is described in three separate Fishery Management Plans (FMP); Pacific Groundfish FMP, Coast Pelagic FMP, and Pacific Coast Salmonid FMP. The Magnuson-Stevens Act requires federal agencies to consult with NOAA Fisheries on projects that may impact EFH. The Magnuson-Stevens Act also requires NOAA Fisheries to designate Habitat Areas of Potential Concern (HAPC) for each FMP. HAPC are habitat types that are particularly susceptible to human-induced degradation, are ecologically important, or are located in an environmentally stressed area. Projects with the potential to adversely affect HAPCs are typically given more scrutiny during the consultation process. Within the Project area, the primary HAPCs are estuary and eelgrass habitat.

##### **4.5.1 Pacific Groundfish FMP**

The Pacific Groundfish FMP covers 82 species of groundfish along the Pacific Coast. While the majority of these fish are not expected to occur within the Project area, many are expected within Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel and will need to be considered further during the CEQA and permitting process.

Arrowtooth flounder (*Atheresthes stomias*), black and yellow rockfish (*Sebastes chrysomelas*), blue rockfish (*Sebastes mystinus*), bocaccio (*Sebastes paucispinus*), big skate (*Raja binoculata*), California skate (*Raja inornata*), canary rockfish (*Sebastes pinniger*), chilipepper (*Sebastes goodei*), spiny dogfish (*Squalus acanthias*), English sole (*Parophrys vetulus*), grass rockfish (*Sebastes rastrelliger*), greenspotted rockfish (*Sebastes chlorostictus*), kelp greenling (*Hexagrammos decagrammus*), lingcod (*Ophiodon elongatus*), leopard shark (*Triakis semifasciata*), Pacific rattail (*Coryphaenoides acrolepis*), sand sole (*Psettichthys melanostictus*), soupfin shark (*Galeorhinus galeus*), splitnose rockfish (*Sebastes diploproa*), starry flounder (*Platichthys stellatus*), and Pacific whiting (*Merluccius productus*) all have some potential to occur within the Project area at some life stage.

#### **4.5.2 Coastal Pelagics FMP**

The Coastal Pelagics FMP covers six species: northern anchovy (*Engraulis mordax*), market squid (*Doryteuthis opalescens*), pacific sardine (*Sardinops sagax caerulea*), pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), and krill. Within the Project area, it is possible that the four fish species, as well as krill, may be present.

#### **4.5.3 Pacific Salmonid FMP**

The Pacific Salmonid FMP covers all salmonid species along the Pacific Coast. In the Project area, this includes steelhead and fall-run Chinook salmon. Both species may occur within aquatic portions of the Project area. Project mitigations for federally-listed steelhead will cover Chinook salmon and other fish species within this FMP.

### **4.6 Sensitive and Special Status Biological Communities**

The Project areas are considered urban habitat as defined by Mayer and Laudenslayer (1988), with the exception of the portion of the Project running under the Oakland Inner Harbor, San Leandro Bay Channel, and the Tidal Canal, which are considered estuarine habitat. A distinguishing feature of urban wildlife habitat is the mixture of native and exotic species. Urban vegetation is relatively static in species composition because of maintenance. The vegetation within the Project areas consist of planted non-native landscape species. A small portion of the Project area on the Oakland side consists of ruderal vegetation dominated by non-native grasses and forbs.

The estuarine portions of the Project areas are characterized by periodically or permanently flooded substrates and open water portions of semi-enclosed coastal waters where tidal seawater is diluted by flowing freshwater. In this case, the estuarine habitat consists of Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel, mud-bottomed channels used for navigation by vessels of a variety of sizes. Within the Project areas, the banks are lined with rip-rap which reduces the habitat available for estuarine and marsh species, with the exception of near Crossing #2 Project areas.

Near the HDD and abandonment project areas at Crossing #2, some small areas of saline emergent wetland habitat occur where the upland project area transitions to aquatic habitat; however, these wetland areas are outside of the Project areas. Saline emergent wetland is characterized as salt or brackish marshes consisting mostly of perennial graminoids and forbs, ranging in height from 0.2 to 2 m or more with algal mats on moist soils and at the base of vascular plant stems (Mayer and Laudenslayer 1988).

The USFWS IPaC report states that no critical habitat is designated within the Project areas. The NMFS considers the entire San Francisco Bay to be within designated critical habitat for California Coastal DPS steelhead and southern DPS green sturgeon. No sensitive wildlife species were observed within the Project areas during the reconnaissance surveys conducted on August 10 and September 30, 2015.

**Sensitive Biological Communities.** The site visits confirmed that sensitive natural communities occur near portions of the Project at the HDD and abandonment project areas of Crossing #2. This includes some small areas of northern coastal salt marsh wetland habitat; however, these wetland areas are outside of the Project areas. Additionally, the HDD and abandonment project areas of Crossing #2 are approximately ½ mile from the Bayview Shoreline Preserve and one mile from Arrowhead Marsh; neither of these sensitive biological communities are within the boundaries of the Project areas.

**Wetlands, Waters and Riparian Habitats.** Aquatic habitats near the Project areas include Oakland Inner Harbor, Tidal Canal, and San Leandro Bay. No other waters, riparian habitats or wetlands occur within the Project areas.

**Other Sensitive Biological Communities.** Wildlife corridors link together areas of suitable wildlife habitat that are otherwise separated by rugged terrain, changes in vegetation, or human disturbance. Wildlife movement activities usually fall into one of three movement categories: (1) dispersal (e.g., juvenile animals from natal areas, or individuals extending range distributions); (2) seasonal migration; and (3) movements related to home range activities (foraging for food or water, defending territories, searching for mates, breeding areas, or cover).

The Project areas do not function as an important regional wildlife corridor, with the exception of Oakland Inner Harbor, Tidal Canal and San Leandro Bay Channel which allows for movement of fish and other aquatic species.

#### **4.7 Potential Impacts**

While no significant impacts to special status species or habitats are expected to occur as a result of this Project, Avoidance and Minimization Measures described in Section 5.0 will help ensure that sensitive resources are not affected by the Project. Potential impacts include noise and sedimentation effects on marine mammals and fish from in-channel geotechnical borings, frac-out during HDD activities, and vibratory pile driving; direct loss of suitable monarch butterfly roosting habitat; indirect noise disturbance effects on nesting birds and roosting bats from general construction activities; and potential introduction of invasive aquatic organisms. Each is described in more detail below.

#### 4.7.1 Effects on Marine Mammals and Fish

Marine mammal and fish species could be temporarily affected by water-borne noise and vibration, sediment displacement, mobilization of contaminants, or collisions with equipment during geotechnical borings in the Oakland Estuary. However, noise impacts from construction-related Project activities are not anticipated to be high enough to cause injury or death (Reyff pers. comm. 2016). The aquatic portions of the Project area are heavily used by boat traffic and noise impacts would not likely be higher than background noise. Tugboats and small vessels would be sources of noise comparable to those occurring in the setting. Increased levels of suspended sediments may affect sensitive fish species through gill abrasion and decreased visibility. Work windows, as described in Section 5.0, will help minimize impacts to these species.

Essential fish habitat for fish species in the Pacific Groundfish, Coastal Pelagics, and Pacific Salmonids FMPs may be affected by the geotechnical borings. These activities may impact these species through noise impacts, increased suspended sediment, and temporary habitat loss. A review of the CBI online “Data Basin” resource shows that eelgrass habitat is likely only to occur at in the San Leandro Bay Channel near Crossing #2 and not at all near Crossing #1 or Crossing #3 (Conservation Biology Institute 2016). The lack of potential eelgrass habitat at Crossing #1 and #3 is further corroborated by the fact that these channels are deep and often dredged. Therefore, minor temporary habitat modifications may occur in the estuary and eelgrass HAPCs during in-channel drilling activities at Crossing #2.

**Frac-Out.** It is not anticipated that HDD activities under Oakland Inner Harbor, Tidal Canal or San Leandro Bay Channel will result in a frac-out. Frac-out typically occurs in soils that may include cracks, sills, or faults that allow drilling fluids to leak from the HDD path. It is highly unlikely that frac-out will occur because the HDD path will be approximately 50-80 feet deeper than the bottom of the Oakland Inner Harbor, Tidal Canal or San Leandro Bay Channel and thick bay muds will likely prevent any materials from entering the waterway. Due to the soil type, cracks, sills and open faults are not anticipated to occur in the area.

**Vibratory Pile-Driving.** In order to abandon existing crossings in the area, vibratory pile driving may be required to install sheet pile walls in order to isolate the Project area which may occur in or near the water. Pile driving is known to cause acoustic impacts to fish species. Generally, vibratory pile driving is considered to fall below the threshold for impacts to fish species (Caltrans 2009).

Avoidance and Minimization Measures described in Section 5.0 will ensure that no impacts to marine mammals and fish occur as a result of the Project.

#### 4.7.2 Effects on Roosting Monarch Butterflies

Impacts to overwintering monarch butterflies may occur during tree removal at Towata Park near the HDD and abandonment project areas of Crossing #2. These potential impacts include injury and death from falling trees and disruption of roosting behavior. Avoidance and Minimization Measures described in Section 5.0 will ensure that no impacts to monarch butterflies occur as a result of the Project.

### **4.7.3 Effects on Nesting Birds**

While no special status bird species are expected to nest within the Project areas or adjacent habitats, all native bird species are covered under the Federal Migratory Bird Treaty Act which protects the nesting habitat of passerine and other bird species. There is some potential that noise or tree removal from the Project may affect birds that may be nesting in the area. Avoidance and Minimization Measures described in Section 5.0 will ensure that no impacts to nesting birds occur as a result of the Project.

### **4.7.4 Effects on Roosting Bats**

Work at the abandonment locations at Crossing #2 may cause noise impacts to bat species utilizing the bridge for roosting habitat. These impacts may cause bats to vacate the roost temporarily or permanently. Avoidance and Minimization Measures described in Section 5.0, which include a pre-construction survey, will ensure that no impacts to bats occur as a result of the Project.

### **4.7.5 Potential for Non-Native Aquatic Invasive Species Introduction**

Non-native aquatic invasive species are widespread in San Francisco Bay. Several invasive species have the potential to occur in the sediment of the Project area. These include Asian clam (*Corbicula amurensis fluminea*), Chinese mitten crab (*Eriocheir sinensis*), and European green crab (*Carcinus maenas*) (USGS 2016). These species may be disturbed by the Project, but are unlikely to be more widely distributed as a result. There are no hard bottom, riprapped areas, reefs, structures such as pier pilings that would be impacted by the Project. Therefore, invasive species that attach themselves to these surfaces (such as bryozoans, tunicates, and other sessile encrusting organisms) would not be affected by the Project. However, vessels, barges, or any other floating equipment that does not originate in the San Francisco Bay could introduce marine invasive species. Avoidance and Minimization Measures described in Section 5.0 will ensure that spread of non-native invasive species does not occur as a result of the Project.

## **4.8 Local Policies and Ordinances**

There are no local policies or ordinances pertaining to biological resources that would be affected by the Project. Therefore, no further discussion of this topic is provided.

## **4.9 Conservation Plans**

There are no approved HCP or NCCPs in the Project area. Therefore, no further discussion of this topic is provided.

## **5.0 Proposed Project Species Avoidance and Minimization Measures**

Based on reconnaissance level field surveys and existing information, the Project is unlikely to adversely impact special status plant or wildlife species. The following avoidance and minimization measures should be implemented to ensure no impacts to sensitive species occur.



1. **Workers' Education Awareness Program.** A worker's education awareness program shall be established for the Project which shall cover all sensitive species and habitats with potential to occur.
2. **Frac-Out Contingency Plan.** To avoid impacting aquatic species during HDD activities, a frac-out contingency plan shall be developed which shall incorporate monitoring and response to accidental frac-out conditions in aquatic habitats.
3. **Conduct a Pre-Construction Monarch Butterfly Survey.** Prior to tree removal at HDD sites for Crossing #2 and pipeline abandonments near Crossing #2, during the monarch butterfly overwintering period from October 1 through March 1, a qualified biologist shall conduct a late fall/early winter butterfly survey within all potential habitats within 200 feet of the proposed project area. If the results of the survey do not identify any potential overwintering of the monarch butterfly on-site, no further mitigation shall be required. If overwintering monarch butterflies are determined to use the site, tree removal shall be deferred until a qualified biologist has determined that overwintering monarch butterflies are no longer using the site, or, per the direction of CDFW.
4. **Pile Driving.** No impact or vibratory pile driving shall occur within 200-feet of the Oakland Inner Harbor, Tidal Canal, or San Leandro Bay Channel.
5. **Eelgrass Survey and Avoidance.** A survey for eelgrass shall be conducted by a qualified biologist prior to pre-construction geotechnical drilling at Crossing #2, as described in the California Eelgrass Mitigation Policy and Implementing Guidelines (NOAA Fisheries 2014). If eelgrass is observed within the pre-construction geotechnical investigation work area, an alternative work area outside of eelgrass shall be chosen. The eelgrass survey shall be conducted during the growing season between April to October. The pre-construction geotechnical investigation shall commence within 60 days of completion of the eelgrass survey or anytime between November and March if the survey was completed in October.
6. **Protection of Northern Coastal Salt Marsh.** Silt and exclusion fencing shall be installed at the edges of work areas, where the work areas are near salt marsh habitat, to delineate the areas and ensure that work does not occur in sensitive habitats or wetland areas, such as at the Alameda Island side of Crossing #2, Bay Farm 1 pipeline abandonment, and Bay Farm 2 pipeline abandonment locations.
7. **Pre-Construction Special-Status Bird Survey.** A pre-construction survey shall be performed prior to construction activities that would require vegetation or tree removal during the nesting season. The following measures shall be implemented:
  - If construction activities (i.e., ground clearing and grading, including removal of trees or shrubs) are scheduled to occur during the nonbreeding season (September 1 through January 31), no measures are required.

- If construction activities are scheduled to occur during the nesting season (February 1 through August 31), the following measures shall be implemented to avoid potential adverse effects on special-status birds: A qualified wildlife biologist shall conduct pre-construction surveys of all potential nesting habitat within 500 feet of construction activities. If active nests are found during pre-construction surveys, a no-disturbance buffer shall be created (acceptable in size to the CDFW) around active raptor nests and nests of other special-status birds during the breeding season, or until it is determined that all young have fledged. Typical buffers include 500 feet for raptors, 250 feet for other nesting birds, and 50 feet for passerines. The size of the buffer zones may be further modified in coordination with the CDFW. Nests initiated during construction are presumed to be unaffected, and no buffer would be necessary.
  - Trees shall be removed outside of the nesting season to the extent feasible.
8. **Pre-Construction Bat Surveys.** A pre-construction survey shall be performed within two weeks prior to tree removal in the Telecare corporation parking lot and in Towata Park, and prior to construction near Otis Drive bridge, High Street bridge, Fruitvale Avenue bridge, and Park Street bridge. Areas within 200 feet of the construction work limits shall be surveyed. The biologist shall conduct a search for suitable entry points, roost cavities or crevices, and, survey for evidence of day roosts, and maternity roosts. The following measures shall be implemented:
- If no roosting is observed, no additional mitigation is required.
  - If roosting surveys are inconclusive, indicate potential occupation by a special-status bat species, and/or identify a large day roosting population or maternity roost by any bat species within 200 feet of an active construction work area, a qualified biologist shall conduct focused day and night emergence surveys.
  - If active maternity roosts or day roosts are found in areas that would be removed or modified as part of project construction, activities shall commence before maternity colonies form (before March 1) or after young are flying (after July 31). Disturbance-free buffer zones (determined by a qualified biologist in coordination with CDFW) shall be observed during the maternity roost season (March 1 through July 31) for any active maternity colony identified during the surveys to protect maternity roosts.
  - If a non-breeding bat roost is found in a structure scheduled for modification or removal, the individual(s) shall be safely evicted, under the direction of a qualified biologist (as determined in consultation with CDFW) in such a way that ensures individuals are not injured.
9. **Seasonal In-Channel Work Window.** In-channel pre-construction geotechnical borings shall be conducted between June 1 and November 30 to avoid impacts to

special-status fish species. If work must occur between June 1 and November 30, EBMUD shall implement additional minimization measures such as buffer zones and monitoring for herring spawn, in consultation with NMFS, USFWS, and CDFW.

10. **Marine Mammal Harassment Consultation.** EBMUD shall consult with the National Marine Fisheries Service (NMFS) to determine whether an Incidental Harassment Authorization (IHA) or Letter of Authorization (LOA) for marine mammals is necessary prior to initiation of in-channel pre-construction geotechnical borings. All IHA or LOA conditions and requirements shall be adhered to by EBMUD and its contractors.
  
11. **Marine Mammal Monitoring Plan.** EBMUD and its contractors shall prepare and implement a Marine Mammal Monitoring Plan. The Marine Mammal Monitoring Plan shall include the following elements:
  - Establishment of an appropriate buffer zone around the work area, generally 400 feet or as defined in consultation with NMFS, that would require work be slowed or otherwise modified if a marine mammal approaches the established buffer zone.
  - A qualified biologist shall be on board the geotechnical drilling vessel during construction.
  - The qualified biologist shall monitor marine mammal presence and behavior in the vicinity of the vessel and the surface above drilling operations. The qualified biologist shall have the authority to stop work until the marine mammal has left the buffer zone.
  
12. **Control of Invasive Marine Species.** In order to prevent introduction and spread of invasive marine species, EBMUD shall utilize a geotechnical contractor that can provide vessels that originate and operate in the San Francisco Bay. If the vessels to be used for pre-construction geotechnical borings have been operating outside the San Francisco Bay, then EBMUD shall develop an Invasive Marine Species Control Plan in order to effectively limit the introduction and spread of invasive marine species. The plan shall require that vessels or in-channel equipment originating or recently operating outside the San Francisco Bay prior to project use follow existing compliance measures established by the California State Lands Commission as part of the Marine Invasive Species Program relating to hull fouling and ballast water control. The plan shall also require that vessels and in-channel equipment originating or operating outside of San Francisco Bay be examined and any invasive species handled and disposed of according to the developed plan prior to vessel or equipment use on the project.

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**Table 2. List of Special Status Plant and Wildlife Species that may occur (CNDDB 2015, USFWS 2015) for the Alameda – North Bay Farm Island Pipeline Crossing Project.**

Scientific Name	Common Name	Federal	State	CNPS	Occurrence Potential	Location
<b>Plants</b>						
<i>Amsinckia lunaris</i>	bent-flowered fiddleneck	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Arctostaphylos pallida</i>	pallid manzanita	Threatened	Endangered	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Astragalus tener</i> var. <i>tener</i>	alkali milk-vetch	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>California macrophylla</i>	round-leaved filaree	None	None	1B.1	<b>No Potential.</b> Presumed extirpated from the area	
<i>Carex comosa</i>	bristly sedge	None	None	2B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Centromadia parryi</i> ssp. <i>congdonii</i>	Congdon's tarplant	None	None	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Clarkia concinna</i> ssp. <i>automixa</i>	Santa Clara red ribbons	None	None	4.3	<b>No Potential.</b> Suitable habitat not present	
<i>Clarkia franciscana</i>	Presidio clarkia	Endangered	Endangered	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Chloropyron maritimum</i> ssp. <i>palustre</i>	Point Reyes salty bird's-beak	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Chorizanthe cuspidata</i> var. <i>cuspidata</i>	San Francisco Bay spineflower	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Chorizanthe robusta</i> var. <i>robusta</i>	robust spineflower	Endangered	None	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Dirca occidentalis</i>	western leatherwood	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	

Scientific Name	Common Name	Federal	State	CNPS	Occurrence Potential	Location
<i>Eriogonum luteolum</i> var. <i>caninum</i>	Tiburon buckwheat	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Extriplex joaquinana</i>	San Joaquin spearscale	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Fritillaria liliacea</i>	fragrant fritillary	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Helianthella castanea</i>	Diablo helianthella	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Hemizonia congesta</i> ssp. <i>congesta</i>	congested-headed hayfield tarplant	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Heteranthera dubia</i>	water star-grass	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Hoita strobilina</i>	Loma Prieta hoita	None	None	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Holocarpha macradenia</i>	Santa Cruz tarplant	Threatened	Endangered	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Horkelia cuneata</i> var. <i>sericea</i>	Kellogg's horkelia	None	None	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Layia carnosa</i>	beach layia	Endangered	Endangered	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Leptosiphon rosaceus</i>	rose leptosiphon	None	None	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Monolopia gracilens</i>	woodland woollythreads	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Plagiobothrys chorisianus</i> var. <i>chorisianus</i>	Choris' popcornflower	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Plagiobothrys diffusus</i>	San Francisco popcornflower	None	Endangered	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Polygonum marinense</i>	Marin knotweed	None	None	3.1	<b>No Potential.</b> Suitable habitat not present	
<i>Sanicula maritima</i>	adobe sanicle	None	Rare	1B.1	<b>No Potential.</b> Suitable habitat not present	

Scientific Name	Common Name	Federal	State	CNPS	Occurrence Potential	Location
<i>Streptanthus albidus</i> ssp. <i>peramoenus</i>	most beautiful jewelflower	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Suaeda californica</i>	California seablite	Endangered	None	1B.1	<b>No Potential.</b> Suitable habitat not present	
<i>Trifolium hydrophilum</i>	saline clover	None	None	1B.2	<b>No Potential.</b> Suitable habitat not present	
<i>Viburnum ellipticum</i>	oval-leaved viburnum	None	None	2B.3	<b>No Potential.</b> Suitable habitat not present	
<b>Invertebrates</b>						
<i>Branchinecta lynchi</i>	Vernal pool fairy shrimp	Endangered	None		<b>No Potential.</b> Suitable habitat not present	
<i>Callophrys mossii bayensis</i>	San Bruno elfin butterfly	Endangered	None		<b>No Potential.</b> Suitable habitat not present	
<i>Cicindela hirticollis grvida</i>	sandy beach tiger beetle	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Euphydryas editha bayensis</i>	Bay checkerspot butterfly	Threatened	None		<b>No Potential.</b> Suitable habitat not present	
<i>Speyeria callippe callippe</i>	Callippe silverspot butterfly	Endangered	None		<b>No Potential.</b> Suitable habitat not present	
<i>Trachusa gummifera</i>	San Francisco Bay Area leaf-cutter bee	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Tryonia imitator</i>	California brackish water snail	None	None		<b>No Potential.</b> Extirpated from SF Bay	
<i>Danaus plexippus</i> pop. 1	monarch - California overwintering population	None	None		<b>Moderate Potential.</b> Known overwintering locations near Crossing 2.	HDD & abandonment locations of Crossing 2
<b>Fish</b>						
<i>Eucyclogobius newberryi</i>	tidewater goby	Endangered	None		<b>No Potential.</b> Extirpated from SF Bay	



Scientific Name	Common Name	Federal	State	CNPS	Occurrence Potential	Location
<i>Acipenser medirostris</i>	North American green sturgeon (Southern DPS)	Threatened	None		<b>Moderate potential.</b> Species is known to occur throughout SF Bay.	Crossing 1, 2, 3
<i>Hypomesus transpacificus</i>	delta smelt	Threatened	Endangered		<b>No Potential.</b> Outside range of species	
<i>Oncorhynchus mykiss</i>	steelhead (Central California Coast DPS)	Threatened	None		<b>Moderate Potential.</b> Species known to occur in SF Bay.	Crossing 1, 2, 3
<i>Spirinchus thaleichthys</i>	longfin smelt	Candidate	Threatened		<b>Moderate Potential.</b> Species known to occur in SF Bay.	Crossing 1, 2, 3
<b>Amphibians</b>						
<i>Rana draytonii</i>	California red-legged frog	Threatened	None		<b>No Potential.</b> Suitable habitat not present	
<i>Ambystoma californiense</i>	California tiger salamander	Threatened	Threatened		<b>No Potential.</b> Suitable habitat not present	
<b>Reptiles</b>						
<i>Emys marmorata</i>	western pond turtle	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Masticophis lateralis euryxanthus</i>	Alameda whipsnake	Threatened	Threatened		<b>No Potential.</b> Suitable habitat not present	
<b>Birds</b>						
<i>Athene cunicularia</i>	burrowing owl	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Rallus longirostris obsoletus</i>	California clapper rail	Endangered	Endangered		<b>Low Potential.</b> Quality habitat components not present	HDD & abandonment locations of Crossing 2
<i>Accipiter cooperii</i>	Cooper's hawk	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Charadrius alexandrinus nivosus</i>	western snowy plover	Threatened	None		<b>No Potential.</b> Suitable habitat not present	

Scientific Name	Common Name	Federal	State	CNPS	Occurrence Potential	Location
<i>Geothlypis trichas sinuosa</i>	saltmarsh common yellowthroat	None	None		<b>No Potential.</b> Suitable habitat not present	HDD & abandonment locations of Crossing 2
<i>Sterna antillarum browni</i>	California least tern	Endangered	Endangered		<b>Low Potential.</b> Quality habitat components not present	HDD & abandonment locations of Crossing 2
<i>Laterallus jamaicensis coturniculus</i>	California black rail	None	Threatened		<b>Low Potential.</b> Quality habitat components not present	HDD & abandonment locations of Crossing 2
<i>Melospiza melodia pusillula</i>	Alameda song sparrow	None	None		<b>Moderate Potential.</b> May occur in portions of the Project area while foraging.	HDD & abandonment locations of Crossing 2
<i>Phalacrocorax auritus</i>	double-crested cormorant	None	None		<b>Moderate Potential.</b> May occur in portions of the Project area while foraging.	HDD & abandonment locations of Crossing 2
<b>Mammals</b>						
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	None	Candidate		<b>Moderate Potential.</b> Some potential for roosting under bridges	
<i>Antrozous pallidus</i>	pallid bat	None	None		<b>Low Potential.</b> Some potential for roosting under bridges. However not known to occur within the area.	
<i>Lasiurus cinereus</i>	hoary bat	None	None		<b>Moderate Potential.</b> May forage in the area. Roosts in large trees.	
<i>Lasionycteris noctivagans</i>	silver-haired bat	None	None		<b>Low Potential.</b> May occur as transients	
<i>Nyctinomops macrotis</i>	big free-tailed bat	None	None		<b>Low Potential.</b> May occur as transients	

Scientific Name	Common Name	Federal	State	CNPS	Occurrence Potential	Location
<i>Dipodomys heermanni berkeleyensis</i>	Berkeley kangaroo rat	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Phoca vitulina</i>	Pacific harbor seal	MMPA	None		<b>Moderate potential.</b> Species is known to occur throughout SF Bay.	Crossing 1, 2, 3
<i>Phocoena phocoena</i>	Harbor porpoise	MMPA	None		<b>Moderate potential.</b> Species is known to occur throughout SF Bay.	Crossing 1, 2, 3
<i>Reithrodontomys raviventris</i>	salt-marsh harvest mouse	Endangered	Endangered		<b>Low Potential.</b> Quality habitat components not present	HDD & abandonment locations of Crossing 2
<i>Scapanus latimanus parvus</i>	Alameda Island mole	None	None		<b>Low Potential.</b> Quality habitat components not present	
<i>Sorex vagrans halicoetes</i>	salt-marsh wandering shrew	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Taxidea taxus</i>	American badger	None	None		<b>No Potential.</b> Suitable habitat not present	
<i>Zalophus californianus</i>	California sea lion	MMPA	None		<b>Moderate potential.</b> Species is known to occur throughout SF Bay.	Crossing 1, 2, 3

\* Endangered – Listed as being in danger of extinction; Threatened – Listed as likely to become endangered in the foreseeable future; MMPA – protected under the federal Marine Mammal Protection Act; Special Animal, Special Plant – Taxa considered by CDFG to be those of greatest conservation need; Conservation Concern - without additional conservation actions are likely to become candidates for listing under the Endangered Species Act; Special Concern - declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction (CDFG); Watch List - The birds on this watch list are 1) not on the current Special Concern list but were on previous lists and they have not been state listed under CESA; 2) were previously state or federally listed and now are on neither list; or 3) are on the list of “fully protected” species; List 1A: Plants Presumed Extinct in California; List 1B: Plants Rare, Threatened, or Endangered in California and Elsewhere; List 2: Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere; List 3: Plants About Which We Need More Information - A Review List; List 4: Plants of Limited Distribution - A Watch List. Threat Ranks: 0.1-Seriously threatened in California (high degree/immediacy of threat); 0.2-Fairly threatened in California (moderate degree/immediacy of threat); 0.3-Not very threatened in California (low degree/immediacy of threats or no current threats known)

APPENDIX G:  
CULTURAL RESOURCES TECHNICAL REPORT

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# CULTURAL RESOURCES REPORT

## Alameda-North Bay Farm Island Pipeline Crossings Project Cities of Alameda and Oakland, Alameda County

For  
PANORAMA ENVIRONMENTAL, INC.  
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With  
WOODRUFF C. MINOR  
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May 2016



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- LETTER NAHC Response
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- SEARCH File No. 14-1748 (7/06/2015) [No Confidential Information]

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## 1 INTRODUCTION

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This technical report evaluates the potential impacts to cultural resources associated with the construction and operation of the Alameda–North Bay Farm Island Pipeline Crossings Project (proposed project). The proposed project involves the construction and operation of three transmission pipelines (24-inch inner diameter) in Alameda County within the cities of Oakland and Alameda. The proposed pipelines would be installed within Oakland and Alameda city streets, a business park parking lot, Estuary Park, and Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel surrounding Alameda Island. The project location is shown in Figure 1. The locations of Crossings #1, #2, and #3 are shown in Figures 2 to 4.

Construction of the three crossings would involve the following construction methods: open trench, jack and bore, and horizontal directional drilling (HDD). Construction of the three crossings would also involve the following activities: geotechnical investigation, connection of the new pipelines to existing water transmission pipelines, in-street pipeline abandonment, abandonment of seven existing underwater crossings, and distribution pipeline replacements. A description of the three crossings and the construction methods and activities that would take place is described below.

### 1.1 CROSSINGS

Each pipeline crossing is described below.

- Crossing #1. Crossing #1, known as the Estuary Park–Marina Village Crossing, is approximately 2.3 miles long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Oakland Inner Harbor, and continue through Alameda to its connection point. One alternate route option for the replacement of an existing pipeline in Oakland is being considered (see Figure 2). Construction activities would occur within city streets, one business park parking lot (the Telecare Corporation), and Estuary Park.
- Crossing #2. Crossing #2, known as the Alameda–North Bay Farm Island Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines on Alameda Island, cross under the San Leandro Bay Channel, and continue on North Bay Farm Island to its connection point (see Figure 3). Construction activities would occur within city streets and Towata Park.
- Crossing #3. Crossing #3, known as the Derby Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Tidal Canal, and continue in Alameda to its connection point. Project activities associated with Crossing #3 would include replacing an existing pipeline (see Figure 4). One alternate route option for open trench

construction in Alameda is being considered. Construction activities would occur within city streets.

## 1.2 ALTERNATIVE ALIGNMENT OPTIONS

This technical report analyzes two alternate transmission pipeline trenching options and one alternate location for a distribution pipeline replacement. The locations of these alternate alignment options are shown in Figures 2 and 4 and described below.

- ***Crossing #1 alternate trench option.*** Instead of using 2nd Street, the open trench construction and pipeline installation would occur along 3rd Street for one block, then along Oak Street for one block, and then would continue along the proposed alignment.
- ***Crossing #1 alternate pipeline replacement option.*** Instead of replacing the existing pipeline on 2nd Street between Madison Street and Oak Street, the pipeline on 3rd Street between Madison Street and Oak Street would be replaced.
- ***Crossing #3 alternate trench option.*** Instead of using Clement Avenue and a portion of Everett Street, open trench construction would occur on Broadway and then along Eagle Avenue until Everett Street, where pipeline installation would continue along the proposed alignment.

## 1.3 PROJECT CONSTRUCTION

Table 1 includes a summary of the construction activities for the proposed project, including the equipment that would be used, the location where the activity would occur, and the dimensions of the construction activity.

Construction hours would typically be between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) might be required when the proposed pipelines are connected to existing pipelines as well as to minimize service disruptions for water customers. Forty-eight-hour construction for one weekend would also be necessary for each HDD underwater pipeline crossing. Additional nighttime construction work could occur at traffic intersections, if required by encroachment permit conditions to minimize traffic impacts. If required, it is expected that nighttime intersection work would only occur at arterial streets such as High Street, Tilden Way, 5th Street, 6th Street, 7th Street, and 8th Street.

## 1.4 OPERATION AND MAINTENANCE

The proposed project would require routine operation and maintenance after construction, which is conducted under existing operations and maintenance procedures and protocols.

Figure 1 Project Location



CULTURAL RESOURCES TECHNICAL REPORT

Figure 2 Crossing #1 Alignment



Figure 3 Crossing #2 Alignment



Figure 4 Crossing #3 Alignment





## CULTURAL RESOURCES TECHNICAL REPORT

Table 1 Summary of Construction Activities

	Description	Equipment	Location	Approximate Dimensions
Transmission Pipeline Open Trench Construction	<p>Open trench construction consists of the following activities:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Saw-cutting the pavement</li> <li>• Excavating a trench</li> <li>• Removing and stockpiling soils</li> <li>• Installing the pipeline</li> <li>• Backfilling the trench and applying temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Pavement saws &amp; jack hammers</li> <li>• Excavators, backhoes, front-end loaders</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Dewatering pumps</li> <li>• Soil-cement mixing machines</li> <li>• Paving equipment (asphalt and/or concrete trucks, vibratory compactors, pavers, and rollers)</li> <li>• Water trucks</li> </ul>	<p>Throughout project roads for Crossing #1, #2, and #3 (see Figures 2, 3, and 4)</p>	<p>Construction corridor: 25 feet Maximum depth of trench: 8 feet Width of trench: 4 feet</p>
Transmission Pipeline Jack and Bore	<p>The jack and bore method would be used twice during project implementation: at Crossing #1 to install pipeline beneath a segment of railroad track on Oak Street, and at Crossing #2 to install pipeline beneath Otis Drive so that Otis Drive could remain open during construction. The jack and bore method would consist of the following activities:</p> <ul style="list-style-type: none"> <li>• Excavating a temporary jacking and receiving pit</li> <li>• Constructing a temporary jacking platform in the jacking pit</li> <li>• Drilling or jacking a casing through the earth under the road or railroad to be avoided</li> </ul>	<ul style="list-style-type: none"> <li>• Horizontal boring machine or auger &amp; hydraulic jack</li> <li>• Excavators</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Backhoes &amp; front-end loaders</li> <li>• Dewatering pumps</li> </ul>	<p>Crossing #1: The pits are located on (1) Oak Street, north of Embarcadero West, just north of the railroad crossing and on (2) Oak Street, south of Embarcadero West, just south of the railroad crossing (see Figure 2)</p> <p>Crossing #2: The pits are located on (1) Peach Street, which divides Towata Park in half, south of Otis Drive and on (2) Peach Street north of Otis Drive, on a part of Peach Street that has</p>	<p>Pit Area: 500 square feet Depth: 10–15 feet Length: 150 feet at Crossing #1 and 300 feet at Crossing #2</p>

## CULTURAL RESOURCES TECHNICAL REPORT

	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Installing the new pipeline in the casing</li> <li>• Connecting the new pipeline-to-pipeline segments on either end of the jacking pit</li> <li>• Backfilling the jacking and receiving pit and temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>		been closed to vehicle access (see Figure 3)	
Geotechnical Investigation	<p>A geologic review and geotechnical investigation would be conducted for the HDD Crossings and jack and bore locations. Exploratory borings would be made at the HDD entry and insertion pit locations and along the underwater alignment as well as at each jack and bore pit. The subsurface soils investigation would originate on the land or water surface and would consist of the following steps:</p> <ul style="list-style-type: none"> <li>• Locate/pothole for utilities</li> <li>• Mobilize land based and barge- or ship-mounted geotechnical drilling equipment</li> <li>• Drill exploratory soils borings at the following locations               <ul style="list-style-type: none"> <li>- HDD entry and insertion pits for all crossings</li> <li>- The underwater alignments for Crossing #1 and #2 at intervals</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Geotechnical drilling rig (truck-mounted and barge-mounted)</li> <li>• Turbidity curtains for drilling</li> <li>• Barge</li> </ul>	HDD entry and insertion pits for all crossings The underwater alignments for Crossings #1 and #2; and jack and bore pits	Depth: 125 feet Width: 2 inches

## CULTURAL RESOURCES TECHNICAL REPORT

	Description	Equipment	Location	Approximate Dimensions
	<p>of approximately 300 feet and depths of 125 feet</p> <ul style="list-style-type: none"> <li>- Jack and bore pits</li> <li>• Collect soils samples for classification and laboratory analysis (geophysical investigation methods may also be used)</li> <li>• Abandon exploratory borings (backfill land-based borings only)</li> </ul>			
<p>Transmission Pipeline Horizontal Directional Drilling</p>	<p>HDD will be used to install the three underwater pipelines under the Oakland Inner Harbor, Tidal Canal, and the San Leandro Bay Channel. HDD is a process that originates on the surface and typically consists of the following steps:</p> <ul style="list-style-type: none"> <li>• Ramming a steel conductor casing approximately 200 feet long into the ground on both sides of the drilling operation to support the pipeline until the pipeline reaches deeper and more stable soil and to prevent hydraulic fracturing ("frac out") at the surface.</li> <li>• Drilling a pilot hole from the entry pit across the water to the insertion pit; drilling could potentially occur at both the entry and insertion pit.</li> <li>• Enlarging the pilot hole through a reaming process</li> <li>• Laying down, fusing together, and pressure testing the pipeline</li> </ul>	<ul style="list-style-type: none"> <li>• HDD rig with control cab for the HDD operator (potentially one for each side)</li> <li>• Slurry separation plants (one for each side)</li> <li>• Small pick-cranes (one for each side)</li> <li>• Pipeline rollers</li> <li>• Slurry and grout pumps (one for each side)</li> <li>• Welders (at insertion pit)</li> <li>• Soil-cement mixing machines (one for each side)</li> <li>• Jet grouting rig (one for each side)</li> <li>• Excavators (one for each side)</li> <li>• Tractors/ loaders/ backhoes (one for each side)</li> </ul>	<p>Crossing #1, entry pit: Adjacent to the parking spaces next to Estuary Park (Oakland) – located approximately 500 feet south of the intersection of Embarcadero West and the road that provides access to the parking lot for Estuary Park</p> <p>Crossing #1, insertion pit: Telecare Corporation parking lot (Alameda) – located in the middle of Telecare Corporation parking lot, approximately 250 feet north of the intersection of Marina Village Parkway and Tynan Avenue</p>	<p>Entry and exit angles: 15 degrees</p> <p>Depth: 50–100 feet</p> <p>Dimensions of entry and insertion pits: 10 by 20 feet</p> <p>Depth of entry and insertion pits: 5 feet</p> <p>Total staging area around entry and insertion pits: 2,000–2,500 square feet</p> <p>HDD length at Crossing #1: 1,800 feet</p> <p>HDD length at Crossing #2: 1,400 feet</p> <p>HDD length at Crossing #3: 1,400 feet</p>

## CULTURAL RESOURCES TECHNICAL REPORT

Description	Equipment	Location	Approximate Dimensions
<ul style="list-style-type: none"> <li>• Pulling the pipeline into the insertion pit, through the enlarged pilot hole, and to the receiving pit</li> <li>• Injecting grout between the pipeline and casing</li> <li>• Injecting jet grouted columns to provide additional support to the casing, between the entry pit and the shoreline</li> <li>• Backfilling the HDD pit and temporary paving</li> <li>• Disinfecting the pipeline</li> <li>• Repaving</li> </ul>		<p>Crossing #2, entry pit:            Towata Park (Alameda)            – located within Towata Park, east of the portion of Peach Street, which divides Towata Park</p> <p>Crossing #2, insertion pit:            Veterans Court (North Bay Farm Island) – located approximately 275 feet north of the intersection of Veterans Court and Island Drive</p> <p>Crossing #3, entry pit:            Derby Avenue (Oakland) – located on Derby Avenue, between Ford Street and Glascock Street, approximately 50 feet north of the intersection of Derby Avenue and Glascock Street</p> <p>Crossing #3, insertion pit:            Broadway (Alameda) – located on Broadway, between Blanding Avenue and Clement Avenue, approximately 160 feet south of the intersection of Broadway and Blanding Avenue</p>	

## CULTURAL RESOURCES TECHNICAL REPORT

Description	Equipment	Location	Approximate Dimensions
<p>Connections</p> <p>The proposed project would connect the new water pipelines to existing EBMUD water transmission pipelines. The work to connect the new pipelines to existing pipelines would require the excavation of a trench or pit at each connection location. Temporary shoring would be required to ensure the stability of the excavation, which may include the use of vibratory sheet piles. The proposed tie-ins would be located within street rights-of-way and sited to minimize disruptions to traffic and homeowner access. Construction of the connections would generally be completed within a 12-hour period. For connections that require a new tee, construction could require a full 24-hour period, and night work might be necessary.</p>	<ul style="list-style-type: none"> <li>• Excavators</li> <li>• Generator Sets for night lighting</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering pumps</li> <li>• Hot tap machine</li> </ul>	<p>Connections would be located where open trench construction would occur (See Figure 2, 3, and 4)</p>	<p>The connections would be in the open trench construction corridor and would have similar dimensions as open trench construction.</p>
<p>In-Street Pipeline Abandonment</p> <p>Pipeline abandonment would require three construction pits in 5th Street to move service connections and fire hydrants and to install two endcaps, one at 5th Street and another at Oak Street. The abandoned pipeline would be filled with cellular concrete between the two endcaps, and an existing valve near the intersection of Madison Street and 5th Street would be abandoned in place after opening the valve.</p>	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> </ul>	<p>Oakland side of Crossing #1: On 5th Street, between Oak Street and Jackson Street</p>	<p>Length: 800 feet. Width of Pit: 10 feet Length of Pit: 10 feet Depth: 4–10 feet</p>

## CULTURAL RESOURCES TECHNICAL REPORT

Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Flatbed delivery trucks</li> </ul>		
Underwater Pipeline Crossings Abandonment	<p>The seven existing underwater pipeline crossings would be abandoned. Abandonment includes filling onshore sections of pipelines with cellular concrete and abandoning submarine sections of pipelines in place. Bumped heads or blind flanges will be constructed at the demarcation between the onshore and submarine sections and at the end of the onshore sections to be abandoned. To install the bumped heads or blind flanges, a pit would be excavated down to the pipeline. The bumped head at the two abandonment locations at Crossing #2 would be installed in existing vaults and would not require pit excavation (see Figure 3). Additional pits may be necessary to remove valves, hydrants, move service laterals, and at low points along the onshore pipeline alignment to facilitate concrete pumping; the location of these additional pits would be determined during detailed design.</p>	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> <li>• Vibratory pile driving may be used to install sheet pile walls for the abandonment pits</li> </ul>	<p>See Figures 2, 3, and 4</p> <p>Width of Pit: 10 feet Length of Pit: 10 feet Depth: 4-10 feet</p>

## CULTURAL RESOURCES TECHNICAL REPORT

Description	Equipment	Location	Approximate Dimensions
<p>Distribution Pipeline Replacement</p>	<p>Distribution pipeline replacement would require the same equipment used for open trench construction.</p>	<p>Crossing #1, Oakland: On 2nd Street (see Figure 2).</p> <p>Crossing #3, Alameda: On Everett Street (see Figure 4).</p>	<p>The distribution pipeline replacement would be in the open trench construction corridor and would have similar dimensions as open trench construction.</p> <p>Length of pipeline replacement at Crossing #1: 400 feet</p> <p>Length of pipeline replacement at Crossing #3: 750 feet</p>

## 1.5 KNOWN PREVIOUS SUBSURFACE IMPACTS

Prior subsurface impacts include installation of various subsurface utilities and other infrastructure with repair and maintenance over the past 80 years. In addition, the current water front and crossings have been subject to filling and dredging to create open land and navigable waterways.

## 1.6 AREA OF POTENTIAL EFFECTS

The Area of Potential Effects (APE) includes all areas where direct or indirect impacts may occur within the project. The horizontal and vertical APE of the proposed project site consists of a minimum corridor width of 25 feet within the public right of way and construction easement widths of up to 40 feet depending on the locations of existing and project-related utilities. Excavation dimensions are summarized in Table 1. Construction staging areas and temporary construction work spaces (including equipment, laydown of materials, and storage of excavated materials) are anticipated and would occur within the project corridors with subsurface disturbance anticipated.



## 2 REGULATORY CONTEXT

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Cultural resources include prehistoric and historic archaeological sites, districts, and objects; standing historic structures, buildings, districts, and objects; and locations of important historic events or sites of traditional and/or cultural importance to various groups. The analysis of cultural resources can provide valuable information on the cultural heritage of both local and regional populations.

Cultural resources may be determined significant or potentially significant in terms of national, state, or local criteria either individually or in combination. Resource evaluation criteria are determined by the compliance requirements of a specific project.

Pursuant to California Government Code Section 53091, EBMUD, as a local agency and utility district serving a broad regional area, is not subject to building and land use zoning ordinances (such as tree ordinances) for projects involving facilities for the production, generation, storage, or transmission of water. However, it is the practice of EBMUD to work with local jurisdictions and neighboring communities during project planning, and to consider local environmental protection policies for guidance.

### 2.1 STATE OF CALIFORNIA

This report has been prepared to meet applicable California Environmental Quality Act (CEQA) and the Historic Preservation Goals and Policies of the Cities of Alameda and Oakland for historic properties (cultural resources), which require the identification and evaluation of cultural resources that could be affected by the project.

The California Register of Historical Resources (CRHR) (Public Resources Code (PRC) Section 5024.1) is a listing of those properties that are to be protected from substantial adverse change, and it includes properties that are listed, or have been formally determined to be eligible for listing in, the National Register of Historic Places (NRHP), State Historical Landmarks, and eligible Points of Historical Interest. A historical resource may be listed in the CRHR if it meets one or more of the following criteria:

- It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States;
- It is associated with the lives of persons important to local, California, or national history;
- It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master or possesses high artistic values; or,

- It has yielded or has the potential to yield information important in the prehistory or history of the local area, California, or the nation.

### 2.1.1 Historical Resources

PRC Code Section 21084.1 stipulates that any resource listed in, or eligible for listing in the CRHR, is presumed to be historically or culturally significant. Resources listed in a local historic register or deemed significant in a historical resource survey (as provided under PRC Section 5024.1g) are presumed historically or culturally significant unless the preponderance of evidence demonstrates they are not. A resource that is not listed in or determined to be eligible for listing in the PRC, not included in a local register or historic resources, or not deemed significant in a historical resource survey may nonetheless be historically significant (PRC Section 21084.1). This provision is intended to give the Lead Agency discretion to determine that a resource of historic significance exists where none had been identified before and to apply the requirements of PRC Section 21084.1 to properties that have not previously been formally recognized as historic.

CEQA equates a substantial adverse change in the significance of a historical resource with a significant effect on the environment (PRC Section 21084.1) and defines substantial adverse change as demolition, destruction, relocation, or alteration that would impair historical significance (PRC 5020.1).

### 2.1.2 Archaeological Resources

Where a project may adversely affect a unique archaeological resource<sup>1</sup>, PRC Section 21083.2 requires the lead agency to treat that effect as a significant environmental effect. When an archaeological resource is listed in or is eligible to be listed in the CRHR, PRC Section 21084.1 requires that any substantial adverse effect to that resource be considered a significant environmental effect. PRC Sections 21083.2 and 21084.1 operate independently to ensure that potential effects on archaeological resources are considered as part of a project's environmental analysis. Either of these benchmarks may indicate that a project may have a potential adverse effect on archaeological resources.

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1. An archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria: (1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information. (2) Has a special and particular quality such as being the oldest of its type or the best available example of its type. (3) Is directly associated with a scientifically recognized important prehistoric or historic event or person [PRC § 21083.2 (g)].

### 2.1.3 Tribal Resources

Assembly Bill 52 (AB 52) provides protections for tribal cultural resources.<sup>2</sup> All lead agencies as of July 1, 2015 approving projects under CEQA are required, if formally requested by a culturally affiliated California Native American Tribe,<sup>3</sup> to consult with such tribe regarding the impacts of a project on tribal cultural resources prior to the release of any negative declaration, mitigated negative declaration or draft environmental impact report. Under PRC Section 21074, tribal cultural resources include site features, places, cultural landscapes, sacred places or objects that are of cultural value to a tribe that are eligible or listed on the CRHR or a local historic register or that the lead agency has determined to be a significant tribal cultural resource.<sup>4</sup>

Tribal consultation is to continue until mitigation measures are agreed to or either the tribe or the lead agency concludes in good faith that an agreement cannot be reached. In the case of agreement, the lead agency is required to include the mitigation measures in the environmental document along with the related Mitigation Monitoring and Reporting Program (MMRP) (see PRC Section 21084.3). If no agreement is reached, the lead agency must still impose all feasible mitigation measures necessary for a project to avoid or minimize significant adverse impacts on tribal cultural resources (PRC Section 21084.3).

### 2.1.4 Other California Laws and Regulations

Other state-level requirements for cultural resources management appear in the California PRC Chapter 1.7, Section 5097.5 "Archaeological, Paleontological, and Historical Sites," and Chapter 1.75 beginning at Section 5097.9 "Native American Historical, Cultural, and Sacred Sites" for lands owned by the state or a state agency.

The disposition of Native American burials is governed by Section 7050.5 of the California Health and Safety Code and PRC Sections 5097.94 and 5097.98, and falls within the jurisdiction of the Native American Heritage Commission.

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2. AB 52 amended Section 5097.94 of, and added Sections 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2 and 21084.3 to, the California Public Resources Code
  3. The Native American Heritage Commission maintains a list of more than 100 federally recognized California tribes and an additional list of tribes not recognized by the federal government but listed as non-recognized California tribes. Both groups have the right to request notification and consultation under the AB 52.
  4. The CEQA Guidelines do not currently address AB 52 requirements and will be revised by July 1, 2016 to add separate consideration of tribal cultural resources.

## 2.2 CITY OF ALAMEDA

The City of Alameda General Plan 1990-2010 (pages 19-20) provides guidance and policies regarding historic and archaeological resources. Those pertaining to archaeological resources are provided below.

### 2.2.1 Guiding Policy: Historic and Archaeologic Resources

- 5.6.a Protect historic sites and archaeological resources for their aesthetic, scientific, educational, and cultural values.

Historic preservation programs, such as the measures proposed within the 1980 Historic Preservation Element, have been successful in preserving the small-town character of many California communities.

### 2.2.2 Implementing Policies: Historic and Archaeologic Resources

- 5.6.b Working in conjunction with the California Archaeological Inventory, review proposed development projects to determine whether the site contains known prehistoric or historic cultural resources and/or to determine the potential for discovery of additional cultural resources.
- 5.6.c Require that areas found to contain significant historic or prehistoric archaeological artifacts be examined by a qualified consulting archaeologist or historian for appropriate protection and preservation.

CEQA requires evaluation of any archaeological resource on the site of a development project. Unique resources, as defined by State law, should be protected, either by physical measures or by locating development away from the site. A preferred preservation method involves covering a site with earth fill for potential future, leisurely excavation; immediate excavation by qualified archaeologists should be undertaken only if such protection is infeasible.

## 2.3 CITY OF OAKLAND

Relevant portions of the *Oakland General Plan Historic Preservation Element* (1993), adopted in 1994 provide goals for historic preservation. The City of Oakland is a Certified Local Government with a local historic preservation office. *Goal 2* of the *City of Oakland Historic Preservation Goals* is applicable to archaeological resources along with Objective 4 Archeological Resources, Policy 4.1 Archeological Resources in the Oakland General Plan Historic Preservation Element, and Actions 4.1.1 and 4.1.2.

### 2.3.1 Goal 2

Goal 2: To preserve, protect, enhance, perpetuate, use, and prevent the unnecessary destruction or impairment of properties or physical features of special character or special historic, cultural, educational, architectural or aesthetic interest or value. Such properties or physical features include buildings, building components, structures, objects, districts, sites, natural features

related to human presence, and activities taking place on or within such properties or physical features.<sup>5</sup>

### 2.3.2 Objective 4 Archeological Resources

To develop databases identifying existing and potential archeological sites and adopt procedures for protecting significant archaeological resources.

### 2.3.3 Policy 4.1 Archeological Resources

To protect significant archaeological resources, the City of Oakland will take special measures for discretionary projects involving ground disturbances located in archeologically sensitive areas. These procedures will include:

- (a) Mapping areas possessing high prehistoric or historic archeological potential.
- (b) Archival studies for new development or other activities involving ground disturbance within areas of high archeological potential.
- (c) Determination of whether the ground disturbance activity could damage archeological materials.
- (d) Surface reconnaissance by archeologist.
- (e) Subsequent actions. If the results of the surface reconnaissance were positive, several options would be available. One option would be to have an archeologist observe the project excavation with authority to stop work for the conduct of further investigations if archeological materials appear. Another option would be to perform limited archeological excavations prior to construction to determine more conclusively whether archeological materials are present.

### 2.3.4 Action 4.1 Archeological Protection Criteria and Procedures

Establish criteria and interdepartmental referral procedures for determining when discretionary City of Oakland approval of ground-disturbing activities located in archeologically sensitive areas should be subject to special condition to safe guard potential archeological resources.

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<sup>5</sup>. Note the definitions of property types or features *Oakland General Plan Historic Preservation Element* (1993:2-4 – 2-5, Table 2-1) are derived from the NRHP.

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### 3 RESEARCH METHODS

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A prehistoric and historic site record and literature search for the project locations and a 0.25-mile radius was completed by the California Historical Resources Information System, Northwest Information Center, Sonoma State University, Rohnert Park (CHRIS/NWIC File No. 14-1748 by Hagel). In addition, reference material from the Bancroft Library, University of California, Berkeley and material on file at Basin Research Associates, San Leandro, was also consulted. Other specialized listings for cultural resources consulted include:

- *National Historic Landmarks* (NHL) and *National Register of Historic Places* (NRHP) listings in Alameda County, California (USNPS 2015).
- *Historic Properties Directory* for Alameda County (CAL/OHP 2012a) with the most recent updates of the NRHP; CRHR; California Historical Landmarks; and, California Points of Historical Interest;
- *Archeological Determinations of Eligibility for Alameda County* (CAL/OHP 2012b);
- *California History Plan* (CAL/OHP 1973);
- *California Inventory of Historic Resources* (CAL/OHP 1976);
- *Five Views: An Ethnic Sites Survey for California* (CAL/OHP 1988);
- *California Historical Resources – Alameda County* [including NRHP, State Landmark, CRHP, and Point of Interest] (CAL/OHP 2015).
- Local county and city lists and general plan elements (Author Unknown/Not Stated n.d.; City of Alameda Planning Department v.d., 1980; Oakland 1994).
- Historic topographic and plan view maps (Bache 1857; Higley 1857; Whitney 1873; Thompson and West 1878; Hoffman 1871; Nelson 1909, ca. 1912; Hendry and Bowman 1940; Sowers 2000; USGS v.d.; US War Dept 1942).

The Native American Heritage Commission (NAHC) was contacted for a search of the Sacred Lands Inventory (Busby 2015a) for the project. A response was received (Pilas-Treadway 2015) and contact was initiated by Basin Research Associates with the 10 American individuals/groups recommended by the NAHC (Busby 2015b-k) followed by telephone contact on October 9, 2015 (see Section 5; Attachments).

Mr. Woodward C. Minor, a consulting architectural historian with extensive knowledge of the City of Alameda and its history provided the American Period Overview and characterizations of the three project crossings. His work involved field review as well as historical research.

No other agencies, departments or local historical societies were contacted regarding landmarks, potential historic sites or structures.

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## 4 BACKGROUND CONTEXT

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### 4.1 NATIVE AMERICAN – PREHISTORIC

Cultural resources are traces of human occupation and activity. In northern California, cultural resources extend back in time for at least 9,000-11,500 years with Native American occupation and use of central California extending over 5,000-8,000 years and possibly longer. The general study area appears to have been located in a favorable environment along the periphery of San Francisco Bay, in an area with a variety of ecological niches available for resource exploitation including the Bay margin, marshlands, riparian and inland resources. Habitation sites in the study area appear to have been selected for accessibility, protection from seasonal flooding, and the availability of both food and tool resources.

Archaeological information for the general Bay Area suggests a slow steady increase in the prehistoric population over time with an increasing focus on permanent settlements with large populations in later periods. This change from hunter-collectors to an increased sedentary lifestyle is due both to more efficient resource procurement as well as to a focus on staple food exploitation, the increased ability to store food at village locations, and the development of increasingly complex social and political systems including long-distance trade networks.

Prehistoric site types recorded in the region consist of shell mounds, lithic scatters, quarries, habitation sites (including burials), bedrock mortars or other milling feature sites, petroglyph sites, and isolated burial locations.

A number of the sites in the general study area were recorded by Nels C. Nelson 1909, ca. 1912 as a result of his systematic review of approximately 425 San Francisco Bay shellmounds between 1906 and 1908 (Moratto 1984:227). None of these “Shell Mound” and/or Nelson sites were located in or adjacent to the various project locations (e.g., Whitney 1873; Thompson and West 1878; Nelson 1909, ca. 1912; Merlin 1977:12, Figure 9; Moratto 1984:227, 252-261).

The majority of the prehistoric archaeological sites in the study area have been discovered as the result of EuroAmerican settlement and development. These sites were undoubtedly selected for relative accessibility, protection from seasonal flooding, and proximity to a diversified resource base. Rising sea levels between 10,000-8,000 years B.P. may have inundated early occupation of the Bay Area. Falling sea levels between ca. 8,000-6,000 years B.P. resulted in changes in the hydrological gradient resulting in increasing sedimentation and the formation of wetlands within the expanding alluvial plains around the drainages flowing into San Francisco Bay. The fresh water marshes around the bay expanded during the middle and late Holocene due to the

changing regime associated with declining sea levels and it is probable that the human populations moved further inland away from the bay periphery due to the expanding wetlands (see Atwater et al. 1977, 1979; Moratto 1984; Bickel 1978a-b).

Archaeological research in the San Francisco Bay Region has been interpreted using several chronological schemes based on stratigraphic differences and cultural traits. A three-part sequence of cultural development over time proposed by Lillard et al. (1939) was first used to document local and regional cultural change in prehistoric central California including the study area. This classification scheme, using Early, Middle and Late "horizons" to designate both chronological periods and social change, was based on stratigraphic patterns and an analysis of grave goods to explain local and regional cultural change from about 4,500 years ago to the time of European contact (see Lillard et al. 1939; Beardsley 1948, 1954).

The scheme was modified by Beardsley (1948, 1954) who renamed the sequence the Central California Taxonomic System (CCTS). This sequence proved inadequate and has since been revised and supplemented by new taxonomic systems recognizing cultural distinctions and associations in the Central California archaeological record (see collected essays by Bennyhoff and Fredrickson in Hughes 1994).

#### 4.1.1 Central California Taxonomic System (CCTS)

Moratto (1984) suggests that the Early Horizon dated to ca. 4,500 to 3,500/3,000 years before present with the Middle Horizon dating to ca. 3,500 to 1,500 years before present and the Late Horizon dating to ca. 1,500 to 250 years before present. The Early Horizon is the most poorly known of the period with relatively few sites known or investigated. Early Horizon traits include hunting, fishing, use of milling stones to process plant foods, use of a throwing board and spear ("atlatl"), relative absence of culturally affected soils (midden) at occupation sites, and elaborate burials with numerous grave offerings.

Middle Horizon sites are more common and usually have deep stratified deposits that contain large quantities of ash, charcoal, fire-altered rocks, and fish, bird and mammal bones. Significant numbers of mortars and pestles signal a shift to plant foods from reliance on hunted animal foods. Middle Horizon peoples generally buried their dead in a fetal position and only small numbers of graves contain artifacts (and these are most often utilitarian). Increased violence is suggested by the number of burials with projectile points embedded in the bones or with other marks of violence.

The Late Horizon emerged from the Middle Horizon with continued use of many early traits and the introduction of several new traits. Late Horizon sites are the most common and are noted for their greasy soils (midden) mixed with bone and fire-altered rocks. The use of the bow-and-arrow, fetal-position burials, deliberately damaged ("killed") grave offerings and occasional cremation of the dead are the best-known traits of this horizon.

#### 4.1.2 Local Sequence Characteristics

The complexity of the archaeological record in the central California region has resulted in the development and refinement of local sequences with specific cultural traits and chronologies (see Hughes 1994). Fredrickson (1974, 1994a-b) has proposed a tripartite scheme - Archaic, Emergent and Ethnographic - each with appropriate characteristics. The Lower Archaic (10,000-6,000 B.P.) and the Initial Middle Archaic (6,000-4,500 B.P.) are not well known and are primarily represented from the research completed at the Los Vaqueros Reservoir in Contra Costa County (Meyer and Rosenthal 1997). The other divisions are reasonably well represented. Additional details on the chronology and characteristics of these cultural divisions are presented in Fredrickson (1974, 1994a-b). These periods do imply cultural uniformity or an evolutionary path.

Terminal Middle Archaic (4,500-2,500 B.P.)

The Terminal Middle Archaic is equivalent to the Early Period in Dating Scheme B (Bennyhoff and Hughes 1987). Initial use of the shell mound sites along San Francisco Bay appears to have started during this period (see Banks and Orlins 1985; Broughton 1996; Lightfoot 1997). Sites from the period are noted as having prehistoric burials, side-notched and stemmed projectile points, rectangular abalone ornaments, shaped and unshaped mortars and pestles, and rectangular *Olivella* shell beads (Fredrickson 1966). Obsidian sources include the North Coast Ranges and eastern Sierra (Wiberg 1996) although local cryptocrystalline raw materials are dominant. Subsistence focused on nuts and berries as well as bayshore resources (shellfish, marine fishes and mammals) while interior sites focused on freshwater fish and shellfish and terrestrial mammals (Banks and Orlins 1985; Simons 1992).

Upper Archaic (2,500-1,300 B.P.)

The Upper Archaic is equivalent to the Early/Middle Transition and the Middle Period in Dating Scheme B (Bennyhoff and Hughes 1987). Numerous Upper Archaic sites are known from the lowland valleys and the San Francisco bayshore as well inland water sources (see Banks and Orlins 1979, 1985; Fredrickson 1968; Holman and Clark 1982; Lightfoot 1997).

Well-developed midden soils typical of long-term residential villages characterize Upper Archaic sites. Archaeological excavations have exposed deposits containing hundreds of flexed human burials and residential features. Early sites have Berkeley Pattern assemblages (ca. 3,000 B.P. to 1,000 B.P.) that are characterized by a bone tool and ornament industry, saucer and saddle-shaped *Olivella* shell beads, abalone ornaments and pendants, and unshaped and well-shaped mortars and pestles. Projectile points are typically shouldered lanceolate forms, although side-notched and stemmed points also occur, along with large lanceolate-shaped bifaces. Locally available chert dominates although obsidian from the North Coast Ranges and a number of eastern Sierran sources was used.

Subsistence appears to have focused on nuts and seeds with the faunal assemblages continuing to reflect either a marine or an interior emphasis depending on site location (Broughton 1996; Fredrickson 1968). However, marine shellfish begin to occur in appreciable amounts in interior valley sites (Fredrickson 1968).

This time period is also linked with the appearance of the Meganos Culture - a cultural group originating in the San Joaquin Delta and identified archaeologically as the Meganos Aspect of the Berkeley Pattern. It is postulated as migrating into various parts of the Bay Area at about 2,500 B.P. (Bennyhoff 1994; Bennyhoff and Hughes 1987) and has been described as a melding of bay and delta populations. The group is recognized archaeologically by a distinctive mortuary complex which featured few to no grave goods and a "non-standardized" mode of burial, including a mix of ventrally and dorsally extended and tightly flexed interments.

Emergent Period (1,300-200 B.P.)

The Emergent Period is equivalent to the Middle/Late Transition and the Late Period in the Dating Scheme B (Bennyhoff and Hughes 1987). The period's distinctive cultural pattern is known at the Augustine Pattern (1,000 B.P. to contact) which is characterized by the appearance of small projectile points. The Meganos culture appears to have retreated to the southern Delta region at the beginning of the period (Bennyhoff 1994).

Emergent Period sites are found in the interior valleys and uplands as well as bayshore locations. The sites generally have a midden deposit with both cremation and inhumation burials and residential features that include house floors. *Olivella* and clamshell disc beads are frequently found as grave goods and non-associated in midden deposits. It is possible that bead manufacture was practiced at some sites based on the presence of manufacturing debris. Napa Valley obsidian dominates the chipped stone tool assemblages.

Bedrock mortar milling stations appear early in the Emergent Period and are used in association with other portable milling equipment. Nuts, berries and seeds, especially small seeds, were collected and processed. Large terrestrial mammals (e.g., deer, elk) appear to have been favored. Marine shellfish and marine fishes appear inland in much larger quantities than in previous periods (Fredrickson 1968).

Patterns within the Emergent Period differ in terms of primary subsistence activities and increasing social stratification. These patterns have been interpreted as linked to the spread of Utian language groups, possibly followed by the Miwok-Costanoan, and later by the Wintuan groups (Moratto 1984:207-211).

General overviews and perspectives on the regional prehistory including chronological sequences can be found in C. King (1978a), Wallace (1978), Moratto (1984), Elsasser (1978, 1986), Allen (1999), Hylkema (2002) and Jones and Klar (2007).

CULTURAL RESOURCES TECHNICAL REPORT

Table 2 Comparison of California Cultural Period with Temporal Phases of Central California (Allen 1999)

Cultural Periods (Fredrickson 1994)	Dating Scheme B1 (Bennyhoff and Hughes 1987)	
	Year	Time Period
EMERGENT PERIOD		Historic Period
	AD 1800	
		Late Period Phase 2-B
	AD 1700	
		Late Period Phase 2-A
	AD 1500	
		Late Period Phase 1-C
	AD 1300	
		Late Period Phase 1-B
		Late Period Phase 1-A
UPPER ARCHAIC PERIOD	AD 900	Middle/Late Period Transition
	AD 700	
		Middle Period Terminal Phase
	AD 500	
		Middle Period Late Phase
	AD 300	
		Middle Period Intermediate Phase
	AD 100	
	Middle Period Early Phase	
	200 BC	
		Early/Middle Period Transition
MIDDLE ARCHAIC PERIOD	500 BC	
		Early Period
	3000 BC	
LOWER ARCHAIC PERIOD		
	6000 BC	
PALEOINDIAN PERIOD		
	8000 BC	

## 4.2 NATIVE AMERICAN – ETHNOGRAPHIC

The aboriginal inhabitants of the Bay Area region belonged to a group known as the Costanoan derived from the Spanish word *Costanos* ("coast people" or "coastal dwellers") who occupied the central California coast as far east as the Diablo Range. The proposed project is within the *Chochenyo* territory of the group (Levy 1978:485, Figure 1) also known as the *Ohlone* (see Galvan 1967/1968; Bean 1994). In 1770 the estimated 50 Ohlone tribelets consisted of politically autonomous groups of 50-500 individuals, with an average population of 200. Tribelet territories, defined by physiographic features, usually had one or more permanent villages surrounded by a number of temporary camps. The camps were used to exploit seasonally available floral and faunal resources (Levy 1978:487).

Research suggests that the study area would have been occupied by the *San Antonio* ethnic group and by the *Huchium*, *Huchium-Southern*, or the *Wekemnayon* tribelet.

The nearest reported villages were in Indian Gulch (later known as Trestle Glen), northeast of Lake Merritt and near High Street and Encinal Avenue [City of Alameda] (Duran 1824 in Bennyhoff 1977; Kroeber 1925; Merlin 1977; Levy 1978; Mosier and Mosier 1986; Milliken 1995, 2006). The presence of numerous Native Americans in the general Alameda, Oakland and Berkeley areas appears to have been so evident that the Spanish named the area in the vicinity of present day Temescal Creek (Oakland) and the Emeryville Shellmound on the edge of San Francisco Bay *Encinal del Temescal* (i.e., "oak grove by the sweathouse") (Gudde 1998:266).

The traditional Native American lifeway disappeared by ca. 1810 due to the introduction of new diseases, a declining birth rate, the cataclysmic impact of the mission system and the later secularization of the missions by the Mexican government. The Ohlone were transformed from hunters and gatherers into agricultural laborers and worked with former neighboring groups such as the Esselen, Yokuts, and Miwok (Levy 1978:486). An estimated 200 or more persons of partial Ohlone descent currently reside in the greater San Francisco Bay area (see Galvan 1967/1968; Margolin 1978).

For a more extensive review of the Native American inhabitants see Kroeber (1925), Harrington (1942), Cook (1957), Galvan (1967/1968), King and Hickman (1973), C. King (1974, 1977, 1978b, 1994), Levy (1978), Margolin (1978), Bean (1994), and Milliken (1995, 2006, 2008).

## 4.3 HISPANIC PERIOD

The Oakland portion of the project (e.g., part Crossing #1 and Crossing #3) and most of the Main Alameda Island portion of the project are within the former *Rancho San Antonio*. The Bay Farm Island (part of Crossing #2) was within ungranted lands.

The *Rancho San Antonio* was granted to Sergeant Luis Maria Peralta, a member of the 1776 Anza expedition, on August 3, 1820 by Governor Pablo Vicente de Sola, the last Spanish governor of Alta California. Two months later, part of this grant was revoked and surrendered to Mission Dolores. Still later, in 1823 under Governor Luis Arguello, part of the revoked portion was

regranted to Peralta. The rancho included the present-day cities of Albany, Berkeley, Emeryville, Oakland, Piedmont, Alameda, and part of San Leandro. Peralta died in 1842. As a result the rancho was sub-divided into approximately equal four parts and patented to his four sons. Antonio Maria secured the present-day East Oakland and the Encinal de San Antonio (City of Alameda) on June 25, 1874. None of the Hispanic Period dwellings or other structures were located in or adjacent to the project areas (USSG 1871; Hendry and Bowman 1940:585-596; Hoover et al. 1966:9-10; Mosier and Mosier 1986:71).

### 4.4 AMERICAN PERIOD - ALAMEDA (BY WOODRUFF C. MINOR)

In the mid-19th century, the majority of the rancho and pueblo lands and some of the ungranted land in California were subdivided as the result of population growth, the American takeover, and the confirmation of property titles. Not until the United States occupation of California in 1846 was land coveted and valued. The initial population boom in the study area was associated with the Gold Rush (1848), followed later by the construction of the transcontinental railroad (1869) with Oakland as its western terminus, and various local railroads. Still later, the development of the refrigerator railroad car (ca. 1880s), used for the transport of agricultural produce to distant markets, had a major impact on population growth in the area (Hart 1987).

Alameda County was named after Alameda Creek the former boundary between Contra Costa and Santa Clara counties. The county was created from portions of Santa Clara and Contra Costa counties on March 25, 1853. Oakland and Alameda are two major cities on the east shore of San Francisco Bay.

#### 4.4.1 Historical Motifs

Alameda is an island city on the urbanized east shore of San Francisco Bay. The main island is approximately six miles long and a mile and a half wide, adjoined by inlets to the north and east and open bay to the south and west. In addition to the main island, the city limits include a portion of Bay Farm Island (actually a peninsula) to the south and Coast Guard Island in Oakland Inner Harbor to the north. Alameda Island is connected to the mainland by five bridges - four to Oakland, over the tidal canal section of the harbor, and one to Bay Farm Island - as well as two underwater tunnels at Webster Street.

Alameda's geographical setting and historical development are similar to Oakland's. Both communities originated during the gold rush on oak-forested shoreline sites across the bay from San Francisco. Transportation and land speculation drove their development as commuter suburbs, and federally funded improvements to the shared harbor stimulated maritime activity on both waterfronts with the 1902 completion of the harbor's tidal canal having the further effect of turning the Alameda peninsula into an island. Yet the two cities are also quite different. Alameda, a fraction the size of Oakland, is a low-rise city with few buildings over three stories. Primarily residential, it is characterized by neighborhoods of detached houses intermixed with apartment buildings and commercial districts.

Alameda began as a farming community serving San Francisco. Early settlement was centered in the east end of the peninsula, along High Street. With the establishment of consolidated rail and ferry service, the peninsula underwent rapid development as a commuter suburb. In 1864, the San Francisco & Alameda Railroad began running trains along Lincoln and Pacific avenues to a ferry pier on the western shoreline, followed in 1878 by the South Pacific Coast Railroad on Encinal and Central avenues. By 1887, both lines formed part of the Southern Pacific system. The two lines stimulated development in the north and south sections of the peninsula, respectively, with Park Street - the site of the main stations - functioning as the new city center. Along with residential growth, the railroads gave rise to bathing resorts on the south shore and industrial plants along the west and north shores, including refineries, factories, mills, depots, and shipyards. A military presence was established in 1940, when Naval Air Station Alameda opened on filled tidelands off the west end of the island. Remnants of several shipyards survive and the largely intact Navy base (decommissioned 1997) awaits redevelopment.

Alameda's population grew from 500 in 1860 to about 25,000 in 1910. During World War II, military and industrial activities brought about a tripling of the population, to nearly 90,000. Though this number declined after the war, widespread apartment construction and massive bay-fill projects in the 1950s and 1960s brought in many new residents, a trend abetted by recent redevelopment of the industrial waterfront for residential and commercial uses. Today the city's population is approximately 75,000 (Cerny 2007; Minor 2009).

### 4.4.2 Architectural Characteristics

Despite the apartment buildings that replaced hundreds of houses in areas with high-density zoning, Alameda is a remarkably well-preserved residential city from the late 19th and early 20th centuries. While there are fine examples of types and styles from the 1850s to the 1960s, local architecture achieved its amplest expression between the 1870s and 1940s, in a stylistic sequence from Italianate, Stick, and Queen Anne to Colonial Revival, Craftsman, and Period Revival. Alameda has a particularly rich stock of bungalows from the 1910s to the 1930s, exhibiting the successive styles of those decades.

Alameda houses tend to be small, on constricted lots. The subdividing of land into ever-smaller parcels, a common practice among real estate speculators beginning in the gold rush, helps explain why neighborhoods often send mixed signals, both suburban and urban: detached houses with yards, but tightly packed. The leading Victorian designer-builders, such as A.W. Pattiani, Joseph A. Leonard, and Marcuse & Rimmel, produced hundreds of houses ranging from workers' cottages to villas for the affluent. By 1910, bungalow builders like Robert C. Hillen, the Strang brothers, George H. Noble dominated the market; these and later firms produced thousands of small houses through World War II. A dearth of vacant land on the main island in the postwar period meant that new tracts of single-family houses were restricted to Bay Farm Island, on former farmland, and to various bay-fill developments, notably South Shore on the main island and Harbor Bay Isle on Bay Farm Island (Alameda 1909; Cerny 2007; Gunn 1985; Minor 2009).



### 4.4.3 Project Crossings

#### Crossing #1

The area north of the Ralph M. Appezato Memorial Parkway and Eagle Avenue was originally marshland that was filled between the 1870s and 1920s with dredged material from harbor shipping channels and basins. Portions of the site were occupied by shipyards (United Engineering Works, 1900-1916; Bethlehem Shipyard, 1916-1948). The Bethlehem site was redeveloped in the 1980s as Marina Village, a mixed-use development with mall, office buildings, townhouses, and marina, including several shipyard structures adapted to commercial use (Minor 2000).

The pipeline route along Marina Village Parkway, Challenger Drive, and Atlantic Avenue runs through the center of the Bethlehem site and Marina Village. One shipyard structure, now offices, was listed on the NRHP in the 1980s. Sherman Street south of Eagle Avenue has several blocks of 19th-century houses. The two blocks between Buena Vista Avenue and Lincoln Avenue are at the center of the “Bay Station Heritage Area,” . . . a neighborhood of more than 30 Queen Anne houses designed and built in the 1890s by the local firm of Marcuse & Remmel, and designated a heritage area in 1980s by the City of Alameda’s Historical Advisory Board (Minor 2009). The Bay Station Heritage Area is recognized by the Alameda City Council as an area of local heritage significant to the city’s history and is designated in the Historic Preservation Element (Alameda 1980) and the City of Alameda’s General Plan. The area has not been evaluated as a district for eligibility on the CRHR or NRHP.

#### Crossing #2

The pipeline route in this area extends through the center of development in gold rush Alameda. The 1853 plat of the town took in the southeast section of the peninsula east of Versailles Avenue and south of Encinal Avenue. By 1860, the town had several hundred residents. Peach Street was the access road to the first Bay Farm Island Bridge, erected in 1854, which connected with an earth-fill roadway across Bay Farm Island marshland to upland farms. Little remains of the area’s 19th-century origins. San Jose Avenue and Peach Street are lined with single-family houses mostly dating from the early-to-mid-20th century, primarily bungalows and postwar tract houses, with a scattering of 19th-century structures. The pipeline route parallels the Bay Farm Island Bridge, built 1951-53, and enters the east edge of the contemporary Harbor Bay Isle bay-fill development west of Island Drive. The municipal golf course east of Island Drive was built in the 1920s on filled marshland. There are no designated local landmarks or NRHP properties along the pipeline route (Alameda 1909; Minor 2009; Stratton 1853).

#### Crossing #3

The pipeline route in this area extends from the Oakland waterfront across the tidal canal portion of the harbor to the Alameda waterfront and south into historic residential neighborhoods. Broadway, located 0.25 mile east of Park Street, is a gold rush era street laid out in 1854 with one-acre lots—the westernmost plat associated with the pioneer town of Alameda to the east. Northwest of Tilden Way—formerly a railroad right of way—the pipeline route

passes through several tracts platted in the vicinity of Park Street soon after the start of rail service, including the Alameda Station Homestead and the Jenks and Mead Homestead. The waterfront area was industrialized in the early 20th century, following the opening of the tidal canal; since the 1970s, this area has been incrementally redeveloped with commercial properties (Higley 1854; Morgan & Smith 1868; Jenks 1869).

The pipeline route along Broadway passes through varied settings. North of Tilden Way, there are remnants of 19th century residential development, including an intact row of Queen Anne houses between Clement and Blanding (1890, Joseph A. Leonard), and several small industrial properties. North of Blanding, the area has been redeveloped with a modern mall. South of Tilden Way, most 19th century houses on Broadway have been replaced with bungalow tracts and postwar apartment buildings, and nothing remains from the gold rush era. The current architectural character of the street south to Santa Clara Avenue is rooted in the early 20th century, notably extensive rows of bungalows. The pipeline route along Clement Avenue, Eagle Avenue, and Everett Street, and Lincoln Avenue presents a varied mix of old houses and newer industrial and commercial infill. Extant houses include rare Italianates dating back to the 1860s, along with other 19th and early 20th century styles and types. There are no designated local landmarks or NRHP listed properties along the pipeline route (Alameda 1909; Gunn 1985) although the Park Street Historic Commercial District with period of significance from 1875-1949 is immediately west of the pipeline termination on Lincoln Avenue. It is characterized by 64 contributing buildings generally consisting of small retail establishments and a few monumental institutional buildings including the Old Alameda Federal Post Office (1912), the Wells Fargo Bank (1888), the Old Masonic Temple (1891) and others (Malandra 1981).

#### 4.5 AMERICAN PERIOD – OAKLAND

In 1850, the firm of Mhoon [Moon], Carpentier & Adams built a small house at the foot of present-day Broadway within *Rancho San Antonio* owned by Vicente Peralta. They were joined by other squatters, survived an attempt at removal, and later negotiated a 160-acre "lease" (Scott 1985:33). The Town of Oakland was incorporated in 1852, became a city in 1854, and established a post office March 2, 1855 (Patera 1991:154).

The first plat of Oakland by Julius Kellersberger in 1853 for Edson Adams, Andrew Moon, and Horace W. Carpentier included the APE. Main Street was later called Broadway and was the major link between communities north and east of Oakland and the Oakland Embarcadero. The City was subdivided into blocks 200 by 300 feet with 80-foot wide streets with the exception of the 110-foot wide Broadway. The city of Oakland was designated the Alameda county seat on March 29, 1873 (Kellersberger 1853; Oakland Tribune 1898:50-52; Hoover et al. 1966:1, 20-21; Abrew 1973:10, Figure 1; Mosier and Mosier 1986:63).

The City of Oakland and its environs quickly grew with the railroads, becoming a major rail terminal in the late 1860s and 1870s with the city grid firmly established by the late 1880s [see Figure 9]. In 1868, the Central Pacific Railroad constructed the Oakland Long Wharf at Oakland Point, the site of the contemporary Port of Oakland. Oakland developed rapidly during the later

American Period and into the Contemporary Period (ca. 1876-1940s) and continues to the present. Oakland is a major port and industrial center noted particularly for machinery manufacture, chemical production, and food processing with the growth dependent on its varied transportation networks or railroads, highways and shipping. Oakland, now the third-largest city in the San Francisco Bay Area, continues to function as the major transportation hub, government center, trade center and industrial focus for the Eastbay (Bagwell 1982; Hart 1987:357-358). The 21<sup>st</sup> century has seen an increasing emphasis on the technology and information service industries as manufacturing and food processing have declined. The Port of Oakland is the fifth busiest in the United States and is major gateway to the Pacific Rim.

#### 4.5.1 Project Crossings

##### Crossing #1

The majority of the proposed pipeline on the Oakland side is south of the Interstate 880 and generally adjacent to the NRHP listed Oakland Waterfront Warehouse District (White 2000) although small sections of Crossing #1 and Pipeline Abandonment 1 are within a bump-out extension of the main district bounded by 5th street on the north, Madison Street on the east, 4th Street on the south and Jackson Street on the west. The district, an industrial area which includes a group of 30 buildings and one structure, is generally of one to three-story warehouses, most in the style of early 20th Century utilitarian and some with Beaux Arts Derivative and Art Deco elements. The period of significance spans 1900 to 1974. The project area is currently undergoing redevelopment with new residential high-density medium-rise housing and existing buildings converted to residential housing interspersed with ongoing commercial and industrial activities.<sup>6</sup>

The area north of Interstate 880 passes through an area of residential housing primarily of Victorian housing converted to multi-family use and new high-density condos and apartments interspersed with commercial and governmental buildings. The area is undergoing redevelopment.

Crossing #1 includes abandonment [see Figure 4] of the existing crossing on the Oakland side on Alice Street between an undeveloped lot and a multi-residence housing complex. The area was former marshland.

##### Crossing #3

Pipeline Crossing #3 follows Broadway northeast in Alameda and crosses under the Tidal Canal via HDD along Derby Street to Ford Street in Oakland. The pipeline alignment turns west along

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<sup>6</sup>. The building bounded by the pipeline alignments is currently used as office and warehouse for Cost Plus World Market International Headquarters - it was formerly used by S&W Fine Foods. The concrete Moderne Warehouse was constructed in 1937 with an addition in 1946. It is listed as a contributing building to the historic district.

## CULTURAL RESOURCES TECHNICAL REPORT

Ford Street to a termination at Park Street/29th Avenue [see Figure 8]. The area is a mixed area of low warehouses and industrial and manufacturing uses with some scattered single-family Victorians with many of the buildings undergoing redevelopment for live-work spaces, commercial offices, in-fill residential and mixed-uses. In particular, the area supports a burgeoning artistic colony. The area buildings appear to date from the early 1900s to the 1940s.

All of the pipelines proposed for abandonment [see Figure 8] are generally in industrial areas on the Oakland side of the Tidal Canal. Pipeline abandonment #2 passes through the Right Away Redy Mix & Concrete Pumping plant and then to intersection of Oak Street and Blanding Avenue. Existing pipeline #3 follows the alignment of the Park Street Bridge in an industrial/commercial area with adjacent new residential and live-work condo development on the Oakland bank along the Tidal Canal. Pipeline abandonment #4 passes under the Tidal Canal from Derby in Oakland to the bank of the canal at the foot of Broadway in the city of Alameda.

## 5 INDIVIDUALS, GROUP AND AGENCY PARTICIPATION

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The Native American Heritage Commission (NAHC) was contacted for a search of the Sacred Lands Inventory (Busby 2015a). The NAHC record search "failed to indicate the presence of Native American cultural resources in the immediate project area" (Pilas-Treadway 2015). Letters soliciting information were sent to the 10 Native Americans individuals/groups listed by the NAHC (Busby 2015b-k) (see Exhibits, Correspondence).

Jakki Kehl, Patterson; Katherine E. Perez, Linden; Linda G. Yamane, Seaside; Irenne Zwierlein, Amah Mutsun Tribal Band of Mission San Juan Bautista, Woodside; Michelle Zimmer Amah/Mutsun Tribal Band, Amah Mutsun Tribal Band of Mission San Juan Bautista, Woodside; Tony Cerda, Chairperson, Coastanoan Rumsen Carmel Tribe, Pomona; Ann Marie Sayers, Chairperson, Indian Canyon Mutsun Band of Costanoan, Hollister; Rosemary Cambra, Chairperson, Muwekma Ohlone Indian Tribe of the SF Bay Area, Milpitas; Andrew Galvan, The Ohlone Indian Tribe, Mission San Jose; and, Ramona Garibay, Representative, Trina Marine Ruano Family, Lathrop.

Mr. Christopher Canzonieri (M.A.), Basin Research Associates contacted the Native American individuals/groups by telephone on October 9, 2015. Detailed messages were left with Native American tribe representatives, including Jakki Kehl, Katherine Perez, Linda Yamane, Tony Cerda, Rosemary Cambra and Ramona Garibay - no calls were returned. Irenne Zwierlein, Michelle Zimmer and Ann Marie Sayers all recommended that the construction crew receive cultural sensitivity training and the archaeologists should have experience with Northern and Central California archaeology. In the event of an unexpected discovery, only qualified and trained Native American monitors should be used. Andrew Galvan, The Ohlone Tribe, recommended that all excavation within the city of Alameda should be monitored during any ground disturbance. Mr. Galvan also recommended that only a Native American monitor who can prove genealogical relationship to the East Bay be used for monitoring.

In regard to AB 52 notification, no culturally affiliated California Native American Tribes have filed requests with EBMUD to be notified of agency CEQA projects (Aaron Hope, P.E., Project Manager, EBMUD, personal communication, October 27, 2015).

With the exception of consulting architectural historian, Mr. Woodruff C. Minor, no other groups, individuals, agencies, or city departments were contacted by Basin Research Associates about the proposed project.

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## 6 FIELD INVENTORY

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An archaeological field inventory/review was not conducted for the proposed project as it is located within urban areas of the city of Oakland, Alameda Island, and North Bay Farm Island with little opportunity to inspect exposed native soil. The area is primarily covered with hardscape, buildings and introduced landscaping in a few areas. No undisturbed and/or unmodified ground surfaces remain.

An architectural field review was also not undertaken as the work will be primarily confined to City Right-of-Way and/or underwater crossings. Locations within private property and public parks would not result in direct impacts to structures. Several trees within public parks would be removed. There would be no significant long term visual/character altering impacts, no direct construction impacts aside from transitory dust and local noise, and no vibration impacts on any historic buildings and structures (see Section 9.0). The GIS database maintained by the City of Alameda was reviewed to identify architectural and historic resources. The review indicated a high density of built environment resources within the city.

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## 7 FINDINGS

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Twenty-two (22) cultural resources reports with a focus on archaeological research are on file with the CHRIS/NWIC that include or are immediately adjacent to the proposed pipeline crossings or pipelines selected for abandonment. No prehistoric, combined prehistoric/historic, or historic period archaeological sites have been recorded or reported in or adjacent to any of the proposed alignments. No resources identified by contemporary Native Americans are known for the project. No Hispanic or American era archaeological resources have been recorded or reported within the project alignments. In addition, no known NRHP and/or CRHR listed, determined eligible, or pending properties have been identified within the various pipeline crossings or proposed abandonments.

### 7.1 RECORDS SEARCH RESULTS (CHRIS/NWIC FILE NO. 14-1748)

#### 7.1.1 Compliance Reports (Archaeological)

Twenty-two (22) cultural resources reports on file with the CHRIS/NWIC cross or are adjacent to the APE that include archaeological reviews. Several of the reports include two or more the proposed pipeline alignments.

*Crossing #1* compliance reports (14) consist primarily of a proposed development project (Alameda Marina Village) and mostly linear alignments including projects involving transportation, fiber optics, cellular telephone equipment, the turning basin/estuary, and the Tidal Canal.

*Crossing #2* compliance reports (2) include City of Alameda linear infrastructure alignments.

*Crossing #3* compliance reports (10) involve fiber optics, the Inner Harbor/Tidal Canal, a review of historic bridges, the evaluation of the High Street Bridge and linear infrastructure alignments.

The twenty-two (22) cultural resources reports that cross the APEs for the proposed crossings, also cross the proposed pipeline abandonments APEs.

## CULTURAL RESOURCES TECHNICAL REPORT

Table 3 Cultural Studies within Proposed Alignments

CHRIS/ NWIC #	Author	Year	Name of Report	Type of Report	Comments	Archaeological & Historic Resources in Project Area
Crossing 1, Estuary Park-Marina Village Crossing						
S-0779	David Chavez	1977	Preliminary Cultural Resources Assessment of the East Bay Municipal Utility District (EBMUD) Wet Weather Facilities/Overflow Project Facilities Sites, Alameda and Contra Costa Counties, California	Archaeological Field study		No archaeological and historic resources within or adjacent to alignment
S-1230	David Chavez	1978	A Cultural Resources Evaluation of the Alameda Marina Village Project Location (letter report).	Archaeological Field study		No archaeological and historic resources within or adjacent to alignment
S-9991	Richard N. Lerner	1988	Historic Properties Assessment, Turning Basin, Oakland Inner Harbor, Alameda County, California	Other research	No historic shipyards and piers are near the proposed HDD crossings	No archaeological and historic resources within or adjacent to alignment
S-22820	Wendy J. Nelson, Tammara Norton, Larry Chiea, and Eugenia Mitsanis	2000	Cultural Resources Survey for the Level (3) Communications Long Haul Fiber Optics Project, Segment WS07: Oakland to San Jose	Archaeological Field study		No archaeological and historic resources within or adjacent to alignment
S-25244	Caltrans	2002	Historic Property Survey Report and Finding of No Historic Properties Affected for the Broadway-Jackson Street Interchange Improvement Project, Interstate 880 in the City of Oakland, Alameda County, 04-ALA-880 KP 49.9/52.1 (PM 31/32.4) and 04-ALA-260/61 KP 0.0/3.2 (PM 0.0/2.2), EA 04-219-260000	Other research		No archaeological resources within or adjacent to alignment
S-25246	Heidi Koenig, Jack McIlroy, and Jack Meyer,	2001	Broadway/Jackson Street Interchange Improvement Project: Archaeological Survey Report, 04-Ala-880, KP 49.9/52.1 (PM 31.0/32.4) in the Cities of Oakland and Alameda, Alameda County, California	Archaeological Field study		No archaeological and historic resources within or adjacent to alignment

## CULTURAL RESOURCES TECHNICAL REPORT

CHRIS/ NWIC #	Author	Year	Name of Report	Type of Report	Comments	Archaeological & Historic Resources in Project Area
S-25247	Thad Van Bueren, Jack Meyer, and Brian Ramos	2002	Report on Archaeological Testing for the Broadway-Jackson Interchange Improvement Project in the City of Oakland, California, 04-ALA-880, P.M. 31.0/32.4 (K.P. 49.9/52.1) - EA 04-260000	Archaeological Excavation, Field study, Other research		No archaeological and historic resources within or adjacent to alignment
S-26419	David Chavez and Jan M. Hupman	2002	Archaeological Resources Investigations for the EBMUD East Bayshore Recycled Water Project, Alameda County, California: Additional Pipeline Alignments	Archaeological Field study		No archaeological and historic resources within or adjacent to alignment
S-29467	Frank Lortie	1993	Historic Resource Evaluation Report, The Posey Tube, Bridge #33-106R, 04-Ala-260, R0.07/R1.2, EA 04-127201	Architectural /historical, Other research	Underwater tunnel outside of the HDD crossings	No archaeological and historic resources within or adjacent to alignment
S-29474	Lorna Billat	2001	Finding of No Adverse Effect Nextel Cell Site No. CA-1119A, Webster/Posey Tube, Bridge #33-106R, Alameda County, California	Archaeological Field study		No archaeological and historic resources within or adjacent to alignment
S-33061	Nancy Sikes, Cindy Arrington, Bryon Bass, Chris Corey, Kevin Hunt, Steve O'Neil, Catherine Pruet, Tony Sawyer, Michael Tuma, Leslie Wagner, and Alex Wesson	2006	Cultural Resources Final Report of Monitoring and Findings for the Qwest Network Construction Project, State of California	Archaeological Architectural /historical, Field study, Monitoring		No archaeological and historic resources within or adjacent to alignment
S-33061a	SWCA	2006	Cultural Resources Final Report of Monitoring and Findings for the Qwest Network Construction Project, State of California	Monitoring		No archaeological and historic resources within or adjacent to alignment
S-33061b	Nancy E. Sikes	2007	Final Report of Monitoring and Findings for the Qwest Network Construction Project (letter report)	Other research		No archaeological and historic resources within or adjacent to alignment
S-43175	Adrian Praetzellis, Michael Konzak, Dana Shew, and Kate Green	2013	A Cultural Resources Inventory of Oakland Estuary Enhancement Project #1, Oakland & Alameda, Alameda County, California	Literature search	Pipelines pass under the estuary and Tidal Canal	No archaeological and historic resources within or adjacent to alignment

## CULTURAL RESOURCES TECHNICAL REPORT

CHRIS/ NWIC #	Author	Year	Name of Report	Type of Report	Comments	Archaeological & Historic Resources in Project Area
Crossing 2, Alameda-North Bay Farm Island Crossing						
S-16077	David Chavez and Jan M. Hupman	1994	Archaeological Resources Investigations for the City of Alameda Sanitary Sewer Relief Line Locations, Alameda County, California	Archaeological Field study		No archaeological resources within or adjacent to alignment
S-28010	Colin I. Busby	2002	Archaeological Records and Limited Literature Review, Alameda Power & Telecom (Department) 12 kV Feeder to Bay Farm Island, City of Alameda, Alameda County, California (letter report)	Literature search		No archaeological resources within or adjacent to alignment
Crossing 3, Derby Crossing and Pipeline Abandonment (No. 5) Adjacent to the High Street Bridge						
S-2152	Stephen A. Brandt	1980	Cultural Resources Investigation of Operating Projects, Oakland Inner Harbor.	Archaeological Field study		No archaeological resources within or adjacent to alignment
S-9991	Richard N. Lerner	1988	Historic Properties Assessment, Turning Basin, Oakland Inner Harbor, Alameda County, California	Other research	No historic shipyards and piers are near the proposed HDD crossings	No archaeological resources within or adjacent to alignment
S-16077	David Chavez and Jan M. Hupman	1994	Archaeological Resources Investigations for the City of Alameda Sanitary Sewer Relief Line Locations, Alameda County, California	Archaeological Field study		No archaeological resources within or adjacent to alignment
S-023393	Colin I. Busby and Melody E. Tannam	2000	Historic Property Survey Report, High Street Bridge (#33C026) Seismic Retrofit Project, Alameda County, California	Other research		01-003158
S-023394	Ward Hill and Basin Research Associates, Inc.	2000	Finding of Effect, High Street Bridge (#33C026) Seismic Retrofit Project, Alameda County, California	Other research		01-003158

## CULTURAL RESOURCES TECHNICAL REPORT

CHRIS/ NWIC #	Author	Year	Name of Report	Type of Report	Comments	Archaeological & Historic Resources in Project Area
S-28010	Colin I. Busby	2002	Archaeological Records and Limited Literature Review, Alameda Power & Telecom (Department) 12 kV Feeder to Bay Farm Island, City of Alameda, Alameda County, California (letter report)	Literature search		No archaeological resources within or adjacent to alignment
S-030907	Christopher McMorris	2004	Caltrans Historic Bridge Inventory Update: Metal Truss, Moveable, and Steel Arch Bridges, Contract: 43A0086, Task Order: 01, EA: 43-984433, Volume I: Report and Figures	Bridge Inventory Update	Includes High Street and Park Street Bridges	01-003158 01-003190 and others
S-33110	Michael Konzak	2007	A Cultural Resources Study for the Derby Avenue to Lancaster Street, Oakland Museum Women's Board Warehouse Waterfront Trail Gap Closure Project	Archaeological Field study		No archaeological resources within or adjacent to alignment
S-43175	Adrian Praetzellis, Michael Konzak, Dana Shew, and Kate Green	2013	A Cultural Resources Inventory of Oakland Estuary Enhancement Project #1, Oakland & Alameda, Alameda County, California	Literature search	Pipelines pass under the estuary and Tidal Canal	No archaeological resources within or adjacent to alignment
S-44854	Basin Research Associates	2007	Draft Cultural Resources Report, Preliminary Assessment of the Oakland Inner Harbor Tidal Canal, From the U.S. Army Corps of Engineers San Francisco District to the Cities of Oakland and Alameda, Alameda County, California, and the Transfer of the Fruitvale Avenue Railroad Bridge to Alameda County.	Evaluation		No archaeological resources within or adjacent to alignment
Pipeline Abandonments - Nos. 1 to 6 (see also Pipeline Crossings 2 and 3)						
S-16077	David Chavez and Jan M. Hupman	1994	Archaeological Resources Investigations for the City of Alameda Sanitary Sewer Relief Line Locations, Alameda County, California	Archaeological Field study		No archaeological resources within or adjacent to alignment
S-43175	Adrian Praetzellis, Michael Konzak, Dana Shew, and Kate Green	2013	A Cultural Resources Inventory of Oakland Estuary Enhancement Project #1, Oakland & Alameda, Alameda County, California	Literature search	Pipelines pass under the estuary and Tidal Canal	No archaeological resources within or adjacent to alignment

### 7.1.2 Recorded and/or Reported Sites Within Alignments

No prehistoric, combined prehistoric/historic, or historic era sites have been recorded or reported in or adjacent to the proposed pipeline crossings or pipelines selected for abandonment.

### 7.1.3 Recorded and/or Reported Archaeological Sites Within 0.25 Mile

Six archaeological resource sites have been recorded within 0.25 mile<sup>7</sup> of Crossing #1 and Crossing #3.

#### Crossing #1

Four archaeological sites have been recorded within 0.25 mile of Crossing #1, all within the City of Oakland. None of the resources are near to any of the project's components.

#### Crossing #3

Two sites have been recorded within 0.25 mile of Crossing #3, both within Alameda Island. None of the resources are near to any of the project's components.

## 7.2 NATIVE AMERICAN RESOURCES

No prehistoric, combined prehistoric/historic or Native American ethnographic resources, settlements and/or use areas including Native American trails have been identified within or adjacent to the project (CHRIS/NWIC File No. 14-1748 and Pilas-Treadway 2015).

## 7.3 HISTORIC ERA RESOURCES

No Hispanic era archaeological resources have been recorded or reported within the project alignments. No known Hispanic Period expeditions, dwellings, or other structures, features, etc. have been reported in or adjacent to the proposed project.

No significant American era archaeological and/or architectural resources have been identified within the project alignments subject to direct impact as a result of the records search, literature review, and/or field reviews. Five of the seven pipelines to be abandoned in-place are 50 years of age or greater. The pipelines, part of EBMUD's distribution system, consist of steel and cast iron pipe ranging in size from 12 to 24 inches in diameter. The oldest pipes are cast iron and date from 1918.<sup>8</sup> Aaron Hope, P.E., Project Manager, EBMUD, indicated that the pipelines

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<sup>7</sup> A quarter mile is the standard search radius and is the required minimum area for the archival review of cultural resources for the U.S. Army Corps of Engineers as well as other agencies.

<sup>8</sup> #1 Alice-Webster built in 1946; #2 Derby built in 1935; #3 Park built in 1918; #5 High built in 1918; #6 Alameda-Bay Farm 1 built in 1952 [see Figures 4 to 8 for pipeline locations].

consist of standard available pipe components and were installed in accordance with generally accepted engineering methods at the time of their installation. No special engineering methods were used and they are not part of a unique design. Other examples are present in the EBMUD system. They are not significant and their abandonment in-place will not result in the removal of the pipe.

#### 7.4 LISTED HISTORIC PROPERTIES

A portion of the project is within the *Rancho San Antonio*, a California State Landmark (Hoover et al. 1966; CAL/OHP 1990). As a State Historical Landmarks from number 770 onward, it is automatically on the CRHR (CAL/OHP 2001). The project will have no effect on the value for which the resource is listed, as explained further in Section 9.0.

A small extension of a NRHP listed historic district, the Oakland Waterfront Warehouse District, includes approximately one block of the Oakland side of Crossing #1 and Pipeline Abandonment 1. In addition, Crossing #3 on Lincoln Avenue, Alameda side is adjacent to the northeast boundary of the Park Street Historic Commercial District. No other NRHP or CRHR listed, determined eligible, or pending properties have been identified within the project alignments.

No other known local, state or federal historically or architecturally significant structures, landmarks or points of interest including properties eligible for the NRHP or the CRHR have been recorded, reported, identified or observed in or adjacent to the project.

#### 7.5 ARCHAEOLOGICAL SENSITIVITY

Prehistoric use of the general Oakland area was heavily influenced by the presence of various seasonal creeks, sloughs, the San Francisco Bay marshlands, the Oakland Hills, and marshes near the shoreline and on higher elevations near the shoreline. The known prehistoric archaeological sites appear to have been selected for relative accessibility, protection from seasonal flooding, and proximity to a diversified resource base. The majority of the prehistoric shellmounds and associated sites in the East Bay are situated at the ecotone (boundary) between the salt marsh and alluvial plain ecozones. Unfortunately, a regional area specific predictive model to identify locations with a high potential for containing buried archaeological sites based on the presence of certain surface landforms and sediments as well as the existing archaeological record has not been developed for the project area.

Several researchers have developed archaeological sensitivity determinations for various areas of the general project area within the cities of Alameda and Oakland based on a review of recorded archaeological sites from the 1960s and early 1970s. The main part of Alameda Island and portions of Oakland near the shoreline have been designated as an area of extreme and high archaeological sensitivity (see Quaternary Research Group 1976). In addition, the southern portion of the main Alameda Island from about Park Street, has been identified as an Area of Archaeological Sensitivity by Chavez (1977:Map 8). These sensitivity designations; however,

reflect the presence of a small number of recorded prehistoric shellmound sites and are not based on a predicted high density of archaeological resources across the island. A sensitivity rating of minimal has been assigned to the Bay Farm Island portion of the project (Quaternary Research Group 1976). All of the areas surrounding the project except for Bay Farm Island have been developed and used over the past 100-150 years for commercial, industrial, and residential purposes. Prior subsurface disturbance includes extensive excavation for infrastructure improvements and development.

#### 7.5.1 Archaeological Sensitivity Within Proposed Alignments

A review of the available archaeological data collected since the 1970s and the physical locations of the proposed pipeline crossings, trenched pipelines, and pipeline abandonment locations suggest a low to low-moderate sensitivity for prehistoric archaeological resources near the San Francisco Bay Margin/Oakland Estuary. None of the prehistoric "Indian Mound[s]" recorded by Whitney (1873) or shellmound sites recorded between 1906 and 1908 by Nels C. Nelson (ca. 1912) associated with extremely high archaeological sensitivity are located within or adjacent to the project locations. However, the presence of six recorded or probable prehistoric resource sites within 0.25 mile of Crossings #1 and #3 suggests a potential low-moderate sensitivity although the northern parts of Crossings #1 and #3 and the southern periphery of the Main Alameda Island and/or Bay Farm Island portion of Crossing #2 are former marshy bay lands, that have been filled for current development. In addition, the Tidal Canal is an engineered channel that was completed in 1920 turning the Alameda peninsula into an island [see Figure 10].

A low sensitivity is suggested for the discovery of significant historic archaeological resources within the various project alignments. Infrastructure improvements over the past 100-150 years including railroad track installation, surface street improvements, freeway construction including column bents associated with the alignment of Interstate I-880, installation of sanitary sewer and storm drainage lines, potable water pipelines and underground utilities and intense urban development have resulted in both surface and subsurface disturbance to varying depths with the proposed ROW. However, isolated historic features associated with the former residential, industrial and commercial uses adjacent to the project locations have been exposed during construction although the resources either in total or individually do not appear to have been eligible for inclusion on either the NRHP and/or CRHR due to integrity issues.

In summary, the available information for the proposed improvement locations strongly suggests a low sensitivity for the discovery of significant subsurface prehistoric and historic archaeological resources within the proposed alignments due to past disturbance and historic filling.



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## 8 CULTURAL RESOURCE IMPACTS AND RECOMMENDED MITIGATION MEASURES

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No recorded archaeological resources are present within the project alignments. The pipeline is within/adjacent to two NRHP listed historic districts, the Oakland Waterfront Warehouse District and Park Street Historic Commercial District, as well as *Rancho San Antonio*, a California Landmark, California Register of Historic Places (CRHP) resources, and other potentially but unevaluated historic buildings and structures. Potential impacts to unknown, buried prehistoric and historic archaeological resources are identified. No direct impacts for historical resources are identified. Three mitigation measures are recommended to mitigate to less-than-significant impacts associated with unexpected archaeological discoveries, including Native American burials, during future ground-disturbing activities.

### 8.1 DEFINITION OF IMPACTS

CEQA states that a project that may cause a substantial adverse change in the significance of a cultural resource may have a significant effect on the environment. Substantial adverse change in the significance of a cultural resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of the resource would be materially impaired. The significance of a cultural resource is materially impaired when a project:

Demolishes or materially alters in an adverse manner those physical characteristics of a cultural resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the CRHR; or,

1. Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of cultural resources pursuant to PRC Section 5020.1(k) or its identification in a cultural resources survey meeting the requirements of PRC 5024.1(g), unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or,
2. Demolishes or materially alters in an adverse manner those physical characteristics of a cultural resource that convey its historical significance and that justify its eligibility for inclusion in the CRHR as determined by a lead agency for purposes of CEQA.

## 8.2 POTENTIAL PROJECT IMPACTS AND MITIGATIONS

The project could potentially affect previously undiscovered prehistoric cultural resources within the project site. Potential impacts include:

Cultural Resources Impact -1: The potential to cause a substantial adverse change in the significance of archeological resources. *Less than Significant with Mitigation.*

No known CRHR-eligible archaeological resources are located within the proposed pipeline alignments or abandonment areas. Although there is no potential to impact known archaeological resources, there is a potential to encounter previously undiscovered archaeological resources during construction activities. The geotechnical borings would disturb a very small area (geotechnical borings are 2-inches wide). Due to the small area that would be impacted, the potential to cause a substantial adverse change in the significance of a previously undiscovered archeological resource from pre-construction geotechnical investigation would be low and the impact would be less than significant. Construction activities could, however, result in the inadvertent exposure of buried prehistoric or historic archaeological materials that could be eligible for inclusion on the CRHR (PRC Section 5024.1) and/or meet the definition of a unique archeological resource as defined in Section 21083.2 of the PRC. Damage to a previously undiscovered archaeological resource during ground disturbing activities would result in a potentially significant impact. This significant impact would be reduced to a less-than-significant impact with implementation of Mitigation Measures CM-1 and CM-2, which requires the review, identification, evaluation and treatment of any significant archaeological finds by a Professional Archaeologist at the time of discovery. Measures CM-1 and CM-2 will be implemented in accordance with state law.

### **CM-1. Cultural Resources Sensitivity Training**

A professional archaeologist shall provide sensitivity training to supervisory staff, prior to initiation of site preparation and/or construction, to alert construction workers to the possibility of exposing significant historic and/or prehistoric archaeological resources within the proposed project area. The training shall include any prehistoric or historic objects that could be exposed, the need to stop excavation at the discovery and within 100 feet of the discovery, and the procedures to follow regarding discovery protection and notification. An "Alert Sheet" shall be posted in staging areas, such as in construction trailers, to alert personnel to the procedures and protocols to follow for the discovery of a potentially significant historic and/or prehistoric archaeological resources.<sup>8</sup>

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<sup>8</sup> Significant prehistoric cultural resources may include:

- a. Human bone - either isolated or intact burials.

**CM-2. Cultural Resources Inadvertent Discoveries.**

In the event that a historical or cultural resource is identified during pre-construction geotechnical investigation borings or during excavation for construction, all work within 100 feet of the resource shall be halted until a professional archaeologist, retained by EBMUD, can review, identify, and evaluate the resource for its significance. Should the archaeologist determine that a cultural resource has the potential to be a tribal cultural resource, then a Native American monitor shall be retained by EBMUD to monitor work in the area where the tribal cultural resource was discovered.

If the historical resource can be preserved in place and no further impacts would occur, the resource shall be documented on California State Department of Parks and Recreation cultural resource record forms and no further effort shall be required. If the resource cannot be avoided and may be subject to further impact, the professional archaeologist shall evaluate the resource and determine whether it is (1) eligible for the CRHR (and thus a historical resource for purposes of CEQA), and/or (2) a unique archaeological resource as defined by CEQA.

If the resource is determined to be neither a unique archaeological nor an historical resource, work may commence in the area. If the resource meets the criteria for either an historical or unique archaeological resource, or both, work shall remain halted, and the professional archaeologist shall consult with EBMUD regarding methods to ensure that no substantial adverse change would occur to the significance of the resource pursuant to *CEQA Guidelines* Section 15064.5(b). Methods to be considered shall include preservation in place or evaluation, collection, recordation, and analysis of any significant cultural materials in accordance with a Cultural Resources Work Plan (known as data recovery) prepared by the professional archaeologist. The methods and results of evaluation or data recovery work at an archaeological find shall be documented

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- b. Habitation, occupation or ceremonial structures as interpreted from rock rings/features, distinct ground depressions, differences in compaction (e.g., house floors).
  - c. Artifacts including chipped stone objects such as projectile points and bifaces; groundstone artifacts such as manos, metates, mortars, pestles, grinding stones, pitted hammerstones; and, shell and bone artifacts including ornaments and beads.
  - d. Various features and samples including hearths (fire-cracked rock; baked and vitrified clay), artifact caches, faunal and shellfish remains (which permit dietary reconstruction), distinctive changes in soil stratigraphy indicative of prehistoric activities.
  - e. Isolated prehistoric artifacts (Basin 2015).

## CULTURAL RESOURCES TECHNICAL REPORT

in a professional level technical report to be filed with CHRIS. Work may commence upon completion of treatment, as approved by EBMUD.

*A Monitoring Closure Report* shall be filed by EBMUD at the conclusion of ground disturbing construction if archaeological and Native American monitoring of excavation was undertaken.

Impact CR-2: The potential to cause a substantial adverse change in the significance of a historic resource, including historic buildings or historic districts. *Less than Significant*

The pipeline is within/adjacent to two NRHP listed historic districts as well as a California Landmark and CRHP resources, and other potentially but unevaluated historic buildings and structures. Crossing #1 on the Oakland side is located within a small extension of the Oakland Waterfront Warehouse District, a NRHP Historic District that includes approximately 30 historic buildings. The extension includes one building covering one city block listed as contributing to the historic district. Crossing #3 on the Alameda side terminates at the northeast corner of the NRHP listed Park Street Commercial District on Lincoln Avenue. Both Crossings #1 and #3 on the Oakland side are within the Rancho San Antonio Landmark. The California Inventory of Historic Resources lists the San Antonio Rancho (Peralta Grant) under the theme of exploration and settlement (CAL/OHP 1976:154, 224 and the California History Plan lists the Rancho San Antonio, Oakland for the Hispanic Era (Spain) 1542-1822 (CAL/OHP 1973:32). As a State Historical Landmark from number 770 onward, it is automatically on the CRHR (CAL/OHP 2001).

The pipelines cross through several residential and commercial areas on both the Oakland and Alameda sides that may include individually significant potential historic resources and/or contributing and non-contributing buildings and structures that could comprise a potential historic district. The pipelines would be constructed entirely within roadways and would not have any direct impacts on buildings or other known or potentially historic buildings and/or structures. Indirect impacts to historic buildings and structures from vibration caused by construction of the proposed project are not anticipated. Were construction-generated vibration to cause structural damage or significant cosmetic damage to the exterior of potentially historic buildings, such as cracking of exterior plaster, cracking of masonry foundations, or cracking of windows, then the historical significance of a building could be altered, which would be a significant impact. Mitigation would be implemented to keep vibration levels below significance thresholds, which ensures that no cosmetic damage would occur to the buildings (Illingworth and Rodkin 2016). Construction would not damage structures and therefore would not have any impacts to any potential historic resources. The project would have no effect on the Rancho San Antonio Landmark because the project would not affect the historic values for which the Landmark is listed - exploration and settlement and representing the Hispanic Era.

Pre-construction geotechnical investigation borings would occur at the HDD entry and insertion pits, along the underwater alignments for all three crossings, and in jack and bore pits. Geotechnical investigations would require the drilling of borings up to 2 inches in diameter and

up to 125 feet deep. Many of the boring locations would be in the water or away from areas with historic uses. Historic resources are unlikely to be encountered within borings. There is a higher likelihood for encountering historical resources in the jack and bore locations as these are within neighborhoods with historic structures. Even if historic artifacts are encountered, these artifacts have a low potential to be impacted by such a small disturbance. The boring would not remove or displace enough material to impact a potential historic resource; therefore, the impact from pre-construction geotechnical investigation borings would be less than significant.

The seven pipelines proposed for abandonment do not represent significant or unique resources in regard to design, components, installation methods or purpose. They will be abandoned in-place. Water distribution will continue through either new or existing pipelines.

Impact CR-3: The potential to disturb any human remains, including those interred outside of formal cemeteries.

Previously unknown Native American human remains could be exposed during ground disturbing construction operations associated with soil removal. Construction operations could result in the inadvertent exposure of buried prehistoric or protohistoric (ethnographic) Native American human remains.

This significant impact would be reduced to a less-than-significant impact with implementation of Mitigation Measure CM-3 which requires that the treatment of human remains and or associated or unassociated funerary objects during any soil-disturbing activity must comply with applicable state law for Native American burials.

The geotechnical borings would disturb a very small area (geotechnical borings are 2-inches wide). Due to the small area that would be impacted, the potential to cause a substantial adverse change in the significance of a previously undiscovered archeological resource from pre-construction geotechnical investigation would be low and the impact would be less than significant.

### **CM-3. Human Remains Inadvertent Discoveries.**

- a) The treatment of human remains and of associated or unassociated funerary objects discovered during any soil-disturbing activity within the proposed project area shall comply with applicable state laws. Treatment shall include halting all work within 100 feet of the discovery and immediate notification of the Alameda County Medical Examiner and the City of Alameda and/or the City of Oakland and EBMUD.
- b) In the event of the coroner's determination that the human remains are Native American, notification of the Native American Heritage Commission is required, who shall appoint a Most Likely Descendant (MLD) (PRC §5097.98).
- c) EBMUD, the professional archeologist, the landowner, and MLD shall make all reasonable efforts to develop an agreement for the treatment,

## CULTURAL RESOURCES TECHNICAL REPORT

with appropriate dignity, of human remains and associated or unassociated funerary objects (*CEQA Guidelines* Section 15064.5[d]). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. If the MLD and the other parties do not agree on the disposition of the remains, the reburial method will follow PRC §5097.98(b) which states that:

. . . the landowner or his or her authorized representative shall reinter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance.

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### Abbreviations

n.d. no date

v.d. various dates

N.P. no publisher noted

n.p. no place of publisher noted

Note: The abbreviated phrase CHRIS/NWIC, Sonoma State University, Rohnert Park is used for material on file at the California Historical Resources Information System, Northwest Information Center, Sonoma State University, Rohnert Park.

## EXHIBITS

### FIGURES

- FIGURE 1 Project Areas in 1915 (USGS San Francisco, Calif. 1915; Concord, Calif. 1915; and Haywards, Calif. 1915)
- FIGURE 2 Project Alignments with Historic Coastlines (USGS Oakland West, CA 1993; Oakland East, CA 1997; San Leandro, CA 1993, and USCGS T-Sheets 481 and 592, 1855-56)
- FIGURE 3 **CONFIDENTIAL** - Pipeline Components with Archaeological Resources and Historic Districts Within 1/4 mile (USGS Oakland West, CA 1993; Oakland East, CA 1997; and San Leandro, CA 1993) (Redacted for Confidentiality)

### CORRESPONDENCE

- LETTER Request to Native American Heritage Commission (NAHC) for Review
- LETTER NAHC Response
- LETTERS Request to Native Americans Identified by NAHC
- MEMO Record of Native American Contacts

#### 9.1.1 CHRIS/NWIC SEARCH RESULTS

- SEARCH File No. 14-1748 (7/06/2015) [No Confidential Information]

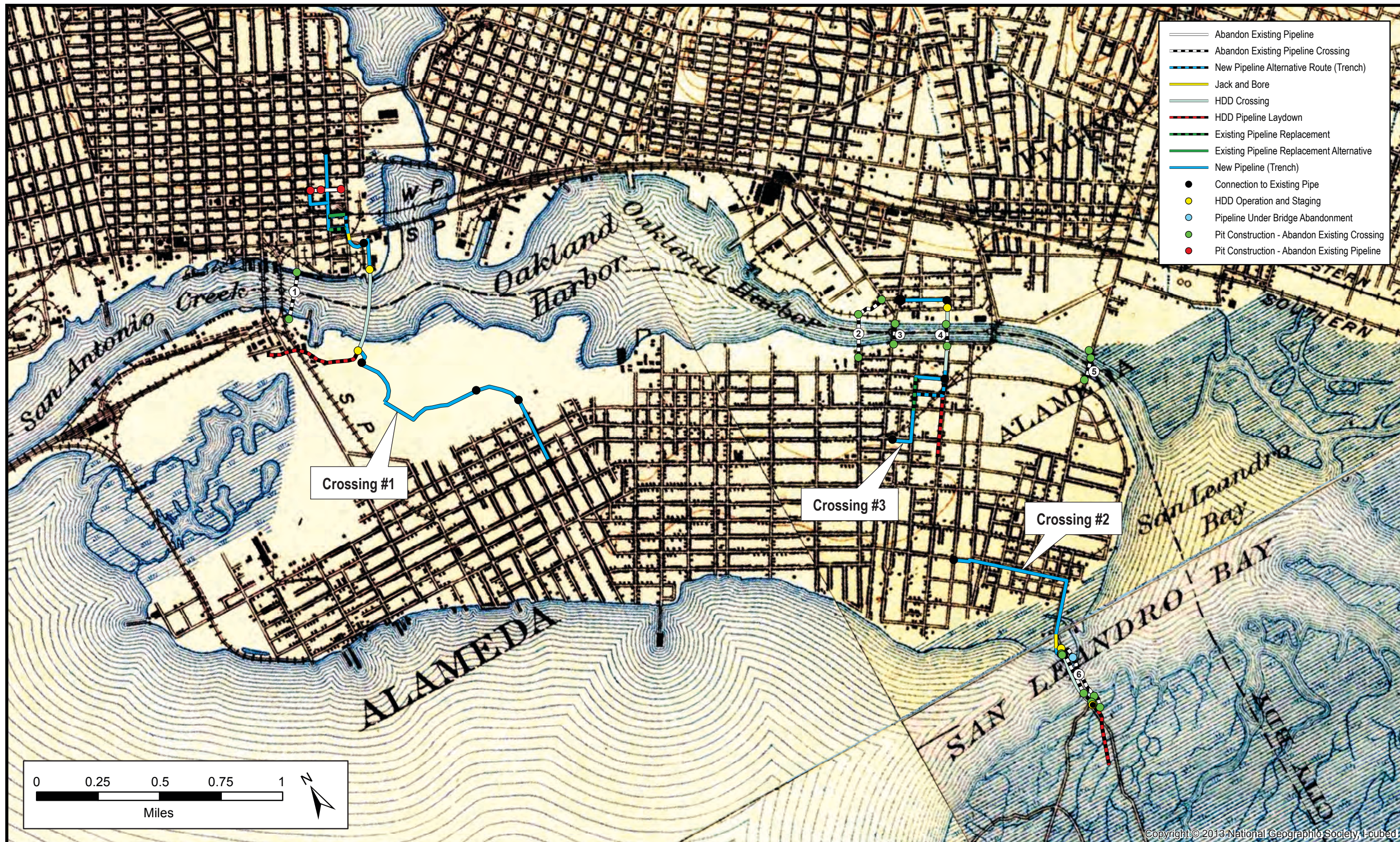


Figure 1: Project Areas in 1915 (USGS San Francisco, Calif. 1915; Concord, Calif. 1915; and Haywards, Calif. 1915)



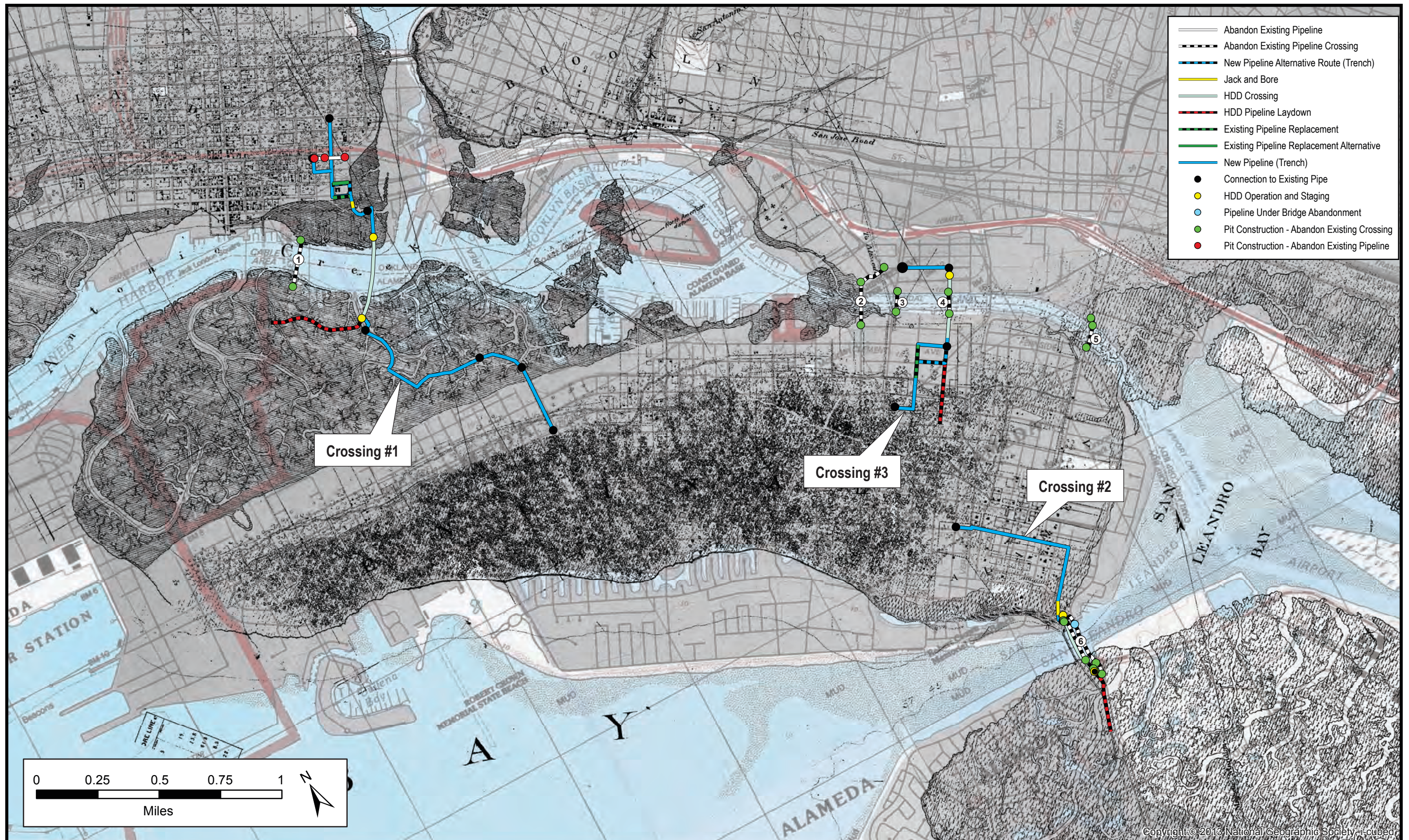


Figure 2: Project Alignments with Historic Coastlines (USGS Oakland West, CA 1993; Oakland East, CA 1997; San Leandro, CA 1993, and USCGS T-Sheets 481 and 592, 1855-56)

FIGURE 3 CONFIDENTIAL - Pipeline Components with Archaeological Resources and Historic Districts Within 1/4 mile (USGS Oakland West, CA 1993; Oakland East, CA 1997; and San Leandro, CA 1993) (Redacted for Confidentiality)

**Sacred Lands File & Native American Contacts List Request  
NATIVE AMERICAN HERITAGE COMMISSION**

1556 Harbor Boulevard, STE 100  
West Sacramento, CA 95691  
(916) 373-3710  
(916) 373-5471 – Fax  
nahc@nahc.ca.gov

*Information Below is Required for a Sacred Lands File Search*

**Project:** Alameda-North Bay Farm Island Pipeline Crossings Project

**County:** Alameda

**USGS Quadrangle Name:** USGS Oakland West, CA 1993; Oakland East, CA 1997; and San Leandro, CA 1993

**Address:** None - three water pipelines in City of Alameda

**Township:** 1 and 2 South, **Range:** 3 and 4 West; unsectioned (former rancho).

**Company/Firm/Agency:** Basin Research Associates

**Contact Person:** Colin I. Busby, PhD, RPA

**Street Address:** 1933 Davis Street, STE 210

**City/Zip:** San Leandro, CA 94577

**Phone:** (510) 430-8441 x202

**Fax:** (510) 430-8443

**Email:** basinres1@gmail.com

**Project Description:**

Alameda-North Bay Farm Island Pipeline Crossings Project is needed to ensure continued reliable water service to customers located in the City of Alameda on both Alameda Island and the North Bay Farm Island. Water service to the city is dependent on existing underwater pipeline crossings between the City of Oakland, Alameda Island, and North Bay Farm Island. Failure of one of three existing crossings could lead to a reduction in the level of service for existing customers and potentially reduce the available water supply to the city. Three new pipeline crossings are proposed to replace the existing pipeline crossings to ensure long-term reliability and redundancy of the water distribution system, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

The project involves the construction and operation of three new water transmission pipeline segments within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island) to ensure continued reliable water service to customers located in the City of Alameda. The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island.

Information will be used in a CEQA EIS for the East Bay Municipal Utility District.

9/9/15

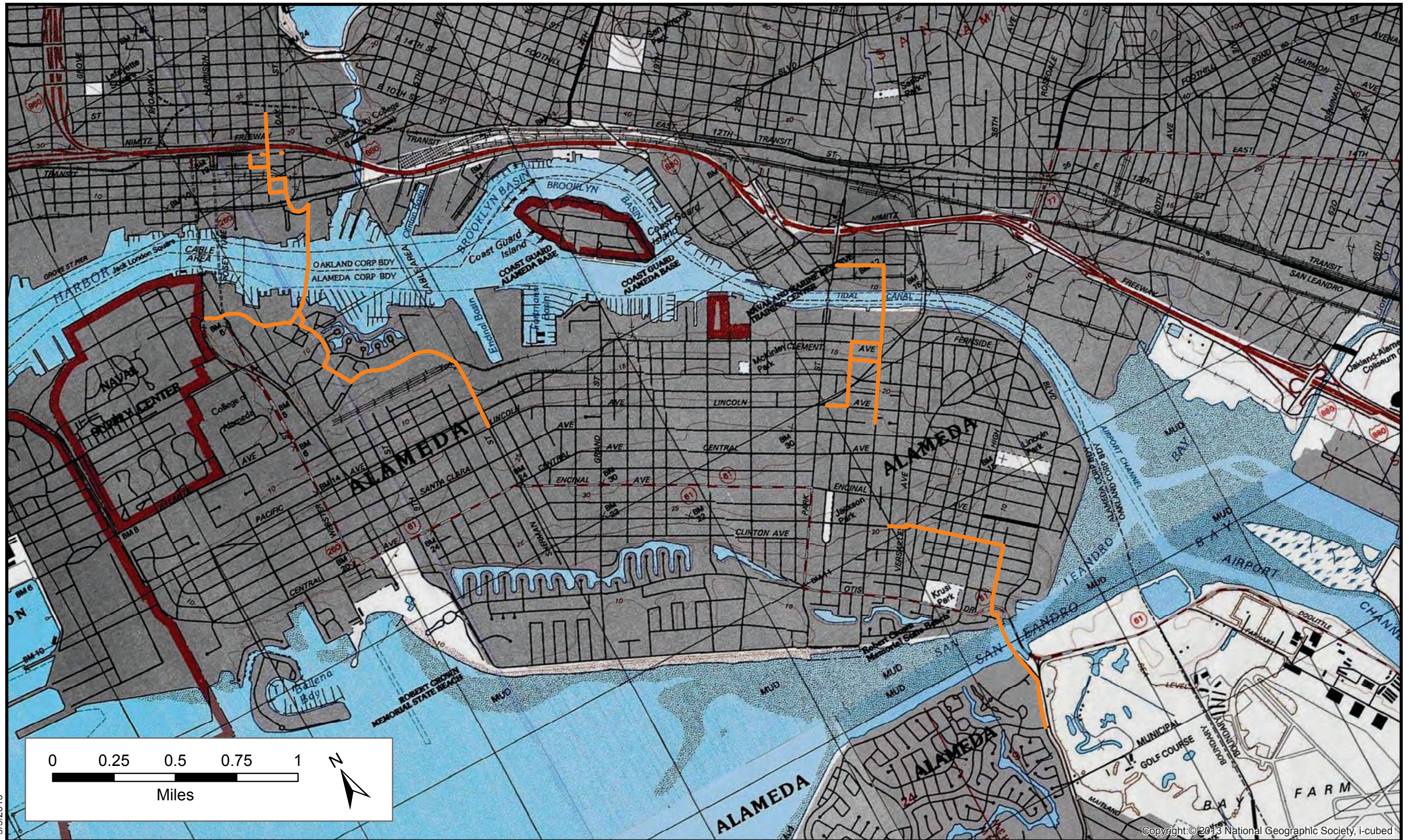


Figure 1: Project Alignments T1-2S R3-4W (USGS Oakland West, CA 1993; Oakland East, CA 1997; and San Leandro, CA 1993)

**NATIVE AMERICAN HERITAGE COMMISSION**

1550 Harbor Blvd.  
West Sacramento, CA 95691  
(916) 373-3710  
Fax (916) 373-5471



September 22, 2015

Colin I. Busby  
Basin Research Associates  
1933 Davis Street, Ste. 210  
San Leandro, CA 94577

Via E-mail: [basinres1@gmail.com](mailto:basinres1@gmail.com)

Number of Pages: 2

RE: Alameda-North Bay Farm Island Pipeline Crossing Project, Alameda County

Dear Mr. Busby,

A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the sacred lands file does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Enclosed is a list of Native Americans individuals/organizations who may have knowledge of cultural resources in the project area. The Commission makes no recommendation or preference of a single individual, or group over another. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe or group. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at [dpt\\_nahc@pacbell.net](mailto:dpt_nahc@pacbell.net).

Sincerely,

A handwritten signature in black ink, appearing to read "DR" with a flourish.

Debbie Pilas-Treadway  
Environmental Specialist III

**Native American Contact  
Alameda County  
September 22, 2015**

Jakki Kehl  
720 North 2nd Street  
Patterson, CA 95363  
jakkikehl@gmail.com  
510-701-3975

Ohlone/Costanoan

Coastanoan Rumsen Carmel Tribe  
Tony Cerda, Chairperson  
240 E. 1st Street  
Pomona, CA 91766  
rumsen@aol.com  
(909) 524-8041 Cell  
(909) 629-6081

Ohlone/Costanoan

Katherine Erolinda Perez  
P.O. Box 717  
Linden, CA 95236  
canutes@verizon.net  
(209) 887-3415

Ohlone/Costanoan  
Northern Valley Yokuts  
Bay Miwok

Indian Canyon Mutsun Band of Costanoan  
Ann Marie Sayers, Chairperson  
P.O. Box 28  
Hollister, CA 95024  
ams@indiancanyon.org  
(831) 637-4238

Ohlone/Costanoan

Linda G. Yamane  
1585 Mira Mar Ave  
Seaside, CA 93955  
rumsien123@yahoo.com  
(831) 394-5915

Ohlone/Costanoan

Muwekma Ohlone Indian Tribe of the SF Bay Area  
Rosemary Cambra, Chairperson  
P.O. Box 360791  
Milpitas, CA 95036  
muvekma@muvekma.org  
(408) 205-9714  
(510) 581-5194

Ohlone / Costanoan

Amah Mutsun Tribal Band of Mission San Juan Bautista  
Irene Zwielerlein, Chairperson  
789 Canada Road  
Woodside, CA 94062  
amahmutsuntribal@gmail.com  
(650) 400-4806 Cell

Ohlone/Costanoan

The Ohlone Indian Tribe  
Andrew Galvan  
P.O. Box 3152  
Fremont, CA 94539  
chochenyo@AOL.com  
(510) 882-0527 Cell

Ohlone/Costanoan  
Bay Miwok  
Plains Miwok  
Patwin

(650) 332-1526 Fax

(510) 687-9393 Fax

Amah Mutsun Tribal Band of Mission San Juan Bautista  
Michelle Zimmer  
789 Canada Road  
Woodside, CA 94062  
amahmutsuntribal@gmail.com  
(650) 851-7747 Home

Ohlone/Costanoan

Trina Marine Ruano Family  
Ramona Garibay, Representative  
30940 Watkins Street  
Union City, CA 94587  
soaprootmo@comcast.net  
(510) 972-0645

Ohlone/Costanoan  
Bay Miwok  
Plains Miwok  
Patwin

(650) 332-1526 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed Alameda-North Bay Farm Island Pipeline Crossing project, Alameda County



September 22, 2015

**BASIN**  
RESEARCH  
ASSOCIATES

1933 DAVIS STREET  
SUITE 210  
SAN LEANDRO, CA 94577  
VOICE (510) 430-8441  
FAX (510) 430-8443

Ms. Jakki Kehl  
720 North Second Street  
Patterson, CA 95363

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Jakki,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

Any information received will be used in a CEQA EIS for the East Bay Municipal Utility District.

If I can provide any further information, please don't hesitate to contact me (510 430-8441 or [Basinres1@gmail.com](mailto:Basinres1@gmail.com)). Thank you for your timely review of our request.

BASIN RESEARCH ASSOCIATES, INC.

Colin I. Busby, Ph.D., RPA  
Principal

CIB/dg

BASIN RESEARCH ASSOCIATES



September 22, 2015

**BASIN**  
RESEARCH  
ASSOCIATES

1933 DAVIS STREET  
SUITE 210  
SAN LEANDRO, CA 94577  
VOICE (510) 430-8441  
FAX (510) 430-8443

Ms. Katherine Erolinda Perez  
P.O. Box 717  
Linden, CA 95236

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Kathy,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

Any information received will be used in a CEQA EIS for the East Bay Municipal Utility District.

If I can provide any further information, please don't hesitate to contact me (510 430-8441 or [Basinres1@gmail.com](mailto:Basinres1@gmail.com)). Thank you for your timely review of our request.

BASIN RESEARCH ASSOCIATES, INC.

Colin I. Busby, Ph.D., RPA  
Principal

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September 22, 2015

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SAN LEANDRO, CA 94577  
VOICE (510) 430-8441  
FAX (510) 430-8443

Ms. Linda G. Yamane  
1585 Mira Mar Avenue  
Seaside, CA 93955

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Linda,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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Ms. Irenne Zwierlein, Chairperson  
Amah/Mutsun Tribal Band of Mission San Juan Bautista  
789 Canada Road  
Woodside, CA 94062

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Irenne,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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Ms. Michelle Zimmer  
Amah/Mutsun Tribal Band of Mission San Juan Bautista  
789 Canada Road  
Woodside, CA 94062

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Michelle,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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Mr. Tony Cerda  
Coastanoan Rumsen Carmel Tribe  
240 E. 1<sup>st</sup> Street  
Pomona, CA 91766

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Tony,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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Ms. Ann Marie Sayers, Chairperson  
Indian Canyon Mutsun Band of Costanoan  
P.O. Box 28  
Hollister, CA 95024

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Ann Marie,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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Ms. Rosemary Cambra, Chairperson  
Muwekma Ohlone Tribe of the SF Bay Area  
P.O. Box 360791  
Milpitas, CA 95036

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Rosemary,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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FAX (510) 430-8443

Mr. Andrew Galvan  
The Ohlone Indian Tribe  
P.O. Box 3152  
Fremont, CA 94539

RE: Request for Information  
*Alameda-North Bay Farm Island Pipeline Crossings Project,  
City of Alameda, Alameda County*

Dear Andrew,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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FAX (510) 430-8443

Ms. Ramona Garibay, Representative  
Trina Marine Ruano Family  
30940 Watkins Street  
Union City, CA 94587

RE: Request for Information *Alameda-North Bay Farm Island Pipeline Crossings Project,*  
*City of Alameda, Alameda County*

Dear Ramona,

The Native American Heritage Commission has provided your name as an individual who may have information regarding Native American sites within or adjacent to the above proposed project (see enclosed USGS map).

The Alameda-North Bay Farm Island Pipeline Crossings Project involves the construction and operation of three new water transmission pipeline segments to replace the existing pipeline crossings within the cities of Oakland and Alameda (Alameda Island and North Bay Farm Island). The proposed pipelines would be located within existing city streets, one business park parking lot, Estuary Park, Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay channel surrounding Alameda Island. The project will ensure long-term reliability and redundancy customers located in the City of Alameda, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

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If I can provide any further information, please don't hesitate to contact me (510 430-8441 or [Basinres1@gmail.com](mailto:Basinres1@gmail.com)). Thank you for your timely review of our request.

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***Record of Native American Contacts***  
**Proposed Alameda-North Bay Farm Island Pipeline Crossing Project**  
**Alameda County.**

- 9/9/15 Letter to Native American Heritage Commission (NAHC), Sacramento.  
Regarding: Request for Review of Sacred Lands Inventory for project.
- 9/22/15 Letter response by Debbie Pilas-Treadway, NAHC
- 9/22/15 Letters sent to all parties recommended by NAHC

Letters to Jakki Kehl, Patterson; Katherine E. Perez, Linden; Linda G. Yamane, Seaside; Irene Zwierlein, Amah Mutsun Tribal Band of Mission San Juan Bautista, Woodside; Michelle Zimmer Amah/Mutsun Tribal Band, Amah Mutsun Tribal Band of Mission San Juan Bautista, Woodside; Tony Cerda, Chairperson, Coastanoan Rumsen Carmel Tribe, Pomona; Ann Marie Sayers, Chairperson, Indian Canyon Mutsun Band of Costanoan, Hollister; Rosemary Cambra, Chairperson, Muwekma Ohlone Indian Tribe of the SF Bay Area, Milpitas; Andrew Galvan, The Ohlone Indian Tribe, Mission San Jose; and Ramona Garibay, Representative, Trina Marine Ruano Family, Lathrop.

- 10/9/15 Telephone calls and/or emails made by Basin Research Associates (Christopher Canzonieri) in the late afternoon to non-responding parties.

**Jakki Kehl** – called at 3:19 PM; left a detailed message.

**Katherine Perez** – called at 3:20 PM; left a detailed message.

**Linda G. Yamane** – called at 10:15 AM; left a detailed message.

**Irene Zwierlein** – called at 3:22 PM; Ms. Zwierlein recommends that all construction crew receive cultural sensitivity training. The archaeologists should have experience with Northern and Central California archaeology and qualified and trained Native American monitors should be used.

**Michelle Zimmer** – called at 3:30 PM. Ms. Zimmer recommends that all construction crew receive cultural sensitivity training. The archaeologists should have experience with Northern and Central California archaeology and qualified and trained Native American monitors should be used.

**Tony Cerda** - called at 3:41 PM; no answer, unable to leave message.

**Ann Marie Sayers** – called at 3:45 PM; recommends that all construction crew receive cultural sensitivity training. The archaeologists should have experience with Northern and Central California archaeology and qualified and trained Native American monitors should be used.

**Rosemary Cambra** – called at 3:47 PM; unable to leave a message

**Andrew Galvan** – called at 3:43 PM; Mr. Galvan recommends that all excavation within the City of Alameda should be monitored during any ground disturbance. Mr. Galvan also recommends that only a Native American monitor who can prove genealogical relationship to the East Bay be used for monitoring.

**Ramona Garibay** – called at 3:47 PM; left a detailed message.

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SANTA CRUZ  
SOLANO  
SONOMA  
YOLO

**Northwest Information Center**  
Sonoma State University  
150 Professional Center Drive, Suite E  
Rohnert Park, California 94928-3609  
Tel: 707.588.8455  
nwic@sonoma.edu  
<http://www.sonoma.edu/nwic>

7/6/2015

NWIC File No.: 14-1748

Donna Garaventa  
Basin Research Associates  
1933 Davis Street, Suite 210  
San Leandro, CA 94577

re: Alameda North Bay Pipeline

The Northwest Information Center received your record search request for the project area referenced above, located on the Oakland West, Oakland East, & San Leandro USGS 7.5' quads. The following reflects the results of the records search for the project area and a 0.25 mile radius:

Archaeological resources within project area:	None
Archaeological resources within 0.25 mile radius:	P-01-91, 10692, 10693, 74, 10796, & 10733.
Reports within project area:	S-1230, 779, 12950, 29474, 29467, 9991, 33061, 22820, 25246, 25247, 25244, 2152, 44854, 33110, 16077, & 28010.
Other Reports within records search radius:	S-33600, 1784, 2458, 20395, 33239, 18217, 26045, 9462, 9583, 16660, 15529, 17835, 32596, 848, 7903, 14621, & 17773. These reports are classified as Other Reports; reports with little or no field work or missing maps. The electronic maps do not depict study areas for these reports, however a list of these reports has been provided. In addition, you have not been charged any fees associated with these studies.

- Resource Database Printout (list):**                     enclosed    not requested    nothing listed
- Resource Database Printout (details):**                     enclosed    not requested    nothing listed
- Resource Digital Database Records:**                     enclosed    not requested    nothing listed
- Report Database Printout (list):**                     enclosed    not requested    nothing listed
- Report Database Printout (details):**                     enclosed    not requested    nothing listed
- Report Digital Database Records:**                     enclosed    not requested    nothing listed
- Resource Record Copies:**                     enclosed    not requested    nothing listed
- Report Copies:**                     enclosed    not requested    nothing listed
- OHP Historic Properties Directory:**                     enclosed    not requested    nothing listed

**Archaeological Determinations of Eligibility:**  enclosed  not requested  nothing listed

**CA Inventory of Historic Resources (1976):**  enclosed  not requested  nothing listed

**Caltrans Bridge Survey:**  enclosed  not requested  nothing listed

**Ethnographic Information:**  enclosed  not requested  nothing listed

**Historical Literature:**  enclosed  not requested  nothing listed

**Historical Maps:**  enclosed  not requested  nothing listed

**Local Inventories:**  enclosed  not requested  nothing listed

**GLO and/or Rancho Plat Maps:**  enclosed  not requested  nothing listed

**Shipwreck Inventory:**  enclosed  not requested  nothing listed

\*Notes:

- Let us know if you need copies of any of the reports or parts of the Oakland HPD – the invoice will be kept open until 7/13/15.

Please forward a copy of any resulting reports from this project to the office as soon as possible. Due to the sensitive nature of archaeological site location data, we ask that you do not include resource location maps and resource location descriptions in your report if the report is for public distribution. If you have any questions regarding the results presented herein, please contact the office at the phone number listed above.

The provision of CHRIS Data via this records search response does not in any way constitute public disclosure of records otherwise exempt from disclosure under the California Public Records Act or any other law, including, but not limited to, records related to archeological site information maintained by or on behalf of, or in the possession of, the State of California, Department of Parks and Recreation, State Historic Preservation Officer, Office of Historic Preservation, or the State Historical Resources Commission.

Due to processing delays and other factors, not all of the historical resource reports and resource records that have been submitted to the Office of Historic Preservation are available via this records search. Additional information may be available through the federal, state, and local agencies that produced or paid for historical resource management work in the search area. Additionally, Native American tribes have historical resource information not in the CHRIS Inventory, and you should contact the California Native American Heritage Commission for information on local/regional tribal contacts.

Should you require any additional information for the above referenced project, reference the record search number listed above when making inquiries. Requests made after initial invoicing will result in the preparation of a separate invoice.

Thank you for using the California Historical Resources Information System (CHRIS).

Sincerely,

Lisa C. Hagel  
Researcher

APPENDIX H:  
GEOTECHNICAL ASSESSMENT

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# ALAMEDA-NORTH BAY FARM ISLAND CROSSINGS PROJECT GEOTECHNICAL ASSESSMENT

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**EAST BAY MUNICIPAL UTILITY DISTRICT**  
**MATERIALS ENGINEERING SECTION**  
**PREPARED BY YOGESH PRASHAR**  
**JANUARY 28, 2016**

# 1. Introduction

This geotechnical assessment evaluates geologic considerations associated with the construction and operation of the Alameda–North Bay Farm Island Pipeline Crossings Project (Project). Specifically, this assessment evaluates the potential for the Project to be affected by or to increase risks associated with geologic and seismic hazards. Recommended mitigation measures are identified where impacts have been found to remain significant or potentially significant following application and compliance with existing regulations, accepted engineering standards and EBMUD standard practices.

The Project involves the construction and operation of three transmission pipelines (24-inch inner diameter) in Alameda County within the cities of Oakland and Alameda referred to as the three crossings. The proposed pipelines would be installed within Oakland and Alameda city streets, a business park parking lot, Estuary Park, and Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel surrounding Alameda Island. The Project location is shown in Figure 1. Construction of the Project would involve the following construction methods: open trench, jack and bore, and horizontal directional drilling (HDD). Construction of the Project would also involve the following activities: geotechnical investigation, connection of the new pipelines to existing water transmission pipelines, in-street pipeline abandonment, abandonment of seven existing underwater crossings, and distribution pipeline replacements. A description of the three crossings and the construction methods and activities that would take place is described in the following sections.

## 1.1. Crossings

Each pipeline crossing is described below.

- **Crossing #1.** Crossing #1, known as the Estuary Park–Marina Village Crossing, is approximately 2.3 miles long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Oakland Inner Harbor, and continue through Alameda to its connection point. One alternate route option for the replacement of an existing pipeline in Oakland is being considered (see Figure 2). Construction activities would occur within city streets, one business park parking lot (the Telecare Corporation), and Estuary Park.
- **Crossing #2.** Crossing #2, known as the Alameda–North Bay Farm Island Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines on Alameda Island, cross under the San Leandro Bay Channel, and continue on North Bay Farm Island to its connection point (see Figure 3). Construction activities would occur within city streets and Towata Park.
- **Crossing #3** Crossing #3, known as the Derby Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Tidal Canal, and continue in Alameda to its connection point. Project activities associated with Crossing #3 would include replacing an existing pipeline (see Figure 4). One alternate route option for open trench construction in Alameda is being considered. Construction activities would occur within city streets.

Figure 1: Project Location





Figure 2: Crossing #1 Alignment



Figure 3: Crossing #2 Alignment



**Figure 4: Crossing #3 Alignment**



## 1.2. Alternative Alignment Options

This technical report analyzes two alternate transmission pipeline trenching options and one alternate location for a distribution pipeline replacement. The locations of these alternate alignment options are shown in Figures 2 and 4 and described below.

- ***Crossing #1 alternate trench option.*** Instead of using 2nd Street, the open trench construction and pipeline installation would occur along 3rd Street for one block, then along Oak Street for one block, and then would continue along the proposed alignment.
- ***Crossing #1 alternate pipeline replacement option.*** Instead of replacing the existing pipeline on 2nd Street between Madison Street and Oak Street, the pipeline on 3rd Street between Madison Street and Oak Street would be replaced.
- ***Crossing #3 alternate trench option.*** Instead of using Clement Avenue and a portion of Everett Street, open trench construction would occur on Broadway and then along Eagle Avenue until Everett Street, where pipeline installation would continue along the proposed alignment.

## 1.3. Project Construction

Table 1 includes a summary of the construction activities for the proposed project, including the equipment that would be used, the location where the activity would occur, and the dimensions of the construction activity.

Construction hours would typically be between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) might be required when the proposed pipelines are connected to existing pipelines as well as to minimize service disruptions for water customers. Forty-eight-hour construction for one weekend would also be necessary for each HDD underwater pipeline crossing. Additional nighttime construction work could occur at night at traffic intersections when required by encroachment permit conditions to minimize traffic impacts. If required, it is expected that nighttime intersection work would only occur at arterial streets such as High Street, Tilden Way, 5th Street, 6th Street, 7th Street, and 8th Street.

## 1.4. Operation and Maintenance

The proposed project would require routine operation and maintenance after construction.

**Table 1: Summary of Construction Activities**

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Transmission Pipeline Open Trench Construction	<p>Open trench construction consists of the following activities:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Saw-cutting the pavement</li> <li>• Excavating a trench</li> <li>• Removing and stockpiling soils</li> <li>• Installing the pipeline</li> <li>• Backfilling the trench and applying temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Pavement saws &amp; jack hammers</li> <li>• Excavators, backhoes, front-end loaders</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Dewatering pumps</li> <li>• Soil-cement mixing machines</li> <li>• Paving equipment (asphalt and/or concrete trucks, vibratory compactors, pavers, and rollers)</li> <li>• Water trucks</li> </ul>	Throughout project roads for Crossing #1, #2, and #3 (see Figures 2, 3, and 4)	<p>Construction corridor: 25 feet</p> <p>Maximum depth of trench: 8 feet</p> <p>Width of trench: 4 feet</p>
Transmission Pipeline Jack and Bore	<p>The jack and bore method would be used twice during project implementation: at Crossing #1 to install pipeline beneath a segment of railroad track on Oak Street, and at Crossing #2 to install pipeline beneath Otis Drive so that Otis Drive could remain open during</p>	<ul style="list-style-type: none"> <li>• Horizontal boring machine or auger &amp; hydraulic jack</li> <li>• Excavators</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Backhoes &amp; front-end loaders</li> <li>• Dewatering pumps</li> </ul>	<p>Crossing #1: The pits are located on (1) Oak Street, north of Embarcadero West, just north of the railroad crossing and on (2) Oak Street, south of Embarcadero West, just</p>	<p>Pit Area: 500 square feet</p> <p>Depth: 10–15 feet</p> <p>Length: 150 feet at Crossing #1 and 300 feet at Crossing #2</p>

Construction Method/Activity	Description	Equipment	Location	Approximate Dimensions
	<p>construction. The jack and bore method would consist of the following activities:</p> <ul style="list-style-type: none"> <li>• Excavating a temporary jacking and receiving pit</li> <li>• Constructing a temporary jacking platform in the jacking pit</li> <li>• Drilling or jacking a casing through the earth under the road or railroad to be avoided</li> <li>• Installing the new pipeline in the casing</li> <li>• Connecting the new pipeline-to-pipeline segments on either end of the jacking pit</li> <li>• Backfilling the jacking and receiving pit and temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>		<p>south of the railroad crossing (see Figure 2)</p> <p>Crossing #2: The pits are located on (1) Peach Street, which divides Towata Park in half, south of Otis Drive and on (2) Peach Street north of Otis Drive, on a part of Peach Street that has been closed to vehicle access (see Figure 3)</p>	

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Geotechnical Investigation	<p>A geologic review and geotechnical investigation would be conducted for the HDD Crossings and jack and bore locations. Exploratory borings would be made at the HDD entry and insertion pit locations and along the underwater alignment as well as at each jack and bore pit. The subsurface soils investigation would originate on the land or water surface and would consist of the following steps:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Mobilize land based and barge- or ship-mounted geotechnical drilling equipment</li> <li>• Drill exploratory soils borings at the following locations <ul style="list-style-type: none"> <li>- HDD entry and insertion pits for all crossings</li> <li>- The underwater alignments for Crossing #1 and #2 at</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Geotechnical drilling rig (truck-mounted and barge-mounted)</li> <li>• Turbidity curtains for drilling</li> <li>• Barge</li> </ul>	<p>HDD entry and insertion pits for all crossings The underwater alignments for Crossings #1 and #2; and jack and bore pits</p>	<p>Depth: 125 feet</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Transmission Pipeline Horizontal Directional Drilling	<p>intervals of approximately 300 feet and depths of 125 feet</p> <ul style="list-style-type: none"> <li>- Jack and bore pits</li> <li>• Collect soils samples for classification and laboratory analysis (geophysical investigation methods may also be used)</li> <li>• Abandon exploratory borings (backfill land-based borings only)</li> </ul> <p>HDD will be used to install the three underwater pipelines under the Oakland Inner Harbor, Tidal Canal, and the San Leandro Bay Channel. HDD is a process that originates on the surface and typically consists of the following steps:</p> <ul style="list-style-type: none"> <li>• Ramming a steel conductor casing approximately 200 feet</li> </ul>	<ul style="list-style-type: none"> <li>• HDD rig with control cab for the HDD operator (potentially one for each side)</li> <li>• Slurry separation plants (one for each side)</li> <li>• Small pick-cranes (one for each side)</li> <li>• Pipeline rollers</li> <li>• Slurry and grout pumps (one for each side)</li> </ul>	<p>Crossing #1, entry pit: Adjacent to the parking spaces next to Estuary Park (Oakland) – located approximately 500 feet south of the intersection of Embarcadero West and the road that provides access to the parking lot for Estuary Park</p>	<p>Entry and exit angles: 15 degrees            Depth: 50–100 feet            Dimensions of entry and insertion pits: 10 by 20 feet            Depth of entry and insertion pits: 5 feet            Total staging area around entry and</p>



Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<p>long into the ground on both sides of the drilling operation to support the pipeline until the pipeline reaches deeper and more stable soil and to prevent hydraulic fracturing (“frac out”) at the surface.</p> <ul style="list-style-type: none"> <li>• Drilling a pilot hole from the entry pit across the water to the insertion pit; drilling could potentially occur at both the entry and insertion pit.</li> <li>• Enlarging the pilot hole through a reaming process</li> <li>• Laying down, fusing together, and pressure testing the pipeline</li> <li>• Pulling the pipeline into the insertion pit, through the enlarged pilot hole, and to the receiving pit</li> <li>• Injecting grout between the pipeline and casing</li> </ul>	<ul style="list-style-type: none"> <li>• Welders (at insertion pit)</li> <li>• Soil-cement mixing machines (one for each side)</li> <li>• Jet grouting rig (one for each side)</li> <li>• Excavators (one for each side)</li> <li>• Tractors/ loaders/ backhoes (one for each side)</li> </ul>	<p>Crossing #1, insertion pit: Telecare Corporation parking lot (Alameda) – located in the middle of Telecare Corporation parking lot, approximately 250 feet north of the intersection of Marina Village Parkway and Tynan Avenue</p> <p>Crossing #2, entry pit: Towata Park (Alameda) – located within Towata Park, east of the portion of Peach Street, which divides Towata Park</p> <p>Crossing #2, insertion pit: Veterans Court (North Bay Farm Island) – located approximately 275 feet north of the intersection of Veterans</p>	<p>insertion pits: 2,000–2,500 square feet</p> <p>HDD length at Crossing #1: 1,800 feet</p> <p>HDD length at Crossing #2: 1,400 feet</p> <p>HDD length at Crossing #3: 1,400 feet</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Injecting jet grouted columns to provide additional support to the casing, between the entry pit and the shoreline</li> <li>• Backfilling the HDD pit and temporary paving</li> <li>• Disinfecting the pipeline</li> <li>• Repaving</li> </ul>		<p>Court and Island Drive            Crossing #3, entry pit:            Derby Avenue            (Oakland) – located on Derby Avenue, between Ford Street and Glascock Street, approximately 50 feet north of the intersection of Derby Avenue and Glascock Street</p> <p>Crossing #3, insertion pit: Broadway            (Alameda) – located on Broadway, between Blanding Avenue and Clement Avenue, approximately 160 feet south of the intersection of Broadway and Blanding Avenue</p>	

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Connections	<p>The proposed project would connect the new water pipelines to existing EBMUD water transmission pipelines. The work to connect the new pipelines to existing pipelines would require the excavation of a trench or pit at each connection location. Temporary shoring would be required to ensure the stability of the excavation, which may include the use of vibratory sheet piles. The proposed tie-ins would be located within street rights-of-way and sited to minimize disruptions to traffic and homeowner access.</p> <p>Construction of the connections would generally be completed within a 12-hour period. For connections that require a new tee, construction could require a full 24-hour period, and night work might be necessary.</p>	<ul style="list-style-type: none"> <li>• Excavators</li> <li>• Generator Sets for night lighting</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering pumps</li> <li>• Hot tap machine</li> </ul>	<p>Connections would be located where open trench construction would occur (See Figure 2, 3, and 4)</p>	<p>The connections would be in the open trench construction corridor and would have similar dimensions as open trench construction.</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
In-Street Pipeline Abandonment	<p>Pipeline abandonment would require three construction pits in 5th Street to move service connections and fire hydrants and to install two endcaps, one at 5th Street and another at Oak Street. The abandoned pipeline would be filled with cellular concrete between the two endcaps, and an existing valve near the intersection of Madison Street and 5th Street would be abandoned in place after opening the valve.</p>	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> </ul>	<p>Oakland side of Crossing #1: On 5th Street, between Oak Street and Jackson Street</p>	<p>Length: 800 feet.  Width of Pit: 10 feet  Length of Pit: 10 feet  Depth: 4–10 feet</p>

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Underwater Pipeline Crossings Abandonment	<p>The seven existing underwater pipeline crossings would be abandoned. Abandonment includes filling onshore sections of pipelines with cellular concrete and abandoning submarine sections of pipelines in place. Bumped heads or blind flanges will be constructed at the demarcation between the onshore and submarine sections and at the end of the onshore sections to be abandoned. To install the bumped heads or blind flanges, a pit would be excavated down to the pipeline. The bumped heat at the two abandonment locations at Crossing #2 would be installed in existing vaults and would not require pit excavation (see Figure 3). Additional pits may be necessary to remove valves, hydrants, move service laterals, and at low points along the onshore pipeline alignment to facilitate concrete</p>	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> <li>• Vibratory pile driving may be used to install sheet pile walls for the abandonment pits</li> </ul>	See Figures 2, 3, and 4	<p>Width of Pit: 10 feet  Length of Pit: 10 feet  Depth: 4–10 feet</p>

Construction Method/Activity	Description	Equipment	Location	Approximate Dimensions
	pumping; the location of these additional pits would be determined during detailed design.			
Distribution Pipeline Replacement	<p>The proposed project would replace existing small-diameter distribution pipelines at two locations along Crossing #1 and Crossing #3. Open trench construction methods (see above) would be used to install the new pipeline and the existing pipeline would be abandoned in place. Pipeline replacement would occur during open trenching activities, before the new transmission pipeline is installed. The following pipelines would be replaced:</p> <ul style="list-style-type: none"> <li>• Crossing #1: On 2nd Street (see</li> </ul>	Distribution pipeline replacement would require the same equipment used for open trench construction.	<p>Crossing #1, Oakland: On 2nd Street (see Figure 2).            Crossing #3, Alameda: On Everett Street (see Figure 4).</p>	<p>The distribution pipeline replacement would be in the open trench construction corridor and would have similar dimensions as open trench construction. Length of pipeline replacement at Crossing #1: 400 feet            Length of pipeline replacement at Crossing #3: 750 feet</p>

Construction Method/Activity	Description	Equipment	Location	Approximate Dimensions
	<p>Figure 2), approximately 400 feet of existing 10-inch cast-iron pipeline constructed in 1908 would be replaced with a 12-inch steel pipeline.</p> <ul style="list-style-type: none"> <li>• Crossing #3: On Everett Street (see Figure 4), approximately 750 feet of existing 4-inch cast-iron pipeline constructed in 1895 would be replaced with a 6-inch steel pipeline.</li> </ul>			

## 2. Methodology

The methods used to identify existing geotechnical conditions and historical seismicity included performing a seismic and fault database search, conducting a site reconnaissance, and reviewing literature pertinent to the Project. Specifically, the following activities were performed:

- Review of previously prepared documents to identify potential geological issues in the Project area.
- Review of current seismic and fault data from the USGS and CGS, and soils maps from the U.S. Department of Agriculture
- Field reconnaissance to observe geologic conditions, focusing on tunnel portals, bridges, and areas of potential geologic hazards near the Project area.

### 2.1. Data and Literature Review

The descriptions of geology, soils, and seismic hazards provided rely on information gathered from the United States Geologic Survey (USGS), the California Geologic Survey (CGS), and the Alameda-North Bay Farm Island Crossings Master Plan (EBMUD 2014).

Pertinent documents to the Alameda–North Bay Farm Island Crossings Project geotechnical assessment include:

- DRS Marine Inc., June 22, 2009. 20” Water Pipeline Estuary Crossing Derby, Oakland – Broadway, Alameda, Informal Progress Report Data on Excavation Operations to Locate Damage Pipe Section (DOX #1679052).
- Jacobs Associates by G&E Engineering Systems Inc., September 2, 2013. Alameda Bay Farm Island Pipes Report, (DOX #2212444).
- Jacobs Associates, March 2014. Alameda-North Bay Farm Island Crossings Master Plan, Underwater Pipeline Crossings Feasibility Study, (Volume 1 - DOX #2191923 and Volume 2 - DOX #2191925).
- East Bay Municipal Utility District, November 2014. Alameda-North Bay Farm Island Crossings Master Plan, (DOX # 2220624)

## 3. Geologic Setting

### 3.1. Regional Physiography

California has been divided into 12 geomorphic provinces that are topographic-geologic groupings of convenience based primarily on landforms and geologic history (Norris and Webb 1976). The Project area is located within the Coastal Ranges demographic province. The Coastal Ranges are generally divided in two sub-provinces, north and south of the San Francisco Bay. The Project area is located in the southern Coastal Ranges sub-province. The major geographic features in this sub-province include: the Diablo Range, Santa Cruz Mountains, San Francisco Peninsula, and San Francisco Bay.

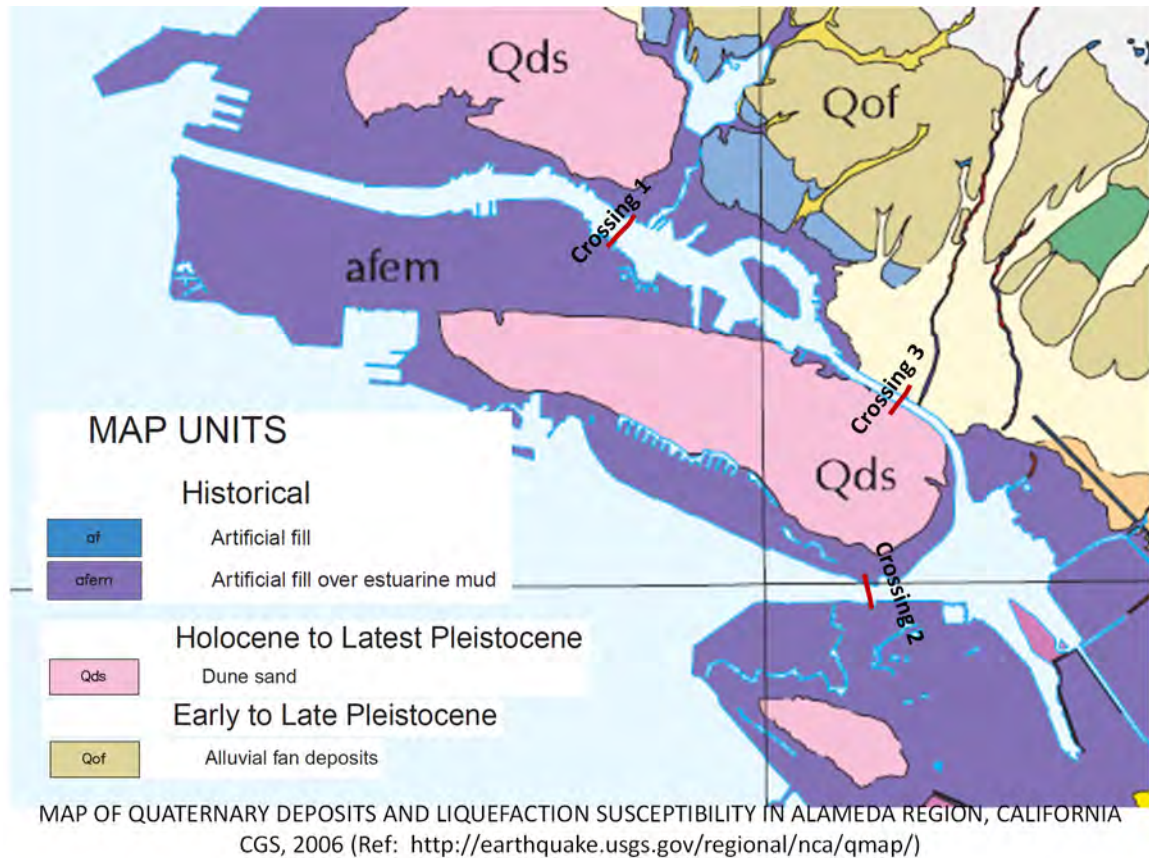


Significant physiographic features include San Francisco Bay and the broad alluvial fans (or flatlands) that were formed between the mountain ranges and the bay. The Coastal Ranges are composed of marine sedimentary deposits and volcanic rocks that form northwest trending mountain ridges and valleys, running roughly parallel to the San Andreas Fault.

### **3.2. Project Area Geology**

The geological setting of the Project area is based on published mapping by the USGS. The Project area is located to the west of the Hayward Fault zone adjacent to San Francisco Bay. The main cities in the Project area are Alameda and Oakland. The local geology consists of artificial fill placed on top of Young Bay Mud (YBM) and Holocene fluvial deposits, Merritt Sand, and Pleistocene alluvial fan deposits as shown **Figure 5**. The artificial fill varies in thickness from 0 to 36 feet with an average thickness of 10 feet. The fan deposits thickness ranges from 0 to 47 feet and overlaps with Pleistocene alluvial fan deposits with a thickness of 15 feet. Ground water is shallow with an approximate depth of 10 feet (Holzer, Noce, and Bennett 2008). The alluvial plain includes sediments eroded from the Oakland Hills over the last 2 million years and generally consists of unconsolidated mixtures of gravel, sand, clay, and silt typically deposited by streams. The specific units present include artificial fills, Young Holocene-age, Holocene to Latest Pleistocene-age, and Latest Pleistocene-age alluvial deposits (USGS 2012).

The geology of the city of Alameda is comprised predominantly of artificial fill, Merritt Sand, and Holocene alluvial fan. The artificial fill is the most vulnerable to liquefaction in an earthquake event. The city of Oakland has slightly better soil conditions by proportion to its area, consisting of Pleistocene alluvial fan deposits, and Holocene alluvial fan deposits. There are significant artificial fill areas towards the west of Oakland located on both the north and south sides of Alameda Island.



**Figure 5: Map of Quaternary Deposits and Liquefaction Susceptibility**

### 3.3. Regional Faulting & Seismicity

The San Francisco Bay Area is situated near the boundary between two major tectonic plates, the Pacific Plate to the southwest and the North American Plate to the northeast. Since the Miocene epoch (approximately 23 million years ago), about 200 miles of right-lateral movement<sup>1</sup> has occurred along the San Andreas Fault Zone to accommodate the relative movement between these two plates. The movement between the Pacific Plate and the North American Plate generally occurs across a 50-mile zone extending from the San Gregorio fault in the southwest to the Great Valley Thrust Belt to the northeast. In addition to the right-lateral slip movement between the two tectonic plates, portions of the North American Plate have moved toward each other during the last 3.5 million years, resulting in compressional forces at the latitude of San Francisco Bay (Fenton and Hitchcock 2001).

**Figure 6** shows the locations of active<sup>2</sup> and potentially active<sup>3</sup> faults in the San Francisco Bay region and the three most active faults are labeled, the Hayward, the Calaveras, and

- 1 The Pacific Plate and the North American Plate are moving past each other along the San Andreas Fault Zone; “right-lateral movement” means that they are moving to the right relative to each other.
- 2 An active fault is one that shows geologic evidence of movement within Holocene time (approximately the last 11,000 years).

the Northern San Andreas. The San Andreas, San Gregorio, Hayward, Rodgers Creek, Calaveras, and Greenville strike-slip faults<sup>4</sup> are active faults of the San Andreas system that predominantly accommodate lateral movement between the North American and Pacific tectonic plates. Active blind- and reverse-thrust faults<sup>5</sup> in the San Francisco Bay region that accommodate compressional movement include the Monte Vista–Shannon and Mount Diablo faults. The Rodgers Creek–Hayward fault system is located between 3 miles and 50 miles from the Project areas.

The USGS estimates that there is a 63 percent probability of a strong earthquake (magnitude [Mw]<sup>6</sup> 6.7 or higher) occurring on one of the regional faults in the 30-year period between 2003 and 2032, with a 31 percent chance of such an earthquake within the Rodgers Creek–Hayward fault system that would affect the Project area. The other faults with the greatest potential to affect the Project area are the San Andreas and Calaveras faults. Each of these faults is capable of generating large (greater than Mw 7) earthquakes.<sup>6</sup>

### 3.3.1. Surface Rupture

Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Surface ruptures associated with the 1906 San Francisco earthquake extended for more than 260 miles, with displacements of up to 21 feet. However, not all earthquakes result in surface rupture. The Loma Prieta earthquake of 1989 caused major damage in the San Francisco Bay Area, but the fault movement did not break through to the surface.

Surface rupture almost always follows pre-existing faults, which are zones of relative weakness in the earth's crust. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they can displace structures and are accompanied by shaking. Fault creep is the slow rupture of the earth's crust. In highly developed areas of Contra Costa and Alameda Counties, the Hayward Fault exhibits fault creep, which offsets and deforms curbs, streets, buildings, and other structures that lie on the fault trace. None of the proposed pipeline alignments cross a known active or potentially active fault trace.

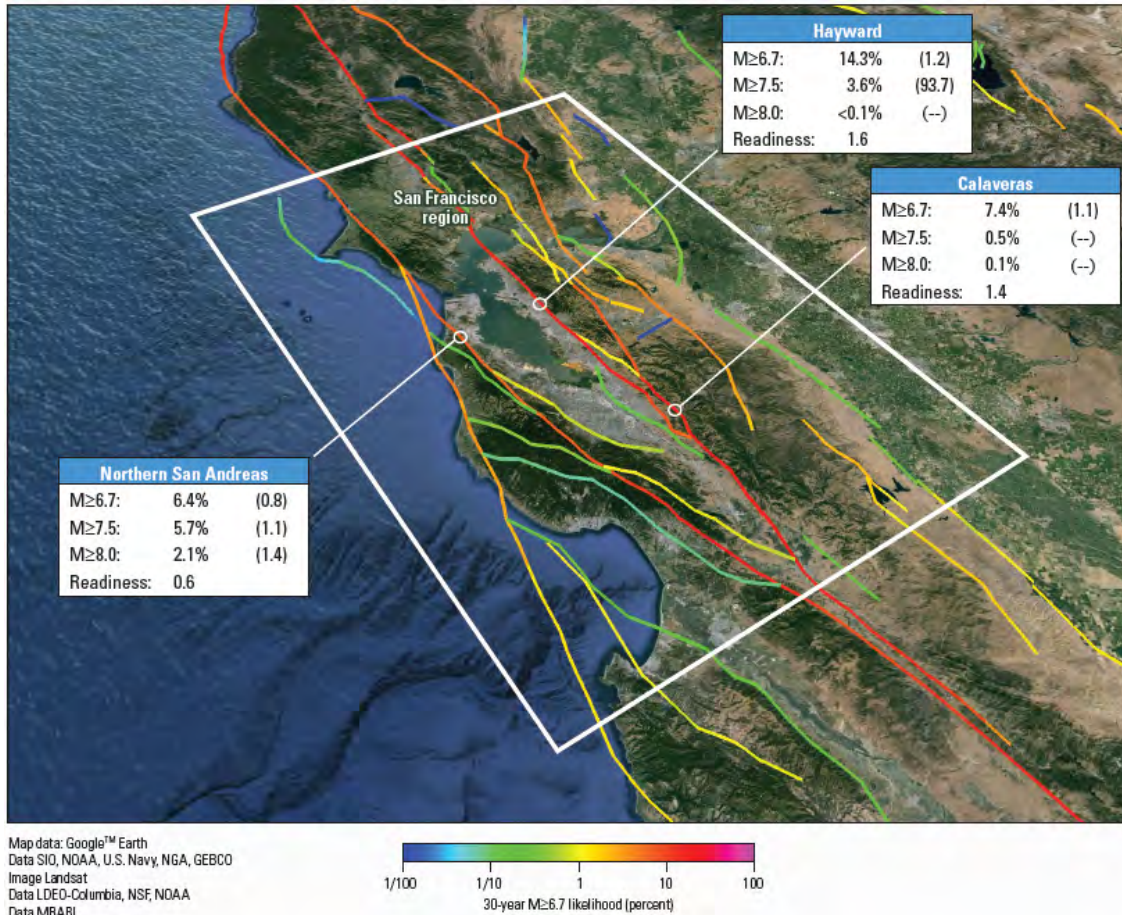
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3 A potentially active fault is one that shows geologic evidence of movement during the Quaternary (approximately the last 1.6 million years).

4 Strike-slip faults involve the two blocks moving parallel to each other without a vertical component of movement.

5 A reverse fault is one with predominantly vertical movement in which the upper block moves upward in relation to the lower block; a thrust fault is a low-angle reverse fault. Blind-thrust faults are low-angled subterranean faults that have no surface expression.

6 Earthquake magnitude is a logarithmic measure of earthquake size. In simple terms, this means that at the same distance from the earthquake, the shaking will be 10 times as large during an Mw 5 earthquake as during an Mw 4 earthquake. The total amount of energy released by the earthquake, however, goes up by a factor of 32. Depending on their location, earthquakes with a magnitude of 7 and greater are capable of causing large amounts of damage.



**Figure 66: Likelihood of M 6.7 or > EQ.'s in 30 Years (starting 2014) on Faults in San Francisco, CA (Ref: <http://pubs.usgs.gov/fs/2015/3009/>)**

### 3.3.2. Ground Shaking

The intensity of the seismic shaking, or strong ground motion, during an earthquake affecting the Project area would depend on the distance to the epicenter of the earthquake, the magnitude of the earthquake, and the geologic conditions underlying and surrounding the area. Earthquakes occurring on faults closest to the Project area would have the potential to generate the largest ground motions.

The intensity of earthquake-induced ground motions and the potential forces that could affect structures within the Project area can be described in terms of “peak ground acceleration,” which is represented as a fraction of the acceleration of gravity (g). As shown in **Figure 7**, the CGS estimates the peak ground accelerations for the 10 percent probability of exceedance in 50 years to be 70%g to 80%g within the Project area. **Table 2** shows the relation of average peak ground accelerations to shaking intensities based on the modified Mercalli intensity scale. As shown, these ground accelerations correlate to a shaking intensity value of IX (violent) where damage could be considerable in specially designed structures; ground failures could occur, and underground pipes could be broken. However, the estimates of peak ground accelerations are used primarily for formulating building codes and for designing structures, and are not intended for site-specific hazard

analysis. Spatial variations and site specific soil response can contribute to ground motions due to the presence of liquefiable soil deposits and YBM.

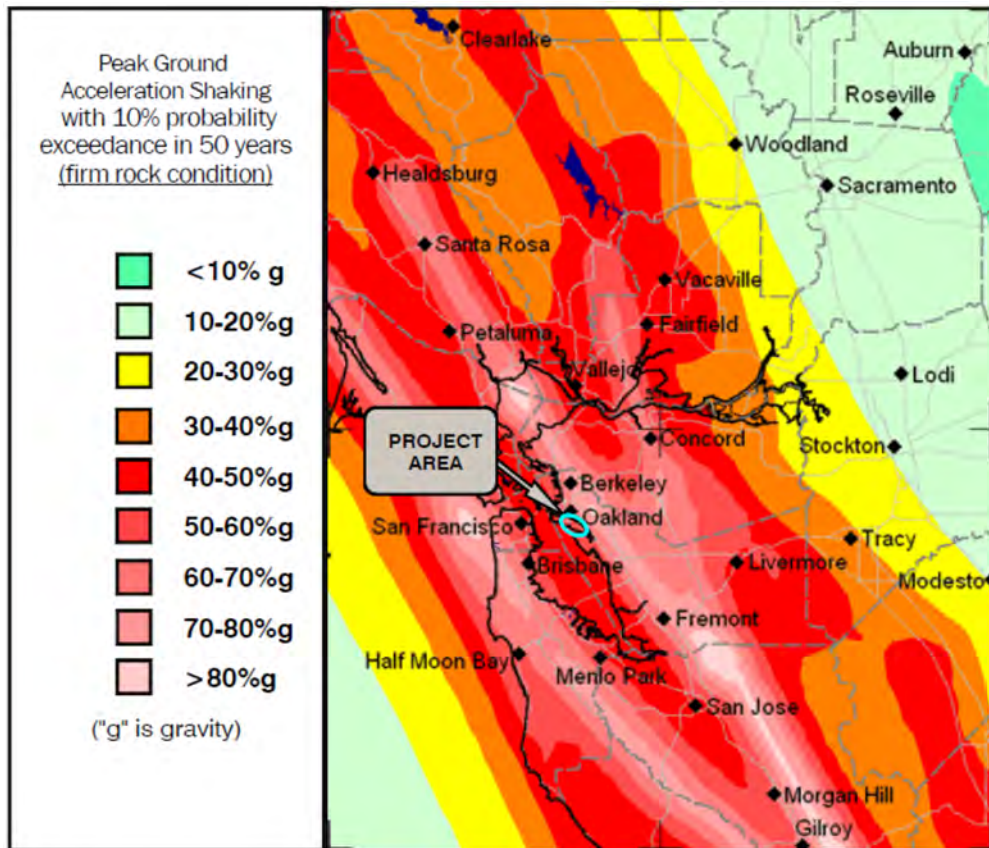


Figure 7: Seismic Shaking Map - USGS CGS/ PSHA Model (Jacobs 2015, App B-18)

**Table 2: Modified Mercalli Intensity Scale**

Intensity Value	Intensity Description	Average Peak Ground Acceleration
I	Not felt except by a very few persons under especially favorable circumstances.	< 0.0017 g
II	Felt only by a few persons at rest, especially on upper floors on buildings. Delicately suspended objects may swing.	0.0017-0.014 g
III	Felt noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly, vibration similar to a passing truck. Duration estimated.	0.0017-0.014 g
IV	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	0.014–0.039g
V (Light)	Felt by nearly everyone, many awakened. Some dishes and windows broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles may be noticed. Pendulum clocks may stop.	0.035 – 0.092 g
VI (Moderate)	Felt by all, many frightened and run outdoors. Some heavy furniture moved; fallen plaster or damaged chimneys. Damage slight.	0.092 – 0.18 g
VII (Strong)	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.	0.18 – 0.34 g
VIII (Very Strong)	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.	0.34 – 0.65 g
IX (Violent)	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.65 – 1.24 g
X (Very Violent)	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.	> 1.24 g
XI (Very Violent)	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	> 1.24 g
XII (Very Violent)	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	> 1.24 g

### **3.3.3. Alquist-Priolo Earthquake Fault Zoning Act**

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this act, the state geologist established regulatory zones, called “earthquake fault zones,” around the surface traces of active faults and published maps showing the earthquake fault zones. Within these zones, buildings for human occupancy cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace because many active faults are complex and consist of more than one branch that may experience ground surface rupture.

Title 14 of the California Code of Regulations (CCR), Section 3601(e), defines buildings intended for human occupancy as those that would be inhabited for more than 2,000 hours per year. The Project area does not cross the Alquist-Priolo Earthquake Fault Zone or the Hayward fault and does not include any buildings that meet this criterion for human occupancy. Therefore, this act does not apply to the Project area.

## **3.4. Project Area Seismic-related Geologic Hazards**

The following sections describe earthquake-related hazards including settlement, expansive soils, liquefaction, slope instability, and non-linear response.

### **3.4.1. Settlement of Soft Clays**

It is anticipated that YBM and/or soft to medium stiff saturated clays underlie all of the Project area. YBM materials can settle (consolidate) an average of a ½ foot for every foot of fill placed above. Long term surcharge loads placed on top of the ground could result in notable settlement and can strain the new pipelines. In areas where soft to medium stiff clays are encountered, the new pipelines will need to be designed to ensure ground settlement does not adversely impact the proposed pipelines.

### **3.4.2. Expansive Soils**

Expansive soils are characterized by their ability to undergo significant volume change (i.e., to shrink and swell) as a result of variations in moisture content. Changes in soil moisture can result from rainfall, landscape irrigation, utility leakage, roof drainage, and/or perched groundwater<sup>7</sup>. Expansive soils are typically very fine-grained and have a high to very high percentage of clay. Expansion and contraction of expansive soils in response to changes in moisture content can lead to differential and cyclical movements that can cause damage and/or distress to structures and equipment. The entire Project area is underlain by YBM and soft to medium stiff slays that can exhibit expansive behavior. If buried pipelines are not properly designed to handle expansive soils, the swelling and shrinkage can damage buried pipelines because these pipelines may deform with the ground surrounding it. Therefore, in areas where expansive soils are encountered, the pipeline and backfill material must be properly designed and specified to mitigate the effects of expansive soils.

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7 Perched groundwater is a local saturated zone above the water table that typically exists above an impervious layer (such as clay) of limited extent.

### 3.4.3. Liquefaction

Liquefaction is a phenomenon in which saturated granular sediments temporarily lose their shear strength during periods of strong ground shaking such as during an earthquake. The susceptibility of a site to liquefaction is a function of the depth, density, and water content of the granular sediments and the magnitude of earthquakes likely to affect the site. Saturated, unconsolidated silts, sands, silty sands, and gravels within 50 feet of the ground surface are most susceptible to liquefaction. Liquefaction-related phenomena include vertical settlement, lateral spreading, and landslides. Therefore, in areas where liquefaction may be encountered, the pipeline must be properly designed to handle potential liquefaction.

On level ground, liquefiable soils settle during an earthquake. During an earthquake, settlement can occur as a result of the relatively rapid rearrangement, compaction, and settling of subsurface materials (particularly loose, non-compacted, and variable sandy sediments). Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different rates). Areas are susceptible to differential settlement if underlain by compressible sediments, such as poorly engineered artificial fill or YBM and the settlement can be significant enough to break a pipeline if the pipelines are not properly designed (Prashar, et. al. 2015). The Project area at the geologic contacts between artificial fills and Merrit sands are particularly susceptible to liquefaction. Seismically induced liquefaction is most likely to occur in the Project area with beds of loose, water-saturated, well-sorted sand within 100 feet of the ground surface. Therefore, liquefiable soils pose a higher risk for shallower pipelines than liquefiable soil layers within the deep, submarine portions.

The USGS classifies liquefaction susceptibility according to five categories that describe the likely proportion of all liquefaction occurrences that could take place in each category, the abundance or frequency of liquefaction occurrence within the category, the strength of shaking required to produce liquefaction, and the geologic units included (USGS 2006).

- **Very High.** The USGS estimates that about 40 to 50 percent of future liquefaction effects would occur within geologic units assigned this category. Only modest ground shaking (peak ground acceleration of about 0.1 g) would be required to cause liquefaction. Geologic map units that fall within this category include the latest Holocene and historical stream channel deposits, as well as artificial fills over bay and other estuarine mud.
- **High.** The USGS estimates that about 20 to 30 percent of future liquefaction effects would occur within geologic units assigned this category. Relatively modest ground shaking (peak ground acceleration of about 0.1 to 0.2 g) would be required to cause liquefaction. Geologic map units within this category include the latest Holocene and historical alluvium, natural levees, and stream terraces.
- **Moderate.** The USGS estimates that about 20 to 30 percent of future liquefaction effects would occur within geologic units assigned this category. Somewhat stronger ground shaking (peak ground acceleration greater than about 0.1 to 0.2 g) would be required to cause liquefaction. Geologic map units within in this category include the latest Pleistocene and

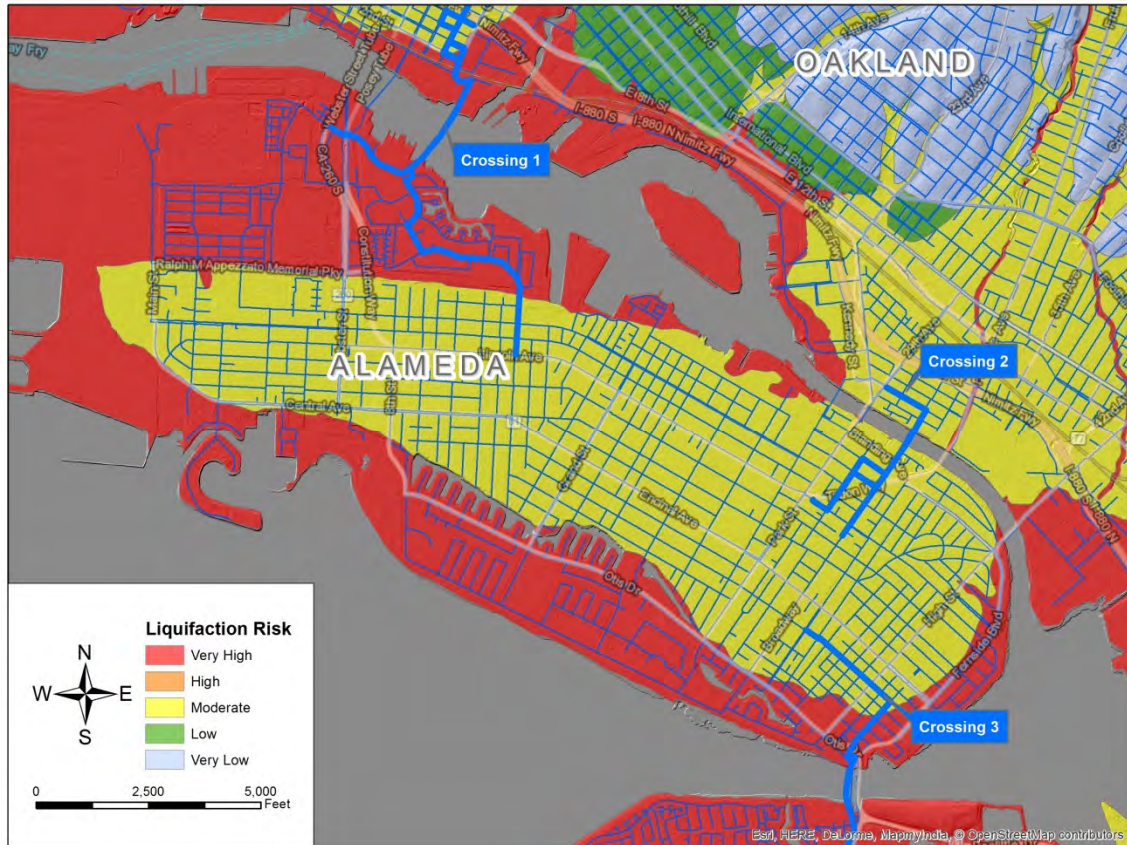


Holocene bay and other estuarine mud, alluvial fan and levee deposits, and stream terrace deposits.

- **Low.** The USGS estimates that about 2 percent of future liquefaction effects would occur within geologic units assigned this category. Stronger ground shaking (peak ground acceleration of about 0.5 g) would be required to cause liquefaction. Geologic map units within in this category include basin deposits, various late Pleistocene deposits, and Pleistocene marine terrace deposits.
- **Very Low.** The USGS estimates that about 2 percent of future liquefaction effects would occur within geologic units assigned this category. Stronger ground shaking (peak ground acceleration greater than about 0.6 g) would be required to cause liquefaction. Geologic map units within in this category include Pleistocene deposits, pre-Quaternary deposits, and bedrock.

**Figure 8** shows the areas of mapped liquefaction potential from very low to very high potential. Project components related to Crossing #1 and Crossing #2 are very highly susceptible to liquefaction and Crossing #3 is moderately susceptible.

On sloped surfaces, liquefiable soils settle and spread during an earthquake, a phenomena known as lateral spreading. Lateral spreading involves large blocks of intact, non-liquefied soil moving downslope on a liquefied substrate of large aerial extent (Youd and Perkins 1978). The mass moves toward an unconfined area, such as a descending slope or stream-cut bluff, and can occur on slope gradients as gentle as 1 degree. Lateral spreading can stretch a pipeline to the point of failure. On a large scale, lateral spreading causes landslides. The 1989 Loma Prieta earthquake triggered thousands of landslides over an area of 770 square miles. The CGS has provided maps showing areas with potential for seismic induced lateral spreading and landslides. Based on these maps, there is little risk of lateral spreading or landslides within the Project area because the surrounding area is relatively flat. However, there is risk of seismic induced landslides underwater along sloped shorelines which are not captured in the CGS maps. The Project area near sloped channel sides (near the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel surrounding Alameda Island) could be subject to lateral spreading and landslides due to the presence of loose sands and soft saturated clays.



**Figure 8: Liquefaction Susceptibility Maps (Ref: Holzer & Bennett, 2002)**

### 3.4.4. Ground Shaking

Along with liquefiable soils (as discussed in previous sections), the most concerning seismic factor within the Project area is the presence of YBM. YBM is soft, unconsolidated silty clay, saturated with water. Due to its high water content and loose packing, YBM has low resistance to penetration, which makes the soil very weak. Although YBM has a low likelihood of liquefaction, it remains a seismic hazard due to its propensity of high seismic shaking amplification which can induce differential stresses that can potentially rupture a pipeline that traverses through YBM or above YBM (pipeline vulnerability is significantly related to the type of soils around and underneath the pipeline; overlying soils do not affect the pipeline). Old Bay Mud (OBM) is more compacted than YBM and has high resistance to penetration. Therefore, pipelines located in or below OBM layers are not as vulnerable to failure during a seismic event. During an earthquake, the portion of the pipeline between shallow YBM and deep OBM soils would be subject to a phenomenon known as differential settlement. As discussed in previous sections, differential settlement is a concern because it can cause uneven movement of pipelines, resulting in substantial damage including cracks and breakage.

Soils underlying the Project area associated with Crossings #1 and #2 are anticipated to be liquefiable deposits and/or YBM of thickness greater than 10-feet and will likely be a Site Class F (Ref: Chapter 21 of ASCE 7-10). A Site Class F classification will require a

site specific ground motion hazard analysis and a site specific response analysis during design. Less liquefiable soils are anticipated at Crossing 3.

## **3.5. Other Project Area Geologic Hazards**

### **3.5.1. Slope Instability (Non-Seismic Landslides)**

Slope failures, commonly referred to as landslides, include many phenomena that involve the downslope displacement and movement of material, triggered either by static (i.e., gravity) or dynamic (i.e., earthquake) forces. Static landslides are discussed here (see prior sections for seismic-induced landslides). Exposed rock slopes undergo rockfalls, rockslides, or rock avalanches, while soil slopes experience soil slumps, rapid debris flows, and deep-seated rotational slides. Slope stability can depend on several complex variables, including the geology, structure, topography, slope geometry, and amount of groundwater present, as well as external processes such as climate and human activity. The factors that contribute to slope movements include those that decrease the resistance in the slope materials and those that increase the stresses on the slope.

Landslides can occur on slopes of 15 percent or less, but the probability is greater on steeper slopes that exhibit old landslide features such as scarps, slanted vegetation, and transverse ridges. Landslides typically occur within slide-prone geologic units that contain excessive amounts of water or are located on steep slopes, or where planes of weakness are parallel to the slope angle. The best available predictor of where static slides and earth flows might occur is the distribution of past movements (Nilsen and Turner 1975). In 1997, the USGS released a preliminary map and geographic information system (GIS) database that provides a summary of the distribution of landslides evident in the landscape of the San Francisco Bay region (USGS 1997). Static (non-seismic related) landslides are not anticipated in the Project area.

### **3.5.2. Corrosive Soils**

Corrosive soils are commonly related to several key parameters, including soil resistivity (the ability to conduct electricity), the presence of chlorides and sulfates, oxygen content, and pH. Typically, the most corrosive soils are those with the lowest pH (acidic) and highest concentration of chlorides and sulfates. Changes in soil moisture can result in a concentration of chlorides and sulfates as well as movement in the soil, both of which tend to break down the protective corrosion films and coatings on the surfaces of building materials. High-sulfate soils are also corrosive to concrete and may prevent complete curing, reducing its strength considerably. Low pH and/or low-resistivity soils can corrode buried or partially buried metal structures. Soil resistivity is also related to the amount of soluble salts in the soil. Low resistivity indicates a more corrosive condition.

Depending on the degree of corrosivity of subsurface soils, building materials such as concrete, reinforcing steel in concrete structures, and bare-metal structures exposed to these soils can deteriorate, eventually leading to failures. There is potential for shallow subsurface soils in the vicinity of the Project area to be classified as corrosive to severely

corrosive to metals, and moderately deleterious to concrete. Typically these conditions are most evident in YBM which exhibit high sulfate and chloride and low pH.

#### **4. EBMUD Engineering Standard Practices**

EBMUD uses two primary Engineering Standard Practices (ESPs) for the design of water pipelines in its distribution system to address geologic hazards. ESP 512.1, Water Main and Services Design Criteria, establishes basic criteria for the design of water pipelines and establishes minimum requirements for pipeline construction materials. ESP 550.1 addresses seismic design of the pipelines to withstand seismic hazards including fault rupture, ground shaking, liquefaction-related phenomena, landsliding, seiches and tsunamis and requires that EBMUD establish project-specific seismic design criteria for pipelines with a diameter of greater than 12-inches, such as the pipelines that would be installed for the Project.

Procedures to avoid seismic hazards include selecting appropriate routing to avoid seismic hazards, use of appropriate materials to withstand seismic hazards, and providing flexibility at locations where the pipeline crosses from one soil condition to another. ESP 550.1 also requires use of steel pipe with restrained joints or the equivalent to address fault rupture, liquefaction, and landslide hazards. Isolation valves may also be required on either side of the seismic hazard zone. For landslide areas, the pipeline may be set back far enough from the toe or top of the slope to avoid being located in a zone of slippage or a buttress or retaining structure may be used to stabilize the slope. ESP 550.1 is based on Guidelines for the Seismic Design of Oil and Gas Pipeline Systems prepared by the American Society of Civil Engineers (ASCE) Committee on Gas and Liquid Fuel Lifelines (1984).

In addition to these internal standards, EBMUD follows the recommendations of the 2004 American Water Works Association (AWWA) M11 Manual for the design and installation of steel pipe, including design for the appropriate wall thickness, external loadings, pipeline supports, pipe joints, fittings and appurtenances, corrosion control, and protective coatings and linings. Other professional publications are used as necessary such as those published by the American Society of Mechanical Engineers, standards of the American Welding Society for structural welding.

## 5. Impacts and Mitigation Measures

### 5.1. Significance Criteria

Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 CCR 15000 et seq.) provides guidance on assessing whether a project would have significant impacts on the environment. Consistent with Appendix G, the Project would have a significant impact on geology and soils resources if the project would:

- 1) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault?
  - ii) Strong seismic ground shaking
  - iii) Seismic-related ground failure, including liquefaction
  - iv) Landslides
- 2) Result in substantial soil erosion or the loss of topsoil.
- 3) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
- 4) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?
- 5) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of waste water.

### 5.2. Approach to the Analysis

Potential geology and soils impacts are evaluated according to the CEQA significance criteria listed above based on published geologic and seismic information for the Project area. Recommended mitigation measures are identified for impacts that would remain significant or potentially significant following application and compliance with existing regulations, accepted engineering standards and EBMUD's standard construction specifications.

No impacts are anticipated with respect to CEQA significance criteria #5 as the use of septic tanks or alternative wastewater disposal systems is not proposed as part of the Project. Therefore, impacts related to the capacity of soils in the Project area to support septic tanks or alternative wastewater disposal systems are not applicable.

## 5.3. Impacts and Recommended Mitigation Measures

### 5.3.1. Impact Geo-1: Would the proposed Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death?

The Project area is located within a seismically active region and earthquakes are known to pose a risk to expose people and structure. However, the risk of exposing people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to surface fault rupture, surface related ground failure (including liquefaction) and seismic ground shaking would be *less than significant with the implementation of Mitigation Measure GEO-1, Site-Specific Geotechnical Investigation*, which would require a geotechnical investigation to evaluate site-specific ground shaking hazards and incorporation of recommendations into the final design. More detail on specific risks and where *Mitigation Measure GEO-1* will take place is provided below.

#### **Surface Fault Rupture**

As discussed in the Setting section, the Rodgers Creek–Hayward fault system is located between 3 miles and 50 miles from the Project area. However, none of proposed pipeline alignments cross an active fault trace and so there would be *no impact* related to surface fault rupture for all aspects of the project.

#### **Seismic-related Ground Failure Including Liquefaction**

Liquefaction-related phenomena can include lateral spreading, ground oscillation, loss of bearing strength, subsidence, and buoyancy effects, and differential settlement all of which can damage pipelines. During the loss of bearing capacity, large deformations can occur within the soil mass which can damage or rupture the pipelines. Damage from liquefaction and lateral spreading is generally most severe when liquefaction occurs within 15 to 20 feet of the ground surface.

There would be *no impact* related to liquefaction and other seismically-induced ground failures for the submarine portions of the Project because the crossings would be constructed in stable OBM soils approximately 50 to 100 feet deep which would be below the liquefaction zone.

Impacts related to liquefaction, differential settlement, and other seismically-induced ground failures for the shallow portions of the HDD will be *less than significant with implementation of Mitigation Measure GEO-1: Site-Specific Geotechnical Investigation*. For the shallow HDD portions of the project, a casing would be used to support the carrier pipe through the weaker soils that are prone to seismic instability. The casing would be further supported with jet-grouted columns. The casing and jet-grouted columns would be designed by a registered civil engineer in accordance with applicable seismic standards and based on recommendations from the site specific geotechnical investigation.

Impacts related to liquefaction, differential settlement, and other seismically-induced ground failures for the jack and bore portions of the Project would be *less than significant with implementation of Mitigation Measure GEO-1: Site-Specific Geotechnical Investigation*. A casing would be used to support the carrier pipe through the weaker soils that are prone to seismic instability and the casing would be designed by a registered civil engineer in accordance with applicable seismic standards and based on recommendations from the site specific geotechnical investigation.

For the open-trench portions of the pipelines, impacts related to liquefaction and other seismically-induced ground failures would be *less than significant* because the pipelines would be imbedded in structural fill and would be constructed in accordance with seismic design standards and EBMUD Engineering Standard Practice 550.1, which would reduce the potential for damage due to liquefaction.

Abandonment of the existing crossings would also be *less than significant* because this aspect of the Project would involve only minor modifications to existing infrastructure and these modifications would not increase risks from seismic-related ground failures.

### **Strong Seismic Ground Shaking**

Ground shaking is the most widespread effect of earthquakes and poses a greater seismic threat than local ground rupture. Depending on the level of ground shaking, an earthquake could damage pipelines, resulting in a disruption of water service if proper design and construction methods are not employed. Such damage could result in short-term, temporary service interruptions for inspections and repairs, and long-term repairs could also be required.

As discussed previous sections, ground shaking during an earthquake, measured as peak ground accelerations, is expected to be quite strong in the Project area, in the range of 0.7 g to 0.8 g. The site-specific ground motions at any of the pipeline alignments can vary greatly due to the variable soil deposits such as YBM and highly liquefiable soils such as artificial fill. Shaking could be sufficient to result in pipeline breakage without proper design of the pipelines. However, because underground pipelines are generally less susceptible to damage from strong ground shaking if they are imbedded in structural fill and because pipelines would be constructed in accordance with seismic design standards as previous sections, the impacts associated with ground shaking would be *less than significant* for all aspects of the project.

### **Landslides**

As discussed in the Settings section, static (non-seismic related) landslides are not anticipated at any the Project areas. Therefore, there would be *no impact* related to static landslides.

#### ***Mitigation Measure GEO-1: Site-Specific Geotechnical Investigation***

A site-specific geotechnical investigation shall be conducted at each side of the HDD operation, in shallow soils, and at the jack and bore pits to determine design parameters to be incorporated into the Project design. EBMUD will conduct

borings (or use other geophysical methods) to gather pertinent geotechnical information. The investigation will evaluate subsurface conditions related to the potential for geological and seismic hazards, including ground shaking, liquefaction, lateral spreading, settlement, seismic slope instabilities, expansive soils, and corrosion in addition to studying the regional seismicity and site-specific geologic conditions. The investigation will also include a static and pseudo-static analysis of the potential for seismic-induced lateral spreading and landslides at shorelines near the Project area.

Recommendations and results from the geotechnical investigation will be incorporated into design of the pipeline, shoring systems, and dewatering methods to comply with current seismic standards and to withstand geologic and seismic hazards. Recommendations will also be incorporated into the project specifications for implementation during construction and shall be verified during construction by a qualified geotechnical engineer who will monitor construction activities.

### **5.3.2. Impact Geo-2 Would the proposed Project result in substantial soil erosion or the loss of topsoil?**

The Project would be constructed in paved streets, in areas adjacent to paved streets, and in landscaped areas. Surfaces, including pavement, would be restored after pipeline installation is completed. Erosion impacts would be limited to the construction period and within construction sites that involve landscaped areas. During construction, the contractor would be required to implement erosion control measures in accordance with Section 01 35 44 and 01 35 46 of the EBMUD Master Specifications, including the following erosion control measures:

- Divert or otherwise control surface water and other waters flowing onto the work areas. The methods of diversions or control must be adequate to ensure the safety of stored materials and personnel in the work area. At the completion of work, ditches, dikes, and other ground alterations made by the contractor must be removed and ground conditions must be returned to their former condition.
- Maintain construction sites to ensure that drainage from the site will minimize erosion of stockpiled or stored materials and the adjacent native soil material. This may include covering of soil stockpiles, runoff diversions, silt fences, and dewatering sediment filter socks.
- Minimize the removal and disturbance of natural vegetation.
- Prevent erosion and loss of soil from the Work area in order to maintain topsoil for revegetation.
- Restore the construction area to pre-project condition and in accordance with the Contract Documents.

Implementation of these required erosion control measures during construction would ensure that geologic impacts related to erosion would be *less than significant* for all aspects of the Project.



### 5.3.3. **Impact Geo-3: Would the proposed Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?**

As discussed in the previous sections, the Project is located in an area of moderate to very high liquefaction susceptibility. Operation of continuous vibratory equipment could induce liquefaction and related differential settlement, depending on the type, magnitude, and duration of vibration. The USGS has provided information regarding the liquefaction susceptibility of soils, indicating that vibration on the order of 0.1 g to 0.2 g peak ground acceleration<sup>8</sup> could cause liquefaction in areas with a moderate to very high susceptibility to liquefaction. A 0.1 g and 0.2 g peak ground acceleration equates to peak particle velocity (PPV)<sup>8</sup> of 0.2 and 0.4 inches per second (in/sec), respectively. Because the project will be constructed in previously disturbed areas and in areas subject to years of vibration from heavy vehicular traffic and previous construction and considering the range of soils encountered throughout the project, 0.3 in/sec is considered a reasonable continuous vibration limit, below which liquefaction induced differential settlement would not likely occur.

Vibratory construction activities associated with HDD, jet-grouting, jack and bore, and vibratory sheet/pile installation, and roller/compactor have the potential to generate PPV above 0.3 inches per second near structures; therefore, vibratory construction activities have the potential for generating liquefaction and differential settlement impacts. These impacts would be *less than significant with implementation of Mitigation Measure GEO-2: Vibration Limits and Monitoring* which requires implementation of vibration limits to prevent vibration-induced liquefaction.

Seismically induced slope instability (including lateral spreading and landslides) could displace or destroy underground pipelines. The Project area located near sloped channel sides (i.e., near the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel surrounding Alameda Island) could be subject to lateral spreading and landslides due to the presence of very soft saturated clays. However, the risk to underground pipelines would be mitigated with a proper geotechnical investigation and design. Therefore, the impact of lateral spreading and seismic-induced landslides at HDD and pipeline abandonment locations would be *less than significant with implementation of Mitigation Measure GEO-1: Site-Specific Geotechnical Investigation*. The impact of lateral spreading at all other Project locations would be *less than significant* because all other Project locations are situated on flat topography.

Dewatering of sandy soils for temporary excavations (trenches) could cause ground settlement and damage to nearby structures and underground utilities and unsupported

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<sup>8</sup> Peak particle velocity is used to describe the level of vibration. It is defined as the maximum instantaneous positive or negative peak of the vibration signal and is used to assess the potential for damage to buildings and structures. Peak particle velocity is expressed in inches per second (in/sec).

excavations into soft or loose soils can cause cracking and slumping and potential undermining of foundations, roadways and other infrastructure near the Project area. Dewatering-related ground settlement would be *less than significant with implementation of Mitigation Measure GEO-1: Site-Specific Geotechnical Investigation and Mitigation Measure GEO-3: Proper Design of Shoring and Dewatering Systems.*

***Mitigation Measure GEO-2: Vibration Limits and Monitoring***

- Construction practices will be utilized that do not generate continuous vibration levels at the closest structures above 0.3 in/sec PPV at 30 Hz. Vibration monitoring will be conducted when vibratory equipment is used that could generate a PPV vibration of 0.3 inches/second (or greater) at the nearest structure.

**Preconstruction Surveys**

- With permission and at the request of homeowners, EBMUD will conduct a preconstruction survey of homes, other sensitive structures, hardscaping, hillsides, and slide areas adjacent to the pipeline alignments, for potential effects due to vibration-generating activities. EBMUD will respond to any claims by inspecting the affected property promptly. Any new cracks or other changes in structures will be compared to preconstruction conditions and a determination made as to whether the proposed Project could have caused such damage. In the event that the Project is demonstrated to have caused the damage, the EBMUD will coordinate with the owner to have the damage repaired to the pre-existing condition.

***Mitigation Measure GEO-3: Proper Design of Shoring and Dewatering Systems***

The proper shoring design depends on the soil type, the extent of groundwater seepage, the height or depth of the excavation, the inclination of the excavation and the amount of time that the excavation will remain open. These factors will be determined during the geotechnical investigation (see **Mitigation Measure Geo-1**) and structural engineers will incorporate recommendations into the project construction specifications for implementation in the Project’s shoring and dewatering systems.

EBMUD will also determine if ground surface and structural monitoring is necessary to ensure that settlement does not exceed acceptable levels as determined by the geotechnical or structural engineer based on results of the geotechnical investigation (see **Mitigation Measure Geo-1**). Ground surface and structural monitoring shall be conducted in locations where soils are found to be susceptible to settlement and where excavations will be made next to sensitive structures such as historic buildings, structures and equipment with little tolerance to settlement, or critical facilities and utilities.

#### **5.3.4. Impact Geo-4: Would the proposed Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?**

Problematic soils, such as expansive and corrosive soils, can cause damage to buried utilities and can also increase required maintenance. Expansion and contraction of expansive soils in response to changes in moisture content can cause differential and cyclical movements that, in turn, can cause damage and/or distress to structures and equipment.

The open trench pipelines would generally be constructed beneath existing streets, and the pipelines would be embedded in compacted structural fill and would be constructed in accordance with seismic design standards which will ensure that the pipelines can tolerate the effects of expansive soils, if present. Therefore, the impact of expansive soils on open-trench pipelines is *less than significant*. The impact of expansive soils on the submarine portions of the pipeline crossings is also *less than significant* because the pipelines would be 50-100 feet deep in OBY where soil expansion is generally not a concern.

The impact of expansive soils in the vicinity of the shallow HDD sections of pipelines (near the surface) and the jack and bore pipelines would be partially alleviated by the steel casings that would be installed to protect and strengthen the pipelines. To further address expansive soils, Mitigation Measure GEO-1 requires a geotechnical investigation to evaluate site-specific hazards and incorporate the recommendations of the geotechnical report into the final design which would ensure that potential effects of expansive soils would be adequately addressed in the shallow HDD pipelines and the jack and bore pipelines. Therefore the impact of expansive soils on the shallow HDD sections and the jack and bore sections of pipelines is *less than significant with Mitigation Measure GEO-1: Site-Specific Geotechnical Investigation*.

Abandonment of the existing crossings would also be *less than significant* because the abandonment would involve only minor modifications to existing infrastructure, which would not affect the existing infrastructure's response to expansive soils.

Corrosive soils can weaken a pipeline if the pipeline is not properly designed. As previously mentioned, there is potential for shallow soils in the vicinity of the Project area to be classified as corrosive to severely corrosive to metals, and moderately deleterious to concrete. For all aspects of the Project, impacts related to corrosive soils would be *less than significant* because all aspects of the Project would be constructed in accordance with EBMUD practices and industry standards. EBMUD's ESP 512.1 (described in a previous section), which would reduce the risk of geologic hazards including corrosion. EBMUD also follows the recommendations of the 2004 American Water Works Association (AWWA) M11 Manual for the design and installation of steel pipe, including design for corrosion control. Some of these design measures may include epoxy coating of reinforcing steel, use of Type 5 Portland cement in structural concrete,

or soil treatment to neutralize pH in the soil or to reduce excessive chloride and sulfate concentrations in the soil.

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APPENDIX I:  
NOISE AND VIBRATION TECHNICAL REPORT

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***ALAMEDA – NORTH BAY FARM ISLAND  
PIPELINE CROSSING PROJECT  
NOISE AND VIBRATION TECHNICAL REPORT***

*OAKLAND AND ALAMEDA, CALIFORNIA*

May 12, 2016

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Project #15-149

# NOISE AND VIBRATION TECHNICAL STUDY

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## 1 INTRODUCTION

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This technical report evaluates the potential noise and vibration impacts associated with the construction and operation of the Alameda–North Bay Farm Island Pipeline Crossings Project (proposed project). This report describes the existing noise environment, presents relevant noise regulations and standards, and identifies sensitive noise receptors that could be affected by the proposed project. Potential noise and vibration impacts on these receptors are evaluated and discussed.

The proposed project involves the construction and operation of three transmission pipelines (24-inch inner diameter) in Alameda County within the cities of Oakland and Alameda. The proposed pipelines would be installed within Oakland and Alameda city streets, a business park parking lot, Estuary Park, and Towata Park, and underneath the Oakland Inner Harbor, Tidal Canal, and San Leandro Bay Channel surrounding Alameda Island. The project location is shown in Figure 1. The locations of Crossings #1, #2, and #3 are shown in Figures 2 to 6.

Construction of the three crossings would involve the following construction methods: open trench, jack and bore, and horizontal directional drilling (HDD). Construction of the three crossings would also involve the following activities: geotechnical investigation, connection of the new pipelines to existing water transmission pipelines, in-street pipeline abandonment, abandonment of seven existing underwater crossings, and distribution pipeline replacements. A description of the three crossings and the construction methods and activities that would take place is described below.

### 1.1 CROSSINGS

Each pipeline crossing is described below.

- **Crossing #1.** Crossing #1, known as the Estuary Park–Marina Village Crossing, is approximately 2.3 miles long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Oakland Inner Harbor, and continue through Alameda to its connection point. One alternate route option for the replacement of an existing pipeline in Oakland is being considered (see Figure 2). Construction activities would occur within city streets, one business park parking lot (the Telecare Corporation), and Estuary Park.
- **Crossing #2.** Crossing #2, known as the Alameda–North Bay Farm Island Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines on Alameda Island, cross under the San Leandro Bay Channel, and continue on North Bay Farm Island to its connection point (see Figure 3). Construction activities would occur within city streets and Towata Park.

- **Crossing #3.** Crossing #3, known as the Derby Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Tidal Canal, and continue in Alameda to its connection point. Project activities associated with Crossing #3 would include replacing an existing pipeline (see Figure 4). One alternate route option for open trench construction in Alameda is being considered. Construction activities would occur within city streets.

## 1.2 ALTERNATIVE ALIGNMENT OPTIONS

This technical report analyzes two alternate transmission pipeline trenching options and one alternate location for a distribution pipeline replacement. The locations of these alternate alignment options are shown in Figures 2 and 4 and described below.

- **Crossing #1 alternate trench option.** Instead of using 2nd Street, the open trench construction and pipeline installation would occur along 3rd Street for one block, then along Oak Street for one block, and then would continue along the proposed alignment.
- **Crossing #1 alternate pipeline replacement option.** Instead of replacing the existing pipeline on 2nd Street between Madison Street and Oak Street, the pipeline on 3rd Street between Madison Street and Oak Street would be replaced.
- **Crossing #3 alternate trench option.** Instead of using Clement Avenue and a portion of Everett Street, open trench construction would occur on Broadway and then along Eagle Avenue until Everett Street, where pipeline installation would continue along the proposed alignment.

## 1.3 PROJECT CONSTRUCTION

Table 1 includes a summary of the construction activities for the proposed project, including the equipment that would be used, the location where the activity would occur, and the dimensions of the construction activity.

Construction hours would typically be between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) might be required when the proposed pipelines are connected to existing pipelines as well as to minimize service disruptions for water customers. Forty-eight-hour construction for one weekend would also be necessary for each HDD underwater pipeline crossing. Additional nighttime construction work could occur at traffic intersections, if required by encroachment permit conditions to minimize traffic impacts. If required, it is expected that nighttime intersection work would only occur at arterial streets such as High Street, Tilden Way, 5th Street, 6th Street, 7th Street, and 8th Street.

#### 1.4 OPERATION AND MAINTENANCE

The proposed project would require routine operation and maintenance after construction, which is conducted under existing operations and maintenance procedures and protocols.



NOISE AND VIBRATION TECHNICAL STUDY

Figure 1 Project Location



NOISE AND VIBRATION TECHNICAL STUDY

Figure 2 Crossing #1 Alignment



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Figure 3 Crossing #2 Alignment



NOISE AND VIBRATION TECHNICAL STUDY

Figure 4 Crossing #3 Alignment



## NOISE AND VIBRATION TECHNICAL STUDY

Table 1 Summary of Construction Activities

Construction Method/Activity	Description	Equipment	Location	Approximate Dimensions
Transmission Pipeline Open Trench Construction	<p>Open trench construction consists of the following activities:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Saw-cutting the pavement</li> <li>• Excavating a trench</li> <li>• Removing and stockpiling soils</li> <li>• Installing the pipeline</li> <li>• Backfilling the trench and applying temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Pavement saws &amp; jack hammers</li> <li>• Excavators, backhoes, front-end loaders</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Dewatering pumps</li> <li>• Soil-cement mixing machines</li> <li>• Paving equipment (asphalt and/or concrete trucks, vibratory compactors, pavers, and rollers)</li> <li>• Water trucks</li> </ul>	Throughout project roads for Crossing #1, #2, and #3 (see Figures 2, 3, and 4)	<p>Construction corridor: 25 feet</p> <p>Maximum depth of trench: 8 feet</p> <p>Width of trench: 4 feet</p>
Transmission Pipeline Jack and Bore	<p>The jack and bore method would be used twice during project implementation: at Crossing #1 to install pipeline beneath a segment of railroad track on Oak Street, and at Crossing #2 to install pipeline beneath Otis Drive so that Otis Drive could remain open during construction. The jack and bore method would consist of the following activities:</p> <ul style="list-style-type: none"> <li>• Excavating a temporary jacking and receiving pit</li> <li>• Constructing a temporary jacking platform in the jacking pit</li> <li>• Drilling or jacking a casing through the earth under the road or railroad to be avoided</li> </ul>	<ul style="list-style-type: none"> <li>• Horizontal boring machine or auger &amp; hydraulic jack</li> <li>• Excavators</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Backhoes &amp; front-end loaders</li> <li>• Dewatering pumps</li> </ul>	<p>Crossing #1: The pits are located on (1) Oak Street, north of Embarcadero West, just north of the railroad crossing and on (2) Oak Street, south of Embarcadero West, just south of the railroad crossing (see Figure 2)</p> <p>Crossing #2: The pits are located on (1) Peach Street, which divides Towata Park in half, south of Otis Drive and on (2) Peach Street north of Otis Drive, on a part of Peach Street that has</p>	<p>Pit Area: 500 square feet</p> <p>Depth: 10–15 feet</p> <p>Length: 150 feet at Crossing #1 and 300 feet at Crossing #2</p>

## NOISE AND VIBRATION TECHNICAL STUDY

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Installing the new pipeline in the casing</li> <li>• Connecting the new pipeline-to-pipeline segments on either end of the jacking pit</li> <li>• Backfilling the jacking and receiving pit and temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>		been closed to vehicle access (see Figure 3)	
Geotechnical Investigation	<p>A geologic review and geotechnical investigation would be conducted at the HDD Crossings and jack and bore locations. Exploratory borings would be made at the HDD entry and insertion pit locations and along the underwater alignment as well as at each jack and bore pit. The subsurface soils investigation would originate on the land or water surface and would include the following steps:</p> <ul style="list-style-type: none"> <li>• Locate/pothole for utilities</li> <li>• Mobilize land based and barge- or ship-mounted geotechnical drilling equipment</li> <li>• Drill exploratory soils borings at the following locations                             <ul style="list-style-type: none"> <li>- HDD entry and insertion pits for all crossings</li> <li>- Along the underwater alignments for Crossing #1 and</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Geotechnical drilling rig (truck-mounted and barge-mounted)</li> <li>• Turbidity curtains for drilling</li> <li>• Barge</li> </ul>	HDD entry and insertion pits for all crossings; The underwater alignments for Crossings #1 and #2; and jack and bore pits	<p>Depth: 125 feet</p> <p>Width: 2 inches</p>

## NOISE AND VIBRATION TECHNICAL STUDY

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<p>#2 at intervals of approximately 300 feet and depths of 125 feet</p> <ul style="list-style-type: none"> <li>- Jack and bore pits</li> <li>• Collect soils samples for classification and laboratory analysis (geophysical investigation methods may also be used)</li> <li>• Abandon exploratory borings (backfill land-based borings only)</li> </ul>			
Transmission Pipeline Horizontal Directional Drilling	<p>HDD will be used to install the three underwater pipelines under the Oakland Inner Harbor, Tidal Canal, and the San Leandro Bay Channel. HDD is a process that originates on the surface and typically consists of the following steps:</p> <ul style="list-style-type: none"> <li>• Ramming a steel conductor casing approximately 200 feet long into the ground on both sides of the drilling operation to support the pipeline until the pipeline reaches deeper and more stable soil and to prevent hydraulic fracturing (“frac out”) at the surface.</li> <li>• Drilling a pilot hole from the entry pit across the water to the insertion pit; drilling could potentially occur at both the entry and insertion pit.</li> <li>• Enlarging the pilot hole through a reaming process</li> <li>• Laying down, fusing together, and pressure testing the pipeline</li> </ul>	<ul style="list-style-type: none"> <li>• HDD rig with control cab for the HDD operator (potentially one for each side)</li> <li>• Slurry separation plants (one for each side)</li> <li>• Small pick-cranes (one for each side)</li> <li>• Pipeline rollers</li> <li>• Slurry and grout pumps (one for each side)</li> <li>• Welders (at insertion pit)</li> <li>• Soil-cement mixing machines (one for each side)</li> <li>• Jet grouting rig (one for each side)</li> <li>• Excavators (one for each side)</li> <li>• Tractors/ loaders/ backhoes (one for each side)</li> </ul>	<p>Crossing #1, entry pit: Adjacent to the parking spaces next to Estuary Park (Oakland) – located approximately 500 feet south of the intersection of Embarcadero West and the road that provides access to the parking lot for Estuary Park</p> <p>Crossing #1, insertion pit: Telecare Corporation parking lot (Alameda) – located in the middle of Telecare Corporation parking lot, approximately 250 feet north of the intersection of Marina Village Parkway and Tynan Avenue</p> <p>Crossing #2, entry pit: Towata Park (Alameda) – located within Towata Park, east of the portion</p>	<p>Entry and exit angles: 15 degrees</p> <p>Depth: 50–100 feet</p> <p>Dimensions of entry and insertion pits: 10 by 20 feet</p> <p>Depth of entry and insertion pits: 5 feet</p> <p>Total staging area around entry and insertion pits: 2,000–2,500 square feet</p> <p>HDD length at Crossing #1: 1,800 feet</p> <p>HDD length at Crossing #2: 1,400 feet</p> <p>HDD length at Crossing #3: 1,400 feet</p>

## NOISE AND VIBRATION TECHNICAL STUDY

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
	<ul style="list-style-type: none"> <li>• Pulling the pipeline into the insertion pit, through the enlarged pilot hole, and to the receiving pit</li> <li>• Injecting grout between the pipeline and casing</li> <li>• Injecting jet grouted columns to provide additional support to the casing, between the entry pit and the shoreline</li> <li>• Backfilling the HDD pit and temporary paving</li> <li>• Disinfecting the pipeline</li> <li>• Repaving</li> </ul>		<p>of Peach Street, which divides Towata Park</p> <p>Crossing #2, insertion pit: Veterans Court (North Bay Farm Island) – located approximately 275 feet north of the intersection of Veterans Court and Island Drive</p> <p>Crossing #3, entry pit: Derby Avenue (Oakland) – located on Derby Avenue, between Ford Street and Glascock Street, approximately 50 feet north of the intersection of Derby Avenue and Glascock Street</p> <p>Crossing #3, insertion pit: Broadway (Alameda) – located on Broadway, between Blanding Avenue and Clement Avenue, approximately 160 feet south of the intersection of Broadway and Blanding Avenue</p>	



## NOISE AND VIBRATION TECHNICAL STUDY

Construction Method/ Activity	Description	Equipment	Location	Approximate Dimensions
Connections	The proposed project would connect the new water pipelines to existing EBMUD water transmission pipelines. The work to connect the new pipelines to existing pipelines would require the excavation of a trench or pit at each connection location. Temporary shoring would be required to ensure the stability of the excavation, which may include the use of vibratory sheet piles. The proposed tie-ins would be located within street rights-of-way and sited to minimize disruptions to traffic and homeowner access. Construction of the connections would generally be completed within a 12-hour period. For connections that require a new tee, construction could require a full 24-hour period, and night work might be necessary.	<ul style="list-style-type: none"> <li>• Excavators</li> <li>• Generator Sets for night lighting</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering pumps</li> <li>• Hot tap machine</li> </ul>	Connections would be located where open trench construction would occur (See Figure 2, 3, and 4)	The connections would be in the open trench construction corridor and would have similar dimensions as open trench construction.
In-Street Pipeline Abandonment	Pipeline abandonment would require three construction pits in 5th Street to move service connections and fire hydrants and to install two endcaps, one at 5th Street and another at Oak Street. The abandoned pipeline would be filled with cellular concrete between the two endcaps, and an existing valve near the intersection of Madison Street and 5th Street would be abandoned in place after opening the valve.	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> </ul>	Oakland side of Crossing #1: On 5th Street, between Oak Street and Jackson Street	Length: 800 feet. Width of Pit: 10 feet Length of Pit: 10 feet Depth: 4–10 feet

## NOISE AND VIBRATION TECHNICAL STUDY

Construction Method/Activity	Description	Equipment	Location	Approximate Dimensions
Underwater Pipeline Crossings Abandonment	<p>The seven existing underwater pipeline crossings would be abandoned. Abandonment includes filling onshore sections of pipelines with cellular concrete and abandoning submarine sections of pipelines in place. Bumped heads or blind flanges will be constructed at the demarcation between the onshore and submarine sections and at the end of the onshore sections to be abandoned. To install the bumped heads or blind flanges, a pit would be excavated down to the pipeline. The bumped head at the two abandonment locations at Crossing #2 would be installed in existing vaults and would not require pit excavation (see Figure 3). Additional pits may be necessary to remove valves, hydrants, move service laterals, and at low points along the onshore pipeline alignment to facilitate concrete pumping; the location of these additional pits would be determined during detailed design.</p>	<ul style="list-style-type: none"> <li>• Flatbed delivery trucks</li> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> <li>• Vibratory pile driving may be used to install sheet pile walls for the abandonment pits</li> </ul>	See Figures 2, 3, and 4	<p>Width of Pit: 10 feet</p> <p>Length of Pit: 10 feet</p> <p>Depth: 4–10 feet</p>

## NOISE AND VIBRATION TECHNICAL STUDY

Construction Method/Activity	Description	Equipment	Location	Approximate Dimensions
Distribution Pipeline Replacement	<p>The proposed project would replace existing small-diameter distribution pipelines at two locations along Crossing #1 and Crossing #3. Open trench construction methods (see above) would be used to install the new pipeline and the existing pipeline would be abandoned in place. Pipeline replacement would occur during open trenching activities, before the new transmission pipeline is installed. The following pipelines would be replaced:</p> <ul style="list-style-type: none"> <li>• Crossing #1: On 2nd Street (see Figure 2), approximately 400 feet of existing 10-inch cast-iron pipeline constructed in 1908 would be replaced with a 12-inch steel pipeline.</li> <li>• Crossing #3: On Everett Street (see Figure 4), approximately 750 feet of existing 4-inch cast-iron pipeline constructed in 1895 would be replaced with a 6-inch steel pipeline.</li> </ul>	Distribution pipeline replacement would require the same equipment used for open trench construction.	<p>Crossing #1, Oakland: On 2nd Street (see Figure 2).</p> <p>Crossing #3, Alameda: On Everett Street (see Figure 4).</p>	<p>The distribution pipeline replacement would be in the open trench construction corridor and would have similar dimensions as open trench construction.</p> <p>Length of pipeline replacement at Crossing #1: 400 feet</p> <p>Length of pipeline replacement at Crossing #3: 750 feet</p>

## 1.5 DEFINITIONS

### 1.5.1 Noise Concepts

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in Table 2.

Most of the sounds we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a weighting that reflects the facts that human hearing is less sensitive at low frequencies and extreme high frequencies than in the mid-range frequencies is known as "A" weighting, and the decibel level so measured is called the A-weighted sound level (dBA). In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. Typical A-weighted levels measured in the environment and in industry are shown in Table 3 for different types of noise.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources, which create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors,  $L_{01}$ ,  $L_{10}$ ,  $L_{50}$ , and  $L_{90}$ , are commonly used. They are the A-weighted noise levels equaled or exceeded during 1%, 10%, 50%, and 90% of a stated time period. A single number descriptor called the  $L_{eq}$  is also widely used. The  $L_{eq}$  is the average A-weighted noise level during a stated period of time.

Table 2 Definitions of Acoustical Terms Used in this Report

Term	Definitions
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.

## NOISE AND VIBRATION TECHNICAL STUDY

Term	Definitions
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, Leq	The average A-weighted noise level during the measurement period.
Lmax, Lmin	The maximum and minimum A-weighted noise level during the measurement period.
L01, L10, L50, L90	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, Ldn or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

*Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998*

## NOISE AND VIBRATION TECHNICAL STUDY

Table 3 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Jet fly-over at 1,000 feet	110 dBA	Rock band
Gas lawn mower at 3 feet	100 dBA	
Diesel truck at 50 feet at 50 mph	90 dBA	Food blender at 3 feet
Noisy urban area, daytime	80 dBA	Garbage disposal at 3 feet
Gas lawn mower, 100 feet Commercial area	70 dBA	Vacuum cleaner at 10 feet Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime	30 dBA	Library
Quiet rural nighttime	20 dBA	Bedroom at night. concert hall
	10 dBA	Broadcast/recording studio
	0 dBA	

Source: *Technical Noise Supplement (TeNS)*, Caltrans, September 2013.

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels; however, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor,  $L_{dn}$  (day/night average sound level), was developed. The  $L_{dn}$  divides the 24-hour day into the daytime of 7:00 AM to 10:00 PM and the nighttime of 10:00 PM to 7:00 AM. The nighttime noise level is weighted 10 dB higher than the daytime noise level. The Community Noise Equivalent Level (CNEL) is another 24-hour average, which includes both an evening and nighttime weighting.

### 1.5.2 Noise Attenuation

When sound propagates over a distance, it changes in both level and frequency content (Technical Noise Supplement (TeNS), Caltrans, November 2009). The manner in which noise is reduced with distance depends on the following important factors:

#### 1.5.2.1 Geometric spreading from point sources

Sound from a single source (i.e., a “point” source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates (or drops off) at a rate of six dBA for each doubling of distance (intensity drops to one-quarter of the previous level with each doubling of distance).

#### 1.5.2.2 Ground absorption

Usually the noise path between the source and the observer is very close to the ground. The excess noise attenuation from ground absorption occurs due to acoustic energy losses on sound wave reflection. Traditionally, excess attenuation has been expressed as an estimated attenuation per doubling of distance. This approximation is done for simplification only; for distances of less than 200 feet, prediction results based on this scheme are sufficiently accurate. For acoustically “hard” sites (i.e., sites with a reflective surface, such as a parking lot or a smooth body of water, between the source and the receptor), no excess ground attenuation is assumed because the sound wave is reflected without energy losses. For acoustically absorptive or “soft” sites (i.e., sites with an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dBA per doubling of distance is normally assumed. When added to the geometric spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dBA per doubling of distance for a line source and 7.5 dBA per doubling of distance for a point source. Although some ground attenuation is expected, it is often ignored in a noise analysis, to ensure a conservative analysis and considering that, in any event, it is very difficult to characterize accurately.

#### 1.5.2.3 Atmospheric effects

Research by Caltrans (TeNS, 2013) and others has shown that atmospheric conditions can have a major effect on noise levels. Wind has been shown to be the single most important meteorological factor within approximately 500 feet, whereas vertical air temperature gradients are more important over longer distances. Other factors, such as air temperature, humidity, and

turbulence, also have major effects. Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lower noise levels. Increased sound levels can also occur because of temperature inversion conditions (i.e., increasing temperature with elevation) which cause reflection of sound from the inversion layer back to the ground. As with ground absorption, atmospheric effects are often ignored, as here, in the interest of a conservative analysis.

### 1.5.2.4 Shielding by natural or human-made features

A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by this shielding depends on the size of the object, proximity to the noise source and receptor, surface weight, solidity, and the frequency content of the noise source. Natural terrain features (such as hills and dense woods) and human-made features (such as buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor with the specific purpose of reducing noise. A barrier that breaks the line of sight between a source and a receptor will typically result in at least 5 dB of noise reduction. A higher barrier may provide as much as 20 dB of noise reduction. Lightly built barriers provide less attenuation.

### 1.5.3 Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the Peak Particle Velocity (PPV) and another is the Root Mean Square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. A PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related ground-borne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess ground-borne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life are evaluated against different



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vibration limits. Studies (*TCVGM, 2013*) have shown that the threshold of perception for average persons is in the range of 0.2 to 0.3 mm/sec (0.008 to 0.012 in/sec), PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels such as people in an urban environment may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

## 2 APPROACH TO DATA COLLECTION

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Noise measurements were made with Larson Davis Model 820 Integrating Sound Level Meters set at “slow” response. The sound level meters were equipped with a G.R.A.S. Type 40AQ ½ - inch random incidence microphone fitted with a windscreen. All instrumentation used meets the requirements of the American National Standards Institute (ANSI) SI.4-1983 for Type 1 use. The meters were calibrated with a Larson Davis Model CA250 precision acoustic calibrator prior to and following the measurement survey. Six (6) long term multiday noise measurements were made, one in the vicinity of the pipeline entry and exit sites for each crossing. The internal clocks of the long-term meters were set to less than one second of each other to ensure both identical sound level response and simultaneous operation. The long term monitors were placed at elevated positions (10 to 12 feet above grade) to allow for secure undisturbed measurements over the measurement period. Considering the relatively close proximity of the monitoring positions to the traffic noise sources and the hard (i.e., paved) surface conditions which result in a general lack of ground absorption, the levels measured at 10 to 12 feet above ground are within 0.5 dBA of those at ear height (5 feet) above ground level. Nine short term, 10-minute duration, measurements were made in noise sensitive areas along pipeline alignments away from the entry/exit sites to document noise levels in areas where trenching work and pipeline build-up and construction will occur.

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### 3 ENVIRONMENTAL SETTING

#### 3.1 NOISE SOURCES AND SENSITIVE RECEPTORS

##### 3.1.1 Existing Noise Sources

The existing noise environment in the proposed project areas was characterized with nine short-term (10-minute duration), and six long-term (49-hour duration) noise measurements conducted between September 23 and 25, 2015. Table 4 summarizes the long term and short term measurement results. The locations of these measurements are shown in Figures 7 through 9. Areas where long term measurements were taken are shown with an LT label and areas where short term measurements were taken are shown with an ST label. The hourly results of the long term noise measurements are shown in Figures A-1 through A-6 in Appendix A.

Table 4 Summary of Noise Measurement Results

Long term Measurement Sites (Date/Time)	Time of day	Daytime & Nighttime Average noise levels (dBA)							
		L <sub>max</sub>	L <sub>01</sub>	L <sub>10</sub>	L <sub>eq</sub>	L <sub>50</sub>	L <sub>90</sub>	L <sub>dn</sub>	CNEL
LT-1 (Crossing 1 entry): Tree at apartment setback north of Estuary Park, (1:00pm, 9/23/15 to 2:00pm, 9/25/15)	Daytime	76	64	57	55	52	50	62	62
	Nighttime	69	60	55	54	53	51		
LT-2 (Crossing 3 entry): Light standard at NW corner of Derby and Glascock, (1:00pm, 9/23/15 to 2:00pm, 9/25/15)	Daytime	81	71	60	59	53	50	76	76
	Nighttime	77	67	57	56	51	49		
LT-3 (Crossing 3 exit): Light standard in front of 1913 Broadway. (1:00pm, 9/23/15 to 2:00pm, 9/25/15)	Daytime	84	74	67	64	60	53	66	67
	Nighttime	79	68	57	56	51	49		
LT-4: (Crossing 2 entry): Light standard in front of 3132 Bridgeview Isle, (1:00pm, 9/23/15 to 2:00pm, 9/25/15)	Daytime	74	67	61	59	58	55	62	62
	Nighttime	67	60	55	53	51	48		
LT-5: (Crossing 2 exit): Tree 75 ft. north of Veterans Ct. centerline, (1:00pm, 9/23/15 to 2:00pm, 9/25/15)	Daytime	72	64	58	56	54	52	61	61
	Nighttime	67	61	55	53	51	48		
LT-6 (Crossing 1 exit): Tree at adjacent to park and parking in Office area. (1:00pm, 9/23/15 to 2:00pm, 9/25/15)	Daytime	72	63	56	54	52	51	60	61
	Nighttime	69	59	53	52	51	49		

## NOISE AND VIBRATION TECHNICAL STUDY

Short-term Measurement Sites (Date/Time)	Measured noise levels (dBA)						Ldn (est.)	CNEL (est.)
	Lmax	L01	L10	Leq	L50	L90		
ST-1: Corner of Madison and 7th Streets (10:40am-10:50 am, 9/25/15)	81	80	74	71	68	66	81	81
ST-2: Corner of 4th and Madison Streets (11:00am-11:10 am, 9/25/15)	76	70	65	63	62	60	69	69
ST-3: In front of 2912 Ford St. (11:20am-11:30 am, 9/25/15)	69	64	58	55	50	46	65	65
ST-4: Little John Park across from 1715 Sherman St. (11:40am-11:50 am, 9/25/15)	76	67	63	60	58	54	66	66
ST-5: Broadway at Noble Ave. (12:00pm-12:10 pm, 9/25/15)	74	70	65	62	61	53	65	65
ST-6: Corner of Everett St. & Eagle Ave. (12:20pm-12:30 pm, 9/25/15)	77	69	59	56	46	44	61	61
ST-7: Corner of Peach & Fillmore Streets. (12:40pm-12:50 pm, 9/25/15)	58	56	48	48	46	45	55	55
ST-8: Corner of San Jose Ave. & Fountain St. (1:00pm-1:10 pm, 9/25/15)	58	53	50	48	46	45	56	56
ST-9: Island Drive next to Earhart School (1:20pm-1:30 pm, 9/25/15)	75	73	66	63	60	55	68	68

NOISE AND VIBRATION TECHNICAL STUDY

Figure 5 Crossing #1 Alignments and Measurement Locations



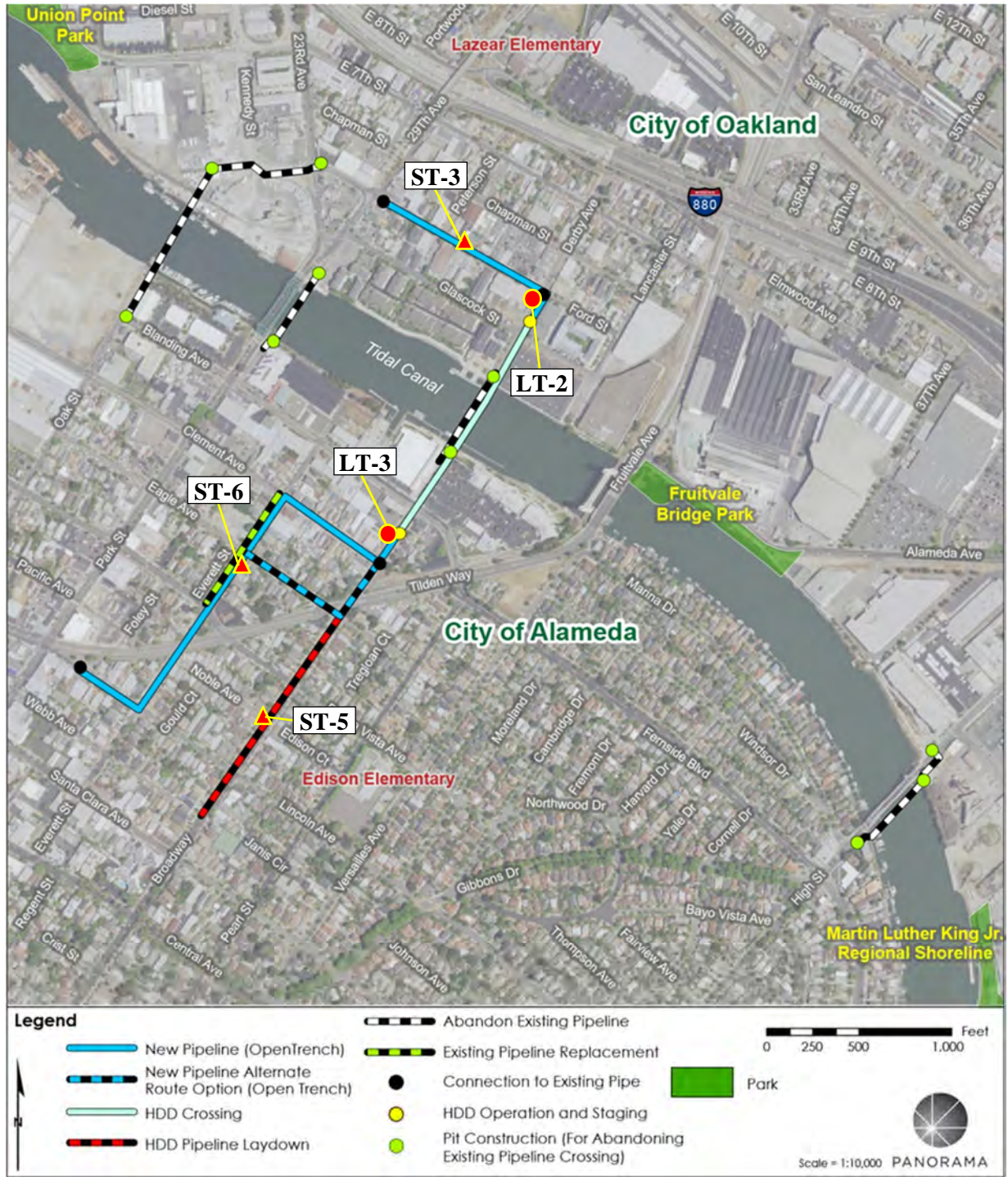
NOISE AND VIBRATION TECHNICAL STUDY

Figure 6 Crossing #2 Alignments and Measurement Locations



NOISE AND VIBRATION TECHNICAL STUDY

Figure 7 Crossing #3 Alignments and Measurement Locations





## NOISE AND VIBRATION TECHNICAL STUDY

### 3.1.2 Sensitive Noise and Vibration Receptors

Human response to noise varies considerably from one individual to another. The effects of noise can include interference with sleep, concentration, and communication; physiological and psychological stress; and hearing loss. Given these effects, some land uses are considered more sensitive to ambient noise levels than others. In general, residences, schools, hospitals, and nursing homes are considered to be the most sensitive to noise. Table 5 identifies sensitive receptors located adjacent to or near the proposed project pipeline alignments.

Table 5 Sensitive Receptors near the Proposed Project

Facility	Location	Distance from Proposed Project Construction
Crossing #1 (Oakland)		
Residential Uses	Interspersed over Entire Alignment	As close as 10 feet from pipeline trenching and excavations, jack and bore, and HDD drilling, but usually 40 feet or more.
Laney College	900 Fallon Street	>500 feet from all construction activities
Lazear Elementary School	1025 2nd Ave	>500 feet from all construction activities
Crossing #1 (Alameda)		
Residential Uses	Interspersed over Entire Alignment	As close as 10 feet but usually 40-50 feet from pipeline trenching
Crossing #2 (Alameda)		
Small Size Big Mind Preschool	3300 Bridgeview Isle	200 feet from jack and bore, and HDD drilling
Otis Elementary School	3010 Fillmore St	>500 feet from all construction activities
Lincoln Middle School	1250 Fernside Blvd	>500 feet from all construction activities
Residential Uses	Entire Alignment	As close as 10 feet but usually 40 feet from pipeline trenching and excavations, and jack and bore; 150 feet from HDD drilling
Crossing #2 (Bay Farm Island)		
Residential Uses	Veterans Court and Island Drive	40 feet from HDD drilling and HDPE pipeline laydown
Earhart Elementary School	400 Packet Landing Rd	40 feet from HDPE pipeline laydown

## NOISE AND VIBRATION TECHNICAL STUDY

Facility	Location	Distance from Proposed Project Construction
Crossing #3 (Oakland)		
Residential Uses	Derby Avenue and Ford St.	As close as 10 feet but usually 40 feet from pipeline trenching and excavations, and HDD drilling
Crossing #3 (Alameda)		
Edison Elementary School	2700 Buena Vista Ave	>500 feet from all construction activities
Alameda Christian School	2226 Pacific Ave	>500 feet from all construction activities
Waters Edge Nursing Home	2401 Blanding Ave	>500 feet from all construction activities
Residential Uses	Interspersed over Entire Alignment	As close as 10 feet but usually 40 feet from pipeline trenching and excavations, HDD drilling, and HDPE pipeline laydown, and abandonment pits

### 3.2 APPLICABLE REGULATIONS, PLANS, AND STANDARDS

#### 3.2.1 Federal Regulations

No federal or state standards related to noise are applicable to the proposed project. The Federal Noise Control Act of 1972 divides powers between federal, state, and local governments, in which the primary federal responsibility is for noise source emission control. State and local governments are responsible for controlling the use of noise sources and determining the levels of noise to be permitted in their environment (USEPA, 1974).

#### 3.2.2 Local Policies

At the local level, noise is addressed through the implementation of general plan policies, including noise and land use compatibility guidelines, and through enforcement of noise ordinances. General plan policies provide guidelines for determining whether a noise environment is appropriate for a proposed or planned land use. Local noise ordinances regulate such sources as mechanical equipment and amplified sounds, as well as prescribe hours of heavy equipment operation. Pursuant to California Government Code Section 53091, EBMUD, as a local agency and utility district serving a broad regional area is not subject to building and land use zoning ordinances (such as noise ordinances) for projects involving facilities that would produce, generate, store, or transmit water. However, it is the practice of EBMUD to work with local jurisdictions and neighboring communities during project planning, and to consider local environmental protection policies for guidance. Project construction will occur in

NOISE AND VIBRATION TECHNICAL STUDY

two cities: Oakland and Alameda. Table 6 summarizes the pertinent construction noise ordinance time and noise limits for each city.

Table 6 Local Policies

Jurisdiction	Construction Time Limits		Construction Noise Limits (Independent of Ambient Conditions)
	Weekdays	Weekends	
City of Oakland <sup>a</sup>	7 a.m. to 7 p.m. (daytime)	9 a.m. to 8 p.m. (daytime)	<p><u>Residential Zones</u></p> <p>Short term (&lt;10 days): 80 dBA on weekdays and 65 dBA on weekends and legal holidays.</p> <p>Long-term (&gt;10 days): 65 dBA on weekdays and 55 dBA on weekends and legal holidays.</p> <p><u>Commercial Zones</u></p> <p>Short term (&lt;10 days): 85 dBA on weekdays and 70 dBA on weekends and legal holidays.</p> <p>Long-term (&gt;10 days): 70 dBA on weekdays and 60 dBA on weekends and legal holidays.</p>
	7 p.m. to 7 a.m. (nighttime)	8 p.m. to 9a.m. (nighttime)	<p><u>Residential Zones</u></p> <p>45 dBA for more than 20 minutes in a 1 hour period</p> <p>50 dBA for more than 10 minutes in a 1 hour period</p> <p>55 dBA for more than 5 minutes in a 1 hour period</p> <p>60 dBA for more than 1 minute in a 1 hour period</p> <p>65 dBA maximum level</p> <p><u>Commercial Zones</u></p> <p>65 dBA for more than 20 minutes in a 1 hour period</p> <p>70 dBA for more than 10 minutes in a 1 hour period</p> <p>75 dBA for more than 5 minutes in a 1 hour period</p> <p>80 dBA for more than 1 minute in a 1 hour period</p> <p>85 dBA maximum level</p>
City of Alameda <sup>b</sup>	7 a.m. to 7 p.m.	8 a.m. to 5 p.m. Saturday	<p>None Specified during the time limits noted.</p> <p>Noise due to construction activities occurring outside of the allowed time limits are restricted by the noise limits contained Section 4-10.4b of the Alameda Municipal Code, which are as follows:</p> <p><u>Daytime (7:00 a.m. to 10:00 p.m.)</u></p> <p><u>Residential Zones</u></p> <p>55 dBA for more than 30 minutes in a 1 hour period</p> <p>60 dBA for more than 15 minutes in a 1 hour period</p> <p>65 dBA for more than 5 minutes in a 1 hour period</p> <p>70 dBA for more than 1 minute in a 1 hour period</p> <p>75 dBA maximum level</p> <p><u>Commercial Zones</u></p> <p>65 dBA for more than 30 minutes in a 1 hour period</p> <p>70 dBA for more than 15 minutes in a 1 hour period</p> <p>75 dBA for more than 5 minutes in a 1 hour period</p> <p>80 dBA for more than 1 minute in a 1 hour period</p> <p>85 dBA maximum level</p> <p><u>Nighttime (10:00 p.m. to 7:00 a.m.)</u></p> <p><u>Residential Zones</u></p> <p>50 dBA for more than 30 minutes in a 1 hour period</p>

## NOISE AND VIBRATION TECHNICAL STUDY

Jurisdiction	Construction Time Limits		Construction Noise Limits (Independent of Ambient Conditions)
	Weekdays	Weekends	
			55 dBA for more than 15 minutes in a 1 hour period 60 dBA for more than 5 minutes in a 1 hour period 65 dBA for more than 1 minute in a 1 hour period 70 dBA maximum level <u>Commercial Zones</u> 60 dBA for more than 30 minutes in a 1 hour period 65 dBA for more than 15 minutes in a 1 hour period 70 dBA for more than 5 minutes in a 1 hour period 75 dBA for more than 1 minute in a 1 hour period 80 dBA maximum level

<sup>a</sup> Time limits and noise levels for construction activity specified in Section 17.120.050 of the Oakland Planning Code.

<sup>b</sup> Time limits for construction activity specified in Section 4-10.7e of the Alameda Municipal Code. Construction that occurs within these time limits is not subject to noise limits contained in Tables I and II of Section 4-10.4b of the Alameda Municipal Code.

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## 4 ANALYSIS AND RECOMMENDATIONS

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### 4.1 SIGNIFICANCE THRESHOLDS

#### 4.1.1 Noise Thresholds

##### 4.1.1.1 Local Noise Standards

Table 6 lists the local noise policies that pertain to construction activities. The time and noise limits specified in the policies were applied in the noise analysis as thresholds to determine the proposed project's construction-related noise impacts under the Significance Criteria #1 listed above.

##### 4.1.1.2 Noise Disturbance Thresholds

For construction noise, a "substantial" noise increase (as referenced under Significance Criteria #4 above) is defined in this analysis as speech interference during the day and sleep disturbance during the night.

#### **Speech Interference**

The thresholds for speech interference indoors are 45 dBA if the noise is steady, such as the constant sound of distant traffic or continuously operating mechanical equipment, and above 55 dBA if the noise is fluctuating or intermittent, such as from backup or car alarms, or passing sirens or train horns. Outdoors the thresholds are about 15 dBA higher due to higher ambient noise levels outdoors than indoors, which result from a lack of building attenuation.

#### **Sleep Disturbance**

Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above 45 dBA have been shown to affect sleep.

Typical structural attenuation is 12-17 dBA with open windows depending on the relative size and the degree of openness of windows in relation to wall area in a given room.. With closed windows in good condition (i.e., properly sealed and not damaged), the noise attenuation factor is around 20 dBA for older dwellings and 25 dBA for newer dwellings. Speech and sleep interference within residential uses would therefore be possible under the exterior noise conditions shown in Table 7.

Table 7 Speech and Sleep Interference Thresholds

State of Exterior Noise	Window Position	Speech Interference threshold	Sleep Interference threshold
Steady	Open	57 to 62 dBA	47 to 52 dBA
Steady	Closed	65 to 70 dBA	55 to 60 dBA
Fluctuating	Open	67 to 72 dBA	57 to 62 dBA
Fluctuating	Closed	75 to 80 dBA	65 to 70 dBA

Project-related construction activities would result in temporary noise increases at adjacent or nearby sensitive receptors. Construction noise levels would vary at any given receptor depending on the construction phase, equipment type, duration of use, distance between the noise source and receptor, and the presence or absence of barriers between the noise source and receptor. For this noise analysis, construction noise levels were first estimated for proposed daytime construction and nighttime construction activities and then compared to the speech interference or sleep disturbance thresholds, as appropriate. For daytime construction noise, the duration of exposure at any given receptor was considered in determining the impact’s significance. Temporary exposure of a sensitive receptor to construction noise during the daytime at levels above the 70 dBA speech interference threshold for 10 days or less is considered to be a less-than-significant impact. However, activities at schools could be disrupted if speech interference effects occurred for even a day or two. Therefore, daytime exterior noise levels above 70 dBA or interior noise levels above 55 dBA for any duration are considered significant at schools. For nighttime construction, noise levels above the 60 dBA sleep disturbance threshold at residential uses for even one night is considered to be a significant impact.

#### 4.1.2 Vibration Thresholds

A considerable amount of research has been done to correlate vibrations from single events such as dynamite blasts with architectural and structural damage; however, “safe” levels for continuous vibrations generated by construction equipment are not well defined (Hendricks 2004). No commonly accepted standard for construction vibration has been established.

Most construction vibration references identify the threshold at which minor cosmetic damage can occur, defined generally as causing the formation of hairline fractures in interior plaster or surfaces and/or the dusting of existing fractures. Other thresholds identify the level at which more significant cosmetic damage occurs, or at which structural damage occurs. The single-event source impact (impact pile driving, for example) thresholds are higher than continuous source standards (vibratory equipment). Continuous source thresholds are typically about half of the threshold for single-event sources before causing the same damage. The thresholds also vary by building type, with lower thresholds applying to older homes (most commonly pre-1950) when homes were constructed with non-engineered wood and plaster as well as unreinforced masonry.

## NOISE AND VIBRATION TECHNICAL STUDY

To assess the cosmetic damage potential from ground vibration induced by construction equipment, Caltrans (2013) synthesized the various vibration references to develop construction vibration threshold criteria, as shown in Table 8. Per Table 8, EBMUD has selected the “Older Residential Structure” category as the CEQA significance threshold for minor cosmetic damage to property. The limits for minor cosmetic damage would be 0.3 in/sec PPV for continuous sources and 0.5 in/sec PPV single-event sources. The “Older Residential Structure” category was selected as the threshold because most of the houses within the vicinity of the proposed project would either be classified as modern industrial/commercial buildings, new residential structures, and older residential structures. Therefore, a CEQA threshold of 0.3 in/sec PPV would protect the vast majority of structures and property from minor cosmetic damage from vibration.

Historic buildings are likely located adjacent to the project. Damage from vibration can impact the historical significance of a building (see Section 3.5 Cultural Resources for a discussion of historical resources and regulatory requirements pertaining thereto). The threshold at which vibration can impact the historical significance of a building is greater than the threshold at which vibration can cause minor cosmetic damage to a historic building. Major cosmetic damage would need to occur such as visible cracking and deterioration of exterior plaster or masonry or breaking of glass in order for the project to have a potentially significant impact on the historical significance of a building. Minor cosmetic damage, as identified as occurring for “Historic and Some Old Buildings” in Table 8, would not be considered a significant impact to the historical significance of a building. For the historic buildings anticipated in the project areas, major cosmetic damage is not anticipated at levels below 0.4 in/sec PPV (Hendricks 2004). The threshold for potential impacts to the historical significance of buildings would, therefore, be at 0.4 in/sec PPV for buildings greater than 50 years old.

Table 8      Vibration Thresholds for Minor Cosmetic Damage Potential

Category	Continuous Source PPV (in/sec)	Single-Event Source PPV (in/sec)
Extremely Fragile Historic Buildings, Ruins, Ancient Monuments <sup>1</sup>	0.08	0.12
Fragile Buildings <sup>1</sup>	0.1	0.2
Historic and Some Old Buildings <sup>2</sup>	0.25	0.5
Older Residential Structures <sup>3</sup>	0.3	0.5
New Residential Structures	0.5	1.0
Modern Industrial/Commercial Buildings	0.5	2.0



## NOISE AND VIBRATION TECHNICAL STUDY

Category	Continuous Source PPV (in/sec)	Single-Event Source PPV (in/sec)
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Notes:

1. There are no extremely fragile historic buildings, ruins, ancient monuments, or fragile buildings within the vicinity of the proposed project; therefore, this category is not relevant to the proposed project
2. Few if any structures that are susceptible to minor cosmetic damage from vibration at levels lower than 0.3 in/sec PPV are anticipated along the pipeline alignments.
3. This threshold was chosen as the CEQA significance threshold for the proposed project because it would be protective of the vast majority of structures along the pipeline alignment.

*Source: Caltrans 2013*

### 4.2 APPROACH TO ANALYSIS

Project implementation would result in temporary increases in construction noise in the vicinity of the crossings and approach pipeline alignments. The noise impact assessment evaluates short-term (temporary) impacts associated with the construction of three new water transmission crossings and associated pipeline segments in the cities of Oakland and Alameda. Potential impacts are assessed considering several factors, including the proximity of project-related noise sources to sensitive receptors; typical noise levels associated with construction equipment; the potential for construction noise levels to interfere with daytime and nighttime activities (e.g., speech interference, sleep disturbance); the duration that sensitive receptors would be affected; and whether proposed activities would occur outside the construction time limits specified in local ordinances or would exceed local ordinance noise limits. Ambient noise levels in the project vicinity (see Table 4 above) were taken into consideration when determining the mitigation measures (i.e., mitigation performance is judged in relation to ambient noise levels).

The impact assessment for vibration evaluates the potential for construction to result in excessive groundborne vibration. Groundborne noise can also be experienced inside buildings or structures but is the result of vibrations produced outside of the building and transmitted as ground vibration between the source and receiver. Because the proposed noise- and vibration-generating construction activities associated with the proposed project would involve techniques that generate airborne noise and surface vibration (i.e., pavement cutting, excavation, vibratory sheet pile driving, bore and jack, HDD, and paving) any potential groundborne noise from construction activities would be imperceptible; therefore, no impact related to groundborne noise would occur, and this topic is not discussed further. The analysis of groundborne vibration impacts uses standard analytical methodologies, such as estimating vibration levels at sensitive receptors for a given vibration source and setback distance, comparing the estimated vibration levels with recommended limits or significance thresholds, determining potentially significant impacts on nearby sensitive receptors, and providing mitigation where applicable.

For operational noise, impacts are typically assessed by evaluating the noise-generation potential of project facilities, determining the proximity of facilities to sensitive receptors, and comparing operational noise levels with noise ordinance limits at the nearest receptors. The

primary sources of noise typically associated with the operation of water facilities include pumps and electrical facilities (substations, transformers, and emergency generators). The proposed project does not include any such noise sources. The proposed project would not result in any permanent surface operations that would introduce new sources of noise or vibration. Thus, no impact related to operational noise would occur, and this topic is not discussed further.

#### 4.3 NOISE IMPACTS AND RECOMMENDED MITIGATION MEASURES

Table 9 presents the estimated project related daytime construction noise levels along the pipeline alignments at the closest sensitive receptors based on distance, expected equipment type and duration of equipment use. The table is organized by construction activity and equipment associated with each activity (i.e., Principal Noise Sources). The table indicates maximum noise levels ( $L_{max}$ ) at 50 feet for the equipment expected to be used during construction and the average ( $L_{eq}$ ) noise level adjusted for distance and usage. For the purposes of this analysis the  $L_{eq}$  is considered equivalent to the median hourly noise level ( $L_{50}$ ). The adjusted  $L_{eq}$  noise level was calculated based on the distance to the closest noise sensitive receptors and the estimated duration of equipment operation using the Roadway Construction Noise Model (RCNM) version.1.1. The RNCM includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed from an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The adjusted  $L_{eq}$  noise level was then compared to the ordinance daytime noise limits. The table provides a determination of significance for both short term (10 days or less) and long term (more than 10 days) construction activities for noise-generating associated with each of the three project crossings. Table 9 also includes the noise levels after implementation of Mitigation Measure NOI-1. Implementation of Mitigation Measure NOI-1 would reduce noise levels by 5 dBA through the implementation of source control measures and 10 dBA through the implementation of barrier control measures. Noise from open trench construction, pipeline abandonments, and pipeline laydown would be reduced by 5 dBA through the implementation of source control measures. Noise levels from jack and bore construction and HDD would be reduced by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA). Table 9 identifies if noise levels exceed the pertinent noise ordinance or the speech interference threshold after the noise reduction from Mitigation Measure NOI-1.

Table 10 presents the estimated project-related *nighttime* construction noise levels along the pipeline alignments for potential nighttime construction activities that may be required when pipelines are connected to existing pipelines during portions of the HDD operations and when the new casing and pipeline are pulled through each crossing. Table 10 has the organization and basic content of Table 9, but the significance thresholds are based on ordinance nighttime noise limits and the sleep disturbance threshold. Table 10 identifies the noise levels from nighttime construction activities before and after noise reductions from Mitigation Measure NOI-1.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #1</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA &gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
Oakland Side: Closest Residential Receptors north of Estuary Park and on 2nd, 4th, Oak and Madison Streets (10 ft.)	Open Trench and Abandonment	Concrete/Industrial Saws	90	96	<10 days	Yes	91	SU	No	LS
		Jackhammer	89	96	<10 days	Yes	91	SU	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	Yes	84	SU	No	LS
	Open Trench Construction Pipeline Connections Abandonment and Replacement	Vibratory sheet pile Driver	95	102	<10 days	Yes	97	SU	No	LS
		Excavator	81	91	<10 days	Yes	86	SU	No	LS
		Hot Tapping Machine	78	89	<10 days	Yes	84	SU	No	LS
		Tapping Machine Motor/Generator	81	92	<10 days	Yes	87	SU	No	LS
		Tractors/Loaders/Backhoes	79	89	<10 days	Yes	84	SU	No	LS
		Dewatering Pumps	78	92	<10 days	Yes	87	SU	No	LS
		Various Trucks (dump, flatbed, water)	74	84	<10 days	Yes	79	LSMI	No	LS
		Repaving	Cement and Mortar Mixers	83	89	<10 days	Yes	84	SU	No
	Paver		77	88	<10 days	Yes	83	SU	No	LS
	Paving Equipment		76	86	<10 days	Yes	81	SU	No	LS
	Roller		80	87	<10 days	Yes	82	SU	No	LS
	Tractors/Loaders/Backhoes		79	89	<10 days	Yes	84	SU	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #1 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA&gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA&gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Oakland Side:</b> Closest Residential Receptors north of Estuary Park (150 ft.)	<b>Jack and Bore under railroad at Oak Street</b>	Vibratory sheet pile Driver	95	79	<10 days	No	64	LS	No	LS
		Bore/Drill Rig	84	68	>10 days	Yes	53	LSMI	No	LS
		Excavator	81	68	>10 days	Yes	53	LSMI	No	LS
		Tractors/Loaders/Backhoes	79	66	>10 days	Yes	51	LSMI	No	LS
		Dump Truck	76	63	>10 days	No	48	LS	No	LS
		Paver	77	65	>10 days	No	50	LS	No	LS
		Roller	80	64	>10 days	No	49	LS	No	LS
<b>Oakland Side:</b> Closest Residential Receptors on Alice Street (40 ft.)	<b>Abandonment of Existing Pipeline between Alice Street and Marina Village</b>	Concrete/Industrial Saws	90	86	< 10 days	Yes	81	SU	No	LS
		Jackhammer	89	85	< 10 days	Yes	80	LSMI	No	LS
		Excavator	81	79	< 10 days	No	74	LS	No	LS
		Vibratory sheet pile Driver	95	90	< 10 days	Yes	85	SU	No	LS
		Tractors/Loaders/Backhoes	80	78	< 10 days	No	73	LS	No	LS
		Cement and Mortar Mixers	83	77	< 10 days	No	72	LS	No	LS
		Paver	77	77	< 10 days	No	72	LS	No	LS
Roller	80	76	< 10 days	No	71	LS	No	LS		

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from jack and bore and HDD by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA). The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #1 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA &gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Alameda Side:</b> Closest Receptors Marina Village Office/Commercial Uses (60 ft)	<b>Abandonment of Existing Pipeline between Alice Street and Marina Village</b>	Concrete/Industrial Saws	90	81	< 10 days	No	76	LS	No	LS
		Jackhammer	89	80	< 10 days	No	75	LS	No	LS
		Excavator	81	75	< 10 days	No	70	LS	No	LS
		Vibratory sheet pile Driver	95	86	< 10 days	No	81	LS	No	LS
		Tractors/Loaders/Backhoes	80	74	< 10 days	No	69	LS	No	LS
		Cement and Mortar Mixers	83	73	< 10 days	No	68	LS	No	LS
		Paver	77	74	< 10 days	No	69	LS	No	LS
Roller	80	71	< 10 days	No	66	LS	No	LS		
<b>Oakland Side:</b> Closest Residential Receptors north of Estuary Park (65 ft)	<b>Drilling, Casing: HDD Entry</b>	Excavator	81	74	>10 days	Yes	59	LSMI	Yes	LSMI
		Tractors/Loaders/Backhoes	80	73	>10 days	Yes	58	LSMI	Yes	LSMI
		Bore/Drill Rig	84	78	>10 days	Yes	63	LSMI	Yes	LSMI
		Slurry Plant	78	76	>10 days	Yes	61	LSMI	Yes	LSMI
		Pick-Crane	81	70	>10 days	Yes	55	LSMI	No	LS
Generator Set	81	75	>10 days	Yes	60	LSMI	Yes	LSMI		
<b>Alameda Side:</b> Closest Receptors Marina Village Office/Commercial Uses (70 ft)	<b>Drilling, Casing: HDD Insertion</b>	Excavator	81	74	>10 days	No	59	LS	Yes	LSMI
		Tractors/Loaders/Backhoes	80	72	>10 days	No	57	LS	Yes	LSMI
		Bore/Drill Rig	84	77	>10 days	No	62	LS	Yes	LSMI
		Slurry Plant	78	75	>10 days	No	60	LS	Yes	LSMI
		Pick-Crane	81	70	>10 days	No	55	LS	No	LS
Generator Set	81	75	>10 days	No	60	LS	Yes	LSMI		

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from jack and bore and HDD by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA). The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #1</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA&gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA&gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Alameda Side:</b> Closest Receptors Office/Commercial Uses (30 ft)	<b>Pipe Laydown and Assembly</b>	Pumps	81	82	< 10 days	No	77	LS	No	LS
		Welders	74	74	<10 days	No	69	LS	No	LS
		Cement and Mortar Mixers (Grouting)	83	79	<10 days	No	74	LS	No	LS
		Flatbed Truck	74	75	<10 days	No	70	LS	No	LS
		Pick-Crane	81	77	<10 days	No	72	LS	No	LS
<b>Alameda Side:</b> Closest Residential Receptors on Sherman Street (10 ft.)	<b>Open Trench</b>	Concrete/Industrial Saws	90	96	< 10 days	No	91	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
	<b>Open Trench Construction and Pipeline Connections</b>	Vibratory sheet pile Driver	95	102	< 10 days	No	97	LS	No	LS
		Excavator	81	91	<10 days	No	86	LS	No	LS
		Hot Tapping Machine	78	89	<10 days	No	84	LS	No	LS
		Tapping Machine Motor/Generator	81	92	<10 days	No	87	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
		Dewatering Pumps	78	92	<10 days	No	87	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	84	<10 days	No	79	LS	No	LS
	<b>Repaving</b>	Cement and Mortar Mixers	83	89	< 10 days	No	84	LS	No	LS
		Pavers	77	88	<10 days	No	83	LS	No	LS
		Paving Equipment	76	86	<10 days	No	81	LS	No	LS
		Rollers	80	87	<10 days	No	82	LS	No	LS
Tractors/Loaders/Backhoes		80	89	<10 days	No	84	LS	No	LS	

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2		
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10-day duration?	Significance Determination	
<b>Crossing #1</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA &gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA &gt;10 days</i>									
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>									
Oakland Side: Closest Residential Receptors north of Estuary Park (65 ft)	Exploratory Geotechnical Borings near HDD Entry Pit	Truck Mounted Drill Rig	79	68	<10 days	No	63	LS	No	LS	
		Various Trucks (dump, flatbed, water)	74	70	<10 days	No	65	LS	No	LS	
Alameda Side: Closest Receptors Marina Village Office/Commercial Uses (70 ft)	Exploratory Geotechnical Borings near HDD Insertion Pit	Truck Mounted Drill Rig	79	67	<10 days	No	62	LS	No	LS	
		Various Trucks (dump, flatbed, water)	74	69	<10 days	No	64	LS	No	LS	

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from geotechnical borings by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, L <sub>max</sub> at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2		
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination	
<b>Crossing #1</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA &gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA &gt;10 days</i>									
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>									
Oakland Side: Closest Residential Receptors north of Estuary Park (150 ft.)	Exploratory Geotechnical Borings near Jack and Bore Pits under railroad at Oak Street	Truck Mounted Drill Rig	79	62	<10 days	No	57	LS	No	LS	
		Various Trucks (dump, flatbed, water)	74	60	<10 days	No	55	LS	No	LS	
Oakland Inner Harbor Marina live-aboard (50 ft.)	Exploratory Geotechnical Borings within the Oakland Inner Harbor	Hammering for Casing <sup>2</sup>	83	76	<10 days	No	76 <sup>5</sup>	LS	No	LS	
		Drill Rig <sup>2</sup>	73	73	<10 days	No	73 <sup>5</sup>	LS	No	LS	
		Vessel Engine <sup>3</sup>	N/A <sup>4</sup>	76	<10 days	No	76 <sup>5</sup>	LS	No	LS	

Notes: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from geotechnical borings by 5 dBA through the implementation of source control measures.

<sup>2</sup> The noise from conducting the hammering and the drilling for the in-channel geotechnical borings was identified in a memorandum prepared by the Washington State Department of Transportation (Washington Department of Transportation 2007)

<sup>3</sup> The engine for the vessel would be a Twin Detroit 671 engine; the specifications of the engine indicate that the noise of the engine would be 100 dBA at 1 meter, without inlet and exhaust. It is likely that the dBA used here is conservative and that the engine would be quieter, since it would not be exposed (Detroit Diesel Corporation 2016).

<sup>4</sup> The L<sub>max</sub> was unavailable in the engine specifications, only the L<sub>eq</sub> was provided (Detroit Diesel Corporation 2016).

<sup>5</sup> No mitigation would be utilized because the impact would be less than significant.



NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #2</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Alameda Side: Closest Residential Receptors on Peach Street and San Jose Avenue (10 ft.)</b>	<b>Open Trench</b>	Concrete/Industrial Saws	90	96	< 10 days	No	91	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
	<b>Open Trench Construction and Pipeline Connections</b>	Vibratory sheet pile Driver	95	102	< 10 days	No	97	LS	No	LS
		Excavator	81	91	<10 days	No	86	LS	No	LS
		Hot Tapping Machine	78	89	<10 days	No	84	LS	No	LS
		Tapping Machine Motor/Generator	81	92	<10 days	No	87	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
		Dewatering Pumps	78	92	<10 days	No	87	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	84	<10 days	No	79	LS	No	LS
	<b>Paving - Open Trench</b>	Cement and Mortar Mixers	83	89	< 10 days	No	84	LS	No	LS
		Paver	77	88	<10 days	No	83	LS	No	LS
		Paving Equipment	76	86	<10 days	No	81	LS	No	LS
		Roller	80	87	<10 days	No	82	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #2 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Alameda Side:</b> Closest Residential Receptors at end of Peach Street (30 ft.)	<b>Jack and Bore under Otis Street</b>	Vibratory sheet pile Driver	95	92	>10 days	No	77	LS	Yes	SU
		Bore/Drill Rig	84	82	>10 days	No	67	LS	Yes	LSMI
		Excavator	81	81	>10 days	No	66	LS	Yes	LSMI
		Tractors/Loaders/Backhoes	80	80	>10 days	No	65	LS	Yes	LSMI
		Dump Truck	76	77	>10 days	No	62	LS	Yes	LSMI
		Paver	77	79	>10 days	No	64	LS	Yes	LSMI
		Roller	80	78	>10 days	No	63	LS	Yes	LSMI
<b>Alameda Side:</b> Closest Residential Receptors on Bridgeview Isle. (150 ft)	<b>Drilling, Casing: HDD Entry</b>	Excavator	81	67	>10 days	No	52	LS	No	LS
		Tractors/Loaders/Backhoes	79	66	>10 days	No	51	LS	No	LS
		Bore/Drill Rig	84	70	>10 days	No	55	LS	No	LS
		Slurry Plant	78	68	>10 days	No	53	LS	No	LS
		Pick-Crane	81	63	>10 days	No	48	LS	No	LS
		Generator Set	81	68	>10 days	No	53	LS	No	LS
<b>Bay Island Side:</b> Closest Residential Receptors on Centre Court (40 ft)	<b>Drilling, Casing: HDD Insertion</b>	Excavator	81	79	>10 days	No	64	LS	Yes	LSMI
		Tractors/Loaders/Backhoes	80	78	>10 days	No	63	LS	Yes	LSMI
		Bore/Drill Rig	84	82	>10 days	No	67	LS	Yes	LSMI
		Slurry Plant	78	80	>10 days	No	65	LS	Yes	LSMI
		Pick-Crane	81	75	>10 days	No	60	LS	Yes	LSMI
		Generator Set	81	80	>10 days	No	65	LS	Yes	LSMI

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from jack and bore and HDD by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #2</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Alameda Side:</b> Closest Residential Receptors on Bridgeview Isle. (40 ft)	<b>Abandonment of the two Existing Pipelines on the north side of the Otis Street Bridge</b>	Concrete/Industrial Saws	90	86	< 10 days	No	81	LS	No	LS
		Jackhammer	89	84	< 10 days	No	79	LS	No	LS
		Excavator	81	79	< 10 days	No	74	LS	No	LS
		Vibratory sheet pile Driver	95	80	< 10 days	No	75	LS	No	LS
		Tractors/Loaders/Backhoes	80	78	< 10 days	No	73	LS	No	LS
		Cement and Mortar Mixers	83	77	< 10 days	No	72	LS	No	LS
		Paver	77	76	< 10 days	No	71	LS	No	LS
		Roller	80	76	< 10 days	No	71	LS	No	LS
<b>Bay Island Side:</b> Closest Residential Receptors on Centre Court (60 ft)	<b>Abandonment of the two Existing Pipelines on the north side of the Otis Street Bridge</b>	Concrete/Industrial Saws	90	81	< 10 days	No	82	LS	No	LS
		Jackhammer	89	80	< 10 days	No	75	LS	No	LS
		Excavator	81	75	< 10 days	No	70	LS	No	LS
		Vibratory sheet pile Driver	95	86	< 10 days	No	81	LS	No	LS
		Tractors/Loaders/Backhoes	80	74	< 10 days	No	69	LS	No	LS
		Cement and Mortar Mixers	83	73	< 10 days	No	68	LS	No	LS
		Paver	77	73	< 10 days	No	68	LS	No	LS
		Roller	80	71	< 10 days	No	66	LS	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

## NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 1 day duration? <sup>2</sup>	Significance Determination
<b>Crossing #2 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
Bay Island Side: Closest Receptors Centre Ct. Residences & Earhart Elementary School (40 ft)	Pipe Laydown and Assembly	Pumps	81	80	< 10 days	No	65	LSMI	Yes	LSMI <sup>1</sup>
		Welders	74	72	<10 days	No	57	LS	Yes	LSMI <sup>1</sup>
		Cement and Mortar Mixers (Grouting)	83	77	<10 days	No	62	LS	Yes	LSMI <sup>1</sup>
		Flatbed Truck	74	72	<10 days	No	57	LS	Yes	LSMI <sup>1</sup>
		Pick-Crane	81	74	<10 days	No	59	LS	Yes	LSMI <sup>1</sup>

Note: <sup>1</sup> The incorporation of Mitigation Measure Noise-1 would reduce the impact from pipeline laydown to less than significant through the implementation of administrative measures to schedule the operation of heavy equipment (including pumps, generators with no noise enclosures, tractors, loaders, backhoes, cement trucks) when the classroom windows facing or perpendicular to construction activities are closed and students are indoors; windows reduce outdoor noise by an average of 15 dBA.

<sup>2</sup> The Speech Interference threshold at schools limits levels to 70 dBA for more than 1 day. Pipe Laydown and Assembly adjacent to Earhart Elementary School would exceed this limit.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, L <sub>max</sub> at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 1 day duration? <sup>2</sup>	Significance Determination
<b>Crossing #2</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Alameda Side:</b> Closest Residential Receptors on Bridgeview Isle. (150 ft)	<b>Exploratory Geotechnical Borings near HDD Entry Pit</b>	Truck Mounted Drill Rig	79	62	<10 days	No	57	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	60	<10 days	No	55	LS	No	LS
<b>Bay Island Side:</b> Closest Residential Receptors on Centre Court (40 ft)	<b>Exploratory Geotechnical Borings near HDD Insertion Pit</b>	Truck Mounted Drill Rig	79	74	<10 days	No	69	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	72	<10 days	No	67	LS	No	LS
<b>Alameda Side:</b> Closest Residential Receptors at end of Peach Street (30 ft.)	<b>Exploratory Geotechnical Borings near Jack and Bore Pits under Otis Street</b>	Truck Mounted Drill Rig	79	83	<10 days	No	78	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	74	<10 days	No	69	LS	No	LS
<b>San Leandro Bay Channel</b> Residential Receptors on Bridgeview Isle (50 ft.)	<b>Exploratory Geotechnical Borings within the San Leandro Bay Channel</b>	Hammering for Casing <sup>2</sup>	83	76	<10 days	No	76 <sup>5</sup>	LS	No	LS
		Drill Rig <sup>2</sup>	73	73	<10 days	No	73 <sup>5</sup>	LS	No	LS
		Vessel Engine <sup>3</sup>	N/A <sup>4</sup>	76	<10 days	No	76 <sup>5</sup>	LS	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from geotechnical borings by 5 dBA through the implementation of source control measures.

<sup>2</sup> The noise from conducting the hammering and the drilling for the in-channel geotechnical borings was identified in a memorandum prepared by the Washington State Department of Transportation (Washington Department of Transportation 2007)

<sup>3</sup> The engine for the vessel would be a Twin Detroit 671 engine; the specifications of the engine indicate that the noise of the engine would be 100 dbas at 1 meter, without inlet and exhaust. It is likely that the dBA used here is conservative and that the engine would be quieter, since it would not be exposed (Detroit Diesel Corporation 2016).

<sup>4</sup> The L<sub>max</sub> was unavailable in the engine specifications, only the Leq was provided (Detroit Diesel Corporation 2016).

<sup>5</sup> No mitigation would be utilized because the impact would be less than significant.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA&gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
Oakland Side: Closest Residential Receptors on Derby Avenue & Ford Street (10 ft.)	Open Trench	Concrete/Industrial Saws	90	96	< 10 days	Yes	91	SU	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	Yes	84	SU	No	LS
	Open Trench Construction and Pipeline Connections	Vibratory sheet pile Driver	95	102	< 10 days	Yes	97	SU	No	LS
		Excavator	81	91	<10 days	Yes	86	SU	No	LS
		Hot Tapping Machine	78	89	<10 days	Yes	84	SU	No	LS
		Tapping Machine Motor/Generator	81	92	<10 days	Yes	87	SU	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	Yes	84	SU	No	LS
		Dewatering Pumps	78	92	<10 days	Yes	87	SU	No	LS
		Various Trucks (dump, flatbed, water)	74	84	<10 days	Yes	79	LSMI	No	LS
	Repaving	Cement and Mortar Mixers	83	89	< 10 days	Yes	84	SU	No	LS
		Paver	77	88	<10 days	Yes	83	SU	No	LS
		Paving Equipment	76	86	<10 days	Yes	81	SU	No	LS
		Roller	80	87	<10 days	Yes	82	SU	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	Yes	84	SU	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3 (continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Oakland Side:</b> Closest Residential Receptors on Derby Avenue (40 ft)	<b>Drilling, Casing: HDD Entry</b>	Excavator	81	79	>10 days	Yes	64	LSMI	Yes	LSMI
		Tractors/Loaders/Backhoes	80	77	>10 days	Yes	62	LSMI	Yes	LSMI
		Bore/Drill Rig	84	82	>10 days	Yes	67	SU	Yes	LSMI
		Slurry Plant	78	80	>10 days	Yes	65	LSMI	Yes	LSMI
		Pick-Crane	81	75	>10 days	Yes	60	LSMI	Yes	LSMI
		Generator Set	81	82	>10 days	Yes	67	SU	Yes	LSMI
<b>Alameda Side:</b> Closest Residential Receptors on Broadway (40 ft)	<b>Drilling, Casing: HDD Insertion</b>	Excavator	81	79	>10 days	No	64	LS	Yes	LSMI
		Tractors/Loaders/Backhoes	79	77	>10 days	No	62	LS	Yes	LSMI
		Bore/Drill Rig	84	82	>10 days	No	67	LS	Yes	LSMI
		Slurry Plant	78	80	>10 days	No	65	LS	Yes	LSMI
		Pick-Crane	81	74	>10 days	No	59	LS	Yes	LSMI
		Generator Set	81	80	>10 days	No	65	LS	Yes	LSMI
<b>Alameda Side:</b> Closest Residential Receptors on Broadway (25 ft)	<b>Pipe Laydown and Assembly</b>	Pumps	81	84	< 10 days	No	79	LS	No	LS
		Welders	74	76	<10 days	No	71	LS	No	LS
		Cement and Mortar Mixers (Grouting)	83	81	<10 days	No	76	LS	No	LS
		Flatbed Truck	74	76	<10 days	No	71	LS	No	LS
		Pick-Crane	81	79	<10 days	No	74	LS	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from jack and bore and HDD by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA). The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
Alameda Side: Closest Residential Receptors on Everett Street, Clement, Eagle and Lincoln Avenues (10 ft.)	Open Trench	Concrete/Industrial Saws	90	96	< 10 days	No	91	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
	Open Trenching, Pipeline Connections and Replacement	Vibratory sheet pile Driver	95	102	< 10 days	No	97	LS	No	LS
		Excavator	81	91	<10 days	No	86	LS	No	LS
		Hot Tapping Machine	78	89	<10 days	No	84	LS	No	LS
		Tapping Machine Motor/Generator	81	92	<10 days	No	87	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
		Dewatering Pumps	78	92	<10 days	No	87	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	84	<10 days	No	79	LS	No	LS
		Repaving	Cement and Mortar Mixers	83	89	< 10 days	No	84	LS	No
	Pavers		77	88	<10 days	No	83	LS	No	LS
	Paving Equipment		76	86	<10 days	No	81	LS	No	LS
	Rollers		80	87	<10 days	No	82	LS	No	LS
	Tractors/Loaders/Backhoes		80	89	<10 days	No	84	LS	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.



NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
Alameda side: Closest Residential Receptors on Everett Street (10 ft)	Jack and Bore under Tilden Way at Everett Street as Required by Traffic Mitigation	Vibratory Sheet Pile Driver	95	102	>10 days	No	87	LS	Yes	SU
		Bore/Drill Rig	84	92	>10 days	No	77	LS	Yes	SU
		Excavator	81	91	>10 days	No	76	LS	Yes	SU
		Tractors/Loaders/Backhoes	80	90	>10 days	No	75	LS	Yes	SU
		Dump Truck	76	87	>10 days	No	72	LS	Yes	SU
		Paver	77	89	>10 days	No	74	LS	Yes	SU
		Roller	80	88	>10 days	No	73	LS	Yes	SU

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from jack and bore and HDD by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA &gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Oakland Side:</b> Closest Receptors Commercial/Retail Uses (70 ft)	<b>Abandonment of the Existing Pipeline between 23<sup>rd</sup> Avenue and Blanding Street</b>	Concrete/Industrial Saws	90	80	< 10 days	No	75	LS	No	LS
		Jackhammer	89	79	<10 days	No	74	LS	No	LS
		Excavator	81	74	< 10 days	No	69	LS	No	LS
		Vibratory Sheet Pile Driver	95	85	<10 days	Yes	80	<b>LSMI</b>	No	LS
		Tractors/Loaders/Backhoes	80	72	<10 days	No	67	LS	No	LS
		Cement and Mortar Mixers	83	72	<10 days	No	67	LS	No	LS
		Paver	77	71	<10 days	No	66	LS	No	LS
Roller	80	70	<10 days	No	565	LS	No	LS		
<b>Alameda Side:</b> Closest Commercial/Retail Uses (25 ft.)	<b>Abandonment of the Existing Pipeline between 23<sup>rd</sup> Avenue and Blanding Street</b>	Concrete/Industrial Saws	90	89	<10 days	No	84	LS	No	LS
		Jackhammer	89	88	< 10 days	No	83	LS	No	LS
		Excavator	81	83	<10 days	No	78	LS	No	LS
		Vibratory Sheet Pile Driver	95	94	<10 days	No	89	LS	No	LS
		Tractors/Loaders/Backhoes	80	81	<10 days	No	76	LS	No	LS
		Cement and Mortar Mixers	83	81	<10 days	No	76	LS	No	LS
		Paver	77	80	< 10 days	No	75	LS	No	LS
Roller	80	79	<10 days	No	74	LS	No	LS		

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Oakland Side:</b> Closest residential receptors on 29 <sup>th</sup> Avenue (10 ft.)	<b>Abandonment of the Existing Pipeline near the Park Street Bridge</b>	Concrete/Industrial Saws	90	97	< 10 days	Yes	92	SU	No	LS
		Jackhammer	89	96	<10 days	Yes	91	SU	No	LS
		Excavator	81	91	< 10 days	Yes	86	SU	No	LS
		Vibratory Sheet Pile Driver	95	102	<10 days	Yes	97	SU	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	Yes	84	SU	No	LS
		Cement and Mortar Mixers	83	89	<10 days	Yes	84	SU	No	LS
		Paver	77	88	<10 days	Yes	83	SU	No	LS
Roller	80	87	<10 days	Yes	82	SU	No	LS		
<b>Alameda Side:</b> Closest Receptors Commercial/Retail Uses (10 ft)	<b>Abandonment of the Existing Pipeline near the Park Street Bridge</b>	Concrete/Industrial Saws	90	97	<10 days	No	92	LS	No	LS
		Jackhammer	89	96	< 10 days	No	91	LS	No	LS
		Excavator	81	91	<10 days	No	86	LS	No	LS
		Vibratory Sheet Pile Driver	95	102	<10 days	No	97	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
		Cement and Mortar Mixers	83	89	<10 days	No	84	LS	No	LS
		Paver	77	88	< 10 days	No	83	LS	No	LS
Roller	80	87	<10 days	No	82	LS	No	LS		

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise 80 dBA &lt;10 days, 65 dBA &gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Oakland Side:</b> Closest Residential Receptors on Derby Avenue (100 ft.)	<b>Abandonment of Derby Street Pipeline</b>	Concrete/Industrial Saws	90	77	< 10 days	No	72	LS	No	LS
		Jackhammer	89	76	<10 days	No	71	LS	No	LS
		Excavator	81	71	< 10 days	No	66	LS	No	LS
		Vibratory Sheet Pile Driver	95	82	<10 days	<b>Yes</b>	77	<b>LMSI</b>	No	LS
		Tractors/Loaders/Backhoes	80	69	<10 days	No	64	LS	No	LS
		Cement and Mortar Mixers	83	69	<10 days	No	64	LS	No	LS
		Paver	77	68	<10 days	No	63	LS	No	LS
		Roller	80	67	<10 days	No	62	LS	No	LS
<b>Alameda Side:</b> Closest Receptors Commercial/Retail Uses (40 ft.)	<b>Abandonment of Derby Street Pipeline</b>	Concrete/Industrial Saws	90	85	<10 days	No	80	LS	No	LS
		Jackhammer	89	84	< 10 days	No	79	LS	No	LS
		Excavator	81	79	<10 days	No	74	LS	No	LS
		Vibratory Sheet Pile Driver	95	90	<10 days	No	85	LS	No	LS
		Tractors/Loaders/Backhoes	80	77	<10 days	No	72	LS	No	LS
		Cement and Mortar Mixers	83	77	<10 days	No	72	LS	No	LS
		Paver	77	76	< 10 days	No	71	LS	No	LS
		Roller	80	75	<10 days	No	70	LS	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA&gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA&gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
<b>Oakland Side:</b> Closest Receptors Commercial/Retail Uses (50 ft.)	<b>Abandonment of the Existing Pipeline near the High Street Bridge</b>	Concrete/Industrial Saws	90	83	<10 days	Yes	78	LSMI	No	LS
		Jackhammer	89	82	<10 days	Yes	77	LSMI	No	LS
		Excavator	81	77	<10 days	No	72	LS	No	LS
		Vibratory Sheet Pile Driver	95	88	<10 days	Yes	83	SU	No	LS
		Tractors/Loaders/Backhoes	80	75	<10 days	No	70	LS	No	LS
		Cement and Mortar Mixers	83	75	<10 days	No	70	LS	No	LS
		Paver	77	74	<10 days	No	69	LS	No	LS
Roller	80	73	<10 days	No	68	LS	No	LS		
<b>Alameda Side:</b> Closest residential receptors on High Street (50 ft.)	<b>Abandonment of the Existing Pipeline near the High Street Bridge</b>	Concrete/Industrial Saws	90	97	<10 days	No	92	LS	No	LS
		Jackhammer	89	96	<10 days	No	91	LS	No	LS
		Excavator	81	91	<10 days	No	86	LS	No	LS
		Vibratory Sheet Pile Driver	95	102	<10 days	No	97	LS	No	LS
		Tractors/Loaders/Backhoes	80	89	<10 days	No	84	LS	No	LS
		Cement and Mortar Mixers	83	89	<10 days	No	84	LS	No	LS
		Paver	77	88	<10 days	No	83	LS	No	LS
Roller	80	87	<10 days	No	82	LS	No	LS		

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction, pipeline laydown, and pipeline abandonments by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3</b> (Continued)		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA&gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA&gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
Oakland Side: Closest Residential Receptors on Derby Avenue (40 ft)	Exploratory Geotechnical Borings near HDD Entry Pit	Truck Mounted Drill Rig	79	74	<10 days	No	69	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	72	<10 days	No	67	LS	No	LS
Alameda Side: Closest Residential Receptors on Broadway (40 ft)	Exploratory Geotechnical Borings near HDD Insertion Pit	Truck Mounted Drill Rig	79	74	<10 days	No	69	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	72	<10 days	No	67	LS	No	LS
Alameda side: Closest Residential Receptors on Everett Street (10 ft)	Exploratory Geotechnical Borings near jack and boring pits under Tilden Way at Everett Street, as required by Traffic Mitigation	Truck Mounted Drill Rig	79	93	<10 days	No	88	LS	No	LS
		Various Trucks (dump, flatbed, water)	74	84	<10 days	No	79	LS	No	LS

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from geotechnical borings by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 9 Estimated Daytime Construction Noise (Continued)

Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, L <sub>max</sub> at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Daytime Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 70 dBA Speech Interference Threshold & 10 day duration?	Significance Determination
<b>Crossing #3 (Continued)</b>		<i>Oakland Ordinance Limits for Daytime Construction Noise Residential 80 dBA &lt;10 days, 65 dBA&gt;10 days, Commercial 85 dBA &lt;10 days, 70 dBA&gt;10 days</i>								
		<i>The Alameda Ordinance contains no noise limits for Construction between 7am &amp; 7pm.</i>								
Tidal Canal Residential Receptors on Derby Avenue (100 ft.)	Exploratory Geotechnical Borings within the San Leandro Bay Channel	Hammering for Casing <sup>2</sup>	83	70	<10 days	No	70 <sup>5</sup>	LS	No	LS
		Drill Rig <sup>2</sup>	73	67	<10 days	No	67 <sup>5</sup>	LS	No	LS
		Vessel Engine <sup>3</sup>	N/A <sup>4</sup>	70	<10 days	No	70 <sup>5</sup>	LS	No	LS

Notes: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from geotechnical borings by 5 dBA through the implementation of source control measures.  
<sup>2</sup> The noise from conducting the hammering and the drilling for the in-channel geotechnical borings was identified in a memorandum prepared by the Washington State Department of Transportation (Washington Department of Transportation 2007)  
<sup>3</sup> The engine for the vessel would be a Twin Detroit 671 engine; the specifications of the engine indicate that the noise of the engine would be 100 dBA at 1 meter, without inlet and exhaust. It is likely that the dBA used here is conservative and that the engine would be quieter, since it would not be exposed (Detroit Diesel Corporation 2016).  
<sup>4</sup> The L<sub>max</sub> was unavailable in the engine specifications, only the L<sub>eq</sub> was provided (Detroit Diesel Corporation 2016).  
<sup>5</sup> No mitigation would be utilized because the impact would be less than significant.

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #1</b>		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Noise Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
<b>Oakland Side:</b> Closest Residential Receptors north of Estuary Park & on 5th, Jackson and Madison Streets (10 ft.)	<b>Pipeline Connections</b>	Hot Tapping Machine	78	89	<10 days	Yes	74	SU	Yes	SU
		Tapping Machine Motor/Generator	81	92	<10 days	Yes	77	SU	Yes	SU
		Tractors/Loaders/Backhoes	79	89	<10 days	Yes	74	SU	Yes	SU
		Dewatering Pumps	78	92	<10 days	Yes	77	SU	Yes	SU
		Various Trucks (dump, flatbed, water)	74	84	<10 days	Yes	69	SU	Yes	SU
<b>Oakland Side:</b> Closest Residential Receptors north of Estuary Park (65 ft)	<b>Casing pull through HDD Entry</b>	Various Trucks (dump, flatbed, water)	74	69	<10 days	Yes	54	SU	Yes	LSMI
		Drill Rig	84	78	<10 days	Yes	63	SU	Yes	SU
		Pick-Crane	81	70	<10 days	Yes	55	SU	Yes	LSMI
<b>Alameda Side:</b> Closest Receptors Marina Village Office/Commercial Uses (70 ft)	<b>Casing pull through HDD Insertion</b>	Various Trucks (dump, flatbed, water)	74	69	<10 days	Yes	54	SU	Yes	LSMI
		Bore/Drill Rig	84	77	<10 days	Yes	62	SU	Yes	SU
		Pick-Crane	81	70	<10 days	Yes	55	SU	Yes	LSMI

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from HDD and pipeline connections by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).



NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #1</b> (continued)		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
Alameda Side: Closest Residential Receptors on Sherman St. & Lincoln Ave. (10 ft.)	Pipeline Connections	Hot Tapping Machine	78	89	<10 days	Yes	74	SU	Yes	SU
		Tapping Machine Motor/Generator	81	92	<10 days	Yes	77	SU	Yes	SU
		Tractors/Loaders/Backhoes	79	89	<10 days	Yes	74	SU	Yes	SU
		Dewatering Pumps	78	92	<10 days	Yes	77	SU	Yes	SU
		Various Trucks (dump, flatbed, water)	74	84	<10 days	Yes	69	SU	Yes	SU

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from HDD and pipeline connections by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #1 (continued)</b>		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Noise Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
Oakland Side: Closest Residential Receptors at the intersection of Madison Street and 6 <sup>th</sup> Street, 7 <sup>th</sup> Street, and 8 <sup>th</sup> Street (15 ft)	Open Trench Construction	Concrete/ Industrial Saws	90	92	<10 days	Yes	87	SU	Yes	SU
		Tractors/ Loaders/ Backhoes	80	85	<10 days	Yes	80	SU	Yes	SU
		Excavator	81	87	<10 days	Yes	82	SU	Yes	SU
		Tractors/ Loaders/ Backhoes	79	85	<10 days	Yes	80	SU	Yes	SU
		Dewatering Pumps	78	88	<10 days	Yes	83	SU	Yes	SU
		Various Trucks (dump, flatbed, water)	74	80	<10 days	Yes	75	SU	Yes	SU
	Repaving	Cement and Mortar Mixers	83	85	<10 days	Yes	80	SU	Yes	SU
		Paver	77	84	<10 days	Yes	79	SU	Yes	SU
		Paving Equipment	76	82	<10 days	Yes	77	SU	Yes	SU
		Roller	80	83	<10 days	Yes	78	SU	Yes	SU
Tractors/ Loaders/ Backhoes		79	85	<10 days	Yes	80	SU	Yes	SU	

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #1</b> (continued)		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Noise Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
<b>Oakland Side:</b> Closest Residential Receptors west of the intersection of 5th Street and Jackson Street (130 ft)	<b>Abandonment of the Existing Pipeline on 5th Street</b>	Concrete/Industrial Saws	90	75	<10 days	Yes	70	SU	Yes	SU
		Jackhammer	89	74	<10 days	Yes	69	SU	Yes	SU
		Excavator	81	69	<10 days	Yes	64	SU	Yes	SU
		Vibratory Sheet Pile Driver	95	80	<10 days	Yes	75	SU	Yes	SU
		Tractors/Loaders/ Backhoes	80	67	<10 days	Yes	62	SU	Yes	SU
		Cement and Mortar Mixers	83	66	<10 days	Yes	61	SU	Yes	SU
		Paver	77	65	<10 days	Yes	60	SU	Yes	SU
		Roller	80	65	<10 days	Yes	60	SU	Yes	SU

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #2</b>		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Noise Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
<b>Alameda Side:</b> Closest Residential Receptors on Peach Street and San Jose Avenue (10 ft.)	<b>Pipeline Connections</b>	Hot Tapping Machine	78	89	<10 days	Yes	74	SU	Yes	SU
		Tapping Machine Motor/Generator	81	92	<10 days	Yes	77	SU	Yes	SU
		Tractors/Loaders/Backhoes	79	89	<10 days	Yes	74	SU	Yes	SU
		Dewatering Pumps	78	92	<10 days	Yes	77	SU	Yes	SU
		Various Trucks (dump, flatbed, water)	74	84	<10 days	Yes	69	SU	Yes	SU
<b>Alameda Side:</b> Closest Residential Receptors on Bridgeview Isle. (150 ft)	<b>Casing pull through HDD Entry</b>	Various Trucks (dump, flatbed, water)	74	61	<10 days	Yes	46	LSMI	Yes	LSMI
		Bore/Drill Rig	84	70	<10 days	Yes	55	SU	Yes	LSMI
		Pick-Crane	81	63	<10 days	Yes	48	LSMI	Yes	LSMI

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from HDD and pipeline connections by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #2</b> (continued)		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
<b>Bay Island Side:</b> Closest Residential Receptors on Centre Ct. (40 ft)	<b>Casing pull through HDD Insertion</b>	Various Trucks (dump, flatbed, water)	74	74	<10 days	Yes	59	SU	Yes	LSMI
		Bore/Drill Rig	84	82	<10 days	Yes	67	SU	Yes	SU
		Pick-Crane	81	75	<10 days	Yes	60	SU	Yes	SU
<b>Bay Island Side:</b> Closest Receptors Centre Ct. Residences & Earhart Elementary School (40 ft)	<b>Pipeline Connections</b>	Hot Tapping Machine	78	77	<10 days	Yes	62	SU	Yes	SU
		Tapping Machine Motor/Generator	81	80	<10 days	Yes	65	SU	Yes	SU
		Tractors/Loaders/Backhoes	79	77	<10 days	Yes	62	SU	Yes	SU
		Dewatering Pumps	78	80	<10 days	Yes	65	SU	Yes	SU
		Various Trucks (dump, flatbed, water)	74	74	<10 days	Yes	59	SU	Yes	LSMI

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from HDD and pipeline connections by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #2 (continued)</b>		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Noise Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
<b>Alameda Side:</b> Closest Residential Receptors at the intersection of High Street and San Jose Avenue (25 ft)	<b>Open Trench Construction</b>	Concrete/ Industrial Saws	90	88	<10 days	Yes	83	SU	Yes	SU
		Tractors/ Loaders/ Backhoes	80	81	<10 days	Yes	76	SU	Yes	SU
		Excavator	81	83	<10 days	Yes	78	SU	Yes	SU
		Tractors/ Loaders/ Backhoes	79	81	<10 days	Yes	76	SU	Yes	SU
		Dewatering Pumps	78	84	<10 days	Yes	79	SU	Yes	SU
		Various Trucks (dump, flatbed, water)	74	76	<10 days	Yes	71	SU	Yes	SU
	<b>Repaving</b>	Cement and Mortar Mixers	83	81	<10 days	Yes	76	SU	Yes	SU
		Paver	77	80	<10 days	Yes	75	SU	Yes	SU
		Paving Equipment	76	78	<10 days	Yes	73	SU	Yes	SU
		Roller	80	79	<10 days	Yes	74	SU	Yes	SU
Tractors/ Loaders/ Backhoes		79	81	<10 days	Yes	76	SU	Yes	SU	

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction by 5 dBA through the implementation of source control measures.

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2		
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination	
<b>Crossing #3</b>		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>									
		<i>Per the Alameda Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>									
<b>Oakland Side:</b> Closest Residential Receptors on Derby Avenue & Ford Street (10 ft.)	<b>Pipeline Connections</b>	Hot Tapping Machine	78	89	<10 days	Yes	74	SU	Yes	SU	
		Tapping Machine Motor/Generator	81	92	<10 days	Yes	77	SU	Yes	SU	
		Tractors/Loaders/Backhoes	79	89	<10 days	Yes	74	SU	Yes	SU	
		Dewatering Pumps	78	92	<10 days	Yes	77	SU	Yes	SU	
		Various Trucks (dump, flatbed, water)	74	84	<10 days	Yes	69	SU	Yes	SU	
<b>Alameda Side:</b> Closest Residential Receptors on Everett Street, Clement, Eagle and Lincoln Avenues (10 ft.)	<b>Pipeline Connections</b>	Hot Tapping Machine	78	89	<10 days	Yes	74	SU	Yes	SU	
		Tapping Machine Motor/Generator	81	92	<10 days	Yes	77	SU	Yes	SU	
		Tractors/Loaders/Backhoes	79	89	<10 days	Yes	74	SU	Yes	SU	
		Dewatering Pumps	78	92	<10 days	Yes	77	SU	Yes	SU	
		Various Trucks (dump, flatbed, water)	74	84	<10 days	Yes	69	SU	Yes	SU	

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from HDD and pipeline connections by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).

NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2		
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination	
<b>Crossing #3</b>		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>									
		<i>Per the Alameda Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>									
<b>Oakland Side:</b> Closest Residential Receptors on Derby Avenue (40 ft.)	<b>Casing pull through HDD Entry</b>	Various Trucks (dump, flatbed, water)	74	74	<10 days	Yes	59	SU	Yes	LSMI	
		Bore/Drill Rig	84	82	<10 days	Yes	67	SU	Yes	SU	
		Pick-Crane	81	75	<10 days	Yes	60	SU	Yes	SU	
<b>Alameda Side:</b> Closest Residential Receptors on Broadway (40 ft.)	<b>Casing pull through HDD Insertion</b>	Various Trucks (dump, flatbed, water)	74	74	<10 days	Yes	59	SU	Yes	LMSI	
		Bore/Drill Rig	84	82	<10 days	Yes	67	SU	Yes	SU	
		Pick-Crane	81	74	<10 days	Yes	59	SU	Yes	LSMI	

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 (described below) will reduce noise levels from HDD and pipeline connections by 15 dBA through the implementation of source control measures (5 dBA) and barriers (10 dBA).



NOISE AND VIBRATION TECHNICAL STUDY

Table 10 Estimated Nighttime Construction Noise (Continued)

Activity and Closest Noise Sensitive Receptor Location	Construction Activity	Principle Noise Sources	Reference Noise Level, Lmax at 50 feet	Leq Level Adjusted for Distance and Usage	Duration at Adjacent Noise Sensitive Receptors	Impact Noise-1			Impact Noise-2	
						Leq Exceeds Time or Noise Ordinance Limit?	Noise Reduction with Mitigation <sup>1</sup>	Significance Determination	Leq Exceeds 60 dBA Sleep Disturbance Threshold	Significance Determination
<b>Crossing #3 (continued)</b>		<i>Oakland Ordinance Limits for Nighttime Construction Noise: 45 dBA-20min/hr, 50 dBA-10min/hr, 55 dBA-5min/hr, 60 dBA-1min/hr, 65 dBA Lmax</i>								
		<i>Per the Alameda Noise Ordinance; because Nighttime Construction falls outside of the allowable hours for construction activities, it is limited by the noise standards contained in Section 4-10.4b of the Alameda Municipal Code. The nighttime allowable L50 levels of 50 dBA for residential and 60 dBA for commercial uses from Table I and II in this section were compared to the calculated Leq levels to evaluate nighttime noise impacts</i>								
Alameda Side: Closest Residential Receptors at the intersection of Tilden Way and Eagle Avenue (20 ft)	Open Trench Construction	Concrete/ Industrial Saws	90	90	<10 days	Yes	85	SU	Yes	SU
		Tractors/ Loaders/ Backhoes	80	83	<10 days	Yes	78	SU	Yes	SU
		Excavator	81	85	<10 days	Yes	80	SU	Yes	SU
		Tractors/ Loaders/ Backhoes	79	83	<10 days	Yes	78	SU	Yes	SU
		Dewatering Pumps	78	86	<10 days	Yes	81	SU	Yes	SU
		Various Trucks (dump, flatbed, water)	74	78	<10 days	Yes	73	SU	Yes	SU
	Repaving	Cement and Mortar Mixers	83	83	<10 days	Yes	78	SU	Yes	SU
		Paver	77	82	<10 days	Yes	77	SU	Yes	SU
		Paving Equipment	76	80	<10 days	Yes	75	SU	Yes	SU
		Roller	80	81	<10 days	Yes	76	SU	Yes	SU
Tractors/ Loaders/ Backhoes		79	83	<10 days	Yes	78	SU	Yes	SU	

Note: <sup>1</sup> The incorporation of Mitigation Measure NOI-1 will reduce noise levels from open trench construction by 5 dBA through the implementation of source control measures.

**Recommended Mitigation Measure NOI-1: Noise Control.**

EBMUD shall implement the noise control measures described below:

*Time Limits*

1. All construction activities shall be limited to the daytime weekday hours (7:00 a.m. - 7:00 p.m.) to the extent feasible. The HDD pullback operations, the pipeline connection work, and work in arterial intersections may extend or take place beyond these hours.
2. All haul and delivery truck operations shall be prohibited during the evening and nighttime hours (7:00 p.m. - 8:00 a.m.) to the extent feasible.
3. Equipment and vehicular activities (e.g., concrete saws, jackhammers, tractors, loaders, backhoes, excavators, pavers, rollers, and all other equipment identified in Tables 9 and 10) identified as generating noise levels in excess of an Leq of 65 dBA in the vicinity of residential uses or an Leq of 80 dBA in the vicinity commercial uses shall be limited to weekday hours between 8 a.m. – 7 p.m., and Saturdays between 8 a.m. - 5 p.m to the extent feasible.

*Noise Level Reduction*

EBMUD shall implement a combination of the following source control measures such that noise is reduced by a minimum of 5 dBA:

1. Best available noise-control techniques (including but not limited to mufflers, intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds) shall be used for all equipment and trucks to reduce construction noise impacts.
2. If impact equipment such as jack hammers, pavement breakers, and rock drills are proposed to be used during construction, hydraulically- or electric-powered equipment shall be used wherever feasible to avoid the noise associated with compressed-air exhaust from pneumatically powered tools. However, where use of pneumatically-powered tools is unavoidable, the construction crews shall place exhaust mufflers on the compressed-air exhaust and external jackets on the tools themselves where feasible.
3. If vibratory sheet piles are used for construction, pre-drill pile holes for shoring systems to eliminate or reduce noise and vibration from vibratory pile driving.
4. Stationary noise sources (e.g., pumps, compressors) shall be located as far from sensitive receptors as possible and practicable, and within the specified construction time limits. If they must be located near receptors, adequate muffling (with enclosures) shall be used. Enclosure openings or venting shall face away from sensitive receptors. A registered engineer qualified in noise control analysis and design shall design the enclosures.
5. If pipe-cutting equipment must be operated at pipeline tie-ins outside the hours of 8 a.m. - 7 p.m., temporary noise barriers or noise enclosures shall be used to

## NOISE AND VIBRATION TECHNICAL STUDY

minimize disturbance when construction occurs adjacent to residential uses.

Operation of trucks and noisier types of heavy equipment shall be minimized to the extent feasible.

EBMUD shall implement the following noise barrier measure, such that noise is reduced by 10 dBA:

6. Noise barriers (e.g., sound walls, sound curtains, etc.) shall be provided at the perimeter of HDD entry and insertion work areas and jack and bore construction sites.

### Administrative Controls

7. Residents located within one block of the project construction shall be notified at least 7 days in advance of extreme noise-generating activities, about the estimated duration of the activity and to update them prior to noise producing phases, such as open trench construction, pipeline connections, pipeline abandonment, HDD, or jack and bore construction.
8. Where pipeline construction zones are within 100 feet of school classrooms or childcare facilities (e.g., Earhart Elementary), construction crews shall coordinate with the school and schedule the operation of heavy equipment (including pumps, generators with no noise enclosures, tractors, loaders, backhoes, cement trucks) when the classroom windows facing or perpendicular to construction activities are closed, and students are indoors.
9. An EBMUD contact person shall be designated as a project liaison for responding to noise complaints during construction. The liaison's name and phone number shall be posted at construction areas and included in all advance notifications. The contact shall take steps to resolve complaints, which could include measuring noise levels, if necessary. The coordinator shall be available during normal business hours (8 a.m. - 5 p.m.) and shall work with residents and business owners and the construction crews to determine the noise problem and resolve conflicts.
10. Provide alternative lodging for residents, if requested, that are adversely affected by nighttime construction; this measure would only be used if nighttime construction occurs. EBMUD shall make a concerted attempt to notify residents located within one block of potential nighttime project construction at least 10 days in advance. Notified residents may request alternative lodging for the night(s) of the potential nighttime construction from EBMUD; alternative lodging shall consist of a standard room at a hotel located within 6 miles of the affected residence or as close as feasible. Alternative lodging shall be provided and approved by EBMUD the day before the known nighttime construction would occur, or sooner, based upon the types of construction activities that may occur during the nighttime hours (7:00 p.m. - 7:00 a.m.).
11. Noise monitoring will be conducted during HDD, jack and bore construction, and during the first 500 feet of open trench construction

4.4 VIBRATION IMPACTS AND RECOMMENDED MITIGATION MEASURES

Open trench construction, jack and bore construction, HDD, and pipeline abandonments for the proposed project would require the use of equipment that would generate groundborne vibration. Table 11 and Table 12 show the equipment, the types of activities that use the equipment, the maximum distances where a significant vibration impact would occur according to significance thresholds, including 0.5 in/sec PPV for single source vibrations and to 0.3 in/sec PPV for continuous vibrations. A significant impact occurs wherever a building is located within the maximum distance from the vibration source (see Table 11 and Table 12).

Table 11 Summary of Single-Source Vibration Impacts

Construction Activity	Principle Vibration Sources	Significance Threshold Range	
		Maximum Distance from Source to 0.5 in/sec PPV	Distance from closest building (feet)
Crossing #1			
Open Trench Construction	Clam Shovel Drop	14	10
HDD	Vibratory Pile Driver (Upper range)	32	65-70
	Vibratory Pile Driver (Upper range)	12	
	Clam shovel drop	14	
Abandonment of Existing Pipeline on 5th Street	Impact Pile Driver	32	20
	Clam shovel drop	14	
Abandonment of Existing Pipeline between Alice Street and Marina Village	Impact Pile Driver	32	40-60
	Clam shovel drop	14	
Crossing #2			
Open Trench Construction	Clam Shovel Drop	14	10
HDD	Vibratory Pile Driver (Upper range)	32	40-150
	Vibratory Pile Driver (Upper range)	12	
	Clam shovel drop	14	
Jack and Bore Construction under Otis Street	Impact Pile Driver	32	30
Abandonment of the two Existing Pipelines on the North Sides of the Otis Street Bridge	Impact Pile Driver	32	40-60
	Clam shovel drop	14	

## NOISE AND VIBRATION TECHNICAL STUDY

Construction Activity	Principle Vibration Sources	Significance Threshold Range Maximum Distance from Source to 0.5 in/sec PPV	Distance from closest building (feet)
<b>Crossing #3</b>			
Open Trench Construction	Clam Shovel Drop	14	10
HDD	Vibratory Pile Driver (Upper range)	32	40
	Vibratory Pile Driver (Upper range)	12	
	Clam shovel drop	14	
Abandonment of the Existing Pipeline Between 23 <sup>rd</sup> Avenue and Blanding Street	Impact Pile Driver	32	25-70
	Clam shovel drop	14	
Abandonment of the Existing Pipeline near the Park Street Bridge	Impact Pile Driver	32	10
	Clam shovel drop	14	
Abandonment of the Derby Street Pipeline	Impact Pile Driver	32	40-100
	Clam shovel drop	14	
Abandonment of the Existing Pipeline near the High Street Bridge	Impact Pile Driver	32	50
	Clam shovel drop	14	

NOISE AND VIBRATION TECHNICAL STUDY

Table 12 Summary of Continuous Vibration Impacts

Construction Activity	Principle Vibration Sources	Significance Threshold Range Maximum Distance from source to 0.3 in/sec PPV	Distance from closest building (feet)
Crossing #1			
Open Trench Construction	Vibratory Roller/Compactor	13	10
	Large Bulldozer	<10	
	Loaded Trucks	<10	
	Jackhammer	<10	
	Small bulldozer	<10	
HDD	Hydro Mill (slurry wall in soil)	<65-70	65-70
	Hydro Mill (slurry wall in rock)	<65-70	
	Vibratory Roller/Compactor	<65-70	
	Jet Grouting	<65-70	
	Large bulldozer	<65-70	
	Caisson drilling	<65-70	
	Loaded trucks	<65-70	
	Jackhammer	<65-70	
Small bulldozer	<65-70		
Jack and Bore Construction under Railroad at Oak Street	Hydro Mill (slurry wall in soil)	<30	30
	Hydro Mill (slurry wall in rock)	<30	
	Vibratory Roller/Compactor	<30	
	Large bulldozer	<30	
	Loaded trucks	<30	
	Jackhammer	<30	
	Small bulldozer	<30	
Abandonment of Existing Pipeline on 5th Street	Vibratory Pile Driver	<20	20
	Vibratory Roller/Compactor	<20	
	Hydro Mill (slurry wall in soil)	<20	
	Hydro Mill (slurry wall in rock)	<20	
	Vibratory Roller/Compactor	<20	
	Large bulldozer	<20	
	Loaded trucks	<20	
	Jackhammer	<20	
Small bulldozer	<20		

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Construction Activity	Principle Vibration Sources	Significance Threshold Range Maximum Distance from source to 0.3 in/sec PPV	Distance from closest building (feet)
Abandonment of Existing Pipeline between Alice Street and Marina Village	Vibratory Pile Driver	<40-60	40-60
	Vibratory Roller/Compactor	<40-60	
	Hydro Mill (slurry wall in soil)	<40-60	
	Hydro Mill (slurry wall in rock)	<40-60	
	Vibratory Roller/Compactor	<40-60	
	Large bulldozer	<40-60	
	Loaded trucks	<40-60	
	Jackhammer	<40-60	
	Small bulldozer	<40-60	
Crossing #2			
Open Trench Construction	Vibratory Roller/Compactor	13	10
	Large Bulldozer	<10	
	Loaded Trucks	<10	
	Jackhammer	<10	
	Small bulldozer	<10	
HDD	Hydro Mill (slurry wall in soil)	<40-150	40-150
	Hydro Mill (slurry wall in rock)	<40-150	
	Vibratory Roller/Compactor	<40-150	
	Jet Grouting	<40-150	
	Large bulldozer	<40-150	
	Caisson drilling	<40-150	
	Loaded trucks	<40-150	
	Jackhammer	<40-150	
	Small bulldozer	<40-150	
Jack and Bore Construction under Otis Street	Hydro Mill (slurry wall in soil)	<30	30
	Hydro Mill (slurry wall in rock)	<30	
	Vibratory Roller/Compactor	<30	
	Large bulldozer	<30	
	Loaded trucks	<30	
	Jackhammer	<30	
	Small bulldozer	<30	

NOISE AND VIBRATION TECHNICAL STUDY

Construction Activity	Principle Vibration Sources	Significance Threshold Range Maximum Distance from source to 0.3 in/sec PPV	Distance from closest building (feet)
Abandonment of the two Existing Pipelines on the North Sides of the Otis Street Bridge	Vibratory Pile Driver	<40-60	40-60
	Vibratory Roller/Compactor	<40-60	
	Hydro Mill (slurry wall in soil)	<40-60	
	Hydro Mill (slurry wall in rock)	<40-60	
	Vibratory Roller/Compactor	<40-60	
	Large bulldozer	<40-60	
	Loaded trucks	<40-60	
	Jackhammer	<40-60	
	Small bulldozer	<40-60	
Crossing #3			
Open Trench Construction	Vibratory Roller/Compactor	13	10
	Large Bulldozer	<10	
	Loaded Trucks	<10	
	Jackhammer	<10	
	Small bulldozer	<10	
HDD	Hydro Mill (slurry wall in soil)	<40	40
	Hydro Mill (slurry wall in rock)	<40	
	Vibratory Roller/Compactor	<40	
	Jet Grouting	<40	
	Large bulldozer	<40	
	Caisson drilling	<40	
	Loaded trucks	<40	
	Jackhammer	<40	
	Small bulldozer	<40	



NOISE AND VIBRATION TECHNICAL STUDY

Construction Activity	Principle Vibration Sources	Significance Threshold Range Maximum Distance from source to 0.3 in/sec PPV	Distance from closest building (feet)
Abandonment of the Existing Pipeline Between 23 <sup>rd</sup> Avenue and Blanding Street	Vibratory Pile Driver	<25-70	25-70
	Vibratory Roller/Compactor	<25-70	
	Hydro Mill (slurry wall in soil)	<25-70	
	Hydro Mill (slurry wall in rock)	<25-70	
	Vibratory Roller/Compactor	<25-70	
	Large bulldozer	<25-70	
	Loaded trucks	<25-70	
	Jackhammer	<25-70	
Abandonment of the Existing Pipeline near the Park Street Bridge	Vibratory Pile Driver	<10	10
	Vibratory Roller/Compactor	<10	
	Hydro Mill (slurry wall in soil)	<10	
	Hydro Mill (slurry wall in rock)	<10	
	Vibratory Roller/Compactor	<10	
	Large bulldozer	<10	
	Loaded trucks	<10	
	Jackhammer	<10	
Abandonment of the Derby Street Pipeline	Vibratory Pile Driver	<40-100	40-100
	Vibratory Roller/Compactor	<40-100	
	Hydro Mill (slurry wall in soil)	<40-100	
	Hydro Mill (slurry wall in rock)	<40-100	
	Vibratory Roller/Compactor	<40-100	
	Large bulldozer	<40-100	
	Loaded trucks	<40-100	
	Jackhammer	<40-100	
Small bulldozer	<40-100		

## NOISE AND VIBRATION TECHNICAL STUDY

Construction Activity	Principle Vibration Sources	Significance Threshold Range Maximum Distance from source to 0.3 in/sec PPV	Distance from closest building (feet)
Abandonment of the Existing Pipeline near the High Street Bridge	Vibratory Pile Driver	<50	50
	Vibratory Roller/Compactor	<50	
	Hydro Mill (slurry wall in soil)	<50	
	Hydro Mill (slurry wall in rock)	<50	
	Vibratory Roller/Compactor	<50	
	Large bulldozer	<50	
	Loaded trucks	<50	
	Jackhammer	<50	
	Small bulldozer	<50	

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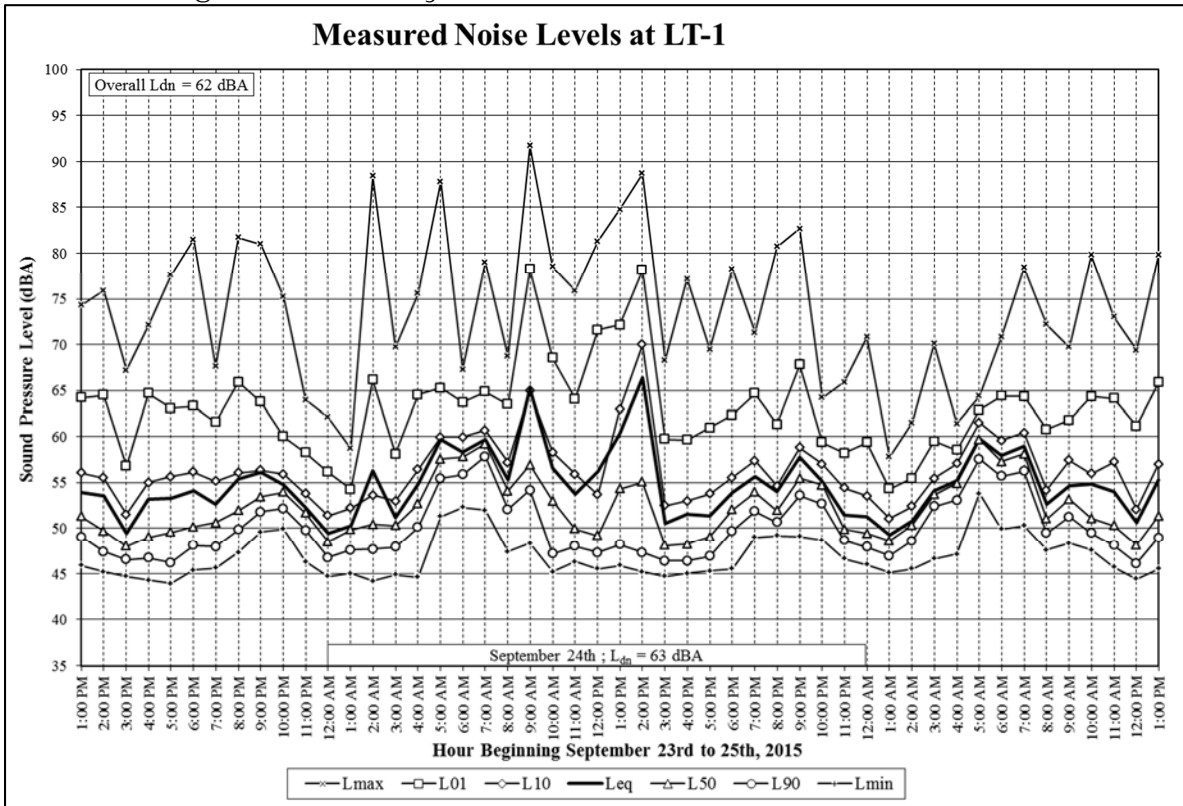
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APPENDIX A: LONG TERM NOISE MEASUREMENTS CHARTS

Figure A-1: Hourly Trend in Noise Levels at Location LT-1



NOISE AND VIBRATION TECHNICAL STUDY

Figure A-2: Hourly Trend in Noise Levels at Location LT-2

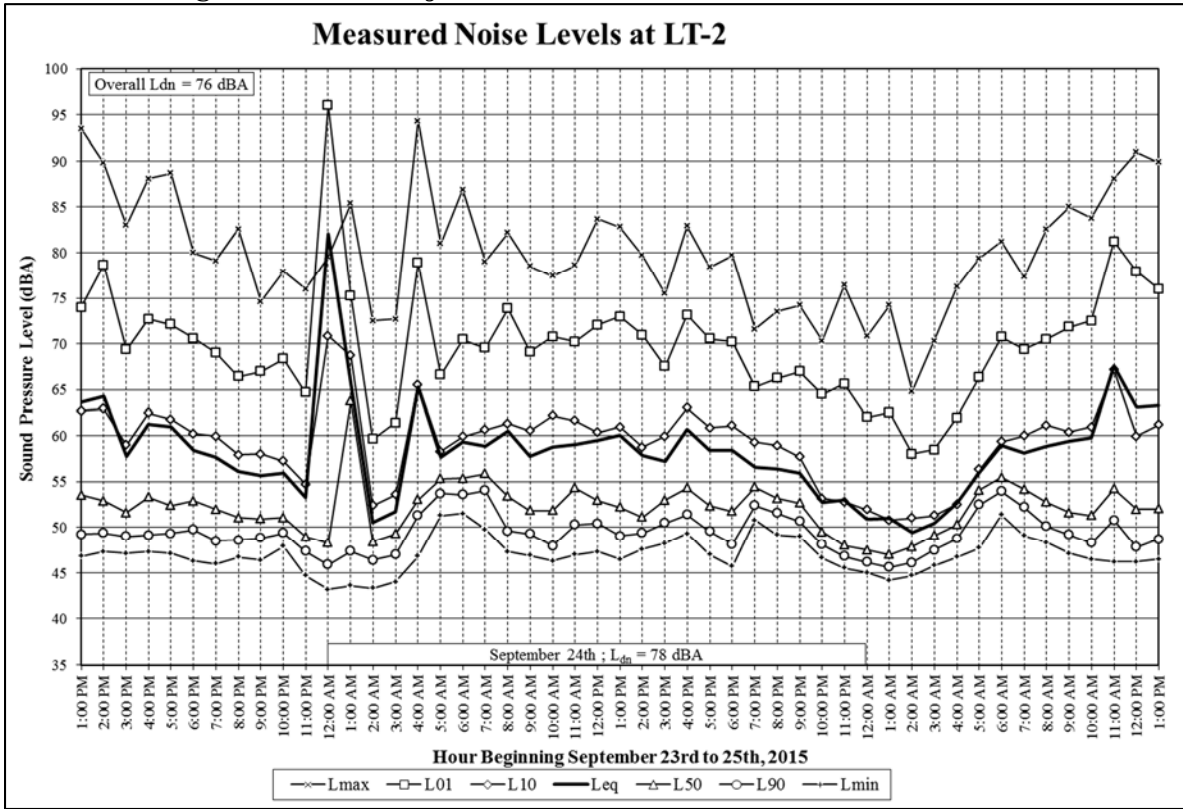
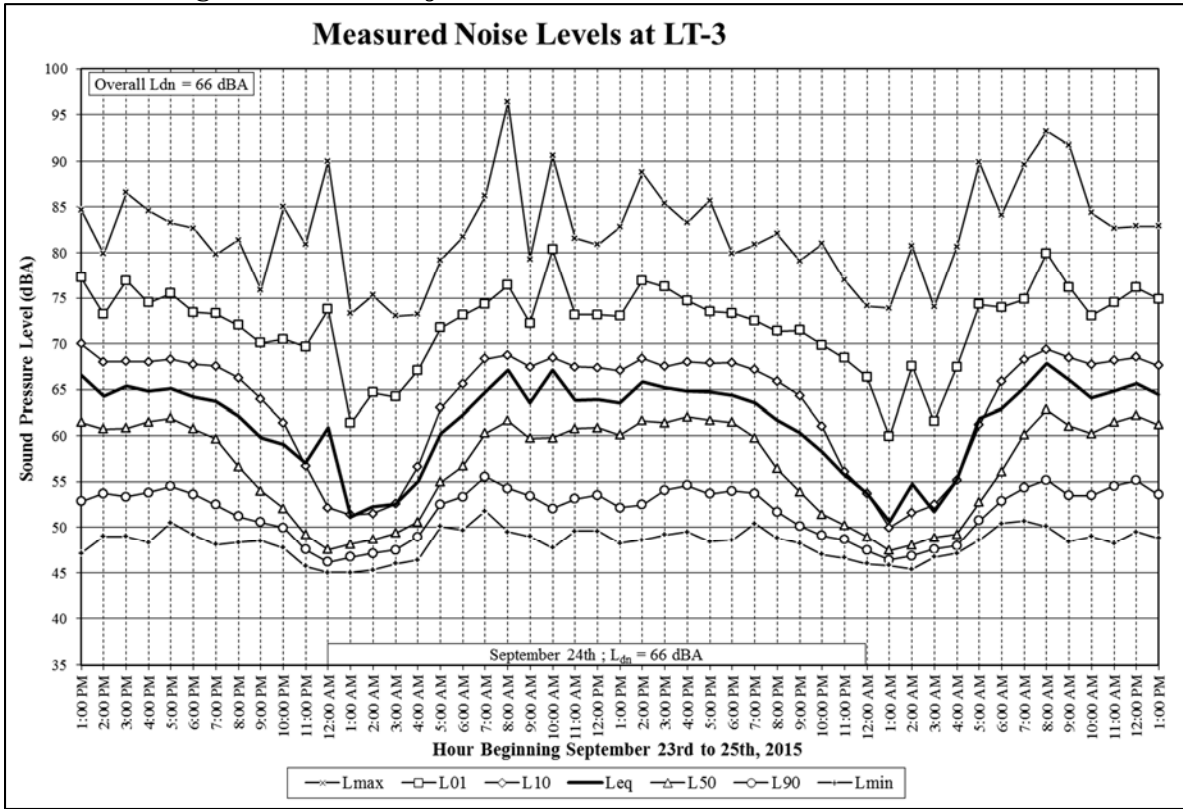
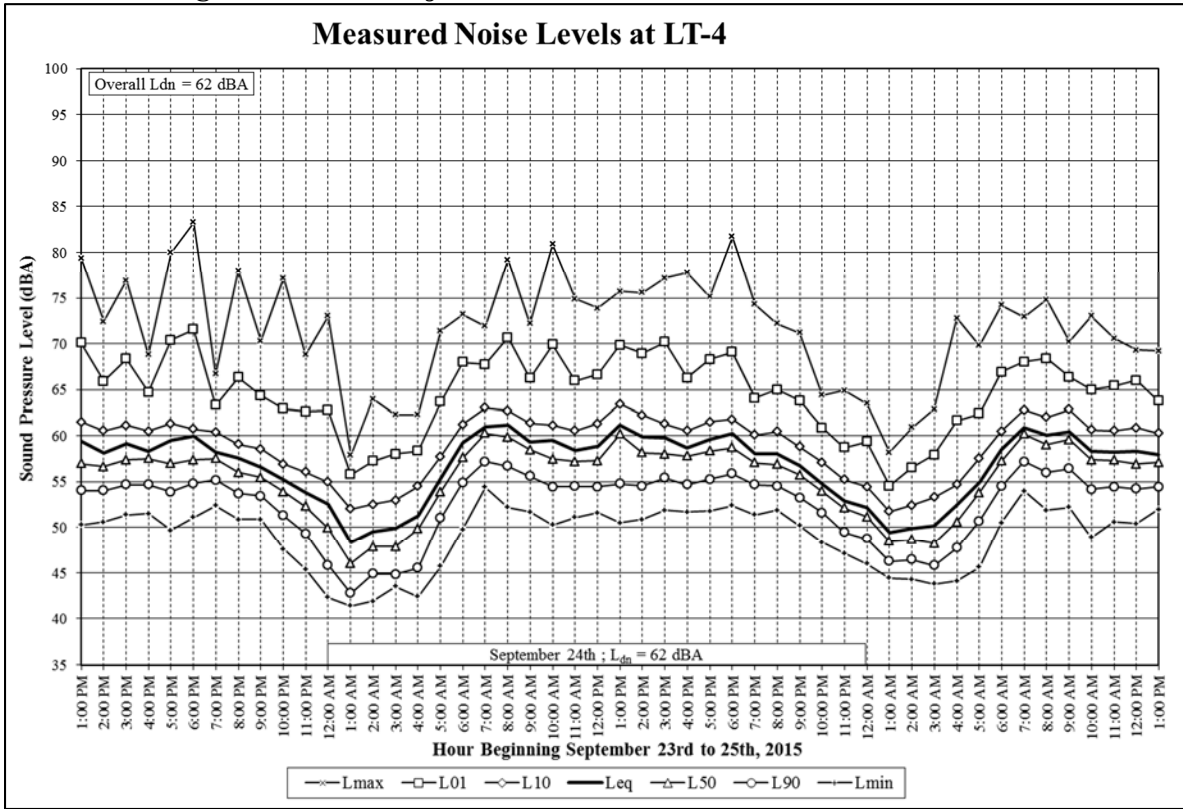


Figure A-3: Hourly Trend in Noise Levels at Location LT-3



NOISE AND VIBRATION TECHNICAL STUDY

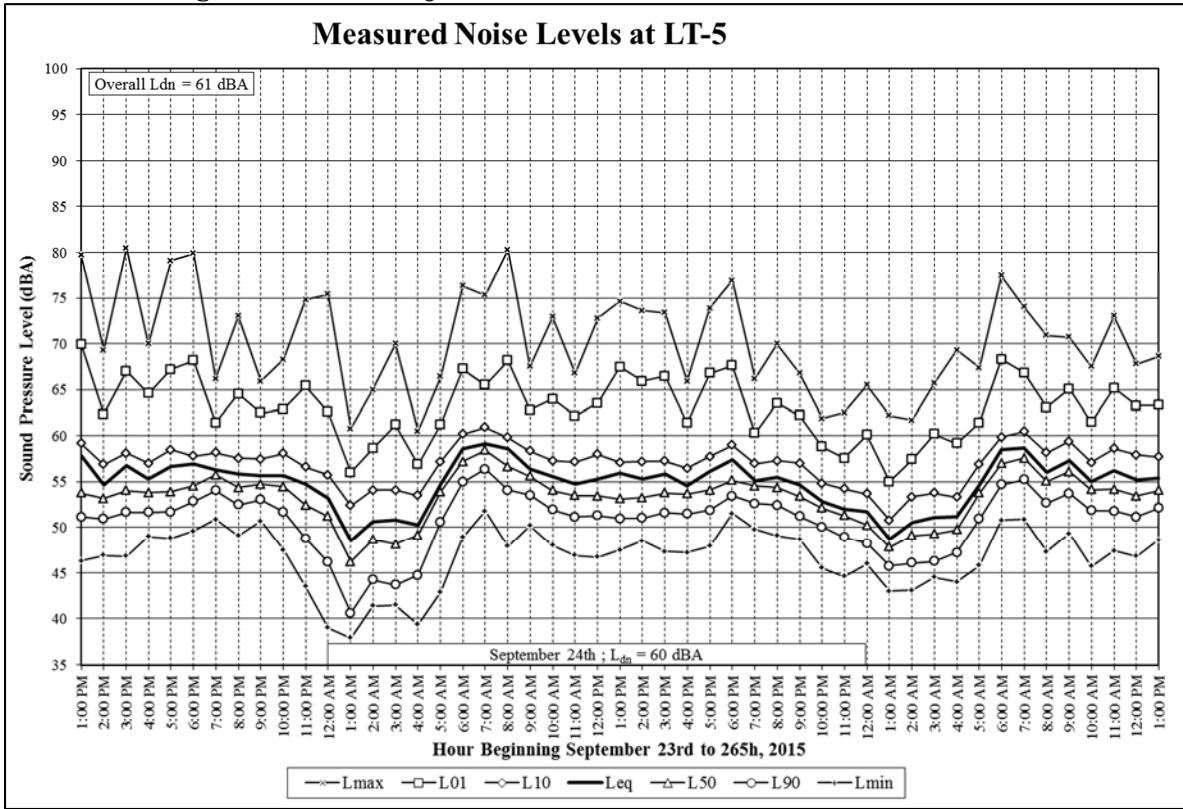
Figure A-4: Hourly Trend in Noise Levels at Location LT-4





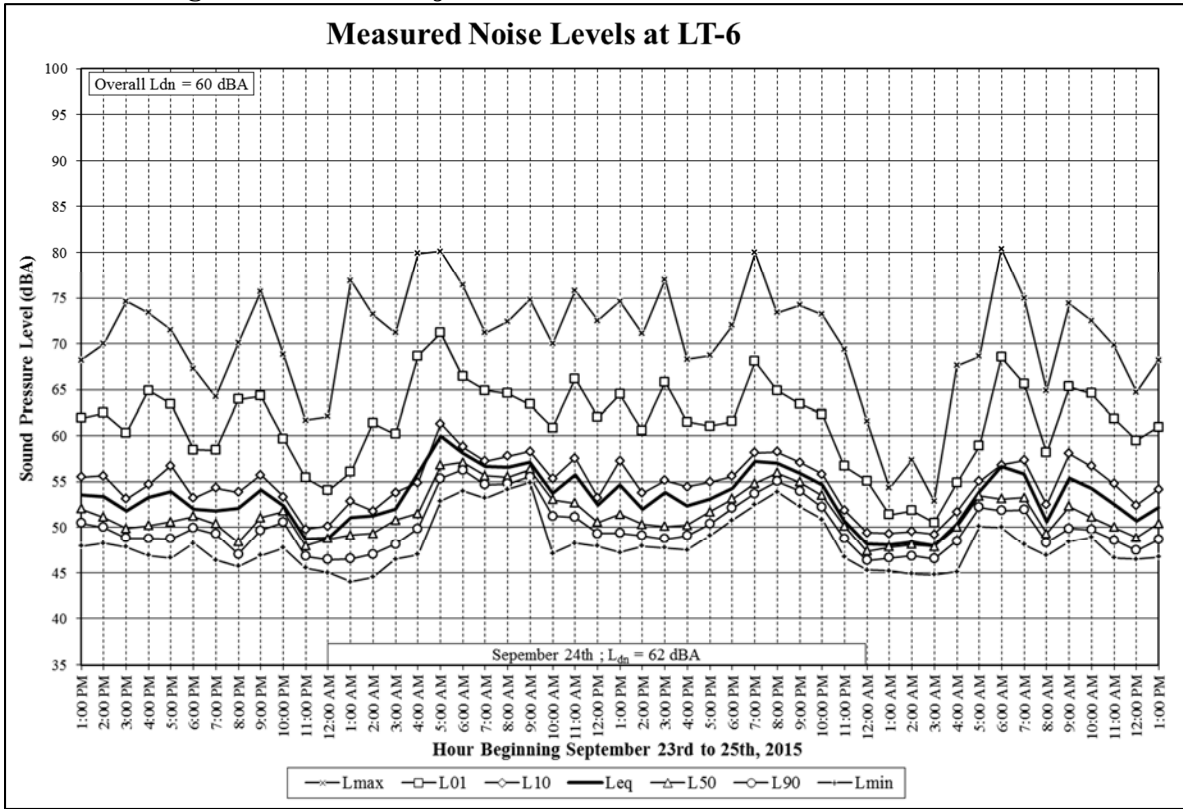
NOISE AND VIBRATION TECHNICAL STUDY

Figure A-5: Hourly Trend in Noise Levels at Location LT-5



NOISE AND VIBRATION TECHNICAL STUDY

Figure A-6: Hourly Trend in Noise Levels at Location LT-6



APPENDIX J:  
TRANSPORTATION AND TRAFFIC TECHNICAL REPORT

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# **Alameda- North Bay Farm Island Pipeline Crossings Project**

## **Transportation and Traffic Technical Report**

Prepared for:

**East Bay Municipal Utility  
District (EBMUD)**

Date:

**May 12, 2016**

Prepared by:



**ALAMEDA-NORTH BAY FARM ISLAND PIPELINE CROSSINGS PROJECT**

**TRANSPORTATION AND TRAFFIC TECHNICAL REPORT**

**Prepared For:**

**East Bay Municipal Utility District**

**375 11th Street**

**Oakland, CA 94607**

**Prepared By:**

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**1901 Olympic Boulevard, Suite 120**

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**35-5138-04 (#2020)**

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**APPENDIX**

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Separate Document



# 1.0 Introduction

This technical report provides an evaluation of temporary construction impacts related to transportation and traffic resulting from the proposed Alameda-North Bay Farm Island Pipeline Crossings Project (proposed project). The project study area encompasses portions of the Cities of Oakland and Alameda including both estuary and downtown areas where proposed pipeline crossings and trenching would occur (see Figure 1). This report identifies the regional and local roadway networks, intersections, pedestrian/bike routes, and transit service that could be affected by temporary construction traffic from the proposed project construction.

Key traffic operation issues include the temporary increases in construction, employee, and truck traffic and the disruption of traffic flows due to pipeline trenching and reduced roadway capacity during that trenching. Potential transit impacts include delays for bus service along pipeline routes. Pedestrian and bicycle impacts include access closures and/or bike lane closures. Finally, pipeline construction activities could temporarily eliminate curb parking along certain routes for periods of time. To the extent possible, alternative parking areas have been investigated for both on-street and construction staging. Finally, recommended mitigation measures have been developed as part of this technical impact analysis to address potential detour and traffic handling plans.

## 1.1 Crossings

Each pipeline crossing is described below.

- **Crossing #1.** Crossing #1, known as the Estuary Park–Marina Village Crossing, is approximately 2.3 miles long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Oakland Inner Harbor, and continue through Alameda to its connection point. One alternate route option for the replacement of an existing pipeline in Oakland is being considered (see Figure 2). Construction activities would occur within city streets, one business park parking lot (the Telecare Corporation), and Estuary Park.
- **Crossing #2.** Crossing #2, known as the Alameda–North Bay Farm Island Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines on Alameda Island, cross under the San Leandro Bay Channel, and continue on North Bay Farm Island to its connection point (see Figure 3). Construction activities would occur within city streets and Towata Park.
- **Crossing #3.** Crossing #3, known as the Derby Crossing, is approximately 1-mile long. The new pipeline would connect to existing transmission pipelines in Oakland, cross under the Tidal Canal, and continue in Alameda to its connection point. Project activities associated with Crossing #3 would include replacing an existing pipeline (see Figure 4). One alternate route option for open trench construction in Alameda is being considered. Construction activities would occur within city streets.

## 1.2 Alternative Alignment Options

This technical report analyzes two alternate transmission pipeline trenching options and one alternate location for a distribution pipeline replacement. The locations of these alternate alignment options are shown in Figures 2 and 4 and described below.

- **Crossing #1 alternate trench option.** Instead of using 2nd Street, the open trench construction and pipeline installation would occur along 3rd Street for one block, then along Oak Street for one block, and then would continue along the proposed alignment.
- **Crossing #1 alternate pipeline replacement option.** Instead of replacing the existing pipeline on 2nd Street between Madison Street and Oak Street, the pipeline on 3rd Street between Madison Street and Oak Street would be replaced.
- **Crossing #3 alternate trench option.** Instead of using Clement Avenue and a portion of Everett Street, open trench construction would occur on Broadway and then along Eagle Avenue until Everett Street, where pipeline installation would continue along the proposed alignment.

### 1.3 Project Construction

Table 1 includes a summary of the construction activities for the proposed project, including the equipment that would be used, the location where the activity would occur, and the dimensions of the construction activity.

Construction hours would typically be between 7 a.m. and 7 p.m.; however, longer construction hours (up to 24 hours per day) might be required when the proposed pipelines are connected to existing pipelines as well as to minimize service disruptions for water customers. Forty-eight-hour construction for one weekend would also be necessary for each HDD underwater pipeline crossing. Additional nighttime construction work could occur at traffic intersections, if required by encroachment permit conditions to minimize traffic impacts. If required, it is expected that nighttime intersection work would only occur at arterial streets such as High Street, Tilden Way, 5th Street, 6th Street, 7th Street, and 8th Street.

### 1.4 Operation and Maintenance

The proposed project would require routine operation and maintenance after construction, which is conducted under existing operations and maintenance procedures and protocols.

**Figure 1** Project Location



**Figure 2** Crossing #1 Alignment



**Figure 3** Crossing #2 Alignment



Figure 4 Crossing #3 Alignment



**TABLE 1  
CONSTRUCTION ACTIVITIES**

<b>Construction Method/Activity</b>	<b>Description</b>	<b>Equipment</b>	<b>Location</b>	<b>Approximate Dimensions</b>
Transmission Pipeline Open Trench Construction	<p>Open trench construction consists of the following activities:</p> <ul style="list-style-type: none"> <li>• Utility location/potholing</li> <li>• Saw-cutting the pavement</li> <li>• Excavating a trench</li> <li>• Removing and stockpiling soils</li> <li>• Installing the pipeline</li> <li>• Backfilling the trench and applying temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>	<ul style="list-style-type: none"> <li>• Pavement saws &amp; jack hammers</li> <li>• Excavators, backhoes, front-end loaders</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Dewatering pumps</li> <li>• Soil-cement mixing machines</li> <li>• Paving equipment (asphalt and/or concrete trucks, vibratory compactors, pavers, and rollers)</li> <li>• Water trucks</li> </ul>	Throughout project roads for Crossing #1, #2, and #3 (see Figures 2, 3, and 4)	<p>Construction corridor: 25 feet</p> <p>Maximum depth of trench: 8 feet</p> <p>Width of trench: 4 feet</p>
Transmission Pipeline Jack and Bore	<p>The jack and bore method would be used twice during project implementation: at Crossing #1 to install pipeline beneath a segment of railroad track on Oak Street, and at Crossing #2 to install pipeline beneath Otis Drive so that Otis Drive could remain open during construction. The jack and bore method would consist of the following activities:</p> <ul style="list-style-type: none"> <li>• Excavating a temporary jacking and receiving pit</li> <li>• Constructing a temporary jacking platform in the jacking pit</li> </ul>	<ul style="list-style-type: none"> <li>• Horizontal boring machine or auger &amp; hydraulic jack</li> <li>• Excavators</li> <li>• Dump trucks</li> <li>• Flatbed delivery trucks</li> <li>• Backhoes &amp; front-end loaders</li> <li>• Dewatering pumps</li> </ul>	<p><b>Crossing #1:</b> The pits are located on (1) Oak Street, north of Embarcadero West, just north of the railroad crossing and on (2) Oak Street, south of Embarcadero West, just south of the railroad crossing (see Figure 2)</p> <p><b>Crossing #2:</b> The pits are located on (1) Peach Street, which divides Towata Park in half, south of Otis Drive and on (2) Peach Street north of Otis Drive, on a part of Peach</p>	<p>Pit Area: 500 square feet</p> <p>Depth: 10–15 feet</p> <p>Length: 150 feet at Crossing #1 and 300 feet at Crossing #2</p>

	<ul style="list-style-type: none"> <li>• Drilling or jacking a casing through the earth under the road or railroad to be avoided</li> <li>• Installing the new pipeline in the casing</li> <li>• Connecting the new pipeline-to-pipeline segments on either end of the jacking pit</li> <li>• Backfilling the jacking and receiving pit and temporary paving</li> <li>• Pressure testing and disinfecting the pipeline</li> <li>• Repaving</li> </ul>		Street that has been closed to vehicle access (see Figure 3)
Geotechnical Investigation	<p>A geologic review and geotechnical investigation would be conducted for the HDD Crossings and jack and bore locations. Exploratory borings would be made at the HDD entry and insertion pit locations and along the underwater alignment as well as at each jack and bore pit. The subsurface soils investigation would originate on the land or water surface and would consist of the following steps:</p> <ul style="list-style-type: none"> <li>• Locate/pothole for utilities</li> <li>• Mobilize land based and barge- or ship-mounted geotechnical drilling equipment</li> <li>• Drill exploratory soils borings at the following locations <ul style="list-style-type: none"> <li>- HDD entry and insertion pits for all crossings</li> <li>- The underwater alignments for Crossing #1 and #2 at intervals of approximately 300 feet and depths of 125 feet</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Geotechnical drilling rig (truck-mounted and barge-mounted)</li> <li>• Turbidity curtains for drilling</li> <li>• Barge</li> </ul>	<p>HDD entry and insertion pits for all crossings; The underwater alignments for Crossings #1 and #2; and jack and bore pits</p> <p>Depth: 125 feet Width: 2 inches</p>



- Jack and bore pits
- Collect soils samples for classification and laboratory analysis (geophysical investigation methods may also be used)
- Abandon exploratory borings (backfill land-based borings only)

Transmission Pipeline Horizontal Directional Drilling

HDD will be used to install the three underwater pipelines under the Oakland Inner Harbor, Tidal Canal, and the San Leandro Bay Channel. HDD is a process that originates on the surface and typically consists of the following steps:

- Ramming a steel conductor casing approximately 200 feet long into the ground on both sides of the drilling operation to support the pipeline until the pipeline reaches deeper and more stable soil and to prevent hydraulic fracturing (“frac out”) at the surface.
- Drilling a pilot hole from the entry pit across the water to the insertion pit; drilling could potentially occur at both the entry and insertion pit.
- Enlarging the pilot hole through a reaming process
- Laying down, fusing together, and pressure testing the pipeline
- Pulling the pipeline into the insertion pit, through the enlarged pilot hole, and to the receiving pit
- Injecting grout between the pipeline and casing

- HDD rig with control cab for the HDD operator (potentially one for each side)
- Slurry separation plants (one for each side)
- Small pick-cranes (one for each side)
- Pipeline rollers
- Slurry and grout pumps (one for each side)
- Welders (at insertion pit)
- Soil-cement mixing machines (one for each side)
- Jet grouting rig (one for each side)
- Excavators (one for each side)
- Tractors/ loaders/ backhoes (one for each side)

**Crossing #1, entry pit:** Adjacent to the parking spaces next to Estuary Park (Oakland) – located approximately 500 feet south of the intersection of Embarcadero West and the road that provides access to the parking lot for Estuary Park

**Crossing #1, insertion pit:** Telecare Corporation parking lot (Alameda) – located in the middle of Telecare Corporation parking lot, approximately 250 feet north of the intersection of Marina Village Parkway and Tynan Avenue

**Crossing #2, entry pit:** Towata Park (Alameda) – located within Towata Park, east of the portion of Peach Street, which divides Towata Park

**Crossing #2, insertion pit:** Veterans Court (North Bay Farm Island) –

Entry and exit angles: 15 degrees

Depth: 50–100 feet

Dimensions of entry and insertion pits: 10 by 20 feet

Depth of entry and insertion pits: 5 feet

Total staging area around entry and insertion pits: 2,000–2,500 square feet

HDD length at Crossing #1: 1,800 feet

HDD length at Crossing #2: 1,400 feet

HDD length at Crossing #3: 1,400 feet

- Injecting jet grouted columns to provide additional support to the casing, between the entry pit and the shoreline
- Backfilling the HDD pit and temporary paving
- Disinfecting the pipeline
- Repaving

located approximately 275 feet north of the intersection of Veterans Court and Island Drive

**Crossing #3, entry pit:**  
Derby Avenue (Oakland)  
– located on Derby Avenue, between Ford Street and Glascock Street, approximately 50 feet north of the intersection of Derby Avenue and Glascock Street

**Crossing #3, insertion pit:** Broadway (Alameda)  
– located on Broadway, between Blanding Avenue and Clement Avenue, approximately 160 feet south of the intersection of Broadway and Blanding Avenue

Connections

The proposed project would connect the new water pipelines to existing EBMUD water transmission pipelines. The work to connect the new pipelines to existing pipelines would require the excavation of a trench or pit at each connection location. Temporary shoring would be required to ensure the stability of the excavation, which may include the use of vibratory sheet piles. The proposed tie-ins would be located within street rights-of-way and sited to minimize disruptions to traffic and homeowner access. Construction of the connections would generally be completed

- Excavators
- Generator Sets for night lighting
- Tractors/Loaders/Backhoes
- Dewatering pumps
- Hot tap machine

Connections would be located where open trench construction would occur (See Figure 2, 3, and 4)

The connections would be in the open trench construction corridor and would have similar dimensions as open trench construction.

	within a 12-hour period. For connections that require a new tee, construction could require a full 24-hour period, and night work might be necessary.			
In-Street Pipeline Abandonment	Pipeline abandonment would require three construction pits in 5th Street to move service connections and fire hydrants and to install two endcaps, one at 5th Street and another at Oak Street. The abandoned pipeline would be filled with cellular concrete between the two endcaps, and an existing valve near the intersection of Madison Street and 5th Street would be abandoned in place after opening the valve.	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> </ul>	<b>Oakland side of Crossing #1:</b> On 5th Street, between Oak Street and Jackson Street	Length: 800 feet. Width of Pit: 10 feet Length of Pit: 10 feet Depth: 4–10 feet
Underwater Pipeline Crossings Abandonment	The seven existing underwater pipeline crossings would be abandoned. Abandonment includes filling onshore sections of pipelines with cellular concrete and abandoning submarine sections of pipelines in place. Bumped heads or blind flanges will be constructed at the demarcation between the onshore and submarine sections and at the end of the onshore sections to be abandoned. To install the bumped heads or blind flanges, a pit would be excavated down to the pipeline. The bumped head at the two abandonment locations at Crossing #2 would be installed	<ul style="list-style-type: none"> <li>• Concrete/Industrial Saws/Jack Hammers</li> <li>• Excavators</li> <li>• Tractors/Loaders/Backhoes</li> <li>• Dewatering Pumps</li> <li>• Welders</li> <li>• Grouting Pumps</li> <li>• Cement and Mortar Mixers (Grouting)</li> <li>• Pavers</li> <li>• Paving Equipment</li> </ul>	See Figures 2, 3, and 4	Width of Pit: 10 feet Length of Pit: 10 feet Depth: 4–10 feet

	<p>in existing vaults and would not require pit excavation (see Figure 3). Additional pits may be necessary to remove valves, hydrants, move service laterals, and at low points along the onshore pipeline alignment to facilitate concrete pumping; the location of these additional pits would be determined during detailed design.</p>	<ul style="list-style-type: none"> <li>• Rollers</li> <li>• Dump trucks</li> <li>• Forklifts</li> <li>• Flatbed delivery trucks</li> <li>• Vibratory pile driving may be used to install sheet pile walls for the abandonment pits</li> </ul>		
Distribution Pipeline Replacement	<p>The proposed project would replace existing small-diameter distribution pipelines at two locations along Crossing #1 and Crossing #3. Open trench construction methods (see above) would be used to install the new pipeline and the existing pipeline would be abandoned in place. Pipeline replacement would occur during open trenching activities, before the new transmission pipeline is installed. The following pipelines would be replaced:</p> <ul style="list-style-type: none"> <li>• <b>Crossing #1:</b> On 2nd Street (see Figure 2), approximately 400 feet of existing 10-inch cast-iron pipeline constructed in 1908 would be replaced with a 12-inch steel pipeline.</li> <li>• <b>Crossing #3:</b> On Everett Street (see Figure 4), approximately 750 feet of existing 4-inch cast-iron pipeline constructed in 1895 would be replaced with a 6-inch steel pipeline.</li> </ul>	Distribution pipeline replacement would require the same equipment used for open trench construction.	<p><b>Crossing #1, Oakland:</b> On 2nd Street (see Figure 2).</p> <p><b>Crossing #3, Alameda:</b> On Everett Street (see Figure 4).</p>	<p>The distribution pipeline replacement would be in the open trench construction corridor and would have similar dimensions as open trench construction.</p> <p>Length of pipeline replacement at Crossing #1: 400 feet Length of pipeline replacement at Crossing #3: 750 feet</p>

## 2.0 Definitions

### 2.1 Roadway Classifications

Roadway classifications by the Cities of Oakland and Alameda vary slightly depending on the expected use, location, and capacity. The following roadway definitions are used within the Cities of Oakland and Alameda and apply to the proposed project study area:

#### Oakland:<sup>1</sup>

- *Arterial Streets:* Roadways that typically serve through-traffic and provide access to/from freeways and expressways and adjacent properties and are often multi-lane.
- *Residential Arterial Streets:* Roadways that serve the same function as arterial streets but are bounded by residential properties that have driveways connecting on street frontages. These residential arterial streets are typically two travel lanes but can be wider (four travel lanes) in specific areas.
- *Collector Streets:* Roadways that provide access between arterial streets and between adjacent properties and are typically two to-four travel lanes.
- *Local Streets:* Minor roadways that provide access to properties and are typically two-lanes.

#### Alameda:<sup>2</sup>

- *Regional Arterial Streets:* These roadways typically serve the largest volumes of traffic over long distances and provide regional access to off-island destinations and the regional freeway network in addition to shopping districts, colleges, employment centers, and recreational areas. Regional arterial streets are typically three to four travel lanes.
- *Island Arterial Streets:* These roadways compliment regional arterials by providing cross-island access for local intra-island trips and generally carry shorter trip lengths, do not provide access to regional destinations and carry less traffic than regional arterials. Island arterial streets are typically two to three travel lanes.
- *Transitional Arterials:* These roadways are arterial streets that operate more as Island Arterial Streets than true regional arterial streets. The desire of Alameda is to implement measures (now or in the future) that would lead to a lower classification such as an Island Collector Street.
- *Island Collector Street:* These roadways are collector streets that provide more direct access to adjacent properties and between arterial streets and are part of a local grid system of streets on the Island and carry more traffic than a typical collector street and have two to three travel lanes.
- *Transitional Collector Streets:* These roadways function as Island Collector Streets but are desired to operate more as local streets. The desire of Alameda is to implement measures (now or in the future) that would lead to a lower classification such as a local street. Transitional Collector Streets typically have two travel lanes.

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<sup>1</sup> ESA, *Oakland Bicycle Master Plan DEIR, Chapter 4: Environmental Setting, Impacts, and Mitigation Measures, A. Transportation, Circulation, and Parking, City of Oakland, 2007.*

<sup>2</sup> *City of Alameda, General Plan, Chapter 4: Transportation Element, Street Classification System, May, 2008.*

- *Local Streets:* Local streets provide for direct property access and emphasize automobiles as a secondary feature and carry the lowest amount of traffic and often serve purely residential areas with small trip distances and are two travel lanes.

## 2.2 Level of Service

### 2.2.1 Intersections

Intersection Level-of-Service (LOS) provides the most accurate measure of operational performance with a scale ranging from LOS A to LOS F. These ratings correspond to a volume/capacity (v/c) ratio and/or vehicle delay in seconds. LOS A represents relatively free-flow conditions with little delay at intersections. LOS E represents unstable or unbalanced flow conditions with volumes at or near design capacity. LOS F represents a significantly congested condition where traffic flows can exceed design capacities resulting in long vehicle queues and/or delays from the minor-street driveway. At unsignalized intersections, stated intersection LOS usually refers to the minor street or stop-sign controlled driveway movement. See Table 2 for LOS Definitions.

Synchro-Simtraffic software is used in this report for intersection LOS and incorporates both Highway Capacity Manual 2010 (HCM 2010) and HCM 2000 operations methodologies.<sup>3</sup> HCM "field level" intersection LOS calculations incorporate appropriate heavy vehicle adjustments factors (trucks and buses), peak hour factors (vehicle progression), and signal lost-time factors (signal timing). A standard peak hour factor (PHF) of 0.92 is applied to analysis scenarios where field inputs are absent (PHF refers to traffic approach progression through the signal). However, vehicle lane storage capacity, control, and vehicle queuing are also accounted for in the Synchro LOS calculations. For unsignalized intersections, stated LOS/delay usually refers to the minor street or stop-sign controlled movements.

### 2.2.2 Average Daily Traffic/Roadway Capacity

For the roadway evaluation process; roadways have been analyzed on a daily volume basis (24-hour two-way volume), based on daily volume capacities by roadway type. These capacities have been determined based on historical peak hour capacities of similar roadways in many different communities and are not refined to represent the unique conditions of specific roadways. These capacities are used to aid in the identification of roadways that may need further improvement without analyzing specific peak hour intersection operations.

Therefore, in locations where typical conditions are not present, such as where there are closely spaced intersections in downtown areas, irregular intersection configurations, or particularly heavy turning movements in certain directions, it is sometimes necessary to revise daily capacities for individual roadways in order to better represent the need for improvement. Such determinations usually require peak hour intersection analysis, from which a peak hour to daily volume conversion can be made in order to assign a daily capacity estimate.

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<sup>3</sup> Transportation Research Board (TRB), *Signalized and Unsignalized Intersections, Highway Capacity Manual 2010 (and 2000)*,

**TABLE 2  
INTERSECTION LEVEL-OF-SERVICE DEFINITIONS**

Level of Service	Type of Flow	Delay	Maneuverability	Stopped Delay/Vehicle (seconds)		
				Signalized	Un signalized	All-Way Stop
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	< 10.0	< 10.0	< 10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10.0 and < 20.0	>10.0 and < 15.0	>10.0 and < 15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted	>20.0 and < 35.0	>15.0 and < 25.0	>15.0 and < 25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35.0 and < 55.0	>25.0 and < 35.0	>25.0 and < 35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55.0 and < 80.0	>35.0 and < 50.0	>35.0 and < 50.0
F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	> 80.0	> 50.0	> 50.0

References: 2000 Highway Capacity Manual

Table 3 presents the roadway capacities used in calculating the Roadway LOS for the proposed project study area.<sup>4</sup>

<sup>4</sup> Based on the Highway Capacity Manual 2000, Transportation Research Board, Peak hour and daily roadway capacities, South County 2006 Model Update.

**TABLE 3  
DAILY ROADWAY CAPACITIES BY FACILITY TYPE**

Roadway Type	Average Daily Traffic (ADT) – Total of Both Directions				
	A	B	C	D	E
Six-Lane Freeway	42,000	64,800	92,400	111,600	120,000
Four-Lane Freeway	28,000	43,200	61,600	74,400	80,000
Six-Lane Divided Expressway	35,500	42,200	46,200	55,800	60,000
Four-Lane Divided Expressway	23,667	28,133	30,800	37,200	40,000
Four-Lane Divided Arterial	22,000	25,000	29,000	32,500	36,000
Four-Lane Arterial (w/LTL)	22,000	25,000	29,000	32,500	36,000
Four-Lane Arterial (No LTL)	18,000	21,000	24,000	27,000	30,000
Two-Lane Divided Arterial	11,000	12,500	14,500	16,000	18,000
Two-Lane Arterial (w/LTL)	11,000	12,500	14,500	16,000	18,000
Two-Lane Arterial (No LTL)	9,000	10,500	12,000	13,500	15,000
Two-Lane Roundabout Arterial	14,300	16,250	18,850	20,800	23,400
Four-Lane Collector	12,000	15,000	18,000	21,000	24,000
Two-Lane Collector	6,000	7,500	9,000	10,500	12,000
Two-Lane Local	1,000	2,000	3,000	4,000	5,000

Source: Transportation Research Board (TRB), Highway Capacity Manual 2000, Daily and peak

## 2.3 Bicycle Route Classes

The Oakland Bicycle Master Plan<sup>5</sup> and Alameda Bike Master Plan<sup>6</sup> have identified existing bike facilities in the proposed project study area. Bicycle facilities can be defined in three different classifications as defined by California Manual on Uniform Traffic Control Devices:<sup>7</sup>

**Class I Bikeway:** A dedicated off-road bicycle and/or pedestrian path (typically multi-use path). Provides for bicycle travel on a paved right-of-way completely separated from any street or highway. The minimum travel width for two-way travel is 8-feet and 5-feet for a one-way path. If adjacent to the highway or arterial with no physical barrier there should be a 5-foot buffer area.

**Class II Bikeway:** A dedicated bike lane on a street and/or highway (not a sidewalk). Bicycle lanes are typically 4 to 5 feet wide and provide for directional one-way travel on one or both sides of the roadway. Requires signing and pavement

<sup>5</sup> City of Oakland Bicycle Master Plan, part of the Land Use & Transportation Element of the Oakland General Plan, December, 2007.

<sup>6</sup> City of Alameda, 1999 Bicycle Master Plan, Alameda Public Works Department (Updated November 2010).

<sup>7</sup> California Manual on Uniform Traffic Control Devices (CAMUTCD), 2014.



markings with a six-inch solid white stripe separating the bicycle lane from adjacent traffic flow.

**Class III Bikeway:** These are dedicated bike routes that provide for shared use with pedestrian or motor vehicle traffic and are identified by signing. Typically, bike routes are used to connect with other Class II or Class I bike facilities where right of way (ROW) acquisition or physical linkage is not possible. Ideally, Class III bike routes should only be used on low volume streets (for safety purposes) with speed limits of 35 miles per hour (mph) or less.

## 2.4 Peak Hour Traffic

The AM (7:00 to 9:00 a.m.) and PM (4:00 to 6:00 p.m.) commute periods are generally considered the peak flow of traffic during the weekday periods. Depending on the specific region, these periods can fluctuate by as much as an hour or more depending on a variety of factors including commute distances, freeway operations, and local incidents. The City of Oakland has indicated that peak periods can fluctuate in the Chinatown areas due to retail business hours and demographics<sup>8</sup>; however, it is very likely that during these established AM and PM peak commute periods the peak flows of traffic will occur. Recent transportation studies conducted in the proposed project study area have also used the same time periods to conduct traffic analyses<sup>9</sup>.

From the AM and PM peak commute period counts the peak hour of traffic flows are determined. The peak hour volumes represent the four highest 15 minute periods (consecutive) that occur within the two-hour commute period. From these peak hour volumes, intersection LOS are calculated to present an operational picture of current traffic conditions. As previously indicated, operational conditions are assigned a letter grade from LOS A to LOS F.

## 2.5 Congestion Management Program Roadways

The Alameda County Transportation Commission (ACTC) through its Congestion Management Plan (CMP) establishes Routes of Regional Significance (RORS) throughout the County. RORS are typically freeways and/or major arterial links that provide regional and sub-regional access between and within County cities. The ACTC requires local jurisdictions to analyze proposed changes on the transportation network due to changes in land use (General Plan Amendments and/or projects generating over 100 net new peak hour vehicle trips). LOS standards for RORS are established through the CMP and a project generating an excess of 100 peak hour trips (or a General Plan Amendment) needs to analyze the roadway link segments to ensure that LOS thresholds are not being exceeded for a specific RORS.

CMP RORS are designated as Tier 1 type or Tier 2 type facilities. Tier 1 facilities are primarily interstate freeways, state highways, or city arterials/roadways located in the study area include the following:

- SR-260 (Posey/Webster Tubes) from Alameda to I-880;
- 23rd/29th Avenues from Alameda to I-880;

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<sup>8</sup> Mr. Wlad Wlassowsky, Senior Traffic Engineer, City of Oakland, meeting on August 18, 2015.

<sup>9</sup> Fehr and Peers, Jack London Square 4<sup>th</sup> & Madison Project EIR, Traffic and Transportation, August, 2015.

- I-880 from I-980 to Hegenberger Road;
- Doolittle Drive from Oakland to Fernside Boulevard;
- Otis Drive from Fernside Boulevard to Broadway;
- Broadway from Otis Drive to Encinal Avenue;
- Encinal Avenue from Broadway to Sherman Street;
- Central Avenue from Sherman Street to Webster Street;
- Webster Street from Central Avenue to Posey/Webster Tubes;
- Posey/Webster Tubes from Webster Street to Oakland;
- Atlantic Avenue from Webster Street to Poggi Street;
- Atlantic Avenue from Poggi Street to Main Street;
- Park Street from Oakland to Central Avenue;
- Park Street from Central Avenue to Encinal Avenue.

In addition, High Street is designated as a Tier 2 roadway between Otis Drive and I-580. Tier 2 roadways are primarily city/county arterials of local significance. The CMP also designates Metropolitan Transportation System (MTS) roadways. MTS roadways are major arterials or transit routes that provide critical access to areas within the Cities of Oakland and Alameda. Within the proposed project study area, MTS roadways include 7th and 8th Streets in Oakland as well as portions of Central Avenue, Constitution Way, Park Street, Otis Drive, Tilden Way (east of Park Street), and Broadway (between Tilden Way and Otis Drive) in the City of Alameda.

## 3.0 Approach To Data Collection

The proposed project study area includes both regional and local transportation networks in the cities of Oakland and Alameda that would serve both EBMUD and contractor construction worker vehicles and construction equipment and haul trucks that would transport workers, equipment, and materials to/from individual worksites. The following section describes the coordination with local agency public works/planning staff and the overall approach to collecting data in the cities of Oakland and Alameda.

### 3.1 Agency Consultation

#### 3.1.1 Cities of Oakland and Alameda

Prior to data collection for the proposed project, both Planning and Public Works staff were contacted at the Cities of Oakland and Alameda to introduce them to the project and to seek early

input on transportation planning for project construction.<sup>10,11</sup> In these meetings, the need for and requirements of the pipeline project was discussed as well as the technical analyses involving traffic, planning, and schedule. The specific pipeline routes were reviewed and current activities and planning projects in the proposed project study area were discussed. In addition, the availability of existing traffic data was determined. To that end, the City of Oakland maintains an existing traffic database that contains both peak hour intersection and daily traffic count data. The Oakland database was reviewed for project study locations both north and south of I-880 for proposed Crossing #1 and Crossing #3. Unfortunately, the database contained only one study intersection (Jackson Street/5th Street) and no average daily traffic (ADT) volumes in the Crossing #1 or #3 study areas. Both the City of Oakland and City of Alameda's traffic engineers were contacted for any associated transportation studies that have been previously conducted in the proposed project study area. To this end, both the recent Jack London Square 4th & Madison Project EIR and Alameda Point Project were reviewed for relevant traffic information.

After meeting with Oakland and Alameda staff (and prior to data collection efforts), the preliminary transportation scope of work was provided to both the City of Oakland and Alameda transportation staff for review and input.

### *3.1.2 California Public Utilities Commission/Rail Activity*

The California Public Utilities Commission (CPUC) was contacted for construction work proposed within the railroad crossing/ROW at the Embarcadero West/ Oak Street and Glascock Street intersections.<sup>12</sup> CPUC staff indicated that unless physical changes to the rail crossings and/or additional crossings are part of the project proposal the CPUC would defer to the rail companies operating in the proposed project study area. Specifically, Union Pacific operates the rail lines that extend along Embarcadero West and Glascock Street in the proposed project study area. Union Pacific staff have indicated that the project applicant would access the Union Pacific website under "Real Estate and Utility Specifications", then "Pipeline Installations" to learn about procedures for encroachment.<sup>13</sup>

### *3.1.3 Caltrans*

Caltrans encroachment staff was contacted for construction work proposed within the State's ROW adjacent to I-880 in downtown Oakland along Madison Street and 5th Street. Caltrans staff has indicated that any pipeline work that would encroach within their ROW would need to apply for an encroachment permit. The applicant would be required to complete the standard application

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<sup>10</sup> Meeting with Mr. Wlad Wlassowsky, City Traffic Engineer, Transportation Division Services Manager, and Panorama Environmental staff (Mr. Jeff Thomas, Ms. Tania Tries), EBMUD staff (Mr. Aaron Hope), and Omni-Means (Mr. Peter Galloway); Introduction to Alameda North Bay Farm Island Pipeline Crossings Project, August 18, 2015.

<sup>11</sup> Meeting with Mr. Virenda Patel, City Traffic Engineer, City of Alameda, and Panorama Environmental staff (Mr. Jeff Thomas) and EBMUD staff (Mr. Aaron Hope), and Omni-Means (Mr. Peter Galloway); introduction to Alameda North Bay Farm Island Pipeline Crossings Project, August 20, 2015.

<sup>12</sup> Mr. Sia Mozzaffari, California Public Utilities Commission (CPUC), Safety and Enforcement Division, Rail Crossings and Engineering Branch Rail Crossings Safety Section, Northern California, Personal communication, EBMUD Alameda—North Bay Farm Island Pipeline Crossings Project, Personal communication on November 3, 2015.

<sup>13</sup> Kevin Yoder, Manager Industry and Public Projects, Union Pacific Railroad Company, Personal communication related to encroachment permits, November 3, 2015.

including plans, location map, environmental documentation, letter of authorization, surety bonds, liability insurance, applicable fees, etc. Caltrans staff directs applicants to the Caltrans website under “Business”, then “Encroachment Permit”.

### 3.2 Data Collection

Peak period intersection and daily traffic count data collection was conducted over a three-week period in October, 2015 by Baymetrics Traffic Resources (see Technical Appendices of this report), a specialized data collection firm familiar with traffic flow patterns in Oakland and Alameda<sup>14</sup> Traffic counts were taken in typical weekday travel conditions during the mid-week (Tuesday, Wednesday, or Thursday) when schools were in session. New traffic data was collected for intersection turning movement counts, pedestrians, and bicycle traffic during the AM peak period (7:00 to 9:00 a.m.) and PM peak periods (4:00 to 6:00 p.m.). Daily traffic counts were typically conducted for a 24 to 48 hour period. Traffic counts at intersections were conducted by 1 to 2 persons dependent on the overall flow of traffic volumes during the peak period. These traffic counts were then summarized (along with intersection geometric and phasing data). Machine counts also were conducted for 24-hour data collection on roadways and summarized (see Technical Appendices of this report).

New traffic counts were conducted where existing data was not available or current construction activities associated with the 23rd Street and 29th Street Overcrossing project precluded collecting data at this time. Existing data was reviewed from the City of Oakland and Alameda’s database websites as well as in recent previous transportation studies conducted in the proposed project study area. Existing transportation data was deemed acceptable if transportation studies were conducted within the last 2 to 3 years (2013-2015). In addition, new traffic data was used to corroborate existing data volumes or adjust less recent data volumes to reflect current levels of traffic flow.

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<sup>14</sup> Baymetrics Traffic Resources, Peak period intersection (7:00-9:00 a.m. and 4:00-6:00 p.m.) and daily roadway counts (24-hr.), Cities of Oakland and Alameda, October, 2015.

## 4.0 Environmental Setting

The following section describes the transportation and circulation system in the areas of the three proposed pipeline crossings (see Figure 5 - Alameda-North Bay Farm Island Proposed Pipeline Crossing Areas and Study Intersections) and include roadway, transit, bicycle, and pedestrian facilities the serve the proposed project study area.

### 4.1 Transportation System Description

#### 4.1.1 Regional Access

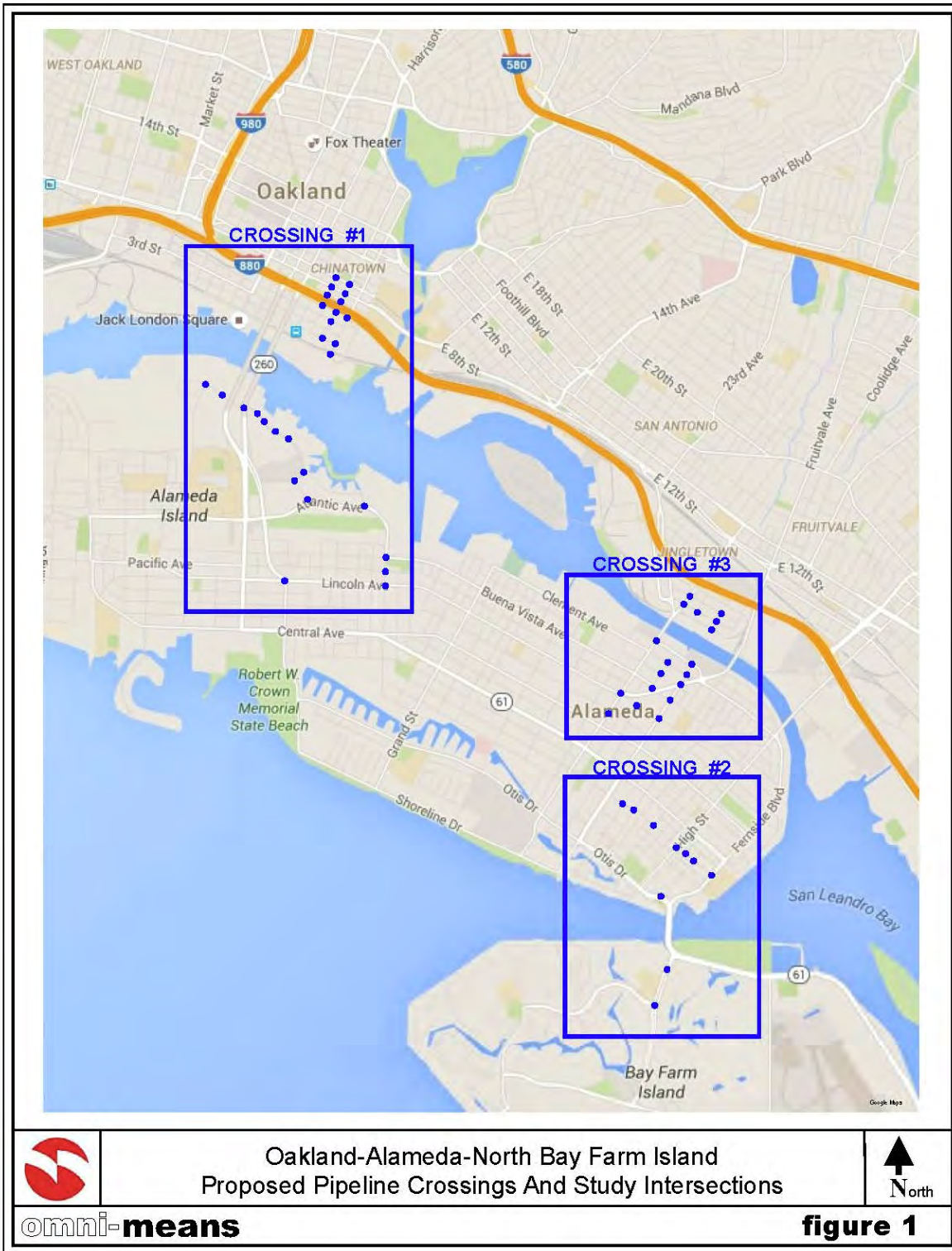
Regional access to the project area is provided by interstate freeways and state highway routes that travel through Oakland and Alameda and connect to the local roadway network. These regional facilities are described as follows:

**Interstate 880** (I-880) extends in a northwest-southeast direction in the proposed project study area and connects to State Route 17/I-280 in the South Bay and I-80 just east of the Bay Bridge. An eight lane facility, I-880 currently carries an ADT (annual) of 225,000 near Oak Street and Madison Street.<sup>15</sup> Vehicle ramps are located at Jackson Street and Oak Street in the project vicinity. I-880 would provide access to the proposed Crossing #1 construction areas.

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<sup>15</sup> Caltrans, 2014 Traffic Volumes on California State Highways, 2014.

**Figure 5** Proposed Project Access Areas/Roadways/Intersections



**State Route 61** (SR-61) starts south of the proposed project study area from Davis Street in San Leandro and extends northwest via Doolittle Drive through Bay Farm Island. Crossing over to Alameda, SR-61 continues northwest via Otis Drive, Broadway, Encinal Avenue, and Central Avenue until extending north via Webster Street and the Webster-Posey Tubes. In Alameda, SR-61 generally has three to four travel lanes and carries 11,300 daily vehicles (annual) between Broadway and Encinal Avenue in the proposed project study area.<sup>16</sup> SR-61 would provide regional access to the proposed Crossings #2 and #3 construction areas.

#### *4.1.2 Local Roadways*

Crossings #1, #2, and #3 are served (generally) by a grid network of streets that are classified as arterial, collector, and local roadways in the Cities of Oakland and Alameda. Descriptions of the roadways that could be affected by construction activities are organized by proposed Crossing number in Table 4. For each pipeline crossing route, the project access roadway segments physical characteristics have been described related to number of lanes, roadway width, the presence of bicycle lanes and on-street parking, transit routes, and vehicles per day.

#### *4.1.3 Local Intersections*

The analysis of specific study intersections along the pipeline crossing routes has been chosen in consultation with the Cities of Oakland and Alameda, and EBMUD staff for both existing (i.e., baseline) and baseline plus project conditions. As previously described in Section 3.2: Data Collection, new intersection counts were conducted for proposed pipeline trenching routes and likely detour routes for all three Crossings during the AM and PM peak commute periods (7:00 to 9:00 am and 4:00 to 6:00 pm). Previous transportation studies conducted for the Cities of Oakland and Alameda were also reviewed for recent intersection data. It is noted the current construction activities along 29th Street in downtown Oakland for the Caltrans 23rd to 29th Avenue Overcrossing Project prevented data collection along 29<sup>th</sup> Street for proposed Crossing #3. Therefore, study intersection peak hour volumes were taken directly from the transportation analysis conducted for the current I-880 Operational and Safety Improvements project.<sup>17</sup> Study intersections associated with each crossing are presented in Table 5. Study intersections located along likely detour routes are highlighted.

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<sup>16</sup> Caltrans, 2014 Traffic volumes on California State Highways, 2014.

<sup>17</sup> RBF Consulting, I-880 Operational and Safety Improvements at 29<sup>th</sup> Avenue and 23<sup>rd</sup> Avenue Overcrossings IS/EA, April, 2010.

**TABLE 4  
PROPOSED PROJECT AREA CONSTRUCTION/DETOUR ROADWAYS**

<b>Roadway/ Segment</b>	<b>No. of Lanes</b>	<b>Road Width (feet)</b>	<b>Bike-Lanes? (Y/N)</b>	<b>On-Street- Parking (Y/N)?</b>	<b>Public-Transit Lines (Y/N)</b>	<b>Traffic Volumes VPD<sup>1</sup></b>
<b>Crossing #1: Oakland</b>						
Madison St./ 8th St.-2nd St.	2 to 3	44 to 52 <sup>2</sup>	No	Yes, both sides	Yes, AC Transit Bus (Routes 11, 26, 62, 88)	6,980
2nd St./ Madison St.-Oak St.	2	44	Yes Sharrows <sup>3</sup> both sides	Yes, both sides	No	100
Oak St./ 2nd St.- Embarcadero West	4	58	Yes Sharrows <sup>3</sup> both sides	Yes, both sides	No	2,350
Jackson St./ 8th St.-4th St.	2	42	No	Yes, both sides	Yes, AC Transit Bus (Routes 11, 26, 62, 88, O, W)	2,800
4th St./ Jackson St.- Madison St.	2	40	No	Yes, both sides	No	4,500
5th St./ Jackson St.-Oak St.	3	44	No	Yes, south side only	No	4,570
<b>Crossing #1: Alameda</b>						
Marina Village Pkwy/ Mariner Sq. Loop- Challenger Dr	2 to 4	45 to 80	Yes Class II both sides	No	Yes, AC Transit Bus (Route 31)	3,000
Challenger Dr./ Marina Village Pkwy. -Altantic Ave.	2	47 to 65	Yes Class II both sides	No	Yes, AC Transit Bus (Route 31)	6,250
Atlantic Ave./ Challenger Dr- Sherman St.	2	46	Yes Class II both sides	No	Yes, AC Transit Bus (Route 31)	9,300
Sherman St./ Altantic Ave.- Lincoln Ave.	2	36	No	Yes, both sides	No	10,116
Mitchell Ave./ Mariner Sq. Loop -5th Ave.	2	44	Yes Class II	No	No	1,800
<b>Crossing #2: Alameda (Only)</b>						
Island Dr./ Stewart Davey Jr.- Veterans Ct.	4	120	Yes Class I west side	No	Yes, AC Transit Bus (Routes 21, OX)	26,200
Veterans Ct./ Island Dr.-north	2	34	Yes Class I west side	Yes both sides	No	100
Bridgeview Isle/ Driftwood Ln.- south	2	36	Yes Class I north side	Yes both sides	No	250
Peach St./ Bridgeville Ct.- San Jose Ave.	2	38	No	Yes both sides	No	205



Roadway/ Segment	No. of Lanes	Road Width (feet)	Bike-Lanes? (Y/N)	On-Street- Parking (Y/N)?	Public-Transit Lines (Y/N)	Traffic Volumes VPD <sup>1</sup>
San Jose Ave/ Peach St.- Pearl St.	2	36	No	Yes both sides	No	550
Versailles Ave./ San Jose Ave.	2	40'	No	Yes both sides	No	1,610
Post St./ Otis Dr.-San Jose Ave.	2	40	No	Yes both sides	No	215
Fernside Blvd./ Otis Dr.-San Jose Ave.	2 to 3	52	Yes Class I&II both sides	No	No	16,000
<b>Crossing #3: Oakland</b>						
Ford St./ 29th Ave.-Derby Ave	2	3	No	Yes both sides	No	1,050
Derby Ave/ Ford St.- Tidal Canal	2	36	No	Yes both sides	No	320
Chapman St./ 29th Ave.-Derby Ave	2	36	No	Yes both sides	No	470
Glascok St./ 29th Ave-Derby Ave	2	36	No	Yes both sides	No	800
<b>Crossing #3: Alameda</b>						
Broadway/ Blanding Ave.- Webb Ave.	2	48	Yes Class II both sides	Yes both sides	Yes, AC Transit Bus (Routes 51A, 851, W)	6,270
Clement Ave/ Everett St.- Broadway	2	48	No	Yes Both sides	No	4,265
Everett St./ Clement Ave.- Lincoln Ave.	2	36	No	Yes Both sides	No	1,000
Lincoln Ave./ Park St.-Everett St.	2	44	No	Yes Both sides	No	300
Eagle Ave./ Everett St.- Broadway	2	36	No	Yes Both sides	No	160
Blanding Ave./ Park St.- Broadway	2	46	No	Yes Both sides (w. of Broadway)	Yes. AC Transit Bus (Routes 51A, 851, W)	5,080
Tilden Way/ Buena Vista Ave.- Blanding Ave.	4	68	No	No	Yes, AC Transit Bus (Routes 51A, 851, O)	14,720
Santa Clara Ave./ Broadway-Park St.	2	40	No	Yes Both sides	Yes, AC Transit Bus(Routes 51A, 851, O)	4,000
Park St./ Santa Clara Ave.- Blanding Ave.	4	54	No	Yes Both sides	Yes, AC Transit Bus (Routes 20, 21, O, OX)	23,000

Roadway/ Segment	No. of Lanes	Road Width (feet)	Bike-Lanes? (Y/N)	On-Street- Parking (Y/N)?	Public-Transit Lines (Y/N)	Traffic Volumes VPD <sup>1</sup>
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Notes:

<sup>1</sup>VPD – Vehicles per day based daily traffic counts conducted by Baymetrics Traffic Resources in the Cities of Oakland/Alameda and/or converted PM Peak Hour intersection approach counts conducted along specific roadway segment, October, 2015.

<sup>2</sup>The 52 feet exists between 7<sup>th</sup> and 8<sup>th</sup> Streets.

<sup>3</sup>Sharrows are pavement markings that indicate a shared use lane between autos and bicycles. They are typically placed in roadways where there is not enough room for bike lanes.

**TABLE 5  
SUMMARY OF STUDY INTERSECTIONS AND ROADWAYS**

Study Intersections (Detour Intersections/Roadway Highlighted)	Study Roadways
<b>Crossing #1 (Oakland)</b>	
1. Madison Street/8th Street	Madison Street
2. Madison Street/7th Street	Oak Street
3. Madison Street/6th Street	Embarcadero West
4. Madison Street/5th Street	5th Street
5. Madison Street 4th Street	Jackson Street
6. Madison Street/2nd Street	
7. Oak Street/2nd Street	
8. Oak Street/Embarcadero West	
9. Jackson Street/8th Street	
10. Jackson Street/7th Street	
11. Jackson Street/6th Street	
12. Jackson Street/5th Street/I-880 EB off-ramp	
13. Oak Street/5th Street	
<b>Crossing #1 (Alameda)</b>	
14. Mitchell Avenue/5th Street	Marina Village Parkway
15. Mitchell Avenue/Mariner Square Loop	Mariner Square Drive
16. Marina Village Parkway/Mariner Square Drive	Challenger Drive
17. Marina Village Parkway/Extended Stay America Driveway	Atlantic Avenue
18. Marina Village Parkway/1250 Driveway	Mitchell Avenue
19. Marina Village Parkway/1210 Driveway	
20. Marina Village Parkway/Tynan Avenue	
21. Marina Village Parkway/Independence Drive	
22. Marina Village Parkway/Challenger Drive	
23. Atlantic Avenue/Challenger Drive	
24. Atlantic Avenue/Triumph Drive	
25. Sherman Street/Buena Vista Avenue	
26. Sherman Street/Pacific Avenue	
27. Sherman Street/Lincoln Avenue	
28. Lincoln Avenue/Constitution Way	
<b>Crossing #2 (Alameda Only)</b>	
1. Robert Davey Jr. Drive/Island Drive	Island Drive

<b>Study Intersections (Detour Intersections/Roadway Highlighted)</b>	<b>Study Roadways</b>
2. Veteran's Court/Island Drive	Peach Street
3. Bridgeview Court/Otis Drive	San Jose Avenue
4. Fernside Boulevard/San Jose Avenue	High Street
5. Peach Street/San Jose Avenue	Mound Street
6. Post Street/San Jose Avenue	Adams Street
7. High Street/San Jose Avenue	Madison Street
8. Mound Street/San Jose Avenue	Encinal Avenue
9. Versailles Avenue/San Jose Avenue	
10. Pearl Street/San Jose Avenue	
<b>Crossing #3 (Oakland)</b>	
1. 29th Avenue/Ford Street	29th Avenue
2. Peterson Street/Ford Street	Ford Street
3. Derby Avenue/Ford Street	Derby Avenue
4. Glascock Street/Derby Avenue	Chapman Street
5. Chapman Street/29th Avenue	Glascock Street
6. Chapman Street/Derby Avenue	
<b>Crossing #3 (Alameda)</b>	
7. Blanding Avenue/Broadway	Broadway
8. Clement Avenue/Broadway	Tilden Way
9. Tilden Way/Broadway	Clement Avenue
10. Buena Vista Avenue/Broadway	Everett Street
11. Lincoln Avenue/Broadway	Lincoln Avenue
12. Clement Avenue/Everett Street	Blanding Avenue
13. Eagle Avenue/Everett Street	Park Street
14. Buena Vista Avenue/Everett Street	
15. Lincoln Avenue/Everett Street	
16. Lincoln Avenue/Tilden Way/Park Street	
17. Blanding Avenue/Park Street	
18. Santa Clara Avenue//Park Street	

## 4.2 Alternative Transportation

Proposed construction activities could temporarily affect pedestrian, bicycle, and transit routes in downtown Oakland in areas east of Jack London Square as well as in Alameda along Broadway and Marina Village Parkway. Relative to downtown Oakland, the construction activities would be centered along Madison and Oak Streets (and a segment of 5th Street). The Lake Merritt BART Station is located nearby at 8th Street/Madison Street. The Alameda-Contra Costa Transit District (AC Transit) provides bus service throughout Oakland and Alameda. In addition to bus service, both Amtrak and the Oakland Ferry Terminal provide transit service via Jack London Square (approximately 0.5 miles west of the Oakland construction area). Transit services are described below.

#### *4.2.1 AC Transit*

AC Transit provides the primary bus service throughout Oakland and Alameda as well as 13 other cities in Alameda and Contra Costa Counties. While most of the AC Transit routes are local in nature, AC Transit also provides Transbay, All-Night, and Supplementary routes. Transbay routes serve San Francisco and cities located on the Peninsula. A brief description of the AC Transit routes operating in the proposed project study area are provided in Table 6.

All AC Transit routes for local and transbay lines that provide service in the city of Oakland and city of Alameda are shown in Figure 6.

#### *4.2.2 Pedestrian/Bicycle Facilities*

With the majority of proposed pipeline construction being located in urban or urban/suburban areas, pedestrian and bicycle facilities are primarily provided by pedestrian sidewalks, crosswalks, corner ramps, signalized intersections/pedestrian signals, traffic calming pedestrian-friendly streetscapes, and bicycle lanes/routes (as identified in Table 4). The majority of street segments have raised curb, gutter, and pedestrian sidewalks. Exceptions to this occur in transitional areas between urban and suburban areas (i.e., Atlantic Avenue to Sherman Street) where pedestrian sidewalks may only be present on one side of the street).

For Crossing #2, a major bicycle/pedestrian corridor exists linking Bay Farm Island and Alameda Island. Specifically, the Bay Farm Island Bicycle Bridge links Class I bike facilities along the shoreline area and Island Drive to Class I and II facilities along Fernside Boulevard and Towata Park. These Class I bicycle and recreation facilities would remain accessible during proposed project construction.

**TABLE 6  
TRANSIT BUS ROUTE SERVICE IN THE PROJECT AREA**

Line	Route Description	Frequency
<b>Crossing #1: Oakland</b>		
11 AC Transit Local	Diamond District; Oakland to Estates Drive and Inverleith Terrace	Weekday 6:00 am – 8:35 pm Headways <sup>1</sup> every 30 minutes Weekend 7:00 am – 8:25 pm Headways every 60 minutes
26 AC Transit Local	Emery Bay Public Market to Lakeshore Avenue and Walla Vista Avenue, Oakland	Weekday 5:50 am – 10:20 pm Headways every 20 minutes Weekend 5:44 am – 10:25 pm Headways every 30 minutes
62 AC Transit Local	West Oakland BART to Fruitvale BART	Weekday 6:15 am – 12:50 am Headways every 20 minutes Weekend 6:15 am – 12:50 am Headways every 30 minutes
88 AC Transit Local	Berkeley BART to Lake Merritt BART	Weekdays 5:15 am – 10:30 pm Headways every 20 minutes Weekends 5:20 am – 10:30 pm Headways every 30 minutes
O AC Transit Transbay	Fruitvale BART to Transbay Temporary Terminal, San Francisco	Weekdays 6:00 am – 10:45 pm Headways every 10-60 minutes Weekends 6:00 am – 10:40 pm Headways every 6 minutes
W AC Transit Transbay	Broadway, Alameda to Transbay Temporary Terminal, San Francisco	Weekdays 4:00 pm – 8:40 pm Headways every 20 minutes Weekends 5:45 pm – 9:20 pm Headways every 20 minutes
<b>Crossing #1: Alameda</b>		
31 AC Transit Local	Alameda Point to MacArthur BART via Midway Ave., Lincoln Ave, and Marina Village Parkway	Weekdays 5:50 am – 10:40 pm Headways every 30 minutes Weekends 6:45 am – 11:15 pm Headways every 30 minutes
<b>Crossing #2: Alameda (Only)</b>		
21 AC Transit Local	Diamond District, Oakland to Oakland Airport via Fruitvale BART, Park Street, Alameda Towne Center and Bay Farm Island	Weekdays 6:25 am – 10:05 pm Headways every 30 minutes Weekends 7:20 am – 10:10 pm Headways every 30 minutes
OX AC Transit Transbay	Bay Farm Island to Temporary Terminal San Francisco via Island Drive Park & Ride, Encinal Avenue, and Park Street	Weekdays 4:20 pm – 8:20 pm Headways every 10-20 minutes No Weekend Service
<b>Crossing #3: Alameda (Only)</b>		
20 AC Transit Local	Diamond District, Oakland, to downtown Oakland via Fruitvale Ave., Fruitvale BART, Park St., Alameda Towne Centre, Shoreline Dr., Grand St., Otis Dr., Westline Dr., Central Ave. and Webster St.	Weekdays 5:00 am – 10:50 pm Headways every 30 minutes Weekends 5:00 am – 10:55 pm Headways every 30 minutes
21 AC Transit Local	Diamond District, Oakland to Oakland Airport via Fruitvale BART, Park Street, Alameda Towne Center and Bay Farm Island	Weekdays 6:25 am – 10:05 pm Headways every 30 minutes Weekends 7:20 am – 10:10 pm Headways every 30 minutes
51A AC Transit Local	Rockridge BART station to Fruitvale BART station	Weekdays 5:00 am – 12:35 pm Headways every 10 minutes Weekends 5:00 am – 12:30 pm Headways every 60 minutes

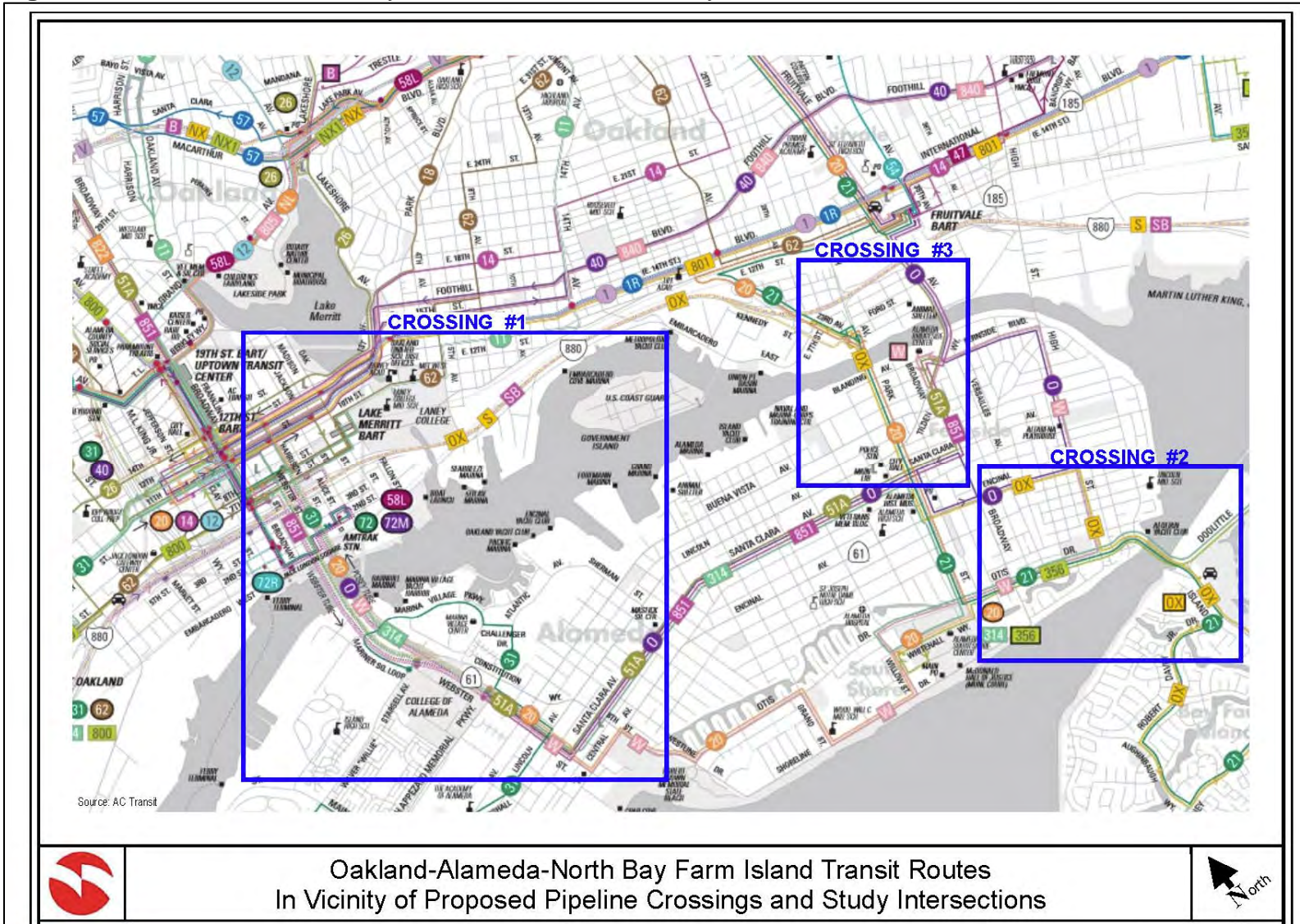
<b>Line</b>	<b>Route Description</b>	<b>Frequency</b>
<b>851</b> AC Transit All-Night	Downtown Berkeley to Fruitvale BART via UC Campus South, College Ave., Broadway, downtown Oakland, Webster St., Santa Clara Ave., Broadway, and Fruitvale Ave	Daily 12:14 am – 5:05 am Headways every 60 minutes
<b>OX</b> AC Transit Transbay	Bay Farm Island to Temporary Terminal San Francisco via Island Drive Park & Ride, Encinal Avenue, and Park Street	Weekdays 4:20 pm – 8:20 pm Headways every 10-20 minutes No Weekend Service
<b>W</b> AC Transit Transbay	Broadway, Alameda to Transbay Temporary Terminal, San Francisco	Weekdays 4:00 pm – 8:40 pm Headways every 20 minutes Weekends 5:45 pm – 9:20 pm Headways every 20 minutes
<b>O</b> AC Transit Transbay	Fruitvale BART to Transbay Temporary Terminal, San Francisco	Weekdays 6:00 am – 10:45 pm Headways every 10-60 minutes Weekends 6:00 am – 10:40 pm Headways every 6 minutes

*Notes:*

<sup>1</sup>Headways are defined as the average interval of time between vehicles moving in the same direction on the same route.

Source: AC Transit, Maps and Schedules, October 2015.

**Figure 6** AC Transit Route—City of Oakland/Alameda Study Areas



### 4.2.3 Rail Activity

Rail activity in the proposed project study area was determined based on previous recent studies conducted in the area and discussions with CPUC and Union Pacific staff.<sup>18</sup> Temporary construction activities would occur at the east-west railroad crossing (a combination of three sets of tracks) immediately north of the Embarcadero West/Oak Street intersection. Temporary construction activities also would occur at a railroad line that crosses Derby Street at Glasscock Avenue. Pipeline construction activities would consist of “jack and bore” installations beneath the railroad tracks at these locations and no disruption of rail traffic would occur. Rail traffic on these facilities are described below.

#### Amtrak

Based on the Amtrak website, Amtrak provides passenger rail service on a local, state-wide, and regional basis. The Amtrak station located nearest the proposed pipeline construction at Crossing #1 is at Jack London Square approximately one-quarter mile west of Madison Street. The station is open from 5:15 a.m. to 11:00 p.m. with parking for up to 115 vehicles. Three Amtrak lines serve the station as follows:

- Coast-Starlight: One train per day in each direction operating between Seattle and Los Angeles;
- San Joaquin InterCity: Four trains per day in each direction to Bakersfield via Modesto and Fresno;
- The Capital Corridor: In excess of 20 trains per day operating between San Jose and the Sacramento-Auburn area.

All Amtrak trains use the rail crossing(s) at the Oak Street/Embarcadero West intersection.

#### Union Pacific

Union Pacific operates freight trains the travel north-south through the study area and Jack London Square. Discussions with Union Pacific staff indicate that there is freight traffic that travels through the proposed project study area near Crossing #1 using the Oak Street/Embarcadero West crossings but due to larger safety concerns (national security), the amount of rail traffic is kept dynamic. At the Derby Street rail crossing at Glascock Street; rail activity primarily serves the Con Agra flour plant and Ready Mix Concrete (RMC--Cemex) concrete plant adjacent to Kennedy Street and Embarcadero Cove west of Derby Street. Rail activity at this location near Crossing #3 is limited to night operations and can average up to 2 to 3 trains per week on its busiest schedule.

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<sup>18</sup> Fehr and Peers, *Jack London Square 4<sup>th</sup> & Madison Project EIR, Section C, Traffic and Transportation*, August, 2015.



## 5.0 Applicable Regulations, Plans, and Standards

### 5.1 Federal Regulations

The Federal Code of Regulations (CFR) includes the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government. These include the Pipeline and Hazardous Materials Safety Administration, the National Highway Safety Administration, and the Surface Transportation Board (all within Department of Transportation). Specific rules under CFR Title 49 address safety considerations for the transport of goods, materials, and substances and govern the transportation of hazardous materials, including types of materials and marking of transportation vehicles.<sup>19</sup>

### 5.2 State Regulations

Caltrans oversees the management and construction activities of the State Highway system. Caltrans is also responsible for the regulation and permitting within state highways and roadways. State highways and roadways within the proposed project study area exist at Crossing #1 where construction workers and construction vehicles and equipment would be operating in the State ROW on Madison Street passing underneath I-880 and along 5<sup>th</sup> Street that parallels I-880.

As part of the Caltrans permitting process, temporary traffic control plans are required as part of construction management “during time periods when the normal function of the roadway is suspended.” Caltrans requires that permits be obtained for construction activities including the transportation of oversized loads involving pipes and/or trenching equipment and for interruptions to traffic flow.<sup>20</sup>

### 5.3 Local Plans and Policies

The proposed pipeline approach alignments for Crossings #1, #2, and #3 occur in the jurisdictions of Oakland and Alameda which have general plan goals, objectives, and policies for maintaining the operation and maintenance of the transportation network within their jurisdictions.<sup>21,22</sup> The City of Oakland planning objectives and policies that would apply to the proposed project include the prioritization of transit and pedestrian flows over vehicle flow, the potential for transportation hazards, safety at railroad crossings, and requirements for construction activities which would typically include the amount of daily and peak hour construction trips, truck routes, and operating hours. Any construction activities that could affect sidewalks, parking lanes, and travel lanes should be addressed.<sup>23</sup> Similarly, the City of Alameda goals and policies are to provide for safe and efficient movement of people, goods, and services (Objective 4.1.1), implement and maintain a truck route map (Policy 4.1.1), develop criteria for safe passage of transit, pedestrians, and bicyclists through construction sites (Policy 4.1.1m), and maintain truck routing throughout the

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<sup>19</sup> *United States Federal Government, Code of Federal Regulations, Title 49; Transportation, Chapters I, II, V, and VII, eCFR, November 20, 2015.*

<sup>20</sup> *Mr. Fred Najadet, Encroachment Permits, Caltrans, Personal communication related to proposed construction activities, November 24, 2015.*

<sup>21</sup> *City of Oakland General Plan (Envision Oakland), Land Use and Transportation Element, March, 1998.*

<sup>22</sup> *City of Alameda, General Plan Transportation Element, 1990.*

<sup>23</sup> *City of Oakland, Transportation Impact Study Guidelines, Transportation Planning and Funding Division, March 19, 2013.*

City wherever possible.<sup>24</sup> In addition, the City of Alameda has a construction matrix for roadway classifications and street closure criteria (see Technical Appendices of this report).

EBMUD and its contractors would be required to obtain encroachment permits from the local jurisdictions and comply with all requirements to prevent or reduce disruption of traffic flow and pedestrian/transit operations in the public ROW.

## 6.0 Impacts and Recommended Mitigation Measures

### 6.1 Significance Criteria and Thresholds

The following significance criteria and thresholds would apply based on the California Environmental Quality Act (CEQA) statute and guidelines and local city threshold guidelines. Please note that proposed project impacts would be construction-related and temporary in nature. While the Cities of Oakland and Alameda significance thresholds apply to permanent traffic-generating projects and not to temporary traffic-generating activities like the proposed project, LOS thresholds for analysis are presented in order to fully inform the reader and decision makers about potential impacts during construction.

#### 6.1.1 CEQA Significance Criteria

The proposed project would result in a significant impact if any of the following occurs:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulations system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.
- Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.
- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.
- Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).
- Result in inadequate emergency access.
- Conflict with adopted policies, plans or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

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<sup>24</sup> City of Alameda, *General Plan Transportation Element*, 1990.

### 6.1.2 City of Oakland Significance Thresholds<sup>25</sup>

According to the City of Oakland's criteria, a project would have a significant impact if it would result in any of the following:

#### Capacity Thresholds

- At a signalized intersection which is located outside the Downtown area and does not provide access to Downtown, the project would cause the motor vehicle level of service (LOS) to degrade to worse than LOS D (i.e. LOS E-F) and cause the total intersection average vehicle delay to increase by four (4) or more seconds;
- At a signalized intersection located within the Downtown area or that provides direct access to the Downtown, the project would cause the motor vehicle LOS to degrade to worse than LOS E (i.e., LOS F) and cause the total intersection average vehicle delay to increase by four (4) seconds;
- At a signalized intersection outside the Downtown area and that does not provide direct access to Downtown where the motor vehicle level of service is LOS E, the project would cause the total intersection average delay to increase by four (4) or more seconds;
- At a signalized intersection outside the Downtown area and that does not provide direct access to Downtown where the motor vehicle level of service is LOS E, the project would cause an increase in the average vehicle delay for any of the critical movements of six (6) seconds or more;
- At a signalized intersection for all areas where motor vehicle level of service is LOS F, the project would cause the overall volume-to-capacity (v/c) ratio to increase by 0.03 or more or, b; the critical movement v/c ratio to increase by 0.05 or more;
- At an unsignalized intersection the project would add ten (10) or more vehicles (per hour) to the critical movement and after project completion satisfy the CA Manual on Uniform Traffic Control Devices (CAMUTDC) peak hour volume signal warrant (would not apply to temporary condition);
- For a roadway segment of the CMP network, the project would cause (a) the LOS to degrade from LOS E or better to LOS F or (b) the v/c ratio to increase to 0.03 or more for a roadway segment that would operate at LOS F without the project;
- Cause congestion of regional significance on a roadway segment on the MTS evaluated per the requirements of the Land Use Analysis Program of the CMP;
- Result in substantially increased travel times for AC Transit Buses. AC Transit bus routes would be considered impacted should proposed construction activities result in a re-routing of bus lines to alternative streets and/or precludes buses from accessing existing bus stops along their normal routes.

#### Traffic Safety Thresholds

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<sup>25</sup> City of Oakland Transportation Impact Study Guidelines, Transportation Planning and Funding Division, March 19, 2013.

- Directly or indirectly cause or expose roadway users (i.e. motorists, pedestrian, bus riders, bicyclists), to a permanent and substantial transportation hazard due to a new or existing physical design feature or incompatible uses;
- Directly or indirectly result in a permanent substantial decrease in pedestrian safety;
- Directly or indirectly result in a permanent substantial decrease in bicycle safety;
- Directly or indirectly result in a permanent substantial decrease in bus rider safety;
- Generate substantial multi-modal traffic travelling across at-grade railroad crossings that cause or expose roadway users (i.e. motorists, pedestrian, bus riders, bicyclists) to a permanent and substantial transportation hazard.

#### Other

- Fundamentally conflict with adopted City policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities adopted for the purpose of avoiding or mitigating and environmental effect and actually result in physical change in the environment;
- Result in a substantial, though temporary, adverse effect on the circulation system during construction of the project; or
- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.

#### 6.1.3 City of Alameda Significance Thresholds

The City of Alameda (as previously established), uses a multi-modal approach to determine proposed project impacts based on pedestrian, bicycle, transit, and vehicular operating conditions. Thresholds are established based on minimum LOS levels and percentage levels (i.e., vehicle delays increase by more than 10 percent). Upon consultation, the City of Alameda Transportation staff indicated that the primary threshold for establishing proposed project impacts would be vehicular based (LOS/Vehicle Delay) since project impacts would be considered temporary in nature.<sup>26</sup> All other temporary project impacts to pedestrian, bicycle, and transit would be addressed in the development of construction management plans required prior to issuance of construction permit(s) to ensure adequate progression during the temporary construction period. According to the City of Alameda's criteria, a project would have a significant impact if it would result in any of the following:

- **Automobile:** Causes an intersection to degrade below LOS D. If an intersection were already at LOS E or worse, an impact would be considered significant if there is a 3 percent or greater increase in the traffic volume. (Automobile LOS at intersections would be calculated using the 2010 and 2000 *Highway Capacity Manual's* methodology for determining the average vehicle delay at an intersection.)
- **Pedestrian:** Causes the Pedestrian LOS to degrade below LOS B at a signalized intersection. If the intersection were already below LOS B, an impact would be considered significant if the delay for a crosswalk increases by 10 percent. (Pedestrian

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<sup>26</sup> Mr. Virenda Patel, Senior Traffic Engineer, City of Alameda, Proposed project impact criteria related to temporary construction, Personal communication, November 3, 2015.

LOS would be determined using the 2000 *Highway Capacity Manual* methodology for determining the average delay for pedestrians at a signalized intersection.) Pedestrian access would be maintained during all full or partial construction-related roadway closures. Appropriate signage would be installed to warn pedestrians of construction/staging activities and direct them across intersections to open sidewalk(s).

- **Bicycle:** Causes the Bicycle segment LOS to degrade below LOS B. If a street segment were already below LOS B, an impact would be considered significant if the LOS score increases by 10 percent or more in value. If a segment has an existing adjacent Class I facility and has not been recommended for a future bicycle lane, the degradation of the Bicycle LOS to E would not be considered a significant impact. (Florida Department of Transportation methodology for street segments will be used for the LOS analysis). Bicycle travel would be maintained during all full or partial construction-related roadway closures. Where bicycle facilities exist, bicyclist would be directed to parallel routes and/or sidewalks (pending authorization with City staff) if no feasible alternative route exists. **Transit:** Causes travel speed to degrade by 10 percent or more along a street segment. A segment would be defined as the impacted bus stop location plus the two previous stops and the two subsequent stops (Transit LOS for an arterial segment would be calculated using the 2000 *Highway Capacity Manual's* methodology for Urban Street (arterial) Level of Service). AC Transit bus routes would be considered impacted should proposed construction activities result in a re-routing of bus lines to alternative roadways and/or precludes buses from accessing existing bus stops along their normal routes. As discussed with City Transportation staff, temporary construction management plans will address the needs of all transportation modes (including needs of the disabled community) as a requirement of project approval and permitting.<sup>27</sup>

## 6.2 Impact Analysis Methodology

### 6.2.1 Trip Generation

The transportation and traffic circulation impacts of the proposed project have been based on field observations, peak hour and daily vehicle counts, and estimated trip generation for the horizon year of project construction. Based on the proposed project description and information supplied by EBMUD, the construction activities for Crossings #1, #2, and #3 would generate 68 worker and truck vehicle trips per day. Assuming (conservatively) that 90 percent of the daily trips would occur during the AM and PM peak commute periods, the project would generate approximately 60 peak hour trips. The resulting peak hour trip generation would consist of 30 AM hour trips (30 in, 0 out) and 30 PM hour trips (0 in, 30 out). Based on the general locations of the pipeline routes there would not be a consistent pattern of trip assignment. Therefore, daily and peak hour project trips were added to all proposed project study area roadways and intersections in addition to the background growth projected for the horizon construction year.

In addition to potential vehicular impacts from proposed project uses, the impacts to alternative modes of transportation that include pedestrian, bicycle, and transit were analyzed.

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<sup>27</sup> Mr. Virenda Patel, Senior Traffic Engineer, City of Alameda, Proposed project impact criteria related to temporary construction, Personal communication, November 3, 2015.

### 6.2.2 Horizon Year Conditions

Construction of the proposed pipeline crossings would not occur until year 2018/2019 (Crossing #1) and year 2020 or beyond (Crossings #2 and #3). Traffic volumes for these horizon years were generated by applying an annual growth rate to the existing peak hour intersection and daily volumes found along the construction and identified detour routes (methodologies for annual growth rates are discussed below). Using an annual growth rate (and an assessments of other local projects as described below), study intersections and roadways were analyzed during the horizon year for construction activities with and without project traffic to provide an evaluation of likely construction impacts.

Annual growth rates for daily and peak hour volumes were derived from Alameda County Transportation Commission (ACTC) Countywide Travel Demand Model and from previous transportation studies conducted in Oakland and Alameda in the proposed project study areas.<sup>28,29</sup> The ACTC Countywide travel demand model projected that traffic volumes between the year 2010 and 2040 would increase by 42 percent (on average) over the 30-year period which would equate to an annual growth rate of 1.4 percent. The resulting growth in overall traffic volumes is conservative given both the cities of Oakland and Alameda's emphasis on alternative transportation modes and prioritization of pedestrian and bicycle travel. The annual growth rate of 1.4 percent was applied to existing intersection and roadway volumes for proposed Crossing #1 to project the future year 2019 conditions and for proposed Crossing's #2 and #3 to project future year 2020 conditions. The adjusted traffic volumes represent future "baseline" without project conditions at the likely period of pipeline construction.

In addition to annual growth rates, local development projects that could be developed within the next 2-3 years were included as part of future horizon (no project) conditions. These include the following projects:

- Jackson London Square 4th & Madison Project: Located between 5th Street and 3rd Street on the blocks bounded by Madison Street and Jackson Street, the project would consist of 330 multi-family residential units and 3,000 square feet of commercial-retail space;
- Del Monte Warehouse Project: Located on the northeast quadrant of the Buena Vista Avenue/Sherman Street intersection, the project would consist of 380 multi-family units and 30,000 square feet of commercial retail space.
- Marina Shore (Marina Cove II) Project: Located immediately east of the proposed Del Monte Warehouse project on Buena Vista Avenue. 89 single-family residential units.

### 6.2.3 Roadway Closures and Detours

Open trench pipeline construction on public roadways would usually require closure of at least one travel lane. Depending on the roadway width and size of the pipeline/trench, full closure of

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<sup>28</sup> Alameda County Transportation Commission (ACTC), *Countywide Travel Demand Model, Baseline year 2010 and future year 2040 daily and peak hour volume projections, 2015.*

<sup>29</sup> Fehr and Peers, *Jack London Square 4<sup>th</sup> & Madison Project EIR, Section C, Traffic and Transportation, August, 2015.*

the roadway may be required in some city block segments. The exact placement of each pipeline within the roadway ROW is currently not finalized because of unknown utility locations.<sup>30</sup> Pipelines will be located to avoid specific utilities by moving vertically and/or horizontally within the roadways. For this reason, EBMUD staff has developed conservative criteria for identifying where road closures may be necessary. Specifically, EBMUD has determined that a minimum roadway width of 48 feet is necessary in order to allow for a 25-foot construction zone with 11.5-foot traffic lanes on either side. This could include the temporary closure of bicycle lanes and/or on-street parking. Many streets along the pipeline open trench alignments would not meet the 48-foot minimum width criteria for remaining open (or partially open). For the purposes of this traffic analysis, streets with widths smaller than 48-feet have been assumed closed during construction hours. Closure is determined on a block-by-block basis. Pipeline alignment roadways with curb-to-curb widths greater than 48 feet have been assumed to be partially closed allowing one-way traffic flow.

An evaluation was conducted to determine the likely change in traffic operations for both roadway and intersection operations along the proposed pipeline construction segments and likely detour routes during the AM and PM peak hour periods. Since the proposed project would require temporary closures of either lanes or entire street segments; some vehicle traffic would be diverted to alternative routes that would result in increased traffic volumes on those alternative routes. The projected changes in daily traffic for the various construction segments for each proposed pipeline alignment are shown in Table 7 in association with the likely detour routes that are expected to capture the detoured traffic volumes. ADT volumes are shown for roadway segments expected for complete closure and partial closure. As indicated for the analysis periods, it is anticipated that construction would occur between 7:00 a.m. and 7:00 p.m. and would affect approximately 75 to 85 percent of the daily traffic volumes for full-closure segments. Approximately 75 to 85 percent of a roadway's daily traffic volumes occur between 7:00 a.m. and 7:00 p.m.; thus a diversion of traffic would occur within this range for full roadway closures. For partial closure roadways, 50 percent of the daily volumes were assumed to be diverted to detour routes.

In addition to likely detour routes and diverted traffic volumes, the approximate number of parking spaces that would be displaced from proposed pipeline construction activities has also been provided in Table 7.<sup>31</sup> The number of parking spaces is listed on a "total segment" basis and represents the entire roadway segment where proposed pipeline construction would occur. Since proposed project construction would typically proceed on a block-by-block basis, the total number of spaces that would be displaced at any one time would be significantly less than the total roadway segment (unless that segment is just one-block). On average, most roadway segments where construction would occur have 16 on-street parking spaces (or less) on a per block basis. The only exception would be where motorists park in perpendicular or diagonal spaces adjacent to existing work buildings. Limited perpendicular and/or diagonal parking was found in the city of Oakland south of I-880 along Madison Street, 2nd Street, Ford Street, and Derby Avenue. Perpendicular parking was also found in the city of Alameda along Bridgeview Isle (at Towata Park).

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<sup>30</sup> Mr. Aaron Hope, Project Manager—Alameda-North Bay Farm Island Pipeline Project, EBMUD, Personal communication related to pipeline construction criteria, October, 2015.

<sup>31</sup> Omni-Means Engineering Solutions, On-street parking surveys for proposed EBMUD pipeline routes (Crossing #'s 1, 2, and 3), February, 2016.

## 6.2.4 Planned Network Improvements

An overview of ongoing and future CIP and transportation projects in the Cities of Oakland and Alameda indicate that circulation improvements have been designated for several transportation modes in the proposed project study area. However, as is often the case, many of the circulation improvements lack funding or final design approval and cannot be considered viable for this transportation analysis. An ongoing Caltrans construction project that would affect traffic flows in both the cities of Oakland and Alameda associated with Crossing #3 is the I-880 Operational and Safety Improvements at the 29th Avenue and 23rd Avenue Overcrossing,<sup>32</sup> which would improve the 29th Avenue and 23rd Avenue overcrossings at I-880 as well as on/off ramp configurations and associated intersection operations on both the Oakland and Alameda side of the estuary. The project is currently under construction and is estimated to be completed by the summer of 2018.

**TABLE 7  
SUMMARY OF DETOURED VOLUMES AND ROUTES**

Anticipated Roadway Segment Closure	Traffic Volume	Parking Spaces Displaced (total segment)	Detoured Volumes <sup>1</sup>	Detour Routes
<b>Crossing #1 (Oakland)</b>				
Madison St./ 8th St.-2nd St.	6,980	83	5,580	Jackson Street, Oak St. (south of I-880)
2nd St./ Madison St.-Oak St.	100	26	80	3rd St, 4th St., 5th St.
Jackson St./ 5th St.-4th St.	2,800	16	2,240	5th St, Madison St., 4th St.
4th St./ Jackson St.- Madison St.	4,500	30	3,600	5th St., 3rd St., 2nd St.
5th Street (Partial Closure)/ Jackson St.-Oak St.	4,570	15	2,290	4th St.
Oak Street- Embarcadero West (Partial Closure)/ 2nd. St-Estuary	2,350	13	1,180	Oak St., Madison St., Jackson St., via 7th or 5th Ave.
<b>Crossing #1 (Alameda)</b>				
Sherman St./ Atlantic Ave.- Lincoln Ave.	10,116	44	8,090	Atlantic Ave, Lincoln Ave., Constitution Way

<sup>32</sup> Caltrans, *Interstate 880 Operational and Safety Improvements at 29<sup>th</sup> Avenue and 23<sup>rd</sup> Avenue Overcrossings, Initial Study with MND/ES with Finding of No Significant Impact*; April 2010.



Anticipated Roadway Segment Closure	Traffic Volume	Parking Spaces Displaced (total segment)	Detoured Volumes <sup>1</sup>	Detour Routes
Marina Village Parkway (Partial Closure)/ Tynan Ave.- Challenger Dr.	3,000	No Parking	1,500	Mariner Square Loop Rd., Atlantic Avenue
Challenger Dr. (Partial Closure)/ Marina Village Parkway- Atlantic Ave.	6,250	No Parking	3,130	Atlantic Ave., Triumph Dr., Independence Dr., Constitution Way
Atlantic Avenue (Partial Closure)/ Challenger Drive- Sherman Street	9,300	No Parking	4,650	Independence Drive, Triumph Drive, Constitution Way, Lincoln Avenue, Atlantic Avenue (west of Challenger Dr.)
<b>Crossing #2 (Alameda Only)</b>				
Peach St/ Otis St.-San Jose Ave.	205	44	160	Fernside Dr., Post St.
San Jose Ave./ Peach St.-Pearl St.	550	123	440	Adams St., Madison St., Encinal Ave.
Veteran's Ct.	100	42	80	N/A—local access only
Bridgeview Isle	250	35	0	N/A—local access only
<b>Crossing #3 (Oakland)</b>				
Ford St./ 29th St.-Derby Ave.	1,050	68	840	Chapman St., Glascock St.
Derby Ave./ Ford St.- Tidal Canal	320	43	260	Peterson St., Lancaster St.
<b>Crossing #3 (Alameda)</b>				
Clement Ave./ Everett St.- Broadway	4,265	36	3,410	Blanding Ave., Buena Vista
Everett St./ Clement Ave.- Lincoln Ave.	1,000	62	800	Park St., Broadway
Lincoln Ave./ Park St.-Everett St.	300	32	240	Webb Ave., Tilden Way
Tilden Way/ Broadway-Park St.	14,720	No Parking	11,780	Blanding Ave., Park St., Santa Clara Ave.
Broadway/ Blanding Ave.- Clement St.	6,270	91	5,020	Blanding Ave, Buena Vista Ave.

Notes:

<sup>1</sup>Detoured volumes were calculated using the assumption that an average of 80 percent of traffic would use detours for roads with full closures and 50 percent of traffic would use detours for roads with partial closures. The numbers are approximate and are rounded to the nearest tenth.

With the 29th Avenue and 23rd Avenue Overcrossing project under construction, the following intersections would be improved:

- **Chapman Street/29th Street:** The northbound approach on 29th Street would be changed to one-way-only. The southbound approach on 29th Avenue would be channelized for left-turn movements only onto Chapman Street.
- **Ford Street/29th Street:** The westbound approach on Ford Street would be changed to right-turn-only. The northbound approach on 29th Street would include a combination through/right-turn lane and two left-turn lanes while the southbound approach would include separate left and right-turn lanes. The intersection would be signalized.
- **Blanding Avenue/Park Street:** The signalized intersection would be improved by optimizing the cycle length to 65 seconds.
- **Clement Avenue/Park Street:** The signalized intersection would be improved by re-striping the eastbound approach on Clement Avenue to establish a left-turn pocket and optimizing the cycle length to 65 seconds.

In addition to the 29th Avenue and 23rd Avenue Overcrossing project, a mixed-use project in the City of Alameda planned for the northeast quadrant of Buena Vista Avenue/Sherman Street intersection would affect traffic flows and operations in the area. Specifically, the proposed Del Monte Warehouse Project would consist of 380 multi-family units and 30,000 square feet of commercial-retail development. With the proposed Del Monte Warehouse project, the following circulation improvements would be installed:

- **Eagle Avenue/Sherman Street:** The stop-sign controlled intersection (minor street) would be signalized. A new eastbound leg to the intersection would provide access to the project site;
- **Buena Vista Avenue/Project Entrance Road:** The project entrance road (t-type intersection) east of Sherman Street would be signalized;
- **Clement Street:** Clement Street would be extended west to Sherman Street to form a new (t-type) intersection north of Eagle Avenue. Clement Street and Atlantic Avenue would form the east-west approaches with Sherman Street being re-aligned to form the northbound approach leg.

The latter westbound extension of Clement Street is not the total responsibility of the Del Monte Warehouse project (even though they would construct a portion of this extension). The Clement Street extension relies on other long-term development in the Brooklyn Basin area. Therefore, the complete westbound extension of Clement Street to Sherman Avenue has not been assumed for this analysis.

Planned circulation improvements associated with the current I-880 Operational and Safety Improvements at 29th Avenue and 23rd Avenue Overcrossing project and planned Del Monte Warehouse project have been incorporated into intersection/roadway analysis for Crossing #1 and Crossing #3 at the Ford Street/29th Street and Chapman Street/29th Street intersections.

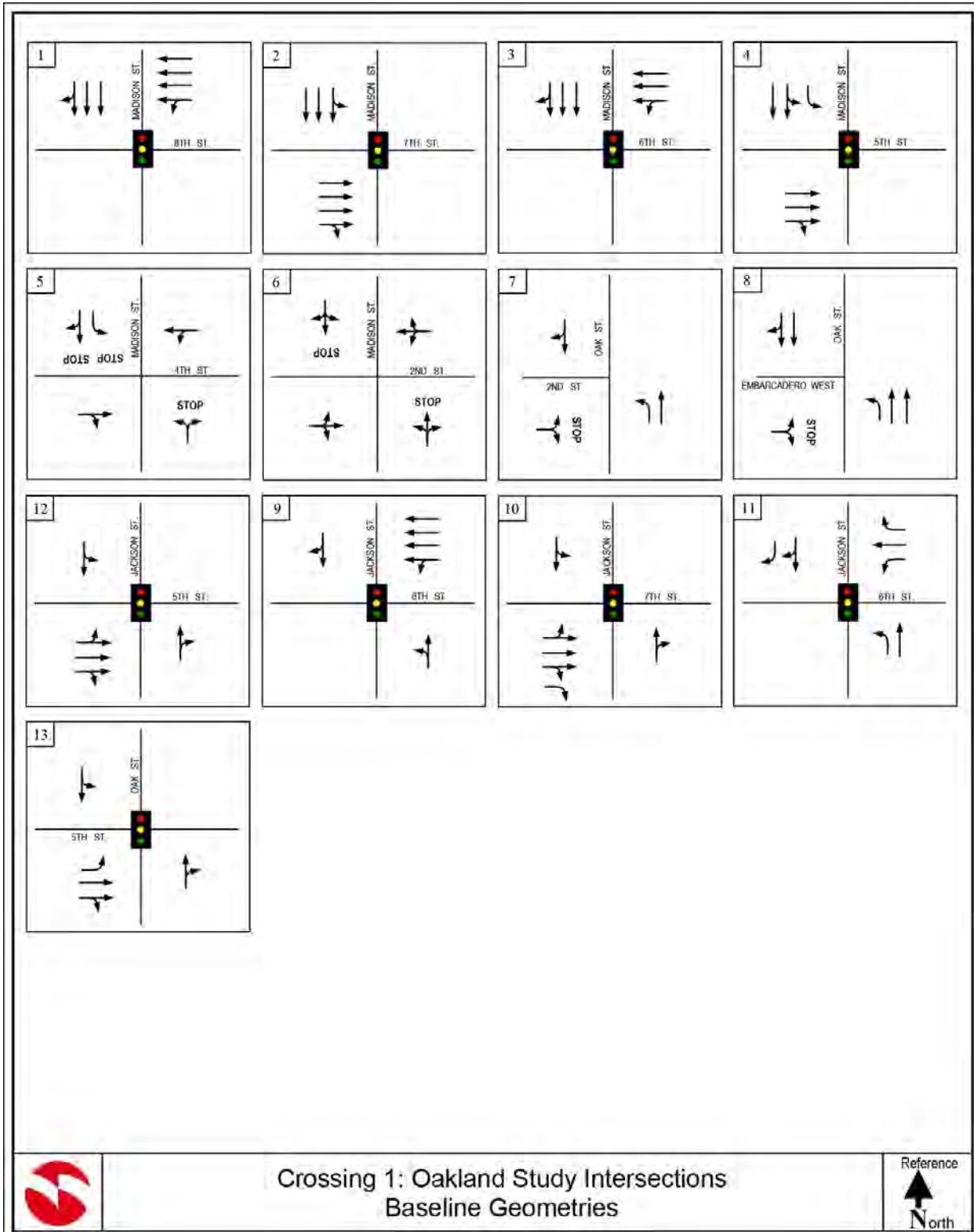
Future baseline (no project) intersection controls and lane geometries have been shown for Crossing #1 (Figures 7 and 8), Crossing #2 (Figure 9), and Crossing #3 (Figure 10). Future

baseline (no project) AM and PM intersection volumes are shown for Crossing #1 (Figures 11 and 12), Crossing #2 (Figure 13), and Crossing #3 (Figure 14).

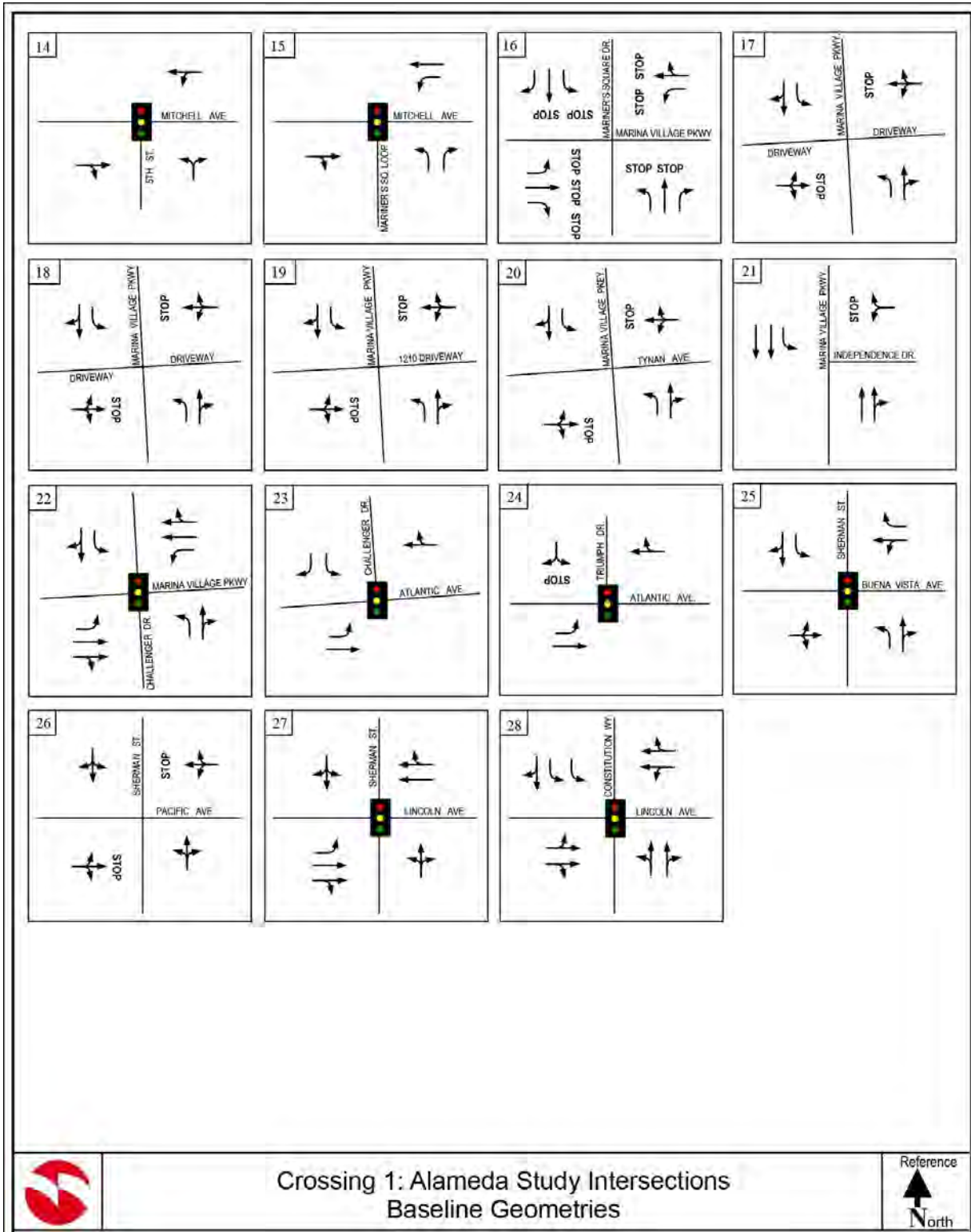
#### *6.2.5 Analysis Periods*

Construction hours would typically occur between 7:00 a.m. and 7:00 p.m. As noted, longer hours (up to 24 hours per day) would be necessary to connect existing pipelines, minimize water disruption to customers, minimize traffic impacts, and for portions of the HDD operations on either side of the Crossings. The AM peak period (between 7:00 to 9:00 a.m.) and PM peak periods (between 4:00 to 6:00 p.m.) have been analyzed to include school traffic and commute traffic and are consistent with transportation studies conducted in the proposed project study area.

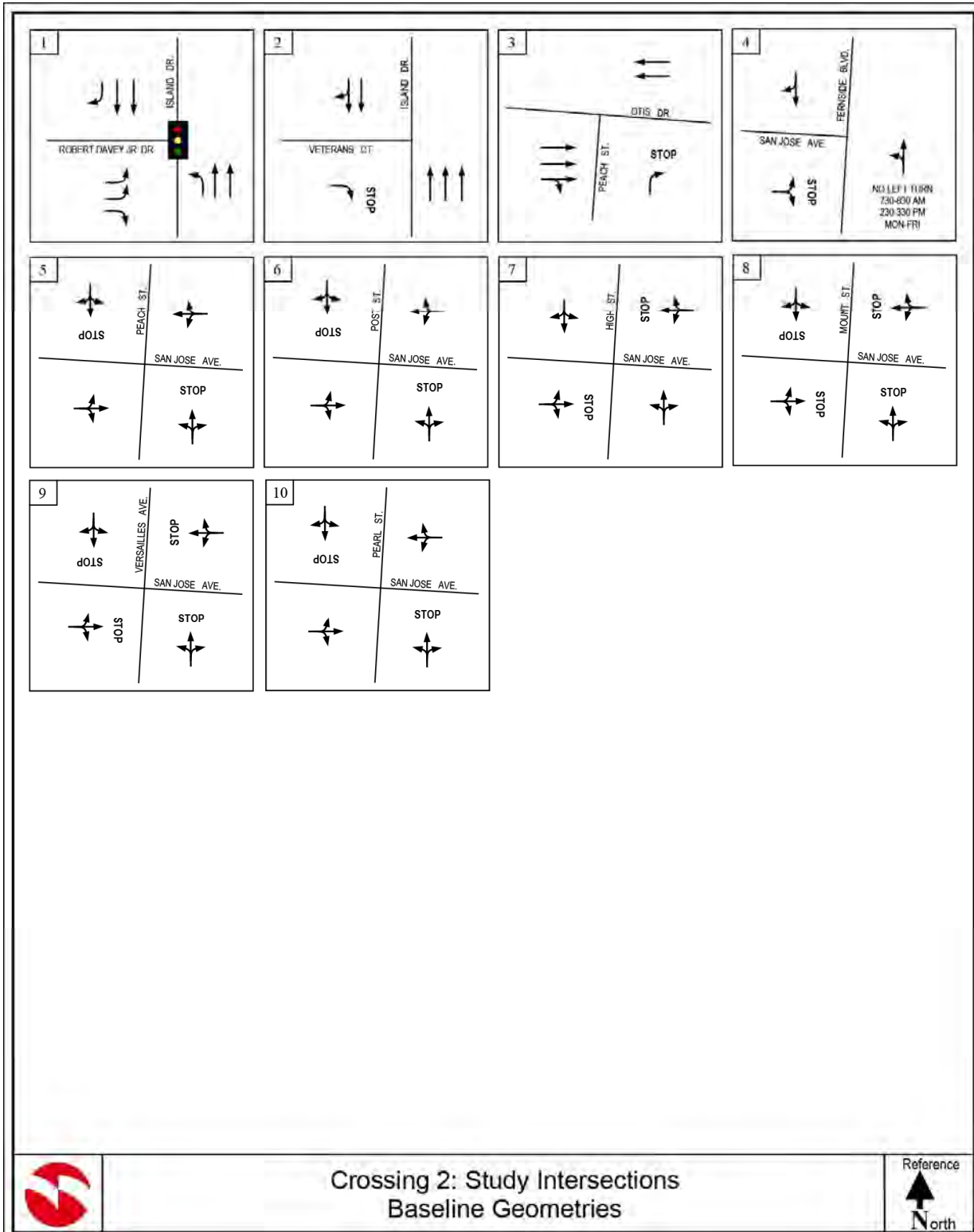
**Figure 7** Crossing #1 Intersection Controls/Lane Geometries (Oakland)



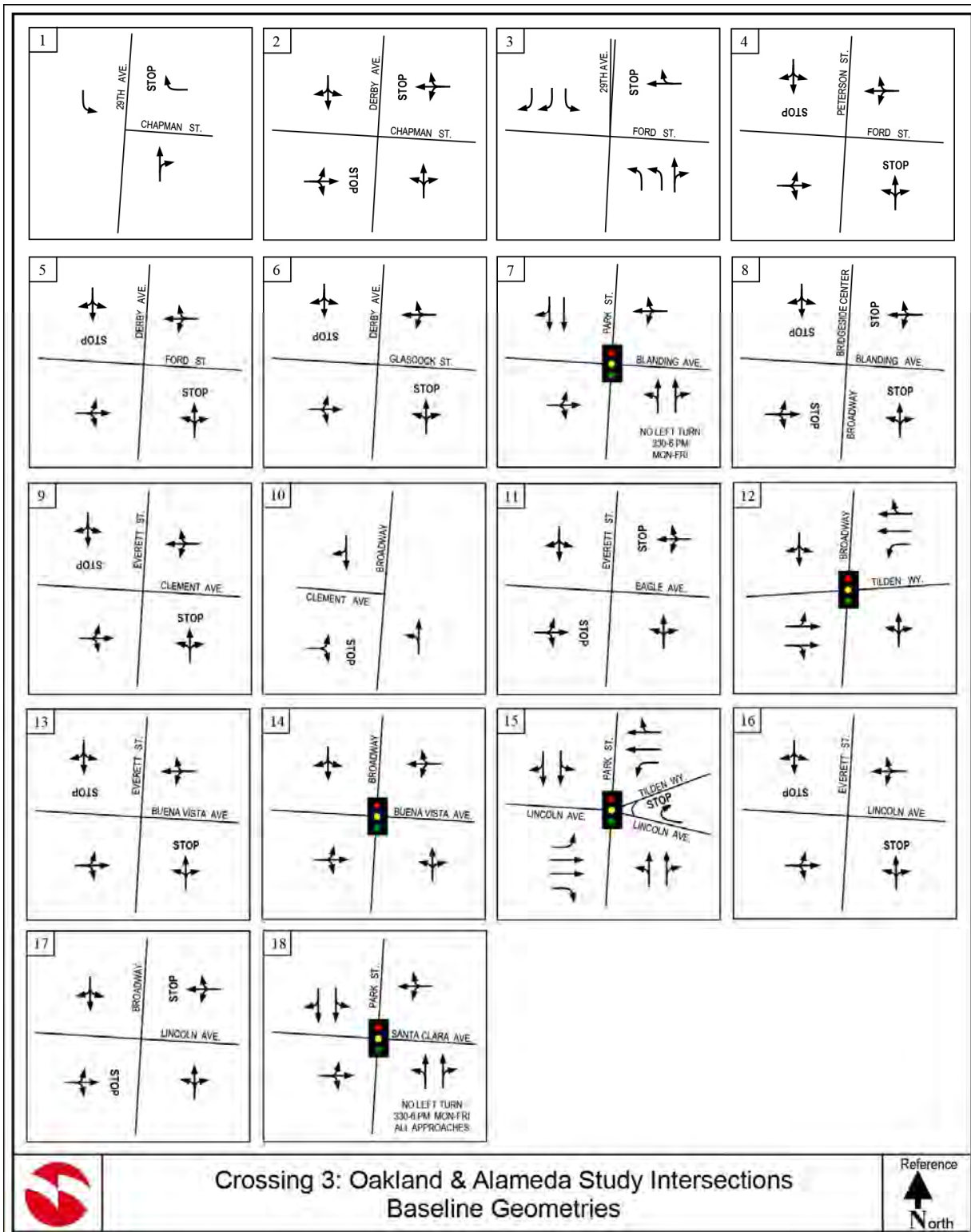
**Figure 8** Crossing #1 Intersection Controls/Lane Geometries (Alameda)



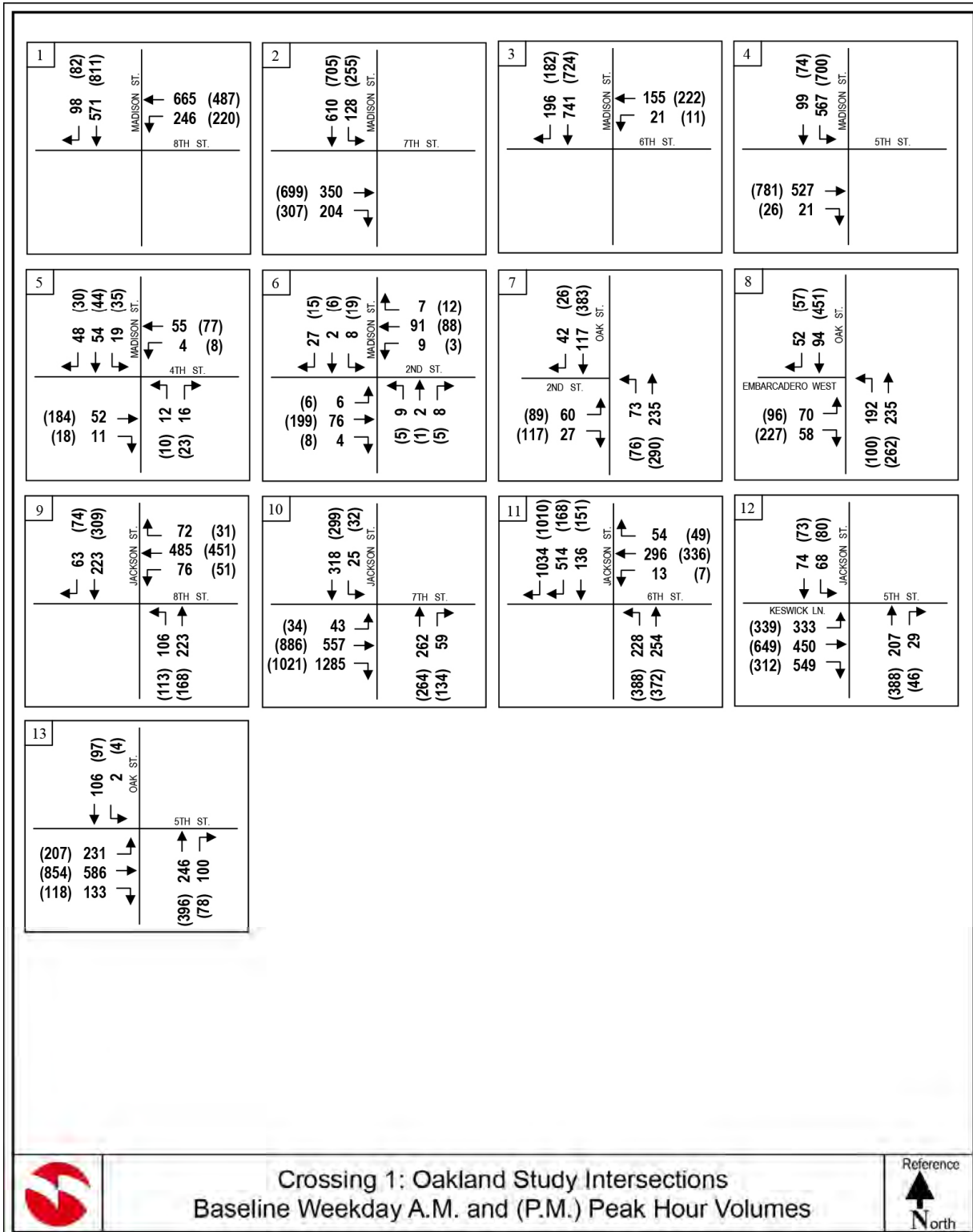
**Figure 9** Crossing #2 Intersection Controls/Lane Geometries (Alameda Only)



**Figure 10** Crossing #3 Intersection Controls/Lane Geometries (Oakland/Alameda)

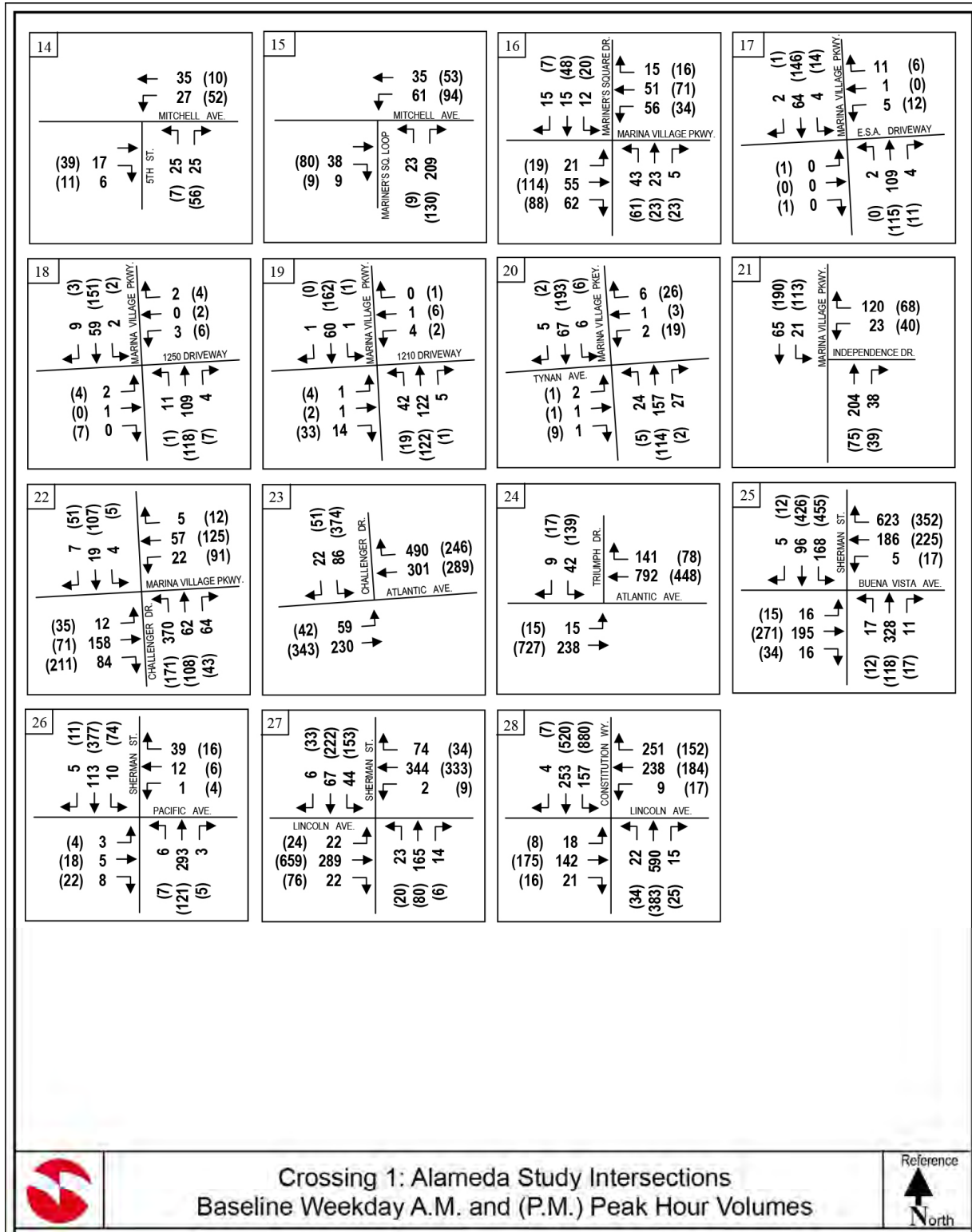


**Figure 11 Crossing #1 Baseline (NP) AM & PM Intersection Volumes (Oakland)**

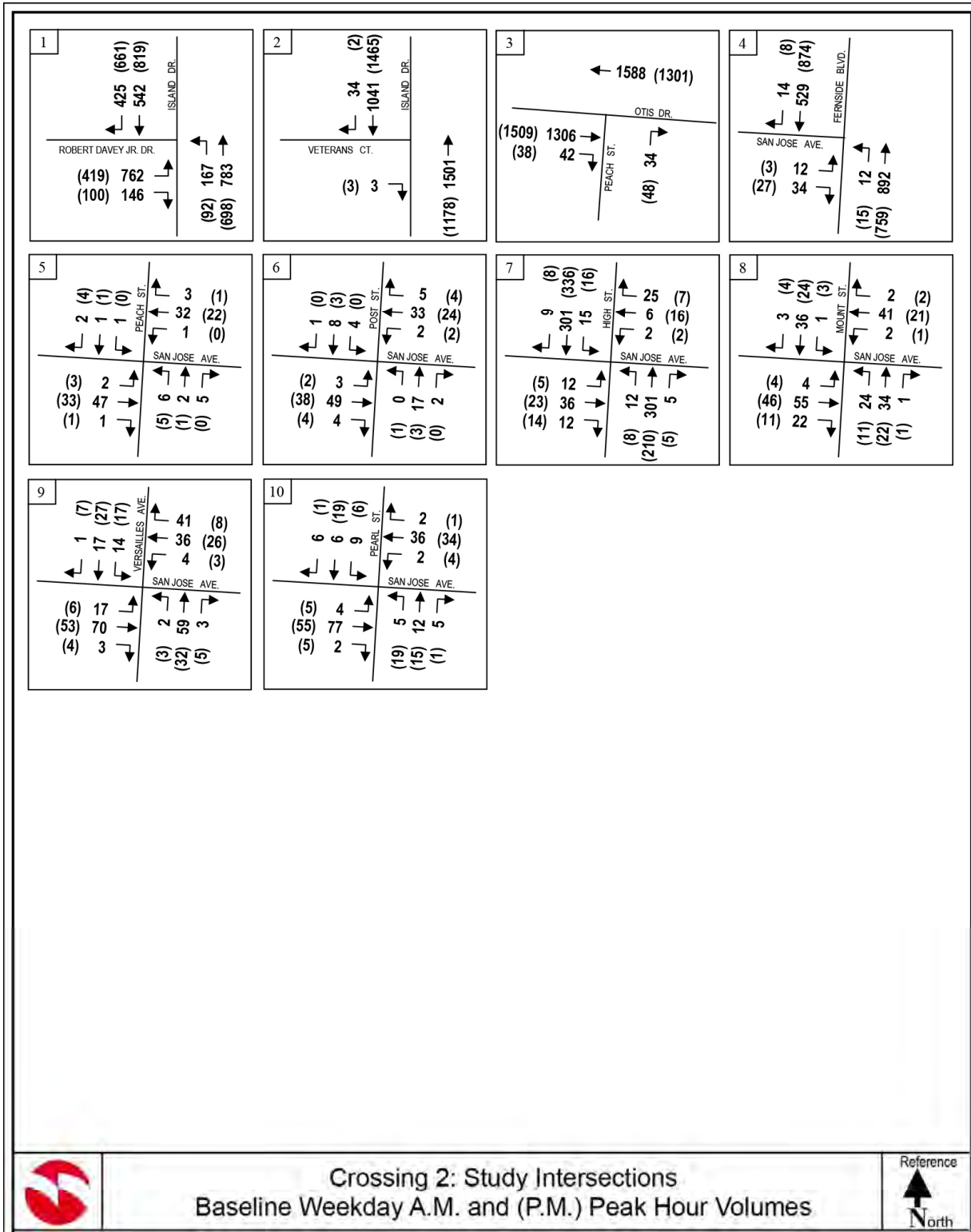




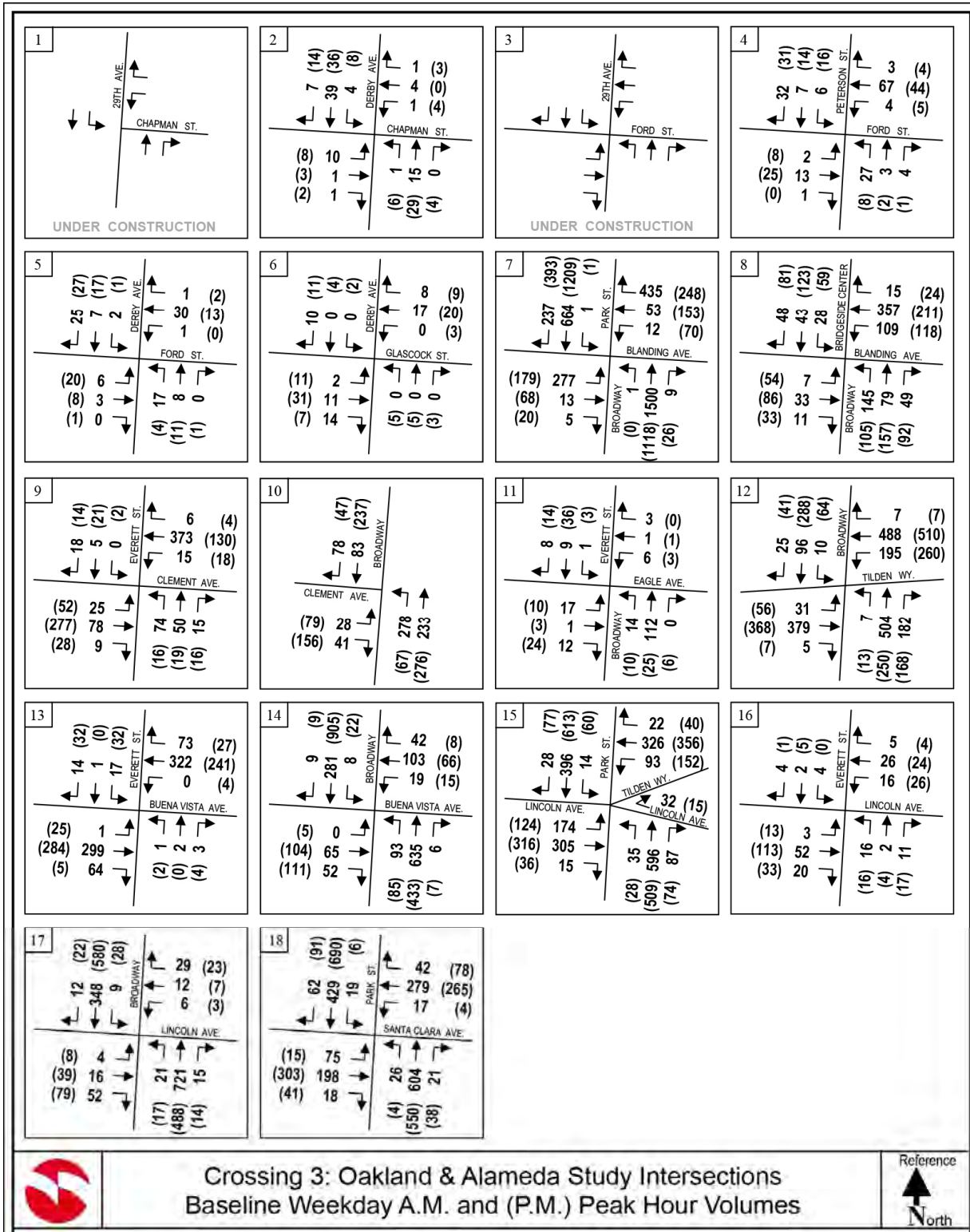
**Figure 12 Crossing #1 Baseline (NP) AM & PM Intersection Volumes (Alameda)**



**Figure 13** Crossing #2 Baseline (NP) AM & PM Intersection Volumes (Alameda Only)



**Figure 14** Crossing #3 Baseline (NP) AM & PM Int. Volumes (Oakland/Alameda)



## 6.3 Impacts and Recommended Mitigation Measures

**Impact Traffic-1: Would the proposed project conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency, taking into account all modes of transportation? (*Less than Significant with Mitigation*)**

### Crossing #1 (Oakland)

Figure 2 shows the proposed pipeline alignment in Oakland including the abandonment along 5th Street between Jackson Street and Oak Street. Many of the streets along the pipeline alignment would not meet the 48-foot minimum width criteria for remaining open (or partially open). The only viable detour route for southbound vehicle traffic north of I-880 would be Jackson Street, as shown in Table 7. Even though there are two roadway segments on southbound Madison Street that could potentially be partially closed (between 8th and 7th Streets and 6th and 5th Streets), the conservative criteria used for this analysis is that Madison Street would be completely closed for construction activities (8th Street through 2nd Avenue block-by-block) to allow for more efficient construction time and reduced periods of overall roadway closures. During construction activities, segments of both 5th Street and Oak Street would be partially closed to allow for the continued flow of traffic through construction areas. The full and partial closures for the pipeline construction roadway segments and likely detour routes for Crossing #1 in Oakland are shown in Figure 15.

Table 8 shows the peak hour intersection LOS results under Baseline (No Project) conditions and Baseline plus Project conditions. Year 2019 AM and PM peak hour Baseline plus Project volumes are shown in Figure 16.

It is noted that the intersection LOS calculations reflect a “worst case” scenario for each intersection related to traffic diversions and construction activities. Intersection impacts are temporary in nature and do not occur over the duration of project construction activities at a given intersection. Construction activities progress on a block-by-block basis (i.e., 8th St. to 7th St., 7th St. to 6th St., etc.) and would typically not extend beyond these boundaries at any one time. Future “with project” traffic volumes reflect both project construction traffic and diverted traffic from required street closures.

The LOS results shown in Table 8 reflect the fact that, during construction activities, some proposed project study area intersections would actually improve in operations (due to less traffic and limited turning movements). This would primarily apply to intersections located along the construction route of Madison Street, 2nd Street, and to a lesser degree, Oak Street. Intersections located along likely detour routes would notice a temporary degradation in peak hour LOS due to increased traffic volumes diverted from construction routes. This would primarily affect intersections along Jackson Street, 5th Street, and Embarcadero West. As indicated in Table 8, the intersections of Jackson Street/7th Street, Jackson Street/6th Street, and Jacksons Street/5th Street/I-880 east bound (EB) off-ramp would be operating at LOS F during the AM peak hour. Poor intersection LOS along Jackson Street is primarily due to southbound traffic on Madison Street having to divert west during the full or partial closures of Madison Street during construction activities. During the PM peak hour, the intersections of Oak Street/Embarcadero West, Jackson Street/8th Street, Jackson Street/7th Street, Jackson Street/6th Street, and Jacksons Street/5th Street/I-880 EB off-ramp would be operating at LOS E-F. These impacts would be significant.

**Figure 15 Full & Partial Closure & Detour Routes (Oakland Crossing #1)**



Detour routes were identified as the most convenient and viable routes based on the one-way traffic flow of selected roadways in the vicinity of the proposed project. The following roads are one-way: Madison Street (between 8<sup>th</sup> Street and 4<sup>th</sup> Street), 8<sup>th</sup> Street, 7<sup>th</sup> Street, 6<sup>th</sup> Street, 5<sup>th</sup> Street, and Oak Street (northbound). The only viable detour route for southbound traffic flow on Madison Street would be Jackson Street due to the one-way roads near Madison Street. Motorists would be diverted at 8<sup>th</sup> Street west to Jackson Street and then continue south on Jackson Street to 5<sup>th</sup> Street. At 5<sup>th</sup> Street, motorists could continue south or east on I-880 to their original destinations. Vehicle traffic originating south of 5<sup>th</sup> Street would be affected by the full-closure of Madison Street south of 5<sup>th</sup> Street. Motorists could use multiple detour routes (Jackson Street, Oak Street, 5<sup>th</sup> Street, 4<sup>th</sup> Street, and 3<sup>rd</sup> Street) to travel around construction zones. Motorists would use the same detour routes to circumvent the one-block closures of Jackson Street, 4<sup>th</sup> Street, and 2<sup>nd</sup> Street. This figure depicts all the road closures that would result from all construction activities associated with Crossing #1; however, construction activities would not occur at the same time. Pipeline trenching would occur on a block-by-block basis. On any given day, traffic movement would only be impacted by either the full or partial closure of streets along one or two city blocks.

**TABLE 8  
CROSSING #1  
BASELINE (NO PROJECT) AND BASELINE PLUS PROJECT INTERSECTION LEVELS-OF-SERVICE  
YEAR 2019 AM AND PM PEAK HOUR**

#	Intersection	Control Type	AM Peak Hr LOS (Grade) Delay (Seconds)		PM Peak Hr LOS (Grade) Delay (Seconds)	
			Base (NP)	Base+Prj.	Base (NP)	Base + Prj.
1	Madison St./8th St.	Signal	B 11.9	B 13.8	B 11.9	B 15.0
2	Madison St./7th St.	Signal	A 5.5	B 12.6	A 8.7	B 13.3
3	Madison St./6th St.	Signal	A 6.5	B 14.0	A 7.4	B 14.2
4	Madison St./5th St.	Signal	A 5.8	B 16.3	A 7.5	D 38.4
5	Madison St./4th St.	TWSC	A 9.9	A 9.9	B 11.0	B 11.0
6	Madison St./2nd St.	TWSC	A 9.3	A 9.3	B 10.3	B 10.3
7	Oak St./2nd St.	TWSC	B 13.0	B 13.0	C 23.8	C 23.8
8	Oak St./Embarcadero West	TWSC	C 17.8	C 17.6	<b>E 41.2</b>	<b>F 57.4</b>
9	Jackson St./8th St.	Signal	A 9.3	D 48.9	B 13.2	<b>F 108.2</b>
10	Jackson St./7th St.	Signal	B 13.3	<b>F 205.0</b>	B 12.1	<b>F 259.9</b>
11	Jackson St./6th St.	Signal	C 28.0	<b>F 113.8</b>	C 21.6	<b>E 75.0</b>
12	Jackson St./5th St./I-880 EB Off	Signal	B 13.1	<b>F 133.1</b>	B 18.3	<b>F 358.8</b>
13	Oak St./5th St.	Signal	A 8.8	A 8.5	B 13.3	B 14.9
14	Mitchell Ave./5th St.	Signal	B 14.6	B 14.6	B 14.2	B 14.2
15	Marina Village Pkwy./Mariner Sq. Lp.	Signal	B 14.4	B 17.3	B 15.7	C 22.0
16	Marina Village Pkwy./Mariner Sq. Dr.	AWSC	A 8.3	A 9.3	A 9.2	B 12.0
17	Marina Village Pkwy./Extend. Stay Dr.	TWSC	A 9.3	A 8.9	B 10.3	A 9.9
18	Marina Village Pkwy./1250 Dr.	TWSC	B 10.1	A 8.9	B 10.2	A 9.9
19	Marina Village Pkwy./1210 Dr.	TWSC	B 10.9	A 9.0	B 11.2	B 10.2
20	Marina Village Pkwy./Tynan Ave.	TWSC	B 10.9	B 10.5	B 10.4	B 11.3
21	Marina Village Pkwy./Independence Dr.	TWSC	B 10.3	B 10.3	B 11.0	A 9.0
22	Marina Village Pkwy./Challenger Dr.	Signal	C 28.5	B 14.8	C 32.3	C 28.7
23	Atlantic Ave./Challenger Dr.	Signal	B 14.5	B 18.0	B 14.9	C 21.9
24	Atlantic Ave./Triumph Dr.	TWSC	D 28.8	A 9.9	<b>F &gt;55.0</b>	<b>F 113.6</b>
25	Sherman St./Buena Vista Ave.	Signal	B 18.7	B 13.6	C 26.0	B 13.2
26	Sherman St./Pacific Ave.	TWSC	B 11.2	A 0.0	B 14.5	A 0.0
27	Sherman St./Lincoln Ave.	Signal	B 11.4	B 12.9	B 14.1	C 25.2
28	8th St./Constitution Wy./Lincoln Ave.	Signal	C 27.2	D 36.4	C 20.9	C 22.9

*Signalized/unsignalized intersection LOS based on HCM 2010 methodology (Synchro-Simtraffic software) which yields a vehicle delay in seconds.*

*TWSC = Two-Way-Stop-Control.*

*AWSC = All-Way-Stop-Control*

**Bold = Exceed the Significance Thresholds**

Implementation of Mitigation Measures TRA-1 and TRA-2 would reduce temporary impacts to proposed project study area intersections along Jackson Street and Oak Street/Embarcadero West. Mitigation Measure TRA-1 requires the preparation of a Construction Traffic Management Plan (CTMP) that conforms to the California Manual on Uniform Traffic Control Devices and the traffic requirements of the City of Oakland. The CTMP will include comprehensive traffic control and traffic safety measures that help minimize construction-related traffic congestion at proposed project study area intersections. Mitigation Measure TRA-2 requires that a minimum of one southbound lane of traffic be maintained between 8th Street and 5th Street to reduce overall traffic impacts on Jackson Street. As a result of these three measures, overall intersection LOS would improve on Jackson Street as shown in Table 9, which shows AM and PM peak hour baseline

plus project intersection LOS with Madison Street closed and Madison Street open with one-lane of southbound traffic. However, vehicle queuing analyses for Madison Street with one-lane of southbound travel indicate that the average vehicle queues (95th percentile) would equal approximately 225-235 feet during the AM and PM commute periods. The calculated vehicle queue would extend back (north) approximately one block from the partially closed construction zone on Madison Street. The amount of southbound traffic that may continue to divert to Jackson Street from Madison Street during the partial closure is difficult to estimate. Motorist familiar with the area would likely divert to Jackson Street if vehicle delays are long.

**TABLE 9**  
**CROSSING #1**  
**BASELINE PLUS PROJECT AFFECTED INTERSECTION LEVELS-OF-SERVICE: MADISON STREET CLOSED**  
**AND MADISON STREET PARTIALLY OPEN**  
**YEAR 2019 AM AND PM PEAK HOUR**

#	Affected Intersections	Control Type	AM Peak Hr/LOS-Delay		PM Peak Hr/LOS Delay	
			Base+Prj Closed	Base+Prj. Open	Base+Prj Closed	Base+Prj. Open
1	Madison St./8th St.	Signal	B 13.8	C 29.3	B 15.0	C 23.9
2	Madison St./7th St.	Signal	B 12.6	B 11.4	B 13.3	B 19.6
3	Madison St./6th St.	Signal	B 14.0	D 39.4	B 14.2	C 29.6
4	Madison St./5th St.	Signal	B 16.3	B 11.1	D 38.4	C 26.4
9	Jackson St./8th St.	Signal	D 48.9	A 9.3	<b>F 108.2</b>	B 13.2
10	Jackson St./7th St.	Signal	<b>F 205.0</b>	B 13.3	<b>F 259.9</b>	B 12.1
11	Jackson St./6th St.	Signal	<b>F 113.8</b>	C 28.0	<b>E 75.0</b>	C 21.6
12	Jackson St./5th St./I-880 EB Off	Signal	<b>F 133.1</b>	B 13.1	<b>F 358.8</b>	B 18.3

*Signalized/unsignalized intersection LOS based on HCM 2000 methodology (Synchro-Simtraffic software) which yields a vehicle delay in seconds.*

*TWSC = Two-Way-Stop-Control.*

*AWSC = All-Way-Stop-Control*

**Bold = Exceedance**

Mitigation Measure TRA-3 requires the use of flag persons at the intersection of Oak Street and Embarcadero West to facilitate traffic flow and improve vehicle progression through this intersection. Previous transportation studies conducted on the use of flaggers at unsignalized intersections indicate significant improvements in overall intersection operations from LOS F to LOS D or better.<sup>33</sup>

With implementation of Mitigation Measures TRA-1, TRA-2, and TRA-3 temporary impacts to study area intersections on the Oakland side of Crossing #1 would be **less than significant**.

### Crossing #1 (Alameda)

As shown in Figure 2, the majority of the pipeline route would extend southeast along Marina Village Parkway ultimately terminating at Lincoln Avenue. During proposed project construction activities on the Alameda Island portion of Crossing #1, the entire construction segments along Marina Village Parkway, Challenger Drive, and Atlantic Avenue would require partial closure of

<sup>33</sup> ESA, *West of Hills Northern Pipelines Project, Transportation and Traffic, Draft EIR, May, 2013.*

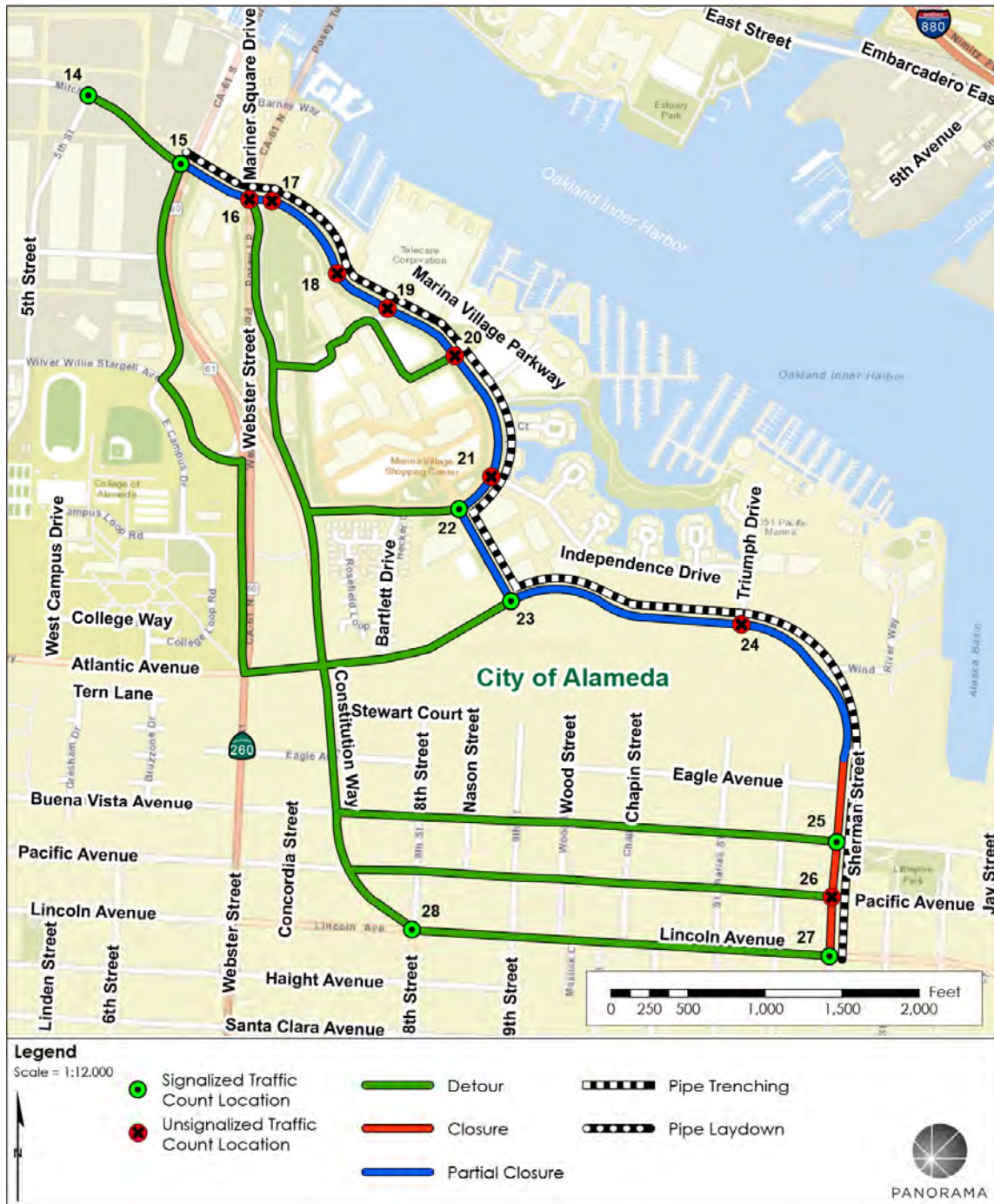
one side of the street. Sherman Avenue would require complete closure during construction. The proposed pipe associated with the HDD installation would be assembled along the central median(s) of Marina Village Parkway with K-rails to allow continued movement of through-traffic along the roadway. However, the temporary laydown of the pipeline/K-rails would temporarily prevent left-turn movements from adjacent streets and driveways for up to two weeks (during pipe assembly and testing). During the 48-hour insertion process where the pipe is pulled into the HDD pit, the westbound direction of Marina Village Parkway would be closed. The full and partial closures for the pipeline construction roadway segments and likely detour routes for Crossing #1 in Alameda are shown in Figure 17.

The most efficient detour routes would direct traffic around the construction areas to the west from Sherman Street via Buena Vista Avenue and Lincoln Avenue, as shown in Summary Detour/Routes Table 7. Motorists would then travel north up Constitution Way to Mariner Square Drive to circumvent construction zones. Similarly, diverted motorists travelling in the opposite direction would likely use Mariner Square Loop Road to Webster Street and Lincoln Avenue to travel east. There is the potential that motorists would use retail and office driveways along Marina Village Parkway, Challenger Drive, and Atlantic Avenue to bypass the construction zones and reach their destinations as opposed to traversing along the proposed detour routes.

Year 2019 AM and PM peak hour Baseline plus Project volumes are shown in Figure 18.

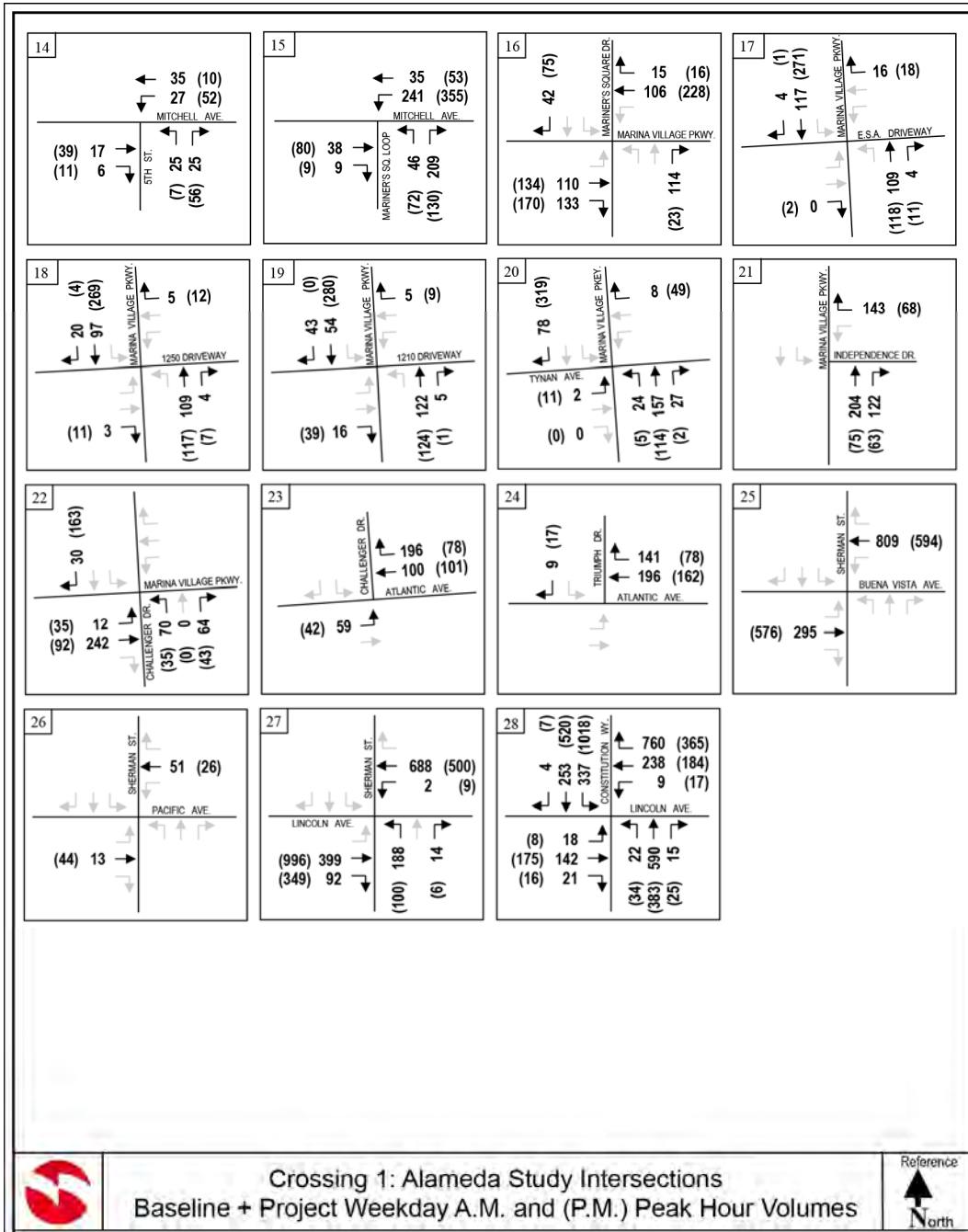


**Figure 16 Full & Partial Closure & Detour Routes (Alameda Crossing #1)**



Detour routes were identified as the most convenient and viable routes. Sherman Street (between Atlantic Avenue and Lincoln Avenue) would be fully closed during pipeline trenching and motorists would be diverted to Atlantic Avenue, Constitution Way, and Lincoln Avenue. Atlantic Avenue, Challenger Drive, and Marina Village Parkway would be partially closed during pipeline trenching and pipeline laydown; likely detour routes for motorists using these roads include Lincoln Avenue, Constitution Way, Atlantic Avenue (west of Challenger Drive), Triumph Drive, Independence Drive, Marina Village Parkway (west of Challenger Drive), Tynan Avenue, Mariner Square Drive, Mariner Square Loop, Willie Stargel Avenue, and Webster Street.

**Figure 17** Crossing #1 Baseline plus Project Volumes, AM & PM Peak Hour (Alameda)



Similar to the Oakland side of Crossing #1, intersections located along the construction route would tend to improve in overall LOS due to limited access and reduced traffic volumes while intersections along the detour routes would experience higher traffic volumes and greater delays. The intersection LOS results shown in Table 8 with Baseline plus Project conditions indicate all of the study intersections located along the construction/detour routes would operate at LOS D or better with the exception of the stop-sign controlled Atlantic Avenue/Triumph Drive intersection. At this intersection location, the overall LOS during the PM peak hour is F with average delays of 113 seconds. However, this impact is not considered significant because the intersection under baseline conditions, without the proposed project is already operating at LOS F. Impacts would be ***less-than-significant***.

As noted, driveway/minor street access and through-traffic along Marina Village Parkway, Challenger Drive, Atlantic Avenue, and Sherman Street would be restricted due to partial road closures during construction periods, creating temporary impacts that would be potentially significant. The proposed detour route of Mariner Square Drive, Constitution Way, and Lincoln Avenue would allow traffic to bypass construction activities along Marina Village Parkway, Challenger Drive, Atlantic Avenue, and Sherman Street. As noted previously, construction activities would be in segments or block-by-block and would not extend beyond these boundaries to all study intersections at once. Therefore, impacts would ultimately be less than significant. Less than significant impacts along Marina Village Parkway, Challenger Drive, Atlantic Avenue, and Sherman Street would be further reduced through CTMP implementation, as described in Mitigation Measure TRA-1.

### **Crossing #2: (Alameda Only)**

Figure 3 shows the proposed pipeline route on Alameda Island and North Bay Farm Island. Roadways along the proposed route are typically 36 feet wide with parking on both sides of the street. The proposed construction activities for Crossing #2 would require the full roadway closure along the proposed pipeline route from San Jose Avenue to Pearl Street on a block-by-block basis. Island Drive on the North Bay Farm Island side of Crossing #2 would be partially closed. One lane (the westernmost lane) of Island Drive would be closed for 48 hours during the HDD pull through and intermittently for 2 weeks during the delivery of the pipeline for pipeline laydown. Full and partial closures for the pipeline construction roadway segments and likely detour routes for Crossing #2 are shown in Figure 19.

The most efficient detour routes for full closures would direct traffic around the construction areas on Peach Street via Fernside Boulevard and/or Post Street, as indicated in Table 7. The ADT counts for Peach Street between Adams Street and San Jose Avenue are low and consistent with LOS A operations for a two-lane local street, reflecting the residential nature of the area. During construction activities on Peach Street, the majority of motorists would be detoured to Post Street. With the addition of daily trips, overall operations on Post Street would continue to be LOS A based on low daily traffic volumes in the area. Should residents prefer to use Fernside Boulevard immediately to the east (a more circuitous route), overall peak hour operations at the San Jose Avenue/Fernside Boulevard intersection would continue to operate at acceptable levels (LOS D or better).

Baseline plus Project AM and PM peak hour intersection volumes for proposed Crossing #2 are shown in Figure 20. Table 10 shows the peak hour intersection LOS results under Baseline (No Project) conditions and Baseline plus Project conditions. With construction activities along San Jose Avenue, the preferred detour routes (parallel routes) would include Adams Street immediately to the south or Madison Street and Encinal Avenue immediately to the north. The

addition of daily traffic volumes along Adams Street or Madison Street from San Jose Avenue would be noticed by residents, but would not change overall operating conditions of LOS A. Additionally, motorists wishing to use Encinal Avenue east/west to avoid construction on San Jose Avenue would not change overall operating conditions. The increase in daily traffic along Encinal Avenue would not change significantly with diverted traffic from San Jose Avenue and would not change overall operating conditions of LOS A. Therefore, the impacts to intersection operation from the full closure of roadways for Crossing #2 construction would be **less than significant**.

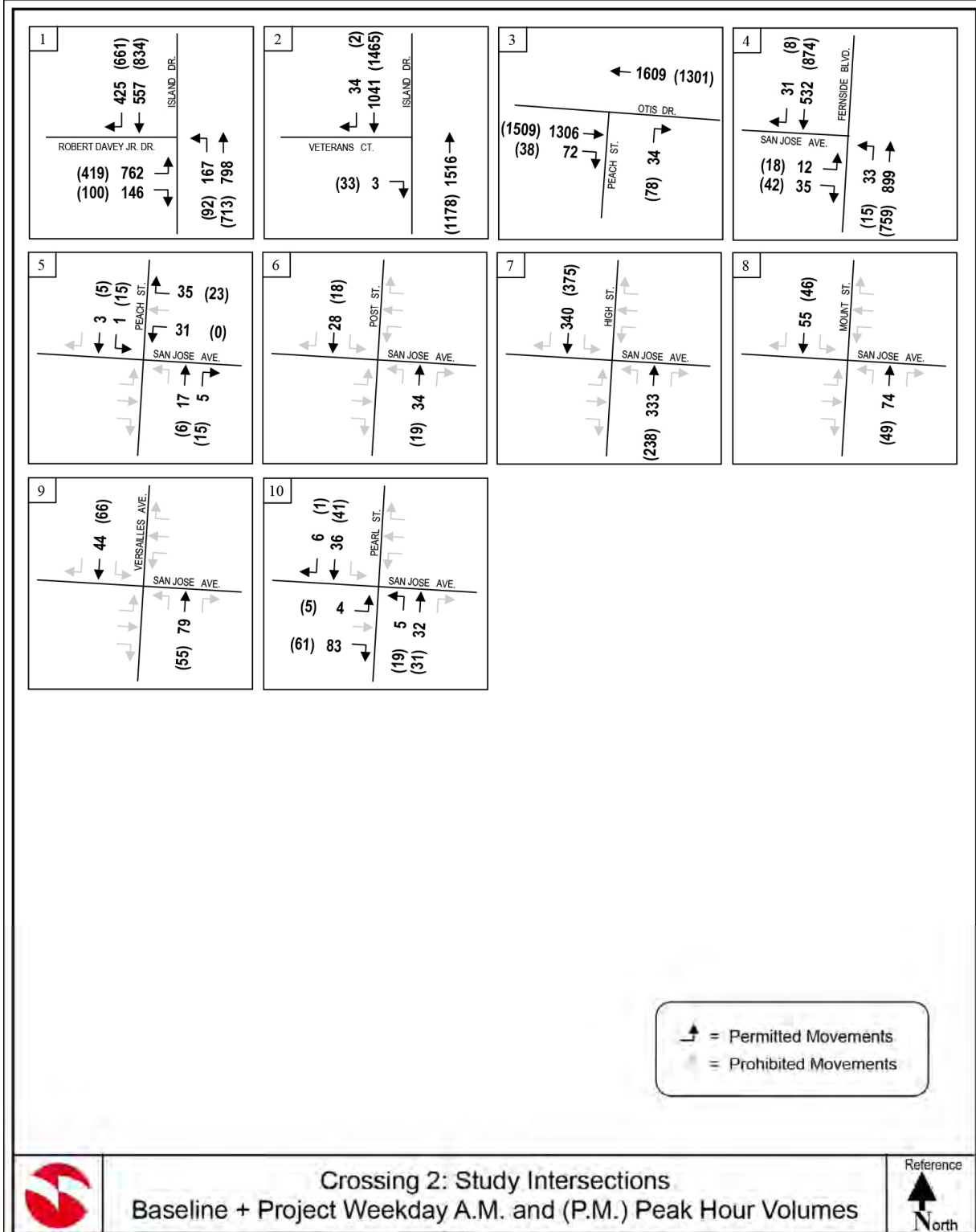
Drivers would be able to use Island Drive during the temporary closure of the one lane; however, the temporary impact could be potentially significant if the one-lane closure occurs during the peak hour traffic periods. The HDD pull through would occur for a 48-hour period during the weekend, outside of peak traffic hours; therefore, the impact to traffic from the HDD pull through would be less than significant. Mitigation Measure TRA-1 requires EBMUD to limit the timing for the delivery of materials for construction to non-peak hours of traffic flow (9:00 a.m. to 4:00 p.m.). With implementation of Mitigation Measures TRA-1 the temporary intermittent closure of one lane of Island Drive would be **less than significant**.

**Figure 18 Full & Partial Closure & Detour Routes (Alameda Crossing #2)**



Detour routes were identified as the most convenient and viable routes. All roadways where pipeline trenching occurs would require full closure. The parallel roads to Peach Street including Fernside Boulevard and Post Street would provide convenient detour routes. For construction activities along San Jose Avenue, likely detour routes would include Adams Street and Madison Street as well as Encinal Avenue. Detour routes would not be required for work on Bridgeview Isle or Veteran's Court. This figure depicts all the road closures that would result from all construction activities associated with Crossing #2; however, construction activities would not occur at the same time. Pipeline trenching would occur on a block-by-block basis. On any given day, traffic movement would only be impacted by either the full or partial closure of streets along one or two city blocks.

**Figure 19** Crossing #2 Baseline plus Project Volumes, AM and PM Peak Hour



**TABLE 10**  
**CROSSING #2**  
**BASELINE (NO PROJECT) AND BASELINE PLUS PROJECT INTERSECTION LEVELS-OF-SERVICE**  
**YEAR 2020 AM AND PM PEAK HOUR**

#	Intersection	Control Type	AM Peak Hr/LOS-Delay		PM Peak Hr/LOS Delay	
			Base (NP)	Base+Prj.	Base (NP)	Base + Prj.
1	Island Dr./Robert Davey Jr. Dr..	Signal	B 19.7	B 19.7	B 13.8	B 13.8
2	Island Dr./Veteran's Ct.	TWSC	B 12.8	B 13.0	C 16.0	C 17.2
3	Peach St./Otis Dr.	TWSC	C 16.0	C 16.3	C 19.0	C 21.0
4	San Jose Ave./Fernside Blvd.	TWSC	C 21.2	C 23.1	C 21.9	D 30.8
5	San Jose Ave./Peach St.	TWSC	A 8.9	A 8.9	A 9.0	A 9.0
6	San Jose Ave./Post St.	TWSC	A 9.5	A 9.5	A 9.5	A 9.5
7	San Jose Ave./High St.	TWSC	C 16.7	C 16.7	B 14.2	B 14.2
8	San Jose Ave./Mound St.	AWSC	A 7.6	A 7.6	A 7.3	A 7.3
9	San Jose Ave./Versailles Ave.	AWSC	A 7.6	A 7.6	A 7.4	A 7.4
10	San Jose Ave./Pearl St.	TWSC	A 9.4	A 9.4	A 9.7	A 9.7

*Signalized/unsignalized intersection LOS based on HCM 2010 methodology (Synchro-Simtraffic software) which yields a vehicle delay in seconds.*

*TWSC = Two-Way-Stop-Control.*

*AWSC = All-Way-Stop-Control*

***Bold = Exceedance***

### Crossing #3 (Oakland)

Figure 4 shows the proposed pipeline route in Oakland. Roadways are typically 30 to 32 feet wide with parking on both sides of the street. Construction activities for Crossing #3 would require the full closure of Ford Street just east of 29th Street extending to Derby Avenue on a block-by-block basis. However, local access would be maintained for all local residents in the construction zones. The full and partial closures for the pipeline construction roadway segments and likely detour routes for Crossing #3 in Oakland and Alameda are shown in Figure 21.

The most efficient detour routes would direct traffic around Ford Street via Chapman Street and/or Glasscock Street, as shown in Table 7. For construction along Derby Avenue (between Ford Street and Tidal Canal), motorists could use Peterson Street/Channel Way or Lancaster Street. Peak hour and daily traffic volumes in this area are very light.

Table 11 shows the peak hour intersection LOS results under Baseline (No Project) conditions and Baseline plus Project conditions. ADT volumes along Ford Street would be approximately 1,120 under Baseline plus Project conditions. If half these daily volumes diverted to Chapman Street or Glasscock Street overall ADT would still remain at LOS A-B levels with approximately 700-1,500 daily trips. As shown below in Table 11. Intersections along Ford Street, Derby Avenue, and Glasscock Street would be operating at LOS A with little delays under Baseline plus Project traffic conditions. Therefore, the impacts to intersection operation from construction of the proposed project would be ***less than significant***. No mitigation is required.

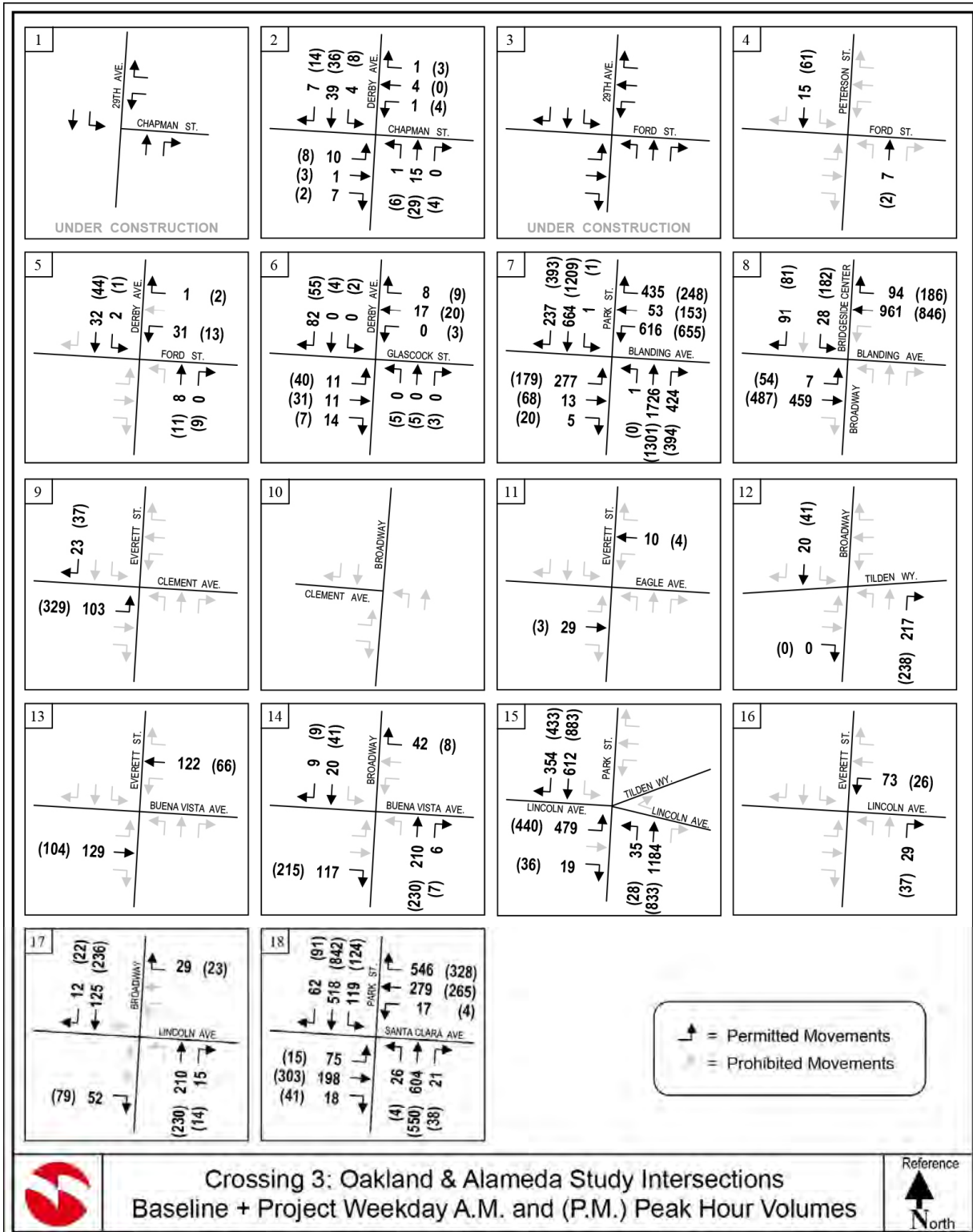
**Figure 20 Full & Partial Closure & Detour Routes (Oakland & Alameda Crossing #3)**



Detour routes were identified as the most convenient and viable routes. On the Oakland side, Derby Avenue and Ford Street would be fully closed. Convenient detour routes would include Chapman Street, Glascocock Street, Peterson Street, and Lancaster Street. On the Alameda side, roads would be fully closed due to pipeline trenching and insertion (i.e., pulling) of the HDD pipeline segment. The primary detour routes when the pipe is pulled across Tilden Way for a 48-hour period for HDD would include Blanding Avenue, Park Street, and Santa Clara Avenue. For pipeline trenching along Clement Avenue, Everett Street, and Lincoln Avenue, parallel detour routes would include Blanding Avenue, Park Street, Eagle Avenue, Buena Vista Avenue, Webb Avenue, and Santa Clara Avenue. This figure depicts all the road closures that would result from all construction activities associated with Crossing #3; however, construction activities would not occur at the same time. Pipeline trenching would occur on a block-by-block basis. On any given day, traffic movement would only be impacted by either the full or partial closure of streets along one or two city blocks.



**Figure 21** Crossing #3 Baseline plus Project Volumes, AM and PM Peak Hour



**TABLE 11  
CROSSING #3  
BASELINE (NO PROJECT) AND BASELINE PLUS PROJECT INTERSECTION LEVELS-OF-SERVICE  
YEAR 2020 AM AND PM PEAK HOUR**

#	Intersection	Control Type	AM Peak Hr/LOS-Delay		PM Peak Hr/LOS Delay	
			Base (NP)	Base + Prj.	Base (NP)	Base + Prj.
1	Chapman St./29th St. <sup>(a)</sup>	TWSC	B 10.6	B 10.6	B 11.6	B 11.6
2	Chapman St./Derby Ave.	TWSC	A 9.3	A 9.4	A 9.3	A 9.93
3	Ford St./29th St. <sup>(a)</sup>	TWSC	C 28.2	C 28.2	D 48.1	D 48.1
4	Ford St./Peterson St.	TWSC	A 9.1	A 9.1	A 9.5	A 9.5
5	Ford St./Derby Ave.	TWSC	A 9.3	A 9.3	A 9.4	A 9.4
6	Glascok St./Derby Ave.	TWSC	A 8.5	A 8.7	A 9.3	A 9.8
7	Blanding Ave./Park St.	Signal	D 46.9	<b>F 258.9</b>	C 30.5	<b>F 191.5</b>
8	Blanding Ave./Broadway	AWSC	C 18.6	<b>E 42.6</b>	C 21.1	<b>F 52.7</b>
9	Clement Ave./Everett St.	TWSC	C 18.3	C 18.3	B 14.5	B 14.5
10	Clement Ave./Broadway	TWSC	C 16.8	A 8.6	C 16.9	A 8.6
11	Eagle Ave./Everett St.	TWSC	A 9.5	A 9.5	A 9.5	A 9.5
12	Tilden Way/Broadway	Signal	C 20.3	A 0.2	C 22.6	A 1.7
13	Buena Vista Ave./Everett St.	TWSC	B 14.5	B 14.5	B 13.4	B 13.4
14	Buena Vista Ave./Broadway	Signal	B 11.6	A 7.0	A 8.8.	A 7.2
15	Tilden Way/Park St./Lincoln Ave.	Signal	B 11.6	C 22.3	B 11.6	B 19.6
16	Everett St./Lincoln Ave.	TWSC	A 9.3	A 9.3	B 10.5	B 10.5
17	Lincoln Ave./Broadway	TWSC	C 24.4	A. 9.7	D 33.9	B 10.2
18	Santa Clara Ave./Park St.	Signal	B 12.2	D 43.7	B 11.8	C 20.8

Signalized/unsignalized intersection LOS based on HCM 2010 methodology (Synchro-Simtraffic software) which yields a vehicle delay in seconds.

TWSC = Two-Way-Stop-Control.

AWSC = All-Way-Stop-Control.

**Bold** = Exceedance

(a) Due to on-going construction activities related to the 23rd Street and 29th Street Overcrossing project, accurate AM and PM peak hour volumes at the 29th Street study intersections could not be obtained. Therefore, projected intersection LOS has been taken from the I-880 Operational and Safety Improvement at 29th Avenue and 23rd Avenue Overcrossings IS/EA, 2013.

### Crossing #3 (Alameda)

Figure 4 shows the proposed pipeline route on Alameda Island. Construction activities related to Crossing #3 would result in several street closures. There are two critical elements related to the pipeline construction route that would affect traffic volumes along Tilden Way (in addition to other identified routes). First, the HDD pipeline “laydown” area would extend from just south of Tilden Way along the roadway segment to south of Lincoln Avenue approximately at Webb Avenue. The proposed project would lay the pipeline down in the middle of Broadway to allow for a 10 to 15 foot work area during assembly and testing of the pipe segments. Currently, Broadway has an approximate curb-to-curb width of 46-feet. During the evening hours after daytime assembly activities, the pipeline would be held between two rows of K-rails taking up about 8 feet of roadway width which would allow through-traffic for residents in the work areas. There would be no left-turn movements on Broadway in the pipeline laydown area. For installation of the HDD pipeline, traffic on Tilden Way would be diverted so that the pipeline can be pulled north across Tilden Way north and into the “insertion pit” on Broadway south of Blanding Avenue. Installation of the HDD pipeline would take approximately 48-hours and would require Tilden Way to be closed at Broadway. The closure of Tilden Way and pulling of the HDD pipeline would be scheduled to occur on a weekend to avoid peak commute times/days.

The second critical Crossing #3 element on Alameda Island would be open trench activities completed across Tilden Way at Everett Street that would require the closure of one or two directional lanes on Tilden Way during construction activities.

Based on the above information related to construction activities at Tilden Way, Tilden Way would be closed for a period of approximately 48-hours to all through-traffic at its Broadway intersection during HDD pipeline insertion and would be partially closed during trenching along Everett Street. Based on discussions with City of Alameda Transportation staff, the preferred detour route for closures of Tilden Way at project-related intersections would be Blanding Avenue to Park Street to Santa Clara Avenue.<sup>34</sup> All through-traffic volumes on Tilden Way would divert to either Blanding Avenue, Park Street, and/or Santa Clara Avenue during these closure periods. In addition, the pipeline routes along Clement Street, Everett Street, and Lincoln Avenue would require full closure (on a block-by block basis) using EBMUD criteria for roadway closures (48-feet or less in width); however, access would be maintained for all local residents in the construction zones. Park Street and/or Broadway would be used as detours to avoid construction zones along Clement Street, Everett Street, and Lincoln Avenue.

Baseline plus Project AM and PM peak hour intersection volumes for Crossing #3 are shown in Figure 22. Project study intersections along Clement Street, Everett Street, Broadway, and Lincoln Avenue would operate at acceptable conditions (LOS D or better) during construction activities. The intersection LOS tends to improve along these routes and degrade along likely detour routes during construction activities requiring detours. As shown in Table 11, Baseline plus Project traffic from Crossing #3 study intersections along Blanding Avenue would be operating below the City of Alameda's threshold levels at LOS E-F during the AM and PM peak periods. Therefore, the impacts to intersection operation from construction of the proposed project would be significant.

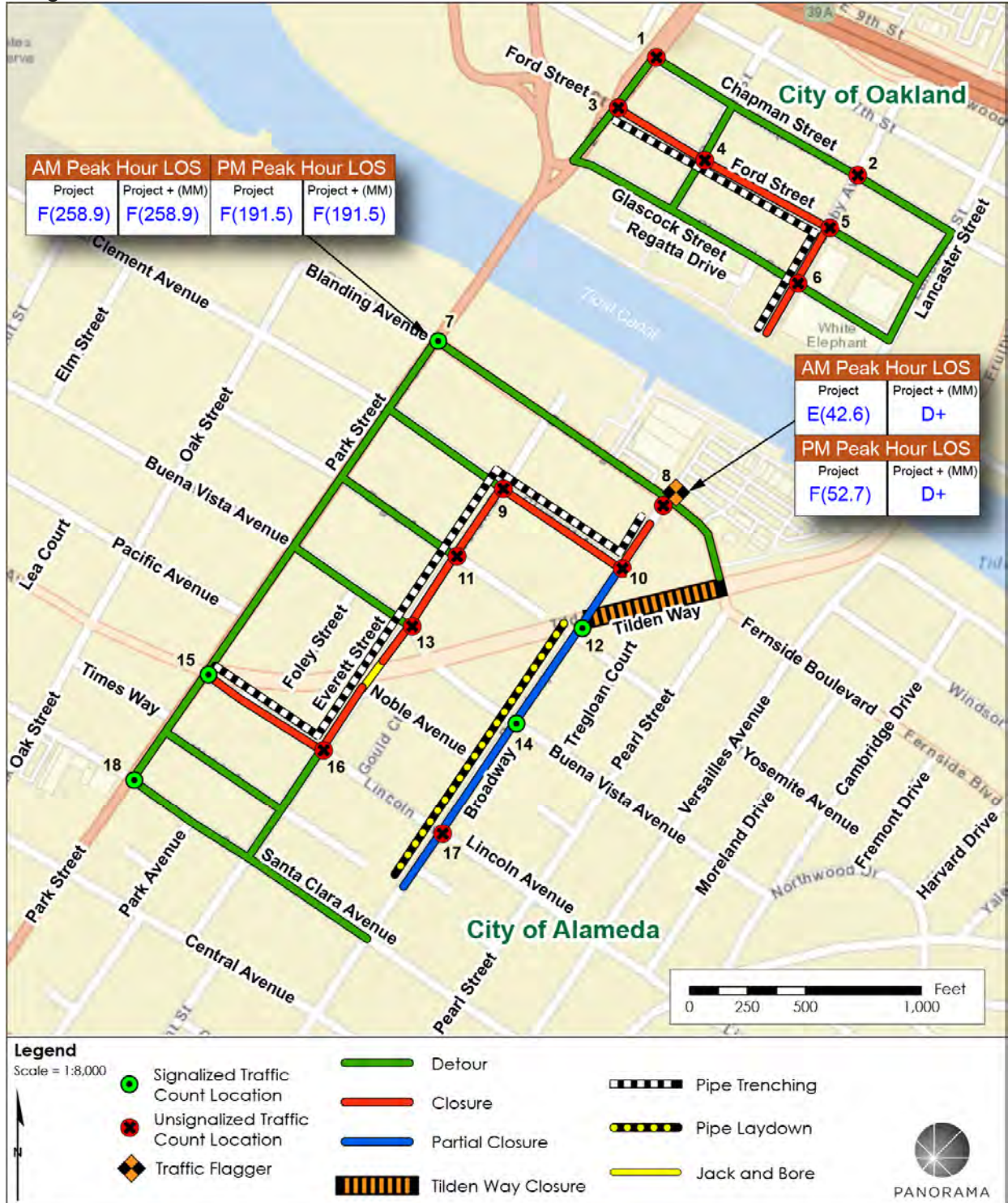
With the implementation of Mitigation Measures TRA-1, TRA-3, and TRA-4 temporary impacts to proposed project study area intersections along Blanding Avenue would be reduced. Mitigation Measure TRA-1 requires the preparation of a CTMP that conforms to the California Manual on Uniform Traffic Control Devices and the traffic requirements of the City of Alameda. The CTMP will include comprehensive traffic control and traffic safety measures that help minimize construction-related traffic congestion at proposed project study area intersections. Mitigation Measure TRA-3 requires the use of flag persons at the unsignalized intersection of Blanding Avenue and Broadway to facilitate the flow of directional traffic and improve vehicle progression through the intersection. Previous transportation studies conducted on the use of flaggers at unsignalized intersections indicate significant improvements in overall intersection operations from LOS F to LOS D or better.<sup>35</sup> The LOS of the unsignalized intersection of Blanding Avenue and Broadway would be improved with Mitigation Measure TRA-3. Mitigation Measure TRA-4 requires the use of jack and bore construction in place of the open trenching proposed across Tilden Way at Everett Street. However, the impacts to overall study intersection operation along Blanding Avenue from construction activities resulting from the 48-hour HDD pipeline insertion across Tilden Way would remain **significant and unavoidable**. Figure 22 shows the LOS at the roadways after mitigation.

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<sup>34</sup> Mr. Virenda Patel, Senior Traffic Engineer, City of Alameda, Potential detour routes for Tilden Way, Personal communication on November 5, 2015.

<sup>35</sup> ESA, West of Hills Northern Pipelines Project, Transportation and Traffic, Draft EIR, May, 2013.

**Figure 22** Full & Partial Closure & Detour Routes (Oakland & Alameda Crossing #3) After Mitigation



In addition, an alternate trench option is available at Crossing #3. Instead of using Clement Avenue and a portion of Everett Street, EBMUD could conduct open trench construction on Broadway across Tilden Way and then along Eagle Avenue until Everett Street, where the pipeline would continue along the proposed alignment. Open trench construction for this alternate trench option would require the full closure of portions of Broadway, Eagle Avenue, and Tilden Way at its intersection with Broadway (see Figure 23). Tilden Way at Eagle Avenue/Broadway would be closed in the same way that Tilden Way would be closed for the HDD pull through, described above. Therefore, the LOS impacts from the alternate trench option would be the same as the LOS impacts from the HDD pull through, which are summarized in Table 11. Mitigation requiring jack and bore construction under Tilden Way at Eagle Avenue/Broadway would result in comparable traffic impacts as open trench construction. One of the jack and bore pits would have to be located within lanes on Tilden Way and closures would be required on Tilden Way. Because jack and bore construction would not reduce traffic impacts, a mitigation measure requiring jack and bore construction under Tilden Way is not proposed. EBMUD would still implement Mitigation Measure TRA-1 and TRA-3. The traffic impacts from construction of the alternate trench option are significant and would remain **significant and unavoidable** even after implementation of Mitigation Measures TRA-1 and TRA-3. This significant and unavoidable impact would only occur during the 2 weeks that open trench construction would occur along Tilden Way.

**Figure 23** Full & Partial Closure & Detour Routes (Oakland & Alameda Crossing #3) For Alternate Trench Option



### **Mitigation Measure TRA-1: Construction Traffic Management Plan**

EBMUD shall develop and implement a project-specific Construction Traffic Management Plan (CTMP). EBMUD shall submit the plan to the Cities of Alameda and Oakland for review and approval at least 30 days prior to construction. The CTMP shall conform to the California Manual on Uniform Traffic Control Devices, and shall include provisions for the following:

1. Implementation of appropriate barriers and/or cones between vehicles and construction areas along partially or fully closed streets.
2. Installation of temporary lane delineation to direct traffic flows through construction areas.
3. Installation of “No Stopping Anytime” and “No Parking Anytime” signs (time and duration) in construction zones 48-hours prior to construction.
4. Use of flaggers and/or signage to guide vehicles through or around construction zones.
5. Use and location of changing message boards and/or appropriate signage indicating preferred detour routes.
6. Timing of material deliveries to use non-peak hours of traffic flow (9:00 a.m. to 4:00 p.m.).
7. Methods for keeping roadways clean.
8. Storage of all equipment and materials in designated work areas in a manner that minimizes traffic obstructions and maximizes sign visibility.
9. Methods and locations for limiting of vehicles to safe speed levels according to posted speed limits, road conditions, and weather conditions
10. Coordination with public transit providers to implement bus detours, bus stop modifications, and to inform public transit providers of potential construction related delays.
11. Methods and locations for routing trucks to avoid minor roads, where possible, to reduce congestion and potential asphalt damage in accordance with EBMUD’s specifications and the Cities of Alameda and Oakland permit requirements.
12. Repair of asphalt and other road damage (e.g., curb and gutter damage, rutting in unpaved roads) caused by construction vehicles. Roadway pavement conditions will be documented for all affected roadways before and after project construction. Roads found to have been damaged by construction vehicles will be repaired to the level at which they existed before project construction.
13. Detours for cyclists and pedestrians when bike lanes or sidewalks must be closed.
14. Abiding by any encroachment permit conditions (e.g., Union Pacific Railroad, Caltrans, City of Oakland, City of Alameda), which shall supersede conflicting provisions in the CTMP.
15. Requirement that heavy equipment brought to the construction site shall be transported by truck, where feasible.
16. Notification procedures for adjacent property owners and public safety personnel related to major equipment deliveries, vehicle detours, and lane closures.
17. A process for responding to and tracking complaints pertaining to construction activities, including identification of an EBMUD contact person, designated as a project liaison for responding to traffic complaints. The liaison’s name and phone number shall be posted at construction areas and included in all advance notifications. The project liaison shall

determine the cause of the complaints and shall take prompt action to correct the problem.

**Mitigation Measure TRA-2: Traffic Control at Crossing #1**

EBMUD shall maintain a minimum of one open lane of southbound traffic flow during construction activities between 8th Street and 5th Street to reduce overall traffic impacts on Jackson Street.

**Mitigation Measure TRA-3: Provide flag persons at unsignalized intersections at Crossing #1 and Crossing #3**

EBMUD shall ensure that the construction contractor deploys flag persons at the following unsignalized intersections to facilitate the flow of directional traffic and improve vehicle progression through the intersection, improving overall operations (to the extent possible):

1. Oak Street and Embarcadero West
2. Blanding Avenue and Broadway

**Mitigation Measure TRA-4: Traffic Control and Maintaining Traffic Flow at Crossing #3**

Pipeline installation across Tilden Way at Everett Street shall use jack and bore construction methods so as to avoid closure of Tilden Way to through traffic.



**Impact Traffic-2 Would the proposed project conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?**

The proposed project would not conflict with established Alameda County standards for their congestion management program (LOS standards, TDM) for roads and highways. Specifically, the proposed project would not be generating over 100 peak hour trips or represent a General Plan Amendment that would typically trigger an ACTC analysis on the CMP roadway network. In addition, overall project trip generation and impacts to intersection/roadway LOS would be temporary in nature and there would not be any significant increase in traffic on a long-term basis as a result of the proposed project. Therefore, there would be no impact.

**Impact Traffic-3 Would the proposed project result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks? (No Impact)**

The proposed project is a water supply improvement project and would not impact air traffic patterns or increase air traffic safety risks. There would be no impact.

**Impact Traffic-4 Would the proposed project substantially increase hazards due to a design feature or incompatible uses? (Less than Significant with Mitigation)**

**Crossing #1 (Oakland/Alameda)**

The presence of open trenches, construction equipment, construction workers, and vehicles in proximity to flowing traffic would create a potential temporary hazard for both workers and vehicular traffic. Roadways with open trenches would be partially or fully closed which could result in a hazard for vehicular traffic associated with reduced travel lanes, confusion in identifying detours, and the potential for a vehicle to accidentally collide with cones or equipment. The hazardous impact from trenching in roadways would be potentially significant. Mitigation Measure TRA-1 requires use of barricades with construction mounted signs or combined with electronic changeable signs for road closures as identified in Table 7. As required, construction cones would be used for marking partial closures. The use of barricades, electronic changeable signs, and construction cones would avoid potential accidents and the traffic hazards impacts would be **less than significant** after implementation of Mitigation Measure TRA-1.

**Crossing #2 (Alameda)**

The presence of open trenches, construction equipment, construction workers, and vehicles in proximity to flowing traffic would create a potential temporary hazard for the workers and vehicular traffic. Bridgeview Isle and Peach Street (south of Otis Drive) would have restricted vehicle access due to jack and bore drilling. Roadways with open trenches would be partially or fully closed which could result in a hazard for vehicular traffic associated with reduced travel lanes, confusion in identifying detours, and the potential for a vehicle to accidentally collide with cones or equipment. The hazardous impact from trenching in the roadway and roadway closures would be potentially significant. Mitigation Measure TRA-1 requires use of barricades with construction mounted signs or combined with electronic changeable signs for road closures as identified in Table 7. The use of barricades, electronic changeable signs, and construction cones would avoid potential accidents and the traffic hazards impacts would be **less than significant** after implementation of Mitigation Measure TRA-1.

### **Crossing #3 (Oakland/Alameda)**

The open trenches, construction equipment, construction workers, and vehicles in proximity to flowing traffic would create a potential temporary hazard for the workers and vehicular traffic. Roadways with open trenches would be partially or fully closed which could result in a hazard for vehicular traffic associated with reduced travel lanes, confusion in identifying detours, and the potential for a vehicle to accidentally collide with cones or equipment. The hazardous impact from trenching in the roadway and roadway closures would be potentially significant. Mitigation Measure TRA-1 requires use of barricades with construction mounted signs or combined with electronic changeable signs for road closures as identified in Table 7. A The use of barricades, electronic changeable signs, and construction cones would avoid potential accidents and the traffic hazards impacts would be **less than significant** after implementation of Mitigation Measure TRA-1.

### **Impact Traffic-5 Would the proposed project result in inadequate emergency access? (Less than Significant with Mitigation)**

#### **Crossing #1 (Oakland/Alameda)**

Roadways may be partially or fully closed temporarily during Crossing #1 construction, as indicated in Table 7. The construction impact to emergency access by emergency response vehicles, local residents, and businesses due to construction roadway closures would be potentially significant. Mitigation Measure TRA-5 requires notification of and coordination with emergency response services as well as notification of businesses, commercial offices, and residents located within one block of construction areas prior to road closures. Mitigation Measure TRA-6 would reduce the impact from daytime access limitations by requiring the use of easily removed, temporary barricades. Mitigation Measure TRA-7 would reduce the impact to emergency access after construction hours by requiring removal of barricades and closure of open trenches at the end of the day. Implementation of Mitigation Measures TRA-5, TRA-6, and TRA-7 would reduce the impact on emergency access to **less than significant**.

#### **Crossing #2 (Alameda Only)**

During construction activities for Crossing #2, several roadways may be temporarily partially or fully closed during construction, as indicated in Table 7. The pipeline laydown would not block any intersections or result in any roadway closures that may limit emergency access on North Bay Farm Island. The construction impact to emergency access by emergency response vehicles, local residents, and businesses due to limited access would be significant. Mitigation Measure TRA-5 requires notification of and coordination with emergency response services as well as notification of businesses, commercial offices, and residents located within one block of construction areas prior to road closures. Mitigation Measure TRA-6 would reduce the impact from daytime construction activities limiting access by requiring the use of easily removed, temporary barricades. Mitigation Measure TRA-7 would reduce the impact to emergency access after construction hours by requiring removal of barricades and closure of open trenches at the end of the day. Implementation of Mitigation Measures TRA-5, TRA-6, and TRA-7 would reduce the impact on emergency access to **less than significant**.

#### **Crossing #3 (Oakland/Alameda)**

Roadways may be partially or fully closed temporarily during Crossing #3 construction, as indicated in Table 7. The construction impact to emergency access by emergency response vehicles, local residents, and businesses due to limited access would be significant. Mitigation Measure TRA-5 requires notification of and coordination with emergency response services as well as notification of businesses, commercial offices, and residents located within one block of

construction areas prior to road closures. Mitigation Measure TRA-6 would reduce the impact from daytime construction activities limiting access by requiring the use of easily removed, temporary barricades. Mitigation Measure TRA-7 would reduce the impact to emergency access after construction hours by requiring removal of barricades and closure of open trenches at the end of the day. Implementation of Mitigation Measures TRA-5, TRA-6, and TRA-7 would reduce the impact on emergency access to ***less than significant***.

#### **Mitigation Measure TRA-5: Advance Notification of Roadway Closures**

Emergency responders (i.e., local police, fire, and ambulance services) shall be notified at least seven days in advance of any activities requiring full or partial roadway closures. Emergency access detour routes shall be determined in consultation with emergency responders as part of the notification process.

Businesses, commercial offices, and residents located within one block of construction shall be notified at least seven days in advance of activities requiring roadway closures, outlining the proposed project schedule and the duration of construction activities. EBMUD will send notices to the individuals and businesses on the proposed project's mailing list to update them prior to any roadway closures.

#### **Mitigation Measure TRA-6: Maintenance of Emergency Access During Roadway Closures**

Temporary barricades and directional cones that can be readily removed shall be used during full or partial roadway closures.

#### **Mitigation Measure TRA-7: Road Barricades and Trenching**

Road barricades shall be removed and open trenches shall be covered (plated) at the end of the day on a daily basis to provide access to businesses and residents.

A portion of the on-street parking zones may be retained to allow for storage and/or staging of construction equipment.

**Impact Traffic-6 Would the proposed project conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities? (*Less than Significant with Mitigation*)**

#### **Crossing #1 (Oakland)**

##### *Pedestrians*

Construction traffic would use streets where pedestrian facilities are present. Therefore, construction equipment and vehicles traveling to and from work sites could pose a hazard to pedestrians. Additionally, open trenching would result in the partial or full closure of streets and partial closure of sidewalks for staging during construction. Based on EBMUD information indicating that pipeline installation would progress at 80 to 120 feet per day, pedestrians would not have to walk more than one block to get around the construction zone. Regardless, potential impacts to pedestrian access from construction equipment, vehicles, and roadway closures would be significant. Mitigation Measure TRA-8 requires that at least one sidewalk remain open for pedestrian traffic during construction activities and appropriate signage directing pedestrians to

detours and sidewalks. Implementation of Mitigation Measure TRA-8 would reduce pedestrian access impacts to **less than significant**.

#### Bicyclists

Pipeline construction activities related to Crossing #1 in the City of Oakland would not directly affect bicycle facilities along 5th Street, 4th Street, and Jackson Street as these roadways are not designated as bicycle routes. However, Madison Street, 2nd Street, Oak Street, and Embarcadero West all serve bicycle traffic in some capacity and would be directly affected by project construction activities. Currently, Madison Street is identified as a Class III bike route and has sharrows<sup>36</sup> pavement markings in the southbound vehicle travel lane. Oak Street is a Class II facility (south of I-880) with bike lanes on both sides of the street and sharrows in the northbound direction (north of I-880). 2nd Street is identified as Class III bike route with sharrows in both east-west travel lanes. Finally, Embarcadero West is a Class II facility with bike lanes on both sides of the street. The closure of the 2nd Street segment between Madison Street and Oak Street would be minimal as there are alternative east-west routes (3rd Street or 4th Street) for bicyclists to bypass the construction zone due to the grid layout of streets in the vicinity. However, the closure of the Madison Street roadway segments would impact bicycle travel. In addition, the partial closures of Oak Street and Embarcadero West would require bicyclists to share the roadway with motorists. Potential impacts to bicyclists would be significant. Mitigation Measure TRA-9 would reduce the impact from partial closures along Oak Street and Embarcadero West and closures along Madison Street and 2nd Street. Implementation of Mitigation Measure TRA-9 would reduce bicycle access impacts to **less than significant**.

#### Public Transit

Pipeline construction activities related to Crossing #1 in the City of Oakland would not directly affect transit facilities along 5th Street, 4th Street, and Jackson Street as these roadways are not designated as transit routes. The segment of Madison Street between 8th Street and 7th Street has been recommended for full closure based on the one-way nature of the streets in this area and the need to detour traffic appropriately. However, recommended mitigation measure TRA-2 requires the maintenance of partial traffic flow on Madison Street between 8th Street and 5th Street, and would allow the progression of vehicular traffic and AC Transit buses (AC Transit bus line 88). The travel time for transit through this construction zone would increase which would be a potentially significant impact. Mitigation Measure TRA-10 requires notification of and coordination with AC Transit to re-locate bus stops and/or re-route affected transit services via parallel streets during construction when affected transit service is subject to delays. The implementation of mitigation measures TRA-2 and TRA-10 would help to reduce overall impacts to transit service from temporary construction impacts associated with Crossing #1 to **less than significant**.

### **Crossing #1 (Alameda)**

#### Pedestrians

Construction traffic would use streets where pedestrian facilities are present (sidewalks, crosswalks, signals). Therefore, construction equipment and vehicles traveling to and from work sites could pose a hazard to pedestrians. Additionally, open trenching would result in the partial or full closure of streets and sidewalks during construction. Based on EBMUD information indicating that pipeline installation would progress at 80 to 120 feet per day, pedestrians would

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<sup>36</sup> Shared-lane marking ("Sharrow") in a travel lane denoting that bicyclists may use the lane. Typically placed in lane where bicyclists should be riding.

not have to walk more than one block to get around the construction zone. Regardless, potential impacts to pedestrians from construction equipment, vehicles, and roadway closures would be significant. Mitigation Measure TRA-8 requires that appropriate signage be used and that pedestrians are directed to detours along other sidewalks during closures. Implementation of Mitigation Measure TRA-8 would reduce the impact to pedestrians to ***less than significant***.

#### Bicyclists

Class II bike lanes are present along both sides of Marina Village Parkway, Challenger Drive, and Atlantic Avenue in the project construction zones. Sherman Street has partial Class II bike lanes to Eagle Avenue before they terminate. Partial roadway closures along the Marina Village Parkway, Challenger Drive, and Atlantic Avenue would require one direction of bicycle travel to be closed. Full closure of Sherman Street would preclude bicycle travel on the roadway segment under construction. Potential impacts to bicyclists would be significant. Implementation of Mitigation Measure TRA-9 would reduce the impact to bicyclists to ***less than significant***.

#### Public Transit

With the partial closures of Marina Village Parkway, Challenger Drive, and Atlantic Avenue due to construction activities, AC Transit Line 31 would be adversely affected along Marina Village Parkway and Challenger Drive. Additionally, some of the bus stops along the partially closed segments would not be accessible. Potential impacts to bus routes would be significant. Mitigation Measure TRA-10 would reduce the impact from partial closures on Marina Village Parkway and Challenger Drive by requiring the re-routing of transit to parallel streets such as Marina Village Shopping Center. AC Transit line 31 could continue to operate on Marina Village Parkway with minor route adjustments. With implementation of Mitigation Measures TRA-10, the impacts to public transit would be reduced to ***less than significant***.

### **Crossing #2 (Alameda Island)**

#### Pedestrians

Construction traffic would use streets where pedestrian facilities are present (sidewalks, crosswalks, signals); therefore, construction equipment and vehicles traveling to and from work sites could pose a hazard to pedestrians. Additionally, open trenching would result in the partial or full closure of streets and sidewalks during construction. Based on EBMUD information indicating that pipeline installation would progress at 80 to 120 feet per day, pedestrians would not have to walk more than one block to get around the construction zone. Regardless, potential impacts to pedestrians from construction equipment, vehicles, and roadway closures would be significant. Mitigation Measure TRA-8 requires that appropriate signage be used and that pedestrians are directed to detours along other sidewalks during closures. Implementation of Mitigation Measure TRA-8 would reduce the impact to pedestrians to ***less than significant***.

#### Bicyclists

There are no bike routes on Alameda Island along Peach Street or San Jose Avenue in the approach pipeline construction zones. However, south of Otis Drive, Peach Street does provide access to recreational paths and bike facilities (Towata Park). Access to these facilities would remain open during HDD construction activities at Towata Park; therefore, impacts to bicyclists would be ***less than significant***.

#### Public Transit

Transit service would not be directly affected by construction activities as there are no transit routes along Peach Street and San Jose Avenue in the construction zone areas; therefore, there would be no impact.

## **Crossing #2 (North Bay Farm Island)**

### Pedestrians and Bicyclists

Island Drive, Veteran's Court, and Bridgeview Isle (Towata Park) all provide access to Class I pedestrian/bike facilities linking Bay Farm Island with Alameda via the Bay Farm Island Bicycle/Pedestrian Bridge. Construction activities associated with Crossing #2 on North Bay Farm Island would affect pedestrian/bicycle travel along Island Drive between Robert Davey Jr. Drive and Veteran's Court due to the construction staging (laydown) of the pipeline and during the 48-hour pipeline pull through activity. There would be adequate width to stage the pipeline along the trail in adjacent landscaped areas; however, one of the pedestrian and/or bike paths could be affected or temporarily removed from service during pipeline laydown. Both the pedestrian and bicycle paths would be removed for 48 hours during the pipeline pull through activity. Bicyclists and pedestrians could share a temporary multi-use path during the temporary laydown of the pipeline. Mitigation Measure TRA-8 requires that appropriate signage be used and that pedestrians are directed to detours along other sidewalks during closures. Mitigation Measure TRA-9 requires EBMUD to provide a detour for bicyclists during closures. Mitigation Measure TRA-11 requires that appropriate signage be used, directing bicyclists and pedestrians to detours and sidewalks. Therefore, impacts related to the partial closure of the pedestrian and/or bike path along Island Drive would be considered ***less than significant***.

### Public Transit

There is one bus stop located on Island Drive on North Bay Farm Island, which serves four different AC Transit Lines (21, OX, 631, and 687). Pipeline laydown would occur for 2 weeks on the sidewalk adjacent to Island Drive, which could potentially interfere with the public accessing the bus stop and thereby result in a potentially significant impact. The bicycle path directly adjacent to Island Drive would remain open and accessible to pedestrians as well as bicyclists. Periodic material deliveries would need to cross the bicycle path. These very short duration interruptions would pose as minor inconveniences and would not substantially affect access to or the use of public transit. The impact from pipeline laydown adjacent to the bus stop along Island Drive would be less than significant.

HDD pipeline pull through would occur for 48 hours on the weekend and the sidewalk adjacent to Island Drive would be fully closed for 48 hours on the weekend. Three of the four AC Transit Lines (OX, 631, 687) do not run on the weekend; therefore, there would be no impact to AC Transit Lines OX, 631, and 687 from the HDD pipeline pull through activity. AC Transit Line 21 does run on the weekend and users of AC Transit Line 21 would not be able to use the bus stop on Island Drive during the 48-hour HDD pipeline pull through, which would result in a significant impact. Mitigation Measure TRA-10 requires that EBMUD notify the public of the temporary unavailability of the bus stop at Island Drive. Users of AC Transit Line 21 would be able to use the bus stop at the intersection of Robert Davey Jr. Drive and Packet Landing Road, which is 0.25 mile from the Island Drive bus stop. Because the public would be notified of the 48-hour closure of the Island Drive bus stop and because the closest bus stop is 0.25 mile, the impact to public transit from HDD pipeline pull through would be less than significant after implementation of Mitigation Measure TRA-10.

## **Crossing #3 (Oakland)**

### Pedestrians

Construction traffic would use streets where pedestrian facilities are present. Therefore, construction equipment and vehicles traveling to and from work sites could pose a hazard to pedestrians. Additionally, open trenching would result in the partial or full closure of streets and sidewalks during construction. Based on EBMUD information indicating that pipeline installation

would progress at 80 to 120 feet per day, pedestrians would not have to walk more than one block to get around the construction zone. Regardless, potential impacts to pedestrians from construction equipment, vehicles, and roadway closures would be significant. Mitigation Measure TRA-8 requires that at least one sidewalk remain open for pedestrian traffic during construction activities and appropriate signage directing pedestrians to detours and sidewalks. Implementation of Mitigation Measure TRA-8 would reduce the impact to pedestrians along Ford Street and Derby Avenue to ***less than significant***.

#### Public Transit and Bicyclists

Construction activities associated with Crossing #3 in the City of Oakland along Ford Street and Derby Avenue would not directly affect bicycle or transit facilities in the area. There are no designated bicycle routes or transit routes on these roadways; therefore, there would be no impact to bicyclists or transit.

### **Crossing #3 (Alameda)**

#### Pedestrians

Construction traffic would use streets that are used by pedestrians. Construction equipment and vehicles traveling to and from work sites would pose a hazard to pedestrians. Additionally, open trenching would result in the partial or full closure of streets and sidewalks during construction. Based on EBMUD information indicating that pipeline installation would progress at 80-120 feet per day, pedestrians would not have to walk more than one block to get around the construction zone. Regardless, potential impacts to pedestrians from construction equipment, vehicles, and roadway closures would be significant. Mitigation Measure TRA-8 requires that appropriate signage be used and that pedestrians are directed to detours along other sidewalks during closures. Implementation of Mitigation Measure TRA-8 would reduce the impact to pedestrians along Broadway, Clement Street, Everett Street, and Lincoln Avenue to ***less than significant***.

#### Bicyclists

Construction activities associated with Crossing #3 in the City of Alameda along Clement Street, Everett Street, and Lincoln Avenue would not directly affect bicycle transit as there are no designated bicycle routes on these roadways in this area. However, Tilden Way and Broadway provide both bicycle and transit facilities that would be directly affected by proposed construction activities. Blanding Avenue is designated as a Class III bike route while both Broadway and Tilden Way (between Broadway and Park Street) have Class II bike lanes on both sides of the street. Construction activities would require partial closures of Broadway and temporary full closure of Tilden Way which would significantly affect bicycle travel in the area. Between Broadway and Park Street, Tilden Way has discontinuous sidewalks. Therefore, bicyclists may not be able to access adjacent sidewalks to ride around construction zone areas. Potential impacts to bicyclists would be significant.

Mitigation Measure TRA-9 would reduce the impact to bicyclists by requiring detours for bicyclists around discontinuous sidewalks along Tilden Way between Broadway and Park Street. With implementation of Mitigation Measures TRA-9, the impacts to bicyclists would be ***less than significant***.

#### Public Transit

Construction activities associated with Crossing #3 in the City of Alameda along Clement Street, Everett Street, and Lincoln Avenue would not directly affect transit facilities as there are no designated transit routes on these roadways in this area. However, AC Transit Routes O, W, and 51A would be directly affected by construction activities along Broadway (between Blanding Avenue and Clement Street) and Tilden Way (at Broadway for the pull through of the HDD pipeline

and potentially at Eagle Avenue/Broadway if the alternate trench option is used). Temporary full closures of these roadways would be required for construction purposes which would result in potentially significant impacts to transit travel times and/or routing. Implementation of Mitigation Measure TRA-10 would reduce overall transit impacts to the extent feasible. The full closure of Tilden Way (for 48 hours for the HDD pull through and potentially for 2 weeks for the alternate open trench construction option) could still potentially cause travel speed to degrade by 10 percent or more along a street alignment, even after coordinating with AC transit per Mitigation Measure TRA-10. Due to the temporary re-routing of transit service on Broadway (between Blanding Avenue and Tilden Way) impacts to transit service routing along Broadway and Tilden Way would remain ***significant and unavoidable***.

#### **Mitigation Measure TRA-8: Pedestrian Safety**

Flaggers shall be used to direct pedestrians and bicyclists using the bicycle lane during construction when material deliveries must cross the bicycle lane. Warning signs shall be posted on sidewalks where construction limits pedestrian access and to identify which side of the street can be safely accessed at intersections prior to construction zones.

#### **Mitigation Measure TRA-9: Bicycle Traffic Management**

EBMUD and its contractors shall:

- use “share the road” signs within the construction zones where partial closures would occur;
- obtain a temporary permit to allow bicyclists to use the sidewalks to bypass the construction zones where allowed by the local jurisdiction; and
- provide detours for bicyclists around areas with discontinuous sidewalks.

These requirements shall also be incorporated in the CTMP prepared under Mitigation Measure TRA-1.

#### **Mitigation Measure TRA-10: Notification of Transit Changes**

EBMUD shall coordinate with AC Transit to re-locate bus stops and/or re-route affected transit services via parallel streets during construction when affected transit service is subject to delays resulting from partial street closure or inaccessible transit stops due to full street closure.

EBMUD shall post signs at the affected bus stop on Island Drive and at other bus stops along the route of AC Transit Line 21. The signs will be posted at least two weeks in advance of the HDD pipeline pull through activity at Crossing #2 and shall indicate when the bus stop at Island Drive would be unavailable and where the nearest bus stop for AC Transit Line 21 is located.

#### **Mitigation Measure TRA-11: Notification to Pedestrians and Bicyclists**

EBMUD shall post signs at affected pedestrian intersections and bike routes at least two weeks in advance of construction. These signs shall state the date range of construction and shall indicate the route pedestrian and/or bike path detours during construction.



## **Parking**

Though there is not a CEQA significance criteria addressing parking, the temporary loss of on-street vehicle parking along proposed pipeline construction routes has been considered. The overall effect of partial or full roadway closures due to construction activities would require the temporary prohibition of on-street parking. The removal of parking would allow for adequate room for construction activities, enhance the public safety, and help to expedite construction activities. During proposed pipeline construction activities requiring full closures, the affect roadway segments would be closed to through-traffic except emergency vehicles, garbage collection, and the U.S. Postal Service. Access for local residences and businesses would generally be maintained with controlled access to/from their locations. Only the roadway segments under construction would be closed. Upon completion of construction for a specific segment, access to that segment would be restored. Open trenches would be covered with plates during non-construction hours and road closures would be removed to allow for access during non-work periods. It is likely that some construction equipment may be left in the work area and/or staging areas.

Where local parking would be displaced due to proposed pipeline construction activities, EBMUD or its contractors would obtain permission from local agencies (City of Oakland and City of Alameda) to temporarily prohibit parking. Where the loss of local parking would prove a hardship to local residences or businesses, EBMUD will (where feasible) work with the owners of parking facilities near the pipeline construction zones to provide parking for residences and businesses affected by construction.

# ***Technical Appendices***

## **Alameda- North Bay Farm Island Pipeline Crossings Project**

### **Draft Transportation and Traffic Technical Report**

Prepared for:

**East Bay Municipal Utility  
District (EBMUD)**

Date:

**February 19, 2016**

Prepared by:



# **Technical Appendices**

**ALAMEDA-NORTH BAY FARM ISLAND PIPELINE CROSSINGS PROJECT**

**DRAFT TRANSPORTATION AND TRAFFIC TECHNICAL REPORT**

**Prepared For:**

**East Bay Municipal Utility District**

**375 11<sup>th</sup> Street**

**Oakland, CA 94607**

**Prepared By:**

**Omni-Means, Ltd.**

**1901 Olympic Boulevard, Suite 120**

**Walnut Creek, CA 94596**

**Draft, 2-19-16**

**35-5138-04 (#2020)**

**Existing AM and PM Peak Period Intersection and ADT Counts (October, 2015):**

Crossing #1 Oakland  
Crossing #1 Alameda  
Crossing #2 (Alameda Only)  
Crossing #3 Oakland  
Crossing #3 Alameda  
Average Daily Traffic (ADT)

**Synchro-Simtraffic (Software 8) AM and PM Peak Hour Intersection Level-of-Service Calculations:**

Crossing #1

AM Baseline (No Project) Oakland & Alameda  
PM Baseline (No Project) Oakland & Alameda  
AM Baseline plus Project Oakland & Alameda  
PM Baseline plus Project Oakland & Alameda  
AM Baseline plus Project (Mitigated) Oakland  
PM Baseline plus Project (Mitigated) Oakland

Crossing #2 (Alameda Only)

AM Baseline (No Project)  
PM Baseline (No Project)  
AM Baseline plus Project  
PM Baseline plus Project

Crossing #3

AM Baseline (No Project) Oakland & Alameda  
PM Baseline (No Project) Oakland & Alameda  
AM Baseline plus Project Oakland & Alameda  
PM Baseline plus Project Oakland & Alameda

**City of Alameda Construction Guidelines for Traffic Lane Controls**

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**Baymetrics Existing AM and PM Peak Period Intersection Counts:**

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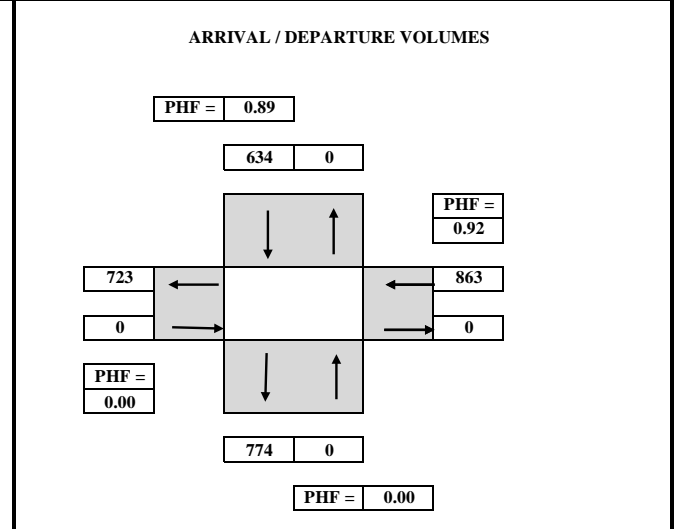
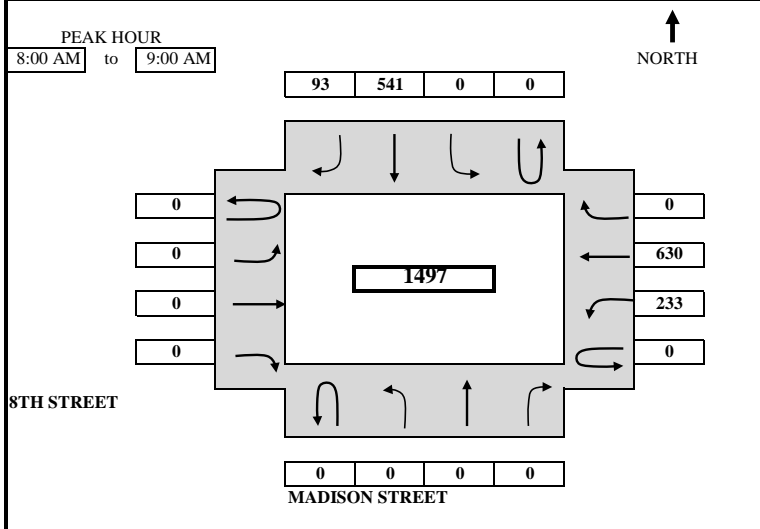
Crossing #1 Oakland

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# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	MADISON STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	8TH STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(01)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																			
7:00 AM	to	7:15 AM					89 5								79 60				233
7:15 AM	to	7:30 AM					178 16								121 117				432
7:30 AM	to	7:45 AM					294 26								173 243				736
7:45 AM	to	8:00 AM					428 37								228 376				1069
8:00 AM	to	8:15 AM					583 60								290 524				1457
8:15 AM	to	8:30 AM					727 86								346 703				1862
8:30 AM	to	8:45 AM					855 116								412 843				2226
8:45 AM	to	9:00 AM					969 130								461 1006				2566

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	0	0	0	0	0	89	5	0	0	0	0	0	79	60	0	233
7:15 AM	to	7:30 AM	0	0	0	0	0	0	89	11	0	0	0	0	0	42	57	0	199
7:30 AM	to	7:45 AM	0	0	0	0	0	0	116	10	0	0	0	0	0	52	126	0	304
7:45 AM	to	8:00 AM	0	0	0	0	0	0	134	11	0	0	0	0	0	55	133	0	333
8:00 AM	to	8:15 AM	0	0	0	0	0	0	155	23	0	0	0	0	0	62	148	0	388
8:15 AM	to	8:30 AM	0	0	0	0	0	0	144	26	0	0	0	0	0	56	179	0	405
8:30 AM	to	8:45 AM	0	0	0	0	0	0	128	30	0	0	0	0	0	66	140	0	364
8:45 AM	to	9:00 AM	0	0	0	0	0	0	114	14	0	0	0	0	0	49	163	0	340

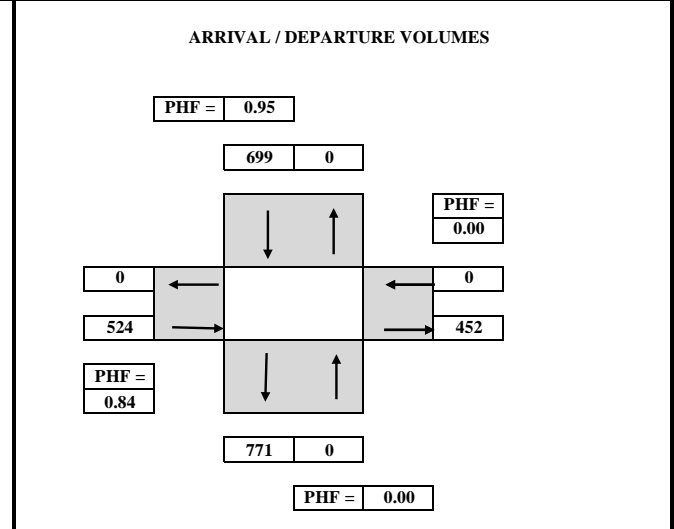
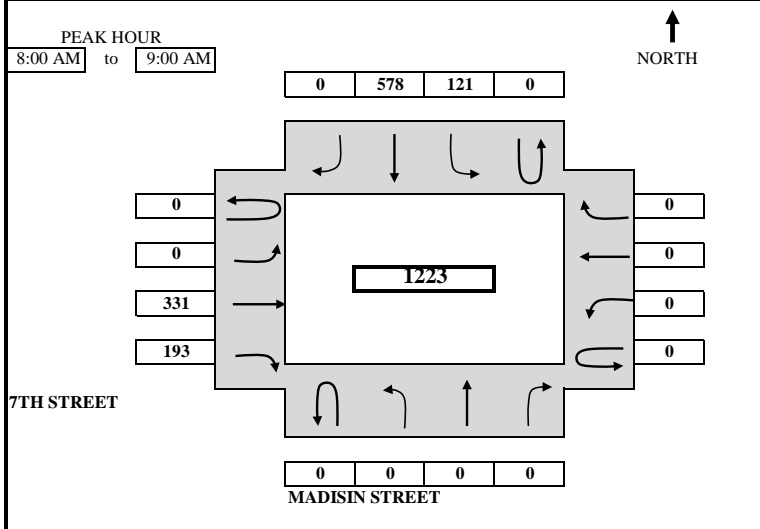
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	0	0	0	0	0	428	37	0	0	0	0	0	228	376	0	1069
7:15 AM	to	8:15 AM	0	0	0	0	0	0	494	55	0	0	0	0	0	211	464	0	1224
7:30 AM	to	8:30 AM	0	0	0	0	0	0	549	70	0	0	0	0	0	225	586	0	1430
7:45 AM	to	8:45 AM	0	0	0	0	0	0	561	90	0	0	0	0	0	239	600	0	1490
8:00 AM	to	9:00 AM	0	0	0	0	0	0	541	93	0	0	0	0	0	233	630	0	1497

PEAK HOUR SUMMARY																				
8:00 AM	to	9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	0	0	0	0	0	0	541	93	0	0	0	0	0	233	630	0	1497
			PHF BY MOVEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.78	0.00	0.00	0.00	0.00	0.00	0.88	0.88	0.00	OVERALL
			PHF BY APPROACH	0.00				0.89				0.00				0.92				0.92
			BICYCLE	0				18				0				28				46
			PEDESTRIAN	58				35				84				89				266
				N-LEG				S-LEG				E-LEG				W-LEG				
			PEDESTRIAN BY LEG:	129				44				35				58				266

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	MADISIN STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	7TH STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(O2)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
7:00 AM	to	7:15 AM						15	117			42	67					241
7:15 AM	to	7:30 AM						35	231			101	149					516
7:30 AM	to	7:45 AM						59	349			169	221					798
7:45 AM	to	8:00 AM						82	478			239	284					1083
8:00 AM	to	8:15 AM						115	629			315	341					1400
8:15 AM	to	8:30 AM						153	764			377	383					1677
8:30 AM	to	8:45 AM						181	899			481	435					1996
8:45 AM	to	9:00 AM						203	1056			570	477					2306

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	0	0	0	0	15	117	0	0	0	42	67	0	0	0	0	241
7:15 AM	to	7:30 AM	0	0	0	0	0	20	114	0	0	0	59	82	0	0	0	0	275
7:30 AM	to	7:45 AM	0	0	0	0	0	24	118	0	0	0	68	72	0	0	0	0	282
7:45 AM	to	8:00 AM	0	0	0	0	0	23	129	0	0	0	70	63	0	0	0	0	285
8:00 AM	to	8:15 AM	0	0	0	0	0	33	151	0	0	0	76	57	0	0	0	0	317
8:15 AM	to	8:30 AM	0	0	0	0	0	38	135	0	0	0	62	42	0	0	0	0	277
8:30 AM	to	8:45 AM	0	0	0	0	0	28	135	0	0	0	104	52	0	0	0	0	319
8:45 AM	to	9:00 AM	0	0	0	0	0	22	157	0	0	0	89	42	0	0	0	0	310

HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	0	0	0	0	82	478	0	0	0	239	284	0	0	0	0	1083
7:15 AM	to	8:15 AM	0	0	0	0	0	100	512	0	0	0	273	274	0	0	0	0	1159
7:30 AM	to	8:30 AM	0	0	0	0	0	118	533	0	0	0	276	234	0	0	0	0	1161
7:45 AM	to	8:45 AM	0	0	0	0	0	122	550	0	0	0	312	214	0	0	0	0	1198
8:00 AM	to	9:00 AM	0	0	0	0	0	121	578	0	0	0	331	193	0	0	0	0	1223

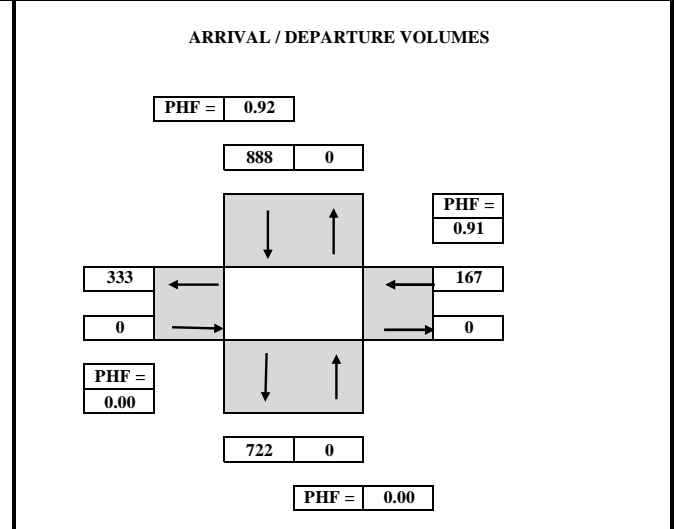
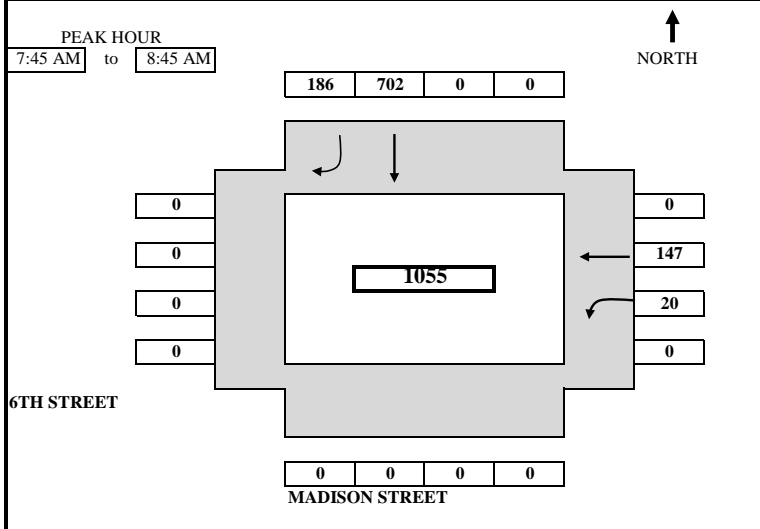
PEAK HOUR SUMMARY																	
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	0	0	0	0	121	578	0	0	0	331	193	0	0	0	0	1223
PHF BY MOVEMENT	0.00	0.00	0.00	0.00	0.00	0.80	0.92	0.00	0.00	0.00	0.80	0.85	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH	0.00				0.95				0.84				0.00				0.96
BICYCLE	0				7				1				0				8
PEDESTRIAN	29				32				25				29				115
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	25				29				35				26				115



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>MADISON STREET</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>6TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O3)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																			
7:00 AM	to	7:15 AM					97 5								6 35				143
7:15 AM	to	7:30 AM					227 99								13 71				410
7:30 AM	to	7:45 AM					356 147								20 119				642
7:45 AM	to	8:00 AM					551 193								26 154				924
8:00 AM	to	8:15 AM					726 238								31 185				1180
8:15 AM	to	8:30 AM					877 291								33 227				1428
8:30 AM	to	8:45 AM					1058 333								40 266				1697
8:45 AM	to	9:00 AM					1208 368								50 304				1930

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	0	0	0	0	0	97	5	0	0	0	0	0	6	35	0	143
7:15 AM	to	7:30 AM	0	0	0	0	0	0	130	94	0	0	0	0	0	7	36	0	267
7:30 AM	to	7:45 AM	0	0	0	0	0	0	129	48	0	0	0	0	0	7	48	0	232
7:45 AM	to	8:00 AM	0	0	0	0	0	0	195	46	0	0	0	0	0	6	35	0	282
8:00 AM	to	8:15 AM	0	0	0	0	0	0	175	45	0	0	0	0	0	5	31	0	256
8:15 AM	to	8:30 AM	0	0	0	0	0	0	151	53	0	0	0	0	0	2	42	0	248
8:30 AM	to	8:45 AM	0	0	0	0	0	0	181	42	0	0	0	0	0	7	39	0	269
8:45 AM	to	9:00 AM	0	0	0	0	0	0	150	35	0	0	0	0	0	10	38	0	233

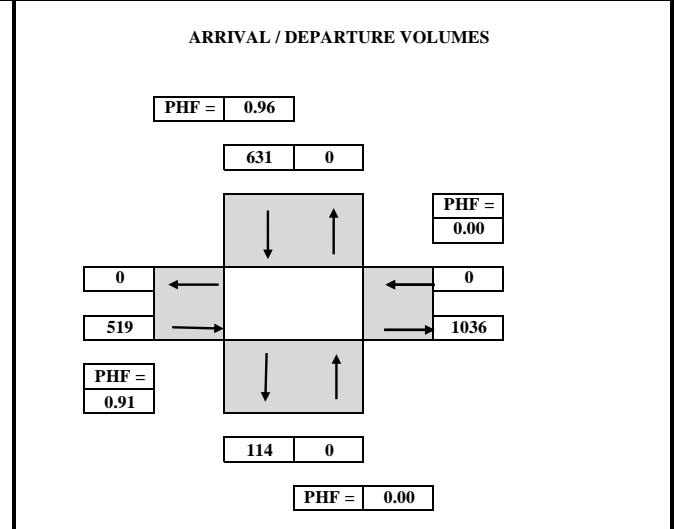
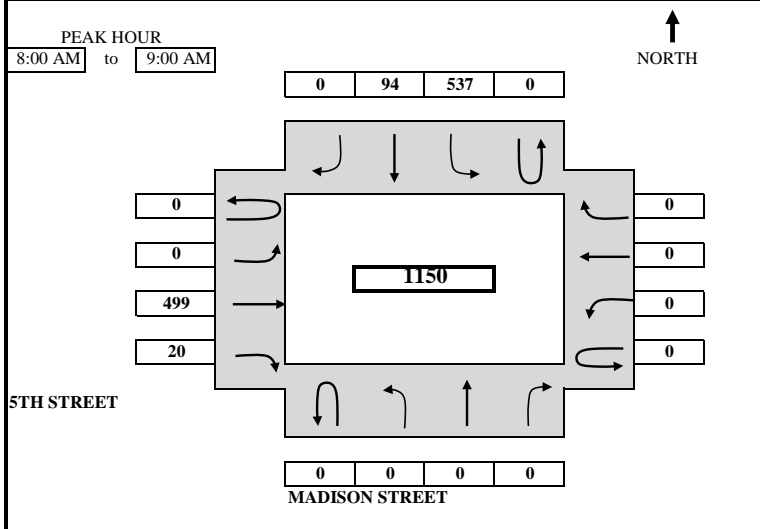
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	0	0	0	0	0	551	193	0	0	0	0	0	26	154	0	924
7:15 AM	to	8:15 AM	0	0	0	0	0	0	629	233	0	0	0	0	0	25	150	0	1037
7:30 AM	to	8:30 AM	0	0	0	0	0	0	650	192	0	0	0	0	0	20	156	0	1018
7:45 AM	to	8:45 AM	0	0	0	0	0	0	702	186	0	0	0	0	0	20	147	0	1055
8:00 AM	to	9:00 AM	0	0	0	0	0	0	657	175	0	0	0	0	0	24	150	0	1006

PEAK HOUR SUMMARY																			
7:45 AM	to	8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	0	0	0	0	0	702	186	0	0	0	0	0	20	147	0	1055
PHF BY MOVEMENT			0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.88	0.00	0.00	0.00	0.00	0.00	0.71	0.88	0.00	OVERALL
PHF BY APPROACH			0.00				0.92				0.00				0.91				0.94
BICYCLE			0				18				0				0				18
PEDESTRIAN			23				32				7				4				66
			N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:			8				3				24				31				66

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/8/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	MADISON STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	5TH STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(O4)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM					93	11			56				2				162
7:15 AM to 7:30 AM					214	22			128				4				368
7:30 AM to 7:45 AM					346	40			201				8				595
7:45 AM to 8:00 AM					497	64			309				10				880
8:00 AM to 8:15 AM					642	84			440				13				1179
8:15 AM to 8:30 AM					784	99			543				16				1442
8:30 AM to 8:45 AM					908	122			672				23				1725
8:45 AM to 9:00 AM					1034	158			808				30				2030

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	0	0	0	93	11	0	0	0	56	2	0	0	0	0	162
7:15 AM to 7:30 AM	0	0	0	0	0	121	11	0	0	0	72	2	0	0	0	0	206
7:30 AM to 7:45 AM	0	0	0	0	0	132	18	0	0	0	73	4	0	0	0	0	227
7:45 AM to 8:00 AM	0	0	0	0	0	151	24	0	0	0	108	2	0	0	0	0	285
8:00 AM to 8:15 AM	0	0	0	0	0	145	20	0	0	0	131	3	0	0	0	0	299
8:15 AM to 8:30 AM	0	0	0	0	0	142	15	0	0	0	103	3	0	0	0	0	263
8:30 AM to 8:45 AM	0	0	0	0	0	124	23	0	0	0	129	7	0	0	0	0	283
8:45 AM to 9:00 AM	0	0	0	0	0	126	36	0	0	0	136	7	0	0	0	0	305

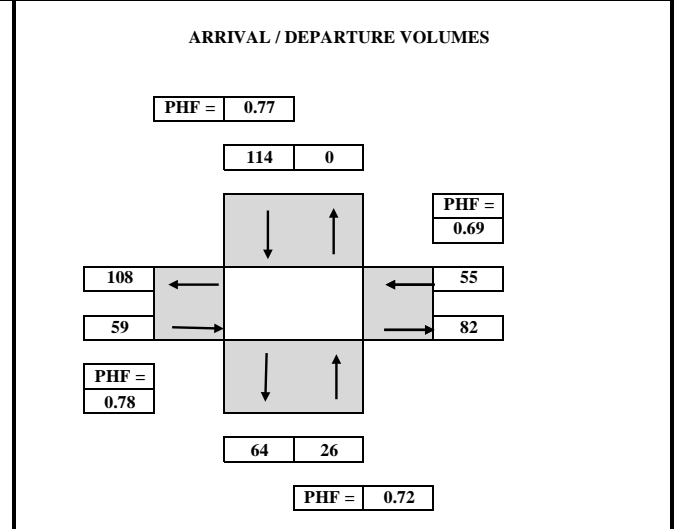
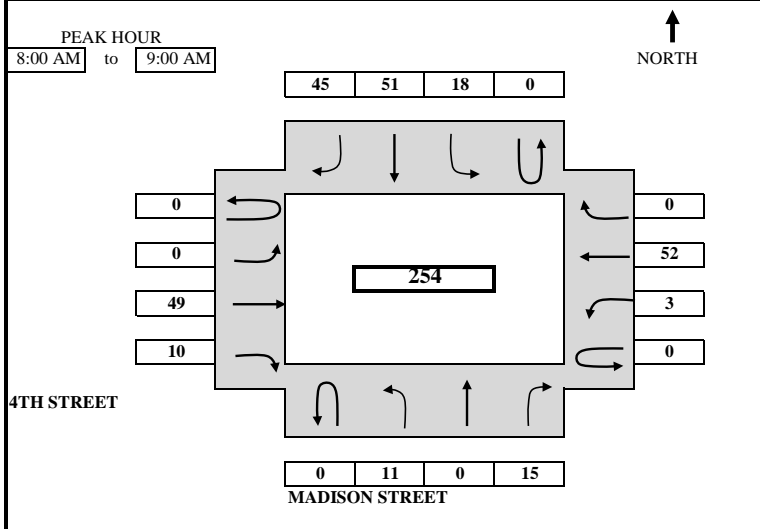
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	0	0	0	0	497	64	0	0	0	309	10	0	0	0	0	880
7:15 AM to 8:15 AM	0	0	0	0	0	549	73	0	0	0	384	11	0	0	0	0	1017
7:30 AM to 8:30 AM	0	0	0	0	0	570	77	0	0	0	415	12	0	0	0	0	1074
7:45 AM to 8:45 AM	0	0	0	0	0	562	82	0	0	0	471	15	0	0	0	0	1130
8:00 AM to 9:00 AM	0	0	0	0	0	537	94	0	0	0	499	20	0	0	0	0	1150

PEAK HOUR SUMMARY																	
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	0	0	0	0	537	94	0	0	0	499	20	0	0	0	0	1150
PHF BY MOVEMENT	0.00	0.00	0.00	0.00	0.00	0.93	0.65	0.00	0.00	0.00	0.92	0.71	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH	0.00				0.96				0.91				0.00				0.94
BICYCLE	2				3				0				0				5
PEDESTRIAN	63				14				2				6				85
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	1				7				3				74				85

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>MADISON STREET</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>4TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(05)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	3	5	2	5	6	11	4	0	15	51					
7:15 AM	to	7:30 AM	4	7	6	11	13	18	5	0	27	91					
7:30 AM	to	7:45 AM	6	16	9	15	28	29	7	0	43	153					
7:45 AM	to	8:00 AM	6	20	15	23	39	44	12	1	56	216					
8:00 AM	to	8:15 AM	8	23	18	34	51	61	14	3	66	278					
8:15 AM	to	8:30 AM	13	27	24	43	58	69	14	3	78	329					
8:30 AM	to	8:45 AM	16	30	28	59	67	81	18	3	98	400					
8:45 AM	to	9:00 AM	17	35	33	74	84	93	22	4	108	470					

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	3	0	5	0	2	5	6	0	0	11	4	0	0	15	0	51
7:15 AM	to	7:30 AM	0	1	0	2	0	4	6	7	0	0	7	1	0	0	12	0	40
7:30 AM	to	7:45 AM	0	2	0	9	0	3	4	15	0	0	11	2	0	0	16	0	62
7:45 AM	to	8:00 AM	0	0	0	4	0	6	8	11	0	0	15	5	0	1	13	0	63
8:00 AM	to	8:15 AM	0	2	0	3	0	3	11	12	0	0	17	2	0	2	10	0	62
8:15 AM	to	8:30 AM	0	5	0	4	0	6	9	7	0	0	8	0	0	0	12	0	51
8:30 AM	to	8:45 AM	0	3	0	3	0	4	16	9	0	0	12	4	0	0	20	0	71
8:45 AM	to	9:00 AM	0	1	0	5	0	5	15	17	0	0	12	4	0	1	10	0	70

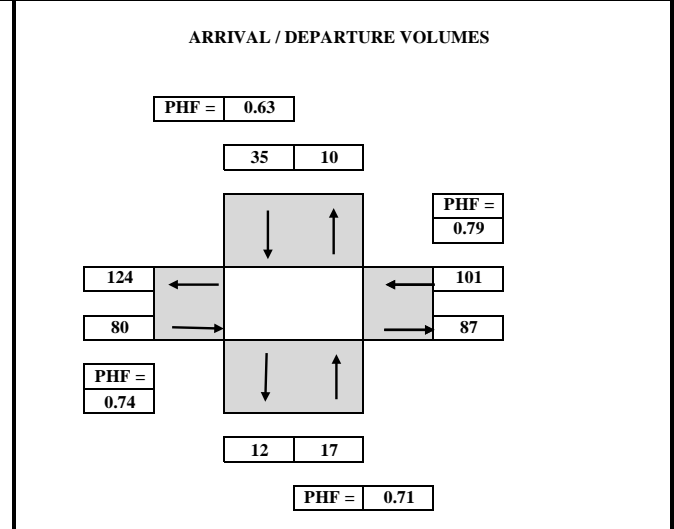
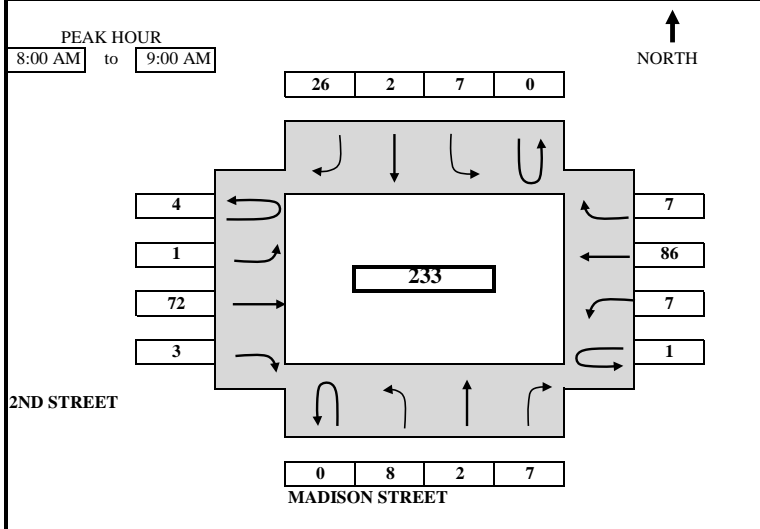
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	6	0	20	0	15	23	39	0	0	44	12	0	1	56	0	216
7:15 AM	to	8:15 AM	0	5	0	18	0	16	29	45	0	0	50	10	0	3	51	0	227
7:30 AM	to	8:30 AM	0	9	0	20	0	18	32	45	0	0	51	9	0	3	51	0	238
7:45 AM	to	8:45 AM	0	10	0	14	0	19	44	39	0	0	52	11	0	3	55	0	247
8:00 AM	to	9:00 AM	0	11	0	15	0	18	51	45	0	0	49	10	0	3	52	0	254

PEAK HOUR SUMMARY																			
8:00 AM	to	9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	11	0	15	0	18	51	45	0	0	49	10	0	3	52	0	254
PHF BY MOVEMENT			0.00	0.55	0.00	0.75	0.00	0.75	0.80	0.66	0.00	0.00	0.72	0.63	0.00	0.38	0.65	0.00	OVERALL
PHF BY APPROACH			0.72				0.77				0.78				0.69				0.89
BICYCLE			0				17				9				3				29
PEDESTRIAN			20				20				26				24				90
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				90
			9				41				14				26				90

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/8/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	MADISON STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	2ND STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(O6)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM	1	0	1		2	1	2		0	0	10	0	1	1	9	0	28
7:15 AM to 7:30 AM	3	0	4		3	2	5		1	0	22	0	1	2	20	3	66
7:30 AM to 7:45 AM	5	1	8		3	2	8		2	0	35	0	2	2	41	4	113
7:45 AM to 8:00 AM	6	2	12		7	2	15		3	0	52	2	2	4	63	5	175
8:00 AM to 8:15 AM	10	2	14		7	2	19		4	0	69	3	2	6	79	5	222
8:15 AM to 8:30 AM	12	3	15		8	2	26		4	0	94	5	2	7	97	9	284
8:30 AM to 8:45 AM	12	4	16		10	2	33		4	1	106	5	3	7	122	11	336
8:45 AM to 9:00 AM	14	4	19		14	4	41		7	1	124	5	3	11	149	12	408

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	1	0	1	0	2	1	2	0	0	10	0	1	1	9	0	28
7:15 AM to 7:30 AM	0	2	0	3	0	1	1	3	1	0	12	0	0	1	11	3	38
7:30 AM to 7:45 AM	0	2	1	4	0	0	0	3	1	0	13	0	1	0	21	1	47
7:45 AM to 8:00 AM	0	1	1	4	0	4	0	7	1	0	17	2	0	2	22	1	62
8:00 AM to 8:15 AM	0	4	0	2	0	0	0	4	1	0	17	1	0	2	16	0	47
8:15 AM to 8:30 AM	0	2	1	1	0	1	0	7	0	0	25	2	0	1	18	4	62
8:30 AM to 8:45 AM	0	0	1	1	0	2	0	7	0	1	12	0	1	0	25	2	52
8:45 AM to 9:00 AM	0	2	0	3	0	4	2	8	3	0	18	0	0	4	27	1	72

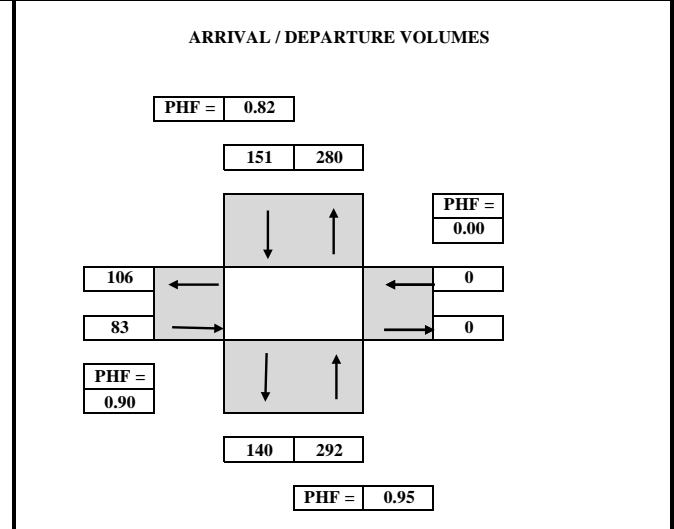
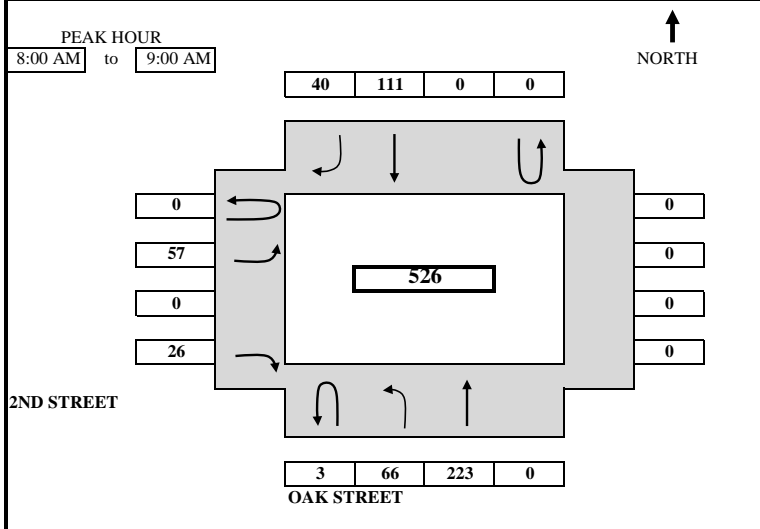
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	6	2	12	0	7	2	15	3	0	52	2	2	4	63	5	175
7:15 AM to 8:15 AM	0	9	2	13	0	5	1	17	4	0	59	3	1	5	70	5	194
7:30 AM to 8:30 AM	0	9	3	11	0	5	0	21	3	0	72	5	1	5	77	6	218
7:45 AM to 8:45 AM	0	7	3	8	0	7	0	25	2	1	71	5	1	5	81	7	223
8:00 AM to 9:00 AM	0	8	2	7	0	7	2	26	4	1	72	3	1	7	86	7	233

PEAK HOUR SUMMARY																	
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	8	2	7	0	7	2	26	4	1	72	3	1	7	86	7	233
PHF BY MOVEMENT	0.00	0.50	0.50	0.58	0.00	0.44	0.25	0.81	0.33	0.25	0.72	0.38	0.25	0.44	0.80	0.44	OVERALL
PHF BY APPROACH	0.71				0.63				0.74				0.79				0.81
BICYCLE	1				7				3				5				16
PEDESTRIAN	6				6				5				17				34
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	7				15				9				3				34

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>OAK STREET</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>2ND STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(07)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	7	15			9	6	9	4						50
7:15 AM	to	7:30 AM	1	16	63			30	13	18	10						151
7:30 AM	to	7:45 AM	1	31	104			52	23	31	15						257
7:45 AM	to	8:00 AM	1	47	167			74	28	50	23						390
8:00 AM	to	8:15 AM	1	61	224			94	36	64	30						510
8:15 AM	to	8:30 AM	3	79	280			126	41	77	36						642
8:30 AM	to	8:45 AM	3	96	331			161	52	93	43						779
8:45 AM	to	9:00 AM	4	113	390			185	68	107	49						916

TOTAL BY PERIOD																		
7:00 AM	to	7:15 AM	0	7	15	0	0	9	6	0	9	0	4	0	0	0	0	50
7:15 AM	to	7:30 AM	1	9	48	0	0	21	7	0	9	0	6	0	0	0	0	101
7:30 AM	to	7:45 AM	0	15	41	0	0	22	10	0	13	0	5	0	0	0	0	106
7:45 AM	to	8:00 AM	0	16	63	0	0	22	5	0	19	0	8	0	0	0	0	133
8:00 AM	to	8:15 AM	0	14	57	0	0	20	8	0	14	0	7	0	0	0	0	120
8:15 AM	to	8:30 AM	2	18	56	0	0	32	5	0	13	0	6	0	0	0	0	132
8:30 AM	to	8:45 AM	0	17	51	0	0	35	11	0	16	0	7	0	0	0	0	137
8:45 AM	to	9:00 AM	1	17	59	0	0	24	16	0	14	0	6	0	0	0	0	137

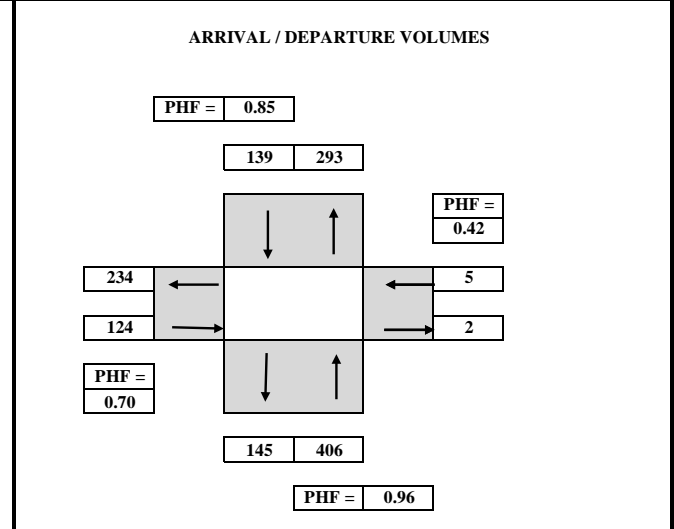
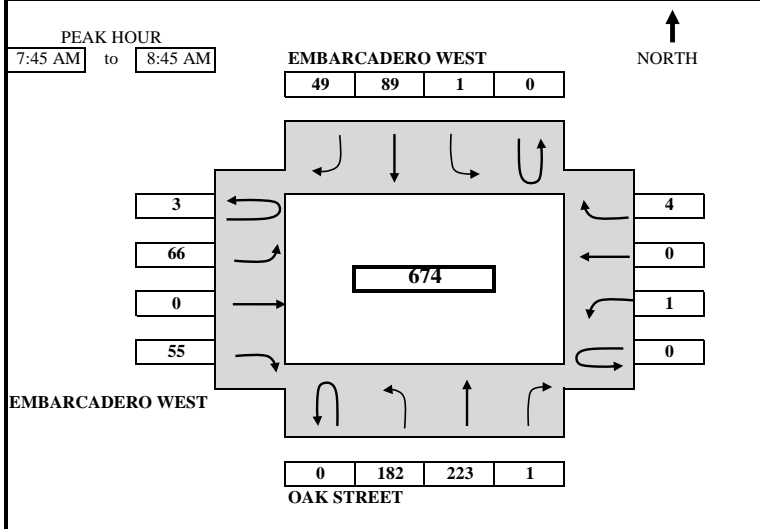
HOURLY TOTALS																		
7:00 AM	to	8:00 AM	1	47	167	0	0	74	28	0	50	0	23	0	0	0	0	390
7:15 AM	to	8:15 AM	1	54	209	0	0	85	30	0	55	0	26	0	0	0	0	460
7:30 AM	to	8:30 AM	2	63	217	0	0	96	28	0	59	0	26	0	0	0	0	491
7:45 AM	to	8:45 AM	2	65	227	0	0	109	29	0	62	0	28	0	0	0	0	522
8:00 AM	to	9:00 AM	3	66	223	0	0	111	40	0	57	0	26	0	0	0	0	526

PEAK HOUR SUMMARY																				
8:00 AM	to	9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	3	66	223	0	0	0	111	40	0	57	0	26	0	0	0	0	526
			PHF BY MOVEMENT	0.38	0.92	0.94	0.00	0.00	0.00	0.79	0.63	0.00	0.89	0.00	0.93	0.00	0.00	0.00	0.00	OVERALL
			PHF BY APPROACH	0.95				0.82				0.90				0.00				0.96
			BICYCLE	14				5				6				0				25
			PEDESTRIAN	39				15				5				0				59
			PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
				1				4				0				54				59

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/8/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	OAK STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	EMBARCADERO WEST	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(08)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
7:00 AM to 7:15 AM	16	13	0	2	0	9	3	0	9	0	8	0	0	0	0	60	
7:15 AM to 7:30 AM	27	57	0	3	0	24	15	0	20	0	15	0	0	0	1	162	
7:30 AM to 7:45 AM	49	99	0	4	0	43	21	0	34	0	23	0	0	0	1	274	
7:45 AM to 8:00 AM	92	160	0	4	0	65	29	0	48	0	34	0	0	0	4	436	
8:00 AM to 8:15 AM	137	216	0	4	0	79	43	1	63	0	46	0	0	0	4	593	
8:15 AM to 8:30 AM	191	267	1	4	0	104	58	2	88	0	64	1	0	0	4	784	
8:30 AM to 8:45 AM	231	322	1	4	1	132	70	3	100	0	78	1	0	0	5	948	
8:45 AM to 9:00 AM	267	383	1	4	1	154	80	3	115	0	85	1	0	0	5	1099	

<b>TOTAL BY PERIOD</b>																	
TIME PERIOD	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	TOTAL
7:00 AM to 7:15 AM	0	16	13	0	2	0	9	3	0	9	0	8	0	0	0	0	60
7:15 AM to 7:30 AM	0	11	44	0	1	0	15	12	0	11	0	7	0	0	0	1	102
7:30 AM to 7:45 AM	0	22	42	0	1	0	19	6	0	14	0	8	0	0	0	0	112
7:45 AM to 8:00 AM	0	43	61	0	0	0	22	8	0	14	0	11	0	0	0	3	162
8:00 AM to 8:15 AM	0	45	56	0	0	0	14	14	1	15	0	12	0	0	0	0	157
8:15 AM to 8:30 AM	0	54	51	1	0	0	25	15	1	25	0	18	0	1	0	0	191
8:30 AM to 8:45 AM	0	40	55	0	0	1	28	12	1	12	0	14	0	0	0	1	164
8:45 AM to 9:00 AM	0	36	61	0	0	0	22	10	0	15	0	7	0	0	0	0	151

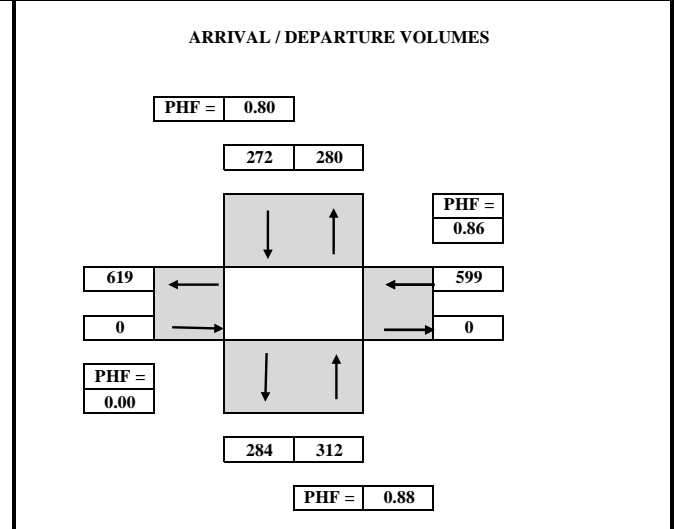
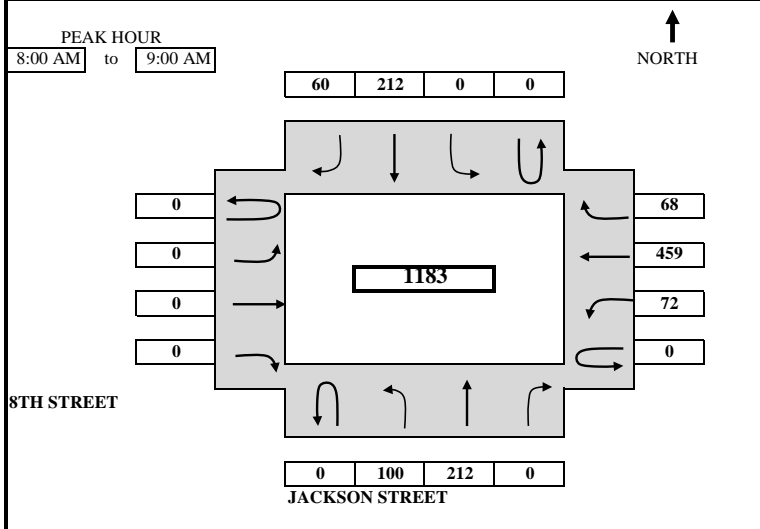
<b>HOURLY TOTALS</b>																	
TIME PERIOD	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	TOTAL
7:00 AM to 8:00 AM	0	92	160	0	4	0	65	29	0	48	0	34	0	0	0	4	436
7:15 AM to 8:15 AM	0	121	203	0	2	0	70	40	1	54	0	38	0	0	0	4	533
7:30 AM to 8:30 AM	0	164	210	1	1	0	80	43	2	68	0	49	0	1	0	3	622
7:45 AM to 8:45 AM	0	182	223	1	0	1	89	49	3	66	0	55	0	1	0	4	674
8:00 AM to 9:00 AM	0	175	223	1	0	1	89	51	3	67	0	51	0	1	0	1	663

<b>PEAK HOUR SUMMARY</b>																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	182	223	1	0	1	89	49	3	66	0	55	0	1	0	4	674
PHF BY MOVEMENT	0.00	0.84	0.91	0.25	0.00	0.25	0.79	0.82	0.75	0.66	0.00	0.76	0.00	0.25	0.00	0.33	OVERALL
PHF BY APPROACH	0.96				0.85				0.70				0.42				0.88
BICYCLE	15				7				5				0				27
PEDESTRIAN	35				17				4				7				63
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	6				5				0				52				63

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	JACKSON STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	8TH STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(O10)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																		
7:00 AM to 7:15 AM			12	19				37	5						11	51	5	140
7:15 AM to 7:30 AM			20	46				80	14						24	118	8	310
7:30 AM to 7:45 AM			35	84				133	21						39	190	16	518
7:45 AM to 8:00 AM			48	113				180	34						52	312	25	764
8:00 AM to 8:15 AM			58	166				232	42						73	408	42	1021
8:15 AM to 8:30 AM			89	224				281	58						92	501	64	1309
8:30 AM to 8:45 AM			118	279				325	76						109	628	77	1612
8:45 AM to 9:00 AM			148	325				392	94						124	771	93	1947

TOTAL BY PERIOD																		
7:00 AM to 7:15 AM	0	12	19	0	0	0	37	5	0	0	0	0	0	0	11	51	5	140
7:15 AM to 7:30 AM	0	8	27	0	0	0	43	9	0	0	0	0	0	0	13	67	3	170
7:30 AM to 7:45 AM	0	15	38	0	0	0	53	7	0	0	0	0	0	0	15	72	8	208
7:45 AM to 8:00 AM	0	13	29	0	0	0	47	13	0	0	0	0	0	0	13	122	9	246
8:00 AM to 8:15 AM	0	10	53	0	0	0	52	8	0	0	0	0	0	0	21	96	17	257
8:15 AM to 8:30 AM	0	31	58	0	0	0	49	16	0	0	0	0	0	0	19	93	22	288
8:30 AM to 8:45 AM	0	29	55	0	0	0	44	18	0	0	0	0	0	0	17	127	13	303
8:45 AM to 9:00 AM	0	30	46	0	0	0	67	18	0	0	0	0	0	0	15	143	16	335

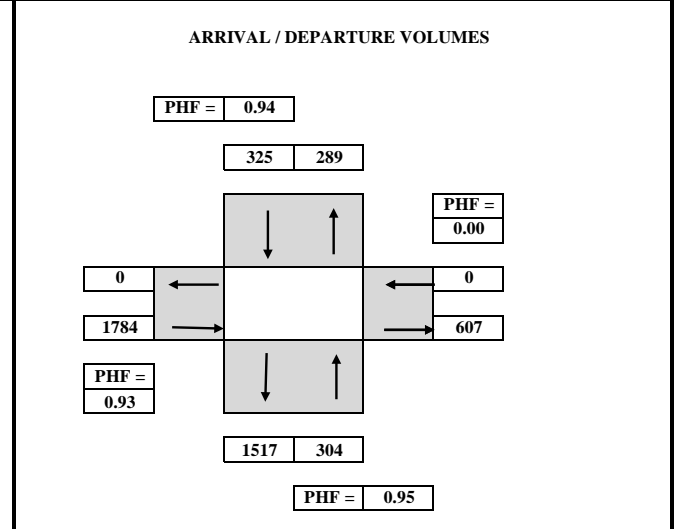
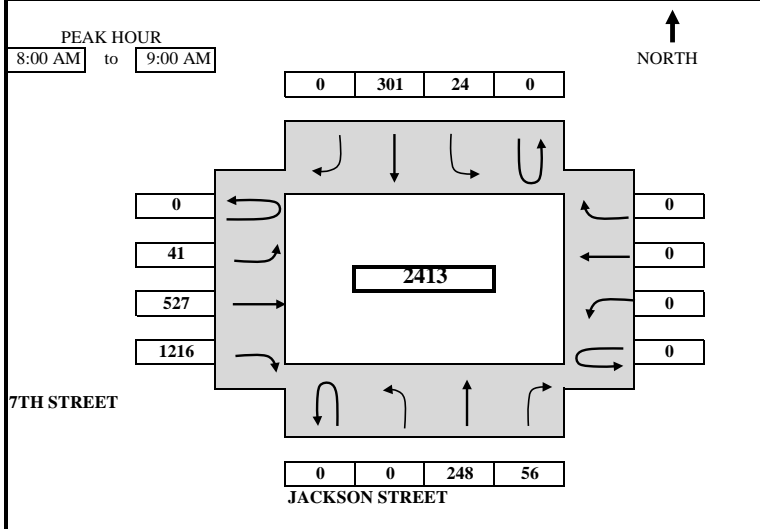
HOURLY TOTALS																		
7:00 AM to 8:00 AM	0	48	113	0	0	0	180	34	0	0	0	0	0	0	52	312	25	764
7:15 AM to 8:15 AM	0	46	147	0	0	0	195	37	0	0	0	0	0	0	62	357	37	881
7:30 AM to 8:30 AM	0	69	178	0	0	0	201	44	0	0	0	0	0	0	68	383	56	999
7:45 AM to 8:45 AM	0	83	195	0	0	0	192	55	0	0	0	0	0	0	70	438	61	1094
8:00 AM to 9:00 AM	0	100	212	0	0	0	212	60	0	0	0	0	0	0	72	459	68	1183

PEAK HOUR SUMMARY																		
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
	VOLUME	0	100	212	0	0	0	212	60	0	0	0	0	0	72	459	68	1183
	PHF BY MOVEMENT	0.00	0.81	0.91	0.00	0.00	0.00	0.79	0.83	0.00	0.00	0.00	0.00	0.00	0.86	0.80	0.77	OVERALL
	PHF BY APPROACH	0.88				0.80				0.00				0.86				0.88
	BICYCLE	1				3				0				8				12
	PEDESTRIAN	84				81				119				97				381
		N-LEG				S-LEG				E-LEG				W-LEG				
	PEDESTRIAN BY LEG:	93				123				110				55				381

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>JACKSON STREET</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>7TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O11)AM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM			23	8		4	39			7	93	274					448
7:15 AM to 7:30 AM			60	15		7	86			8	212	586					974
7:30 AM to 7:45 AM			105	24		11	135			12	324	912					1523
7:45 AM to 8:00 AM			158	31		13	192			14	431	1235					2074
8:00 AM to 8:15 AM			227	36		19	271			25	562	1554					2694
8:15 AM to 8:30 AM			290	50		24	352			34	692	1827					3269
8:30 AM to 8:45 AM			345	68		31	425			46	833	2153					3901
8:45 AM to 9:00 AM			406	87		37	493			55	958	2451					4487

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	23	8	0	4	39	0	0	7	93	274	0	0	0	0	448
7:15 AM to 7:30 AM	0	0	37	7	0	3	47	0	0	1	119	312	0	0	0	0	526
7:30 AM to 7:45 AM	0	0	45	9	0	4	49	0	0	4	112	326	0	0	0	0	549
7:45 AM to 8:00 AM	0	0	53	7	0	2	57	0	0	2	107	323	0	0	0	0	551
8:00 AM to 8:15 AM	0	0	69	5	0	6	79	0	0	11	131	319	0	0	0	0	620
8:15 AM to 8:30 AM	0	0	63	14	0	5	81	0	0	9	130	273	0	0	0	0	575
8:30 AM to 8:45 AM	0	0	55	18	0	7	73	0	0	12	141	326	0	0	0	0	632
8:45 AM to 9:00 AM	0	0	61	19	0	6	68	0	0	9	125	298	0	0	0	0	586

HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	0	158	31	0	13	192	0	0	14	431	1235	0	0	0	0	2074
7:15 AM to 8:15 AM	0	0	204	28	0	15	232	0	0	18	469	1280	0	0	0	0	2246
7:30 AM to 8:30 AM	0	0	230	35	0	17	266	0	0	26	480	1241	0	0	0	0	2295
7:45 AM to 8:45 AM	0	0	240	44	0	20	290	0	0	34	509	1241	0	0	0	0	2378
8:00 AM to 9:00 AM	0	0	248	56	0	24	301	0	0	41	527	1216	0	0	0	0	2413

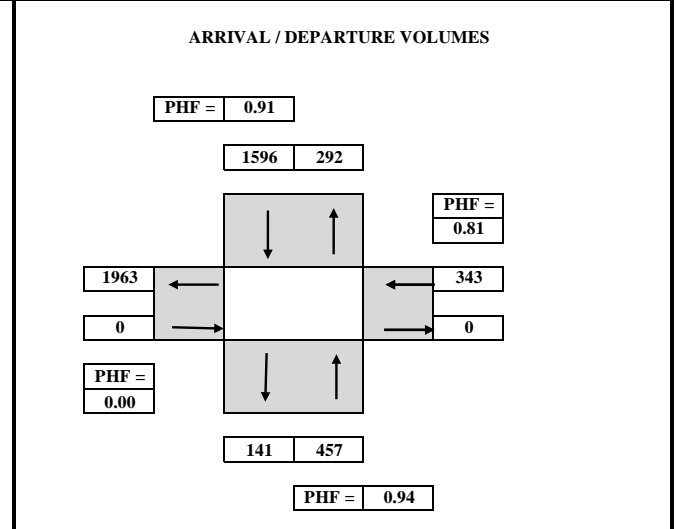
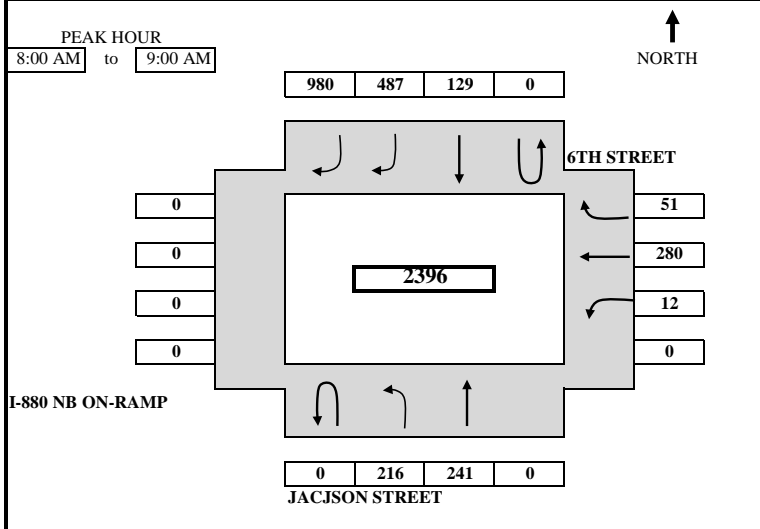
PEAK HOUR SUMMARY																	
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	0	248	56	0	24	301	0	0	41	527	1216	0	0	0	0	2413
PHF BY MOVEMENT	0.00	0.00	0.90	0.74	0.00	0.86	0.93	0.00	0.00	0.85	0.93	0.93	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH	0.95				0.94				0.93				0.00				0.95
BICYCLE	0				0				0				0				0
PEDESTRIAN	0				0				0				0				0
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	0				0				0				0				0



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/8/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	JACJSON STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	I-880 NB ON-RAMP - 6TH STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(O12)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	THRU	RIGHT	RT to Fy	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																		
7:00 AM to 7:15 AM			75	27			23	17	232						6	58	14	452
7:15 AM to 7:30 AM			148	55			59	63	527						8	132	24	1016
7:30 AM to 7:45 AM			212	96			75	151	781						11	202	34	1562
7:45 AM to 8:00 AM			270	142			101	285	996						12	266	48	2120
8:00 AM to 8:15 AM			328	206			139	424	1256						17	350	65	2785
8:15 AM to 8:30 AM			387	263			171	524	1483						19	415	77	3339
8:30 AM to 8:45 AM			428	326			200	662	1710						21	479	88	3914
8:45 AM to 9:00 AM			486	383			230	772	1976						24	546	99	4516

TOTAL BY PERIOD																		
7:00 AM to 7:15 AM	0	75	27	0	0	23	17	232	0	0	0	0	0	0	6	58	14	452
7:15 AM to 7:30 AM	0	73	28	0	0	36	46	295	0	0	0	0	0	0	2	74	10	564
7:30 AM to 7:45 AM	0	64	41	0	0	16	88	254	0	0	0	0	0	0	3	70	10	546
7:45 AM to 8:00 AM	0	58	46	0	0	26	134	215	0	0	0	0	0	0	1	64	14	558
8:00 AM to 8:15 AM	0	58	64	0	0	38	139	260	0	0	0	0	0	0	5	84	17	665
8:15 AM to 8:30 AM	0	59	57	0	0	32	100	227	0	0	0	0	0	0	2	65	12	554
8:30 AM to 8:45 AM	0	41	63	0	0	29	138	227	0	0	0	0	0	0	2	64	11	575
8:45 AM to 9:00 AM	0	58	57	0	0	30	110	266	0	0	0	0	0	0	3	67	11	602

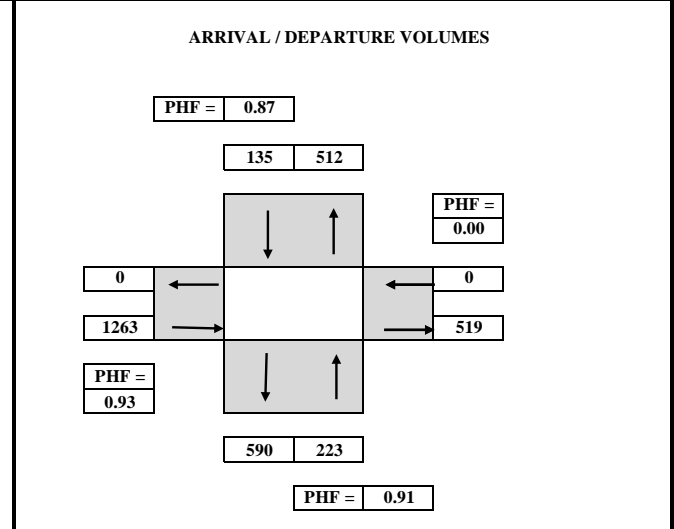
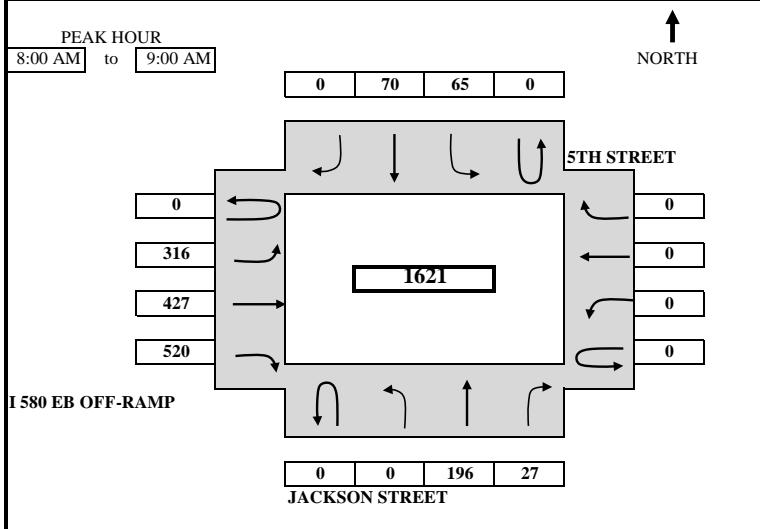
HOURLY TOTALS																		
7:00 AM to 8:00 AM	0	270	142	0	0	101	285	996	0	0	0	0	0	0	12	266	48	2120
7:15 AM to 8:15 AM	0	253	179	0	0	116	407	1024	0	0	0	0	0	0	11	292	51	2333
7:30 AM to 8:30 AM	0	239	208	0	0	112	461	956	0	0	0	0	0	0	11	283	53	2323
7:45 AM to 8:45 AM	0	216	230	0	0	125	511	929	0	0	0	0	0	0	10	277	54	2352
8:00 AM to 9:00 AM	0	216	241	0	0	129	487	980	0	0	0	0	0	0	12	280	51	2396

PEAK HOUR SUMMARY																		
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	216	241	0	0	129	487	980	0	0	0	0	0	12	280	51	2396	
PHF BY MOVEMENT	0.00	0.92	0.94	0.00	0.00	0.85	0.88	0.92	0.00	0.00	0.00	0.00	0.00	0.60	0.83	0.75	OVERALL	
PHF BY APPROACH	0.94				0.91				0.00				0.81				0.90	
BICYCLE	5				9				0				0				14	
PEDESTRIAN	51				24				0				0				75	
	N-LEG				S-LEG				E-LEG				W-LEG					
PEDESTRIAN BY LEG:	0				0				60				15				75	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/8/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	JACKSON STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	5TH STREET - I 580 EB OFF-RAMP	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(09)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																		
7:00 AM to 7:15 AM			30	4			11	14			72	43	68					242
7:15 AM to 7:30 AM			72	7			32	30			135	92	131					499
7:30 AM to 7:45 AM			113	12			44	39			211	152	214					785
7:45 AM to 8:00 AM			155	17			62	53			272	237	333					1129
8:00 AM to 8:15 AM			198	28			80	74			352	343	483					1558
8:15 AM to 8:30 AM			252	31			96	89			426	428	600					1922
8:30 AM to 8:45 AM			307	37			114	107			494	541	729					2329
8:45 AM to 9:00 AM			351	44			127	123			588	664	853					2750

TOTAL BY PERIOD																		
7:00 AM to 7:15 AM	0	0	30	4	0	11	14	0	0	72	43	68	0	0	0	0	0	242
7:15 AM to 7:30 AM	0	0	42	3	0	21	16	0	0	63	49	63	0	0	0	0	0	257
7:30 AM to 7:45 AM	0	0	41	5	0	12	9	0	0	76	60	83	0	0	0	0	0	286
7:45 AM to 8:00 AM	0	0	42	5	0	18	14	0	0	61	85	119	0	0	0	0	0	344
8:00 AM to 8:15 AM	0	0	43	11	0	18	21	0	0	80	106	150	0	0	0	0	0	429
8:15 AM to 8:30 AM	0	0	54	3	0	16	15	0	0	74	85	117	0	0	0	0	0	364
8:30 AM to 8:45 AM	0	0	55	6	0	18	18	0	0	68	113	129	0	0	0	0	0	407
8:45 AM to 9:00 AM	0	0	44	7	0	13	16	0	0	94	123	124	0	0	0	0	0	421

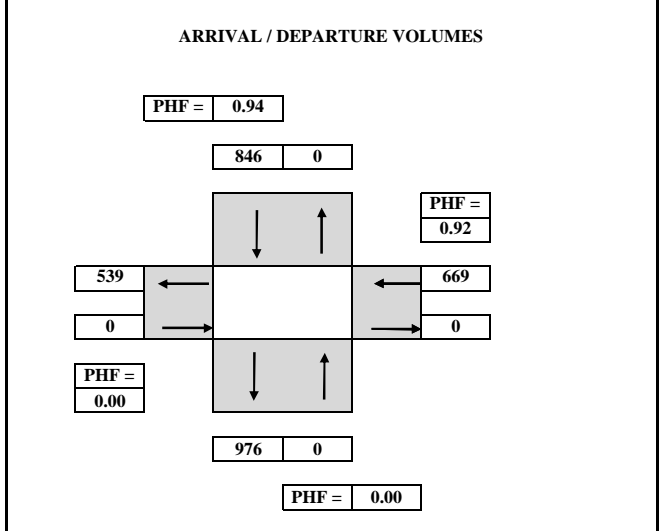
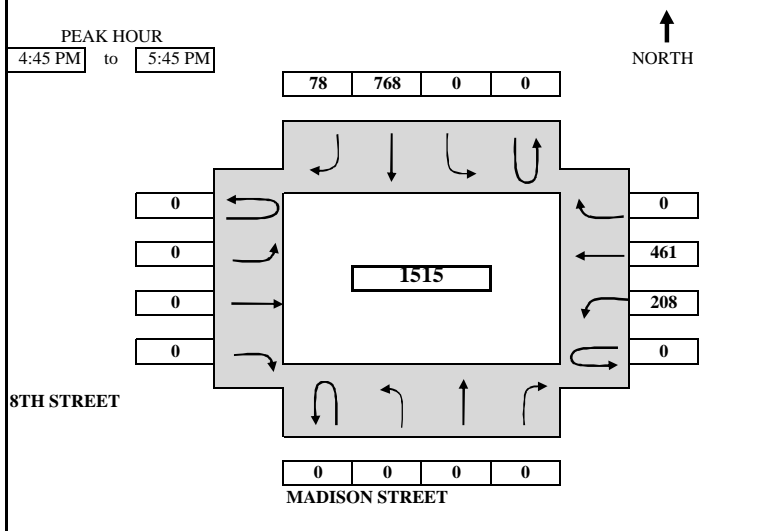
HOURLY TOTALS																		
7:00 AM to 8:00 AM	0	0	155	17	0	62	53	0	0	272	237	333	0	0	0	0	0	1129
7:15 AM to 8:15 AM	0	0	168	24	0	69	60	0	0	280	300	415	0	0	0	0	0	1316
7:30 AM to 8:30 AM	0	0	180	24	0	64	59	0	0	291	336	469	0	0	0	0	0	1423
7:45 AM to 8:45 AM	0	0	194	25	0	70	68	0	0	283	389	515	0	0	0	0	0	1544
8:00 AM to 9:00 AM	0	0	196	27	0	65	70	0	0	316	427	520	0	0	0	0	0	1621

PEAK HOUR SUMMARY																		
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	0	196	27	0	65	70	0	0	316	427	520	0	0	0	0	1621	
PHF BY MOVEMENT	0.00	0.00	0.89	0.61	0.00	0.90	0.83	0.00	0.00	0.84	0.87	0.87	0.00	0.00	0.00	0.00	OVERALL	
PHF BY APPROACH	0.91				0.87				0.93				0.00				0.94	
BICYCLE	4				9				0				0				13	
PEDESTRIAN	47				41				13				6				107	
	N-LEG				S-LEG				E-LEG				W-LEG					
PEDESTRIAN BY LEG:	7				12				68				20				107	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>MADISON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>8TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(01)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM															309
4:15 PM	to	4:30 PM															634
4:30 PM	to	4:45 PM															996
4:45 PM	to	5:00 PM															1332
5:00 PM	to	5:15 PM															1733
5:15 PM	to	5:30 PM															2133
5:30 PM	to	5:45 PM															2511
5:45 PM	to	6:00 PM															2837

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	0	0	0	0	0	152	12	0	0	0	0	0	48	97	309
4:15 PM	to	4:30 PM	0	0	0	0	0	0	164	15	0	0	0	0	0	52	94	325
4:30 PM	to	4:45 PM	0	0	0	0	0	0	185	15	0	0	0	0	0	49	113	362
4:45 PM	to	5:00 PM	0	0	0	0	0	0	166	9	0	0	0	0	0	54	107	336
5:00 PM	to	5:15 PM	0	0	0	0	0	0	196	23	0	0	0	0	0	61	121	401
5:15 PM	to	5:30 PM	0	0	0	0	0	0	201	25	0	0	0	0	0	49	125	400
5:30 PM	to	5:45 PM	0	0	0	0	0	0	205	21	0	0	0	0	0	44	108	378
5:45 PM	to	6:00 PM	0	0	0	0	0	0	154	17	0	0	0	0	0	51	104	326

HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	0	0	0	0	0	667	51	0	0	0	0	0	203	411	1332
4:15 PM	to	5:15 PM	0	0	0	0	0	0	711	62	0	0	0	0	0	216	435	1424
4:30 PM	to	5:30 PM	0	0	0	0	0	0	748	72	0	0	0	0	0	213	466	1499
4:45 PM	to	5:45 PM	0	0	0	0	0	0	768	78	0	0	0	0	0	208	461	1515
5:00 PM	to	6:00 PM	0	0	0	0	0	0	756	86	0	0	0	0	0	205	458	1505

PEAK HOUR SUMMARY																			
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	0	0	0	0	768	78	0	0	0	0	0	208	461	0	1515
			0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.78	0.00	0.00	0.00	0.00	0.00	0.85	0.92	0.00	OVERALL
			PHF BY APPROACH				0.94				0.00				0.92				0.94
			BICYCLE				8				0				9				17
			PEDESTRIAN				41				45				79				207
			N-LEG				S-LEG				E-LEG				W-LEG				
			73				48				51				35				207

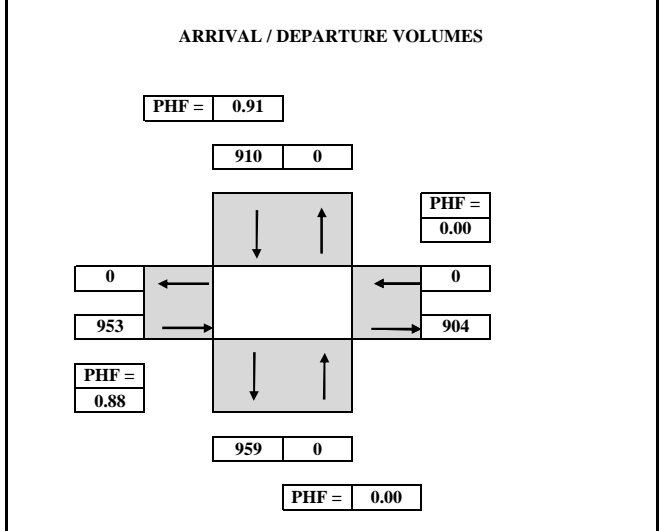
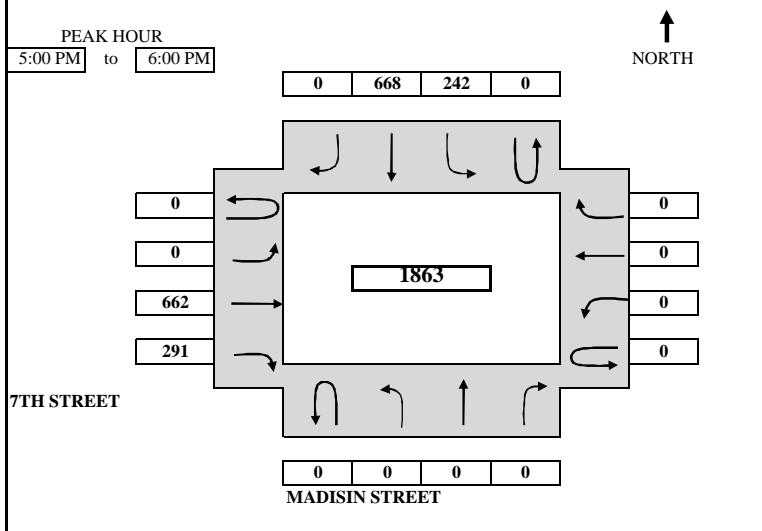
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>MADISIN STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>7TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(02)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM					33	169				127	93				422
4:15 PM	to	4:30 PM					69	331				278	184				862
4:30 PM	to	4:45 PM					117	516				390	270				1293
4:45 PM	to	5:00 PM					155	677				511	333				1676
5:00 PM	to	5:15 PM					229	849				698	416				2192
5:15 PM	to	5:30 PM					291	1019				863	491				2664
5:30 PM	to	5:45 PM					355	1206				1000	584				3145
5:45 PM	to	6:00 PM					397	1345				1173	624				3539

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	0	0	0	0	33	169	0	0	0	127	93	0	0	0	422
4:15 PM	to	4:30 PM	0	0	0	0	0	36	162	0	0	0	151	91	0	0	0	440
4:30 PM	to	4:45 PM	0	0	0	0	0	48	185	0	0	0	112	86	0	0	0	431
4:45 PM	to	5:00 PM	0	0	0	0	0	38	161	0	0	0	121	63	0	0	0	383
5:00 PM	to	5:15 PM	0	0	0	0	0	74	172	0	0	0	187	83	0	0	0	516
5:15 PM	to	5:30 PM	0	0	0	0	0	62	170	0	0	0	165	75	0	0	0	472
5:30 PM	to	5:45 PM	0	0	0	0	0	64	187	0	0	0	137	93	0	0	0	481
5:45 PM	to	6:00 PM	0	0	0	0	0	42	139	0	0	0	173	40	0	0	0	394

HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	0	0	0	0	155	677	0	0	0	511	333	0	0	0	1676
4:15 PM	to	5:15 PM	0	0	0	0	0	196	680	0	0	0	571	323	0	0	0	1770
4:30 PM	to	5:30 PM	0	0	0	0	0	222	688	0	0	0	585	307	0	0	0	1802
4:45 PM	to	5:45 PM	0	0	0	0	0	238	690	0	0	0	610	314	0	0	0	1852
5:00 PM	to	6:00 PM	0	0	0	0	0	242	668	0	0	0	662	291	0	0	0	1863

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	0	0	0	242	668	0	0	0	662	291	0	0	0	0	1863
			0.00	0.00	0.00	0.00	0.00	0.82	0.89	0.00	0.00	0.00	0.89	0.78	0.00	0.00	0.00	0.00	OVERALL
			PHF BY APPROACH				0.91				0.88				0.00				0.90
			BICYCLE				3				1				0				4
			PEDESTRIAN				25				32				26				104
			N-LEG				S-LEG				E-LEG				W-LEG				
			24				23				37				20				104

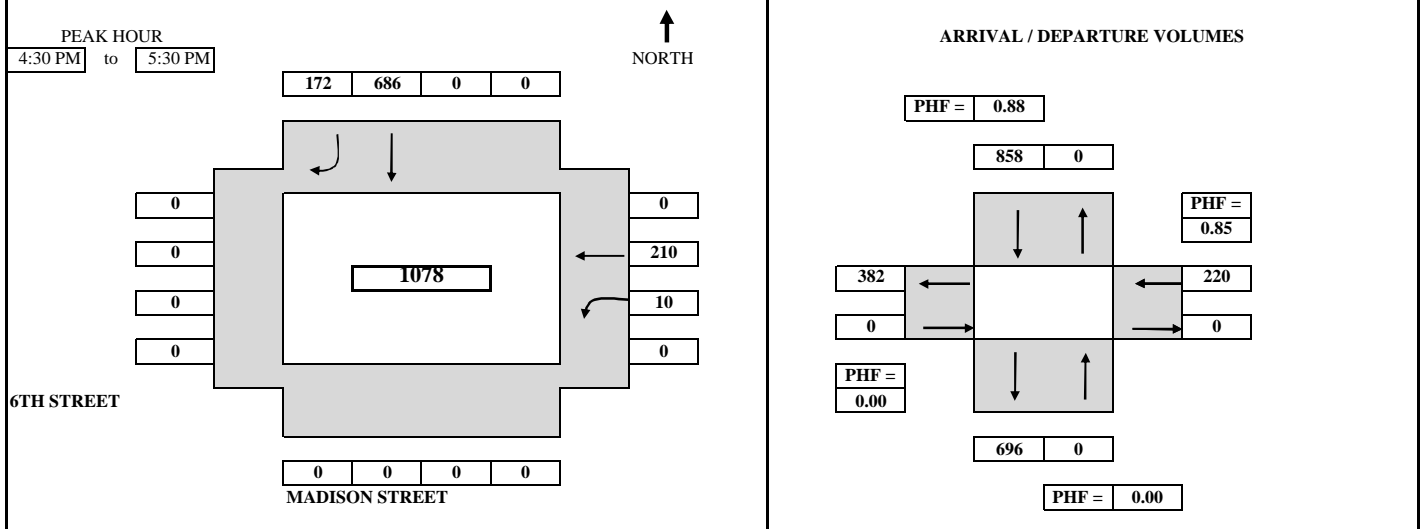
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>MADISON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>6TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O3)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
4:00 PM	to	4:15 PM								195	53					1	46	295
4:15 PM	to	4:30 PM								359	89					2	99	549
4:30 PM	to	4:45 PM								534	126					5	161	826
4:45 PM	to	5:00 PM								690	162					7	204	1063
5:00 PM	to	5:15 PM								859	204					9	261	1333
5:15 PM	to	5:30 PM								1045	261					12	309	1627
5:30 PM	to	5:45 PM								1218	308					13	343	1882
5:45 PM	to	6:00 PM								1379	349					17	386	2131

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	0	0	0	0	0	195	53	0	0	0	0	0	1	46	295
4:15 PM	to	4:30 PM	0	0	0	0	0	0	164	36	0	0	0	0	0	1	53	254
4:30 PM	to	4:45 PM	0	0	0	0	0	0	175	37	0	0	0	0	0	3	62	277
4:45 PM	to	5:00 PM	0	0	0	0	0	0	156	36	0	0	0	0	0	2	43	237
5:00 PM	to	5:15 PM	0	0	0	0	0	0	169	42	0	0	0	0	0	2	57	270
5:15 PM	to	5:30 PM	0	0	0	0	0	0	186	57	0	0	0	0	0	3	48	294
5:30 PM	to	5:45 PM	0	0	0	0	0	0	173	47	0	0	0	0	0	1	34	255
5:45 PM	to	6:00 PM	0	0	0	0	0	0	161	41	0	0	0	0	0	4	43	249

HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	0	0	0	0	0	690	162	0	0	0	0	0	7	204	1063
4:15 PM	to	5:15 PM	0	0	0	0	0	0	664	151	0	0	0	0	0	8	215	1038
4:30 PM	to	5:30 PM	0	0	0	0	0	0	686	172	0	0	0	0	0	10	210	1078
4:45 PM	to	5:45 PM	0	0	0	0	0	0	684	182	0	0	0	0	0	8	182	1056
5:00 PM	to	6:00 PM	0	0	0	0	0	0	689	187	0	0	0	0	0	10	182	1068

PEAK HOUR SUMMARY																			
4:30 PM	to	5:30 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	0	0	0	0	686	172	0	0	0	0	0	10	210	0	
			0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.75	0.00	0.00	0.00	0.00	0.00	0.83	0.85	0.00	
			PHF BY APPROACH				0.88				0.00				0.85				0.92
			BICYCLE				12				0				0				12
			PEDESTRIAN				23				13				4				72
			N-LEG				S-LEG				E-LEG				W-LEG				
			13				4				19				36				72

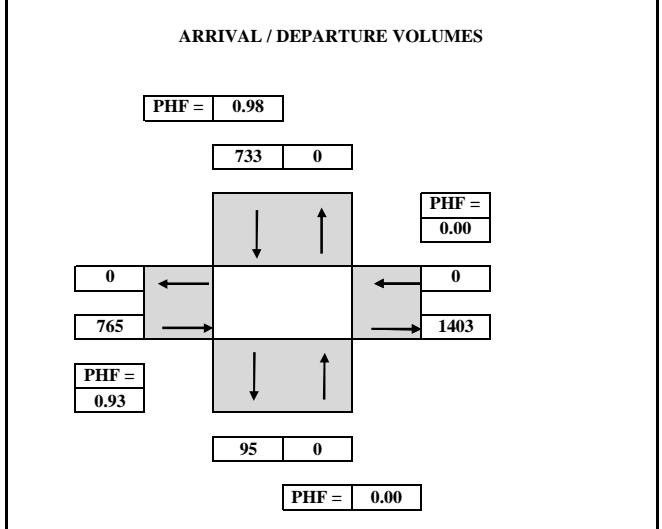
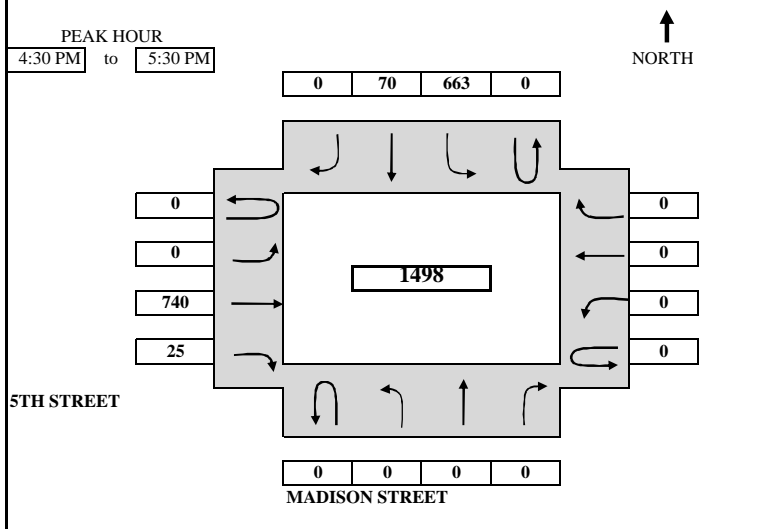
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>MADISON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>5TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O4)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM					153	25				111	11				300
4:15 PM	to	4:30 PM					317	39				280	19				655
4:30 PM	to	4:45 PM					482	51				463	28				1024
4:45 PM	to	5:00 PM					644	72				654	34				1404
5:00 PM	to	5:15 PM					819	84				819	40				1762
5:15 PM	to	5:30 PM					980	109				1020	44				2153
5:30 PM	to	5:45 PM					1115	125				1195	53				2488
5:45 PM	to	6:00 PM					1256	144				1363	61				2824

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	0	0	0	153	25	0	0	0	111	11	0	0	0	0	300
4:15 PM	to	4:30 PM	0	0	0	0	0	164	14	0	0	0	169	8	0	0	0	0	355
4:30 PM	to	4:45 PM	0	0	0	0	0	165	12	0	0	0	183	9	0	0	0	0	369
4:45 PM	to	5:00 PM	0	0	0	0	0	162	21	0	0	0	191	6	0	0	0	0	380
5:00 PM	to	5:15 PM	0	0	0	0	0	175	12	0	0	0	165	6	0	0	0	0	358
5:15 PM	to	5:30 PM	0	0	0	0	0	161	25	0	0	0	201	4	0	0	0	0	391
5:30 PM	to	5:45 PM	0	0	0	0	0	135	16	0	0	0	175	9	0	0	0	0	335
5:45 PM	to	6:00 PM	0	0	0	0	0	141	19	0	0	0	168	8	0	0	0	0	336

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	0	0	0	0	644	72	0	0	0	654	34	0	0	0	0	1404
4:15 PM	to	5:15 PM	0	0	0	0	0	666	59	0	0	0	708	29	0	0	0	0	1462
4:30 PM	to	5:30 PM	0	0	0	0	0	663	70	0	0	0	740	25	0	0	0	0	1498
4:45 PM	to	5:45 PM	0	0	0	0	0	633	74	0	0	0	732	25	0	0	0	0	1464
5:00 PM	to	6:00 PM	0	0	0	0	0	612	72	0	0	0	709	27	0	0	0	0	1420

PEAK HOUR SUMMARY																			
4:30 PM	to	5:30 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	0	0	0	663	70	0	0	0	740	25	0	0	0	0	1498
			0.00	0.00	0.00	0.00	0.00	0.95	0.70	0.00	0.00	0.00	0.92	0.69	0.00	0.00	0.00	0.00	OVERALL
			PHF BY APPROACH				0.98				0.93				0.00				0.96
			BICYCLE				13				0				0				16
			PEDESTRIAN				40				9				5				74
			N-LEG				S-LEG				E-LEG				W-LEG				
			0				14				10				50				74

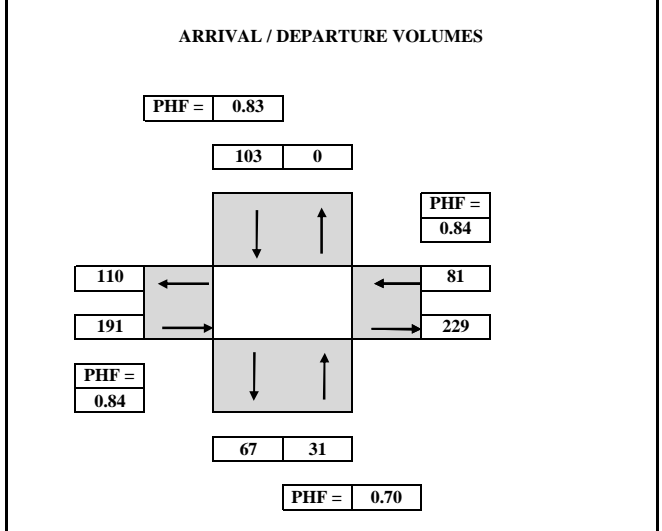
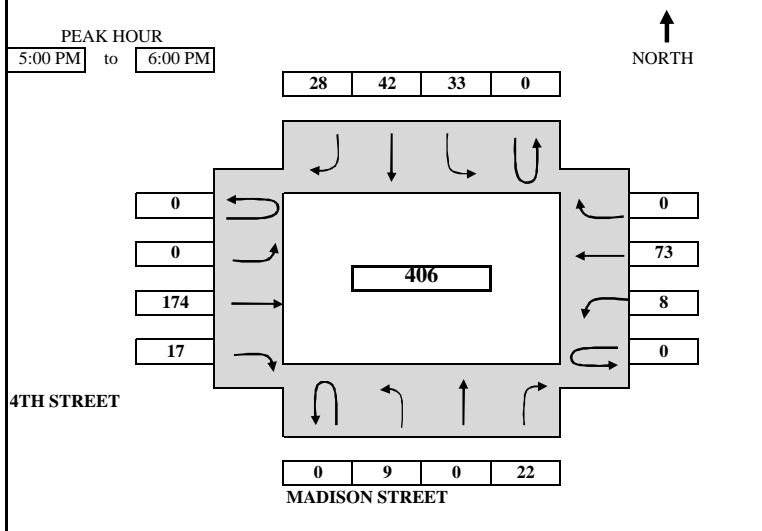
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>MADISON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>4TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O5)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	3	2	15	16	3	32	4	2	21	98					
4:15 PM	to	4:30 PM	5	6	19	30	8	64	6	2	32	172					
4:30 PM	to	4:45 PM	5	6	29	39	14	97	9	2	45	246					
4:45 PM	to	5:00 PM	6	9	38	50	21	124	12	6	56	322					
5:00 PM	to	5:15 PM	8	13	45	59	27	176	17	9	75	429					
5:15 PM	to	5:30 PM	10	19	54	71	37	210	20	11	91	523					
5:30 PM	to	5:45 PM	11	29	60	82	44	250	27	14	112	629					
5:45 PM	to	6:00 PM	15	31	71	92	49	298	29	14	129	728					

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	3	0	2	0	15	16	3	0	0	32	4	0	2	21	0	98
4:15 PM	to	4:30 PM	0	2	0	4	0	4	14	5	0	0	32	2	0	0	11	0	74
4:30 PM	to	4:45 PM	0	0	0	0	0	10	9	6	0	0	33	3	0	0	13	0	74
4:45 PM	to	5:00 PM	0	1	0	3	0	9	11	7	0	0	27	3	0	4	11	0	76
5:00 PM	to	5:15 PM	0	2	0	4	0	7	9	6	0	0	52	5	0	3	19	0	107
5:15 PM	to	5:30 PM	0	2	0	6	0	9	12	10	0	0	34	3	0	2	16	0	94
5:30 PM	to	5:45 PM	0	1	0	10	0	6	11	7	0	0	40	7	0	3	21	0	106
5:45 PM	to	6:00 PM	0	4	0	2	0	11	10	5	0	0	48	2	0	0	17	0	99

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	6	0	9	0	38	50	21	0	0	124	12	0	6	56	0	322
4:15 PM	to	5:15 PM	0	5	0	11	0	30	43	24	0	0	144	13	0	7	54	0	331
4:30 PM	to	5:30 PM	0	5	0	13	0	35	41	29	0	0	146	14	0	9	59	0	351
4:45 PM	to	5:45 PM	0	6	0	23	0	31	43	30	0	0	153	18	0	12	67	0	383
5:00 PM	to	6:00 PM	0	9	0	22	0	33	42	28	0	0	174	17	0	8	73	0	406

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	9	0	22	0	33	42	28	0	0	174	17	0	8	73	0	406
			0.00	0.56	0.00	0.55	0.00	0.75	0.88	0.70	0.00	0.00	0.84	0.61	0.00	0.67	0.87	0.00	OVERALL
			0.70				0.83				0.84				0.84				0.95
			13				10				11				2				36
			7				9				26				16				58
			N-LEG				S-LEG				E-LEG				W-LEG				
			14				28				2				14				58

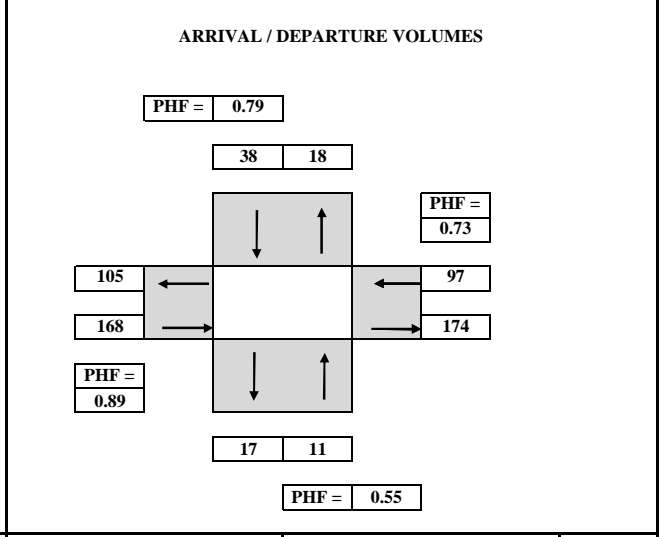
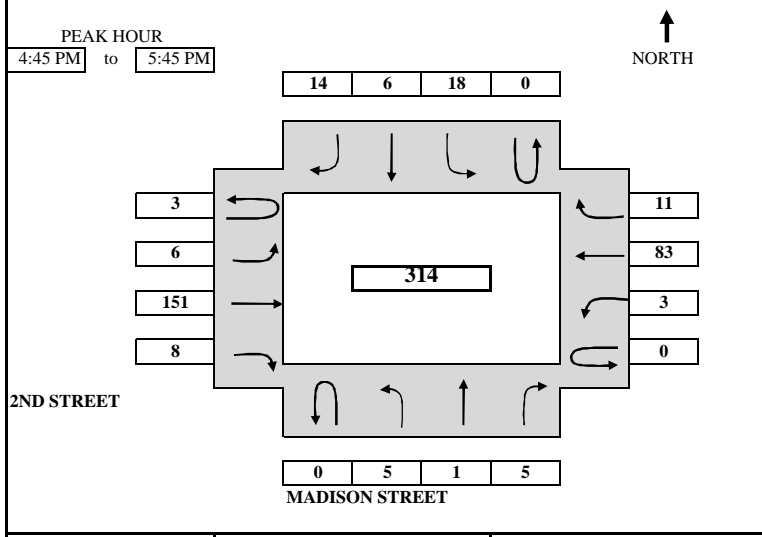
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>MADISON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>2ND STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O6)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																		
4:00 PM to 4:15 PM			2	0	1	0	8	0	5	1	2	26	2	0	19	1		67
4:15 PM to 4:30 PM			4	1	6	0	15	2	7	1	3	54	7	0	25	1		126
4:30 PM to 4:45 PM			5	2	8	0	20	4	11	1	4	77	7	1	29	3		172
4:45 PM to 5:00 PM			7	2	8	0	21	6	14	2	4	115	11	3	47	6		246
5:00 PM to 5:15 PM			9	3	10	0	28	7	16	3	5	157	14	3	78	8		341
5:15 PM to 5:30 PM			10	3	12	0	32	10	19	3	10	197	14	3	95	11		419
5:30 PM to 5:45 PM			10	3	13	0	38	10	25	4	10	228	15	4	112	14		486
5:45 PM to 6:00 PM			11	3	13	2	41	10	29	5	10	260	18	5	125	16		548

TOTAL BY PERIOD																			
4:00 PM to 4:15 PM			0	2	0	1	0	8	0	5	1	2	26	2	0	0	19	1	67
4:15 PM to 4:30 PM			0	2	1	5	0	7	2	2	0	1	28	5	0	0	6	0	59
4:30 PM to 4:45 PM			0	1	1	2	0	5	2	4	0	1	23	0	0	1	4	2	46
4:45 PM to 5:00 PM			0	2	0	0	0	1	2	3	1	0	38	4	0	2	18	3	74
5:00 PM to 5:15 PM			0	2	1	2	0	7	1	2	1	1	42	3	0	0	31	2	95
5:15 PM to 5:30 PM			0	1	0	2	0	4	3	3	0	5	40	0	0	0	17	3	78
5:30 PM to 5:45 PM			0	0	0	1	0	6	0	6	1	0	31	1	0	1	17	3	67
5:45 PM to 6:00 PM			0	1	0	0	2	3	0	4	1	0	32	3	0	1	13	2	62

HOURLY TOTALS																			
4:00 PM to 5:00 PM			0	7	2	8	0	21	6	14	2	4	115	11	0	3	47	6	246
4:15 PM to 5:15 PM			0	7	3	9	0	20	7	11	2	3	131	12	0	3	59	7	274
4:30 PM to 5:30 PM			0	6	2	6	0	17	8	12	2	7	143	7	0	3	70	10	293
4:45 PM to 5:45 PM			0	5	1	5	0	18	6	14	3	6	151	8	0	3	83	11	314
5:00 PM to 6:00 PM			0	4	1	5	2	20	4	15	3	6	145	7	0	2	78	10	302

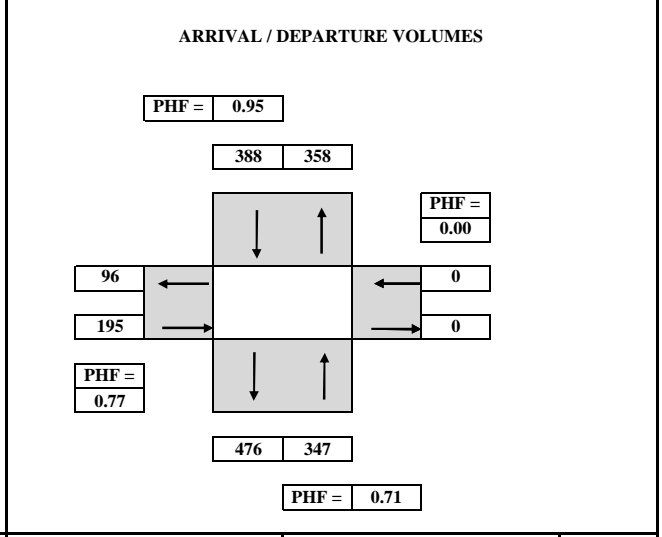
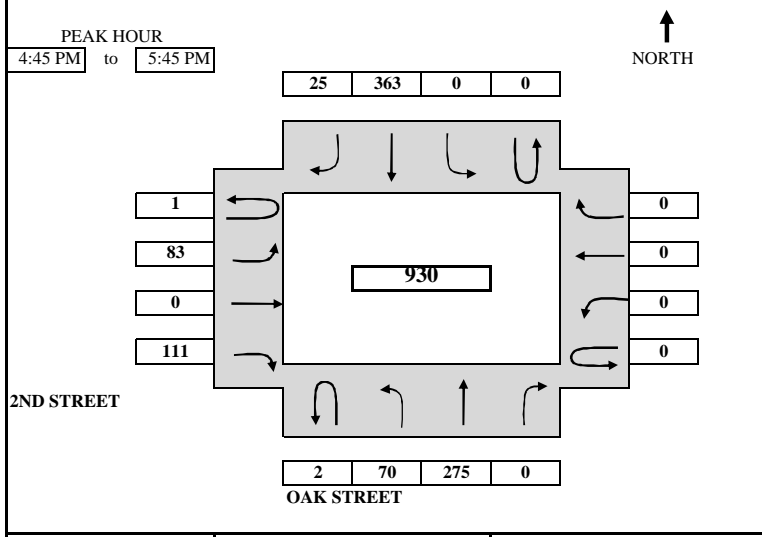
PEAK HOUR SUMMARY																		
4:45 PM to 5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	5	1	5	0	18	6	14	3	6	151	8	0	3	83	11		314
PHF BY MOVEMENT	0.00	0.63	0.25	0.63	0.00	0.64	0.50	0.58	0.75	0.30	0.90	0.50	0.00	0.38	0.67	0.92		OVERALL
PHF BY APPROACH	0.55				0.79				0.89				0.73				0.83	
BICYCLE	0				0				17				8				25	
PEDESTRIAN	9				10				18				11				48	
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG					
	8				21				13				6				48	



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>OAK STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>2ND STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(07)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
4:00 PM	to	4:15 PM	0	8	62	0	0	72	10	0	17	0	15	0	0	0	0	184
4:15 PM	to	4:30 PM	0	10	110	0	0	141	16	0	31	0	35	0	0	0	0	343
4:30 PM	to	4:45 PM	0	13	165	0	0	201	19	0	41	0	55	0	0	0	0	494
4:45 PM	to	5:00 PM	1	24	222	1	0	287	28	0	60	0	83	0	0	0	0	705
5:00 PM	to	5:15 PM	2	56	311	2	0	371	33	1	88	0	117	0	0	0	0	979
5:15 PM	to	5:30 PM	2	72	358	2	0	469	37	1	108	0	142	0	0	0	0	1189
5:30 PM	to	5:45 PM	2	83	440	2	0	564	44	1	124	0	166	0	0	0	0	1424
5:45 PM	to	6:00 PM	3	93	508	3	0	654	48	1	130	0	195	0	0	0	0	1632

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	8	62	0	0	0	72	10	0	17	0	15	0	0	0	184
4:15 PM	to	4:30 PM	0	2	48	0	0	0	69	6	0	14	0	20	0	0	0	159
4:30 PM	to	4:45 PM	0	3	55	0	0	0	60	3	0	10	0	20	0	0	0	151
4:45 PM	to	5:00 PM	1	11	57	0	0	0	86	9	0	19	0	28	0	0	0	211
5:00 PM	to	5:15 PM	1	32	89	0	0	0	84	5	1	28	0	34	0	0	0	274
5:15 PM	to	5:30 PM	0	16	47	0	0	0	98	4	0	20	0	25	0	0	0	210
5:30 PM	to	5:45 PM	0	11	82	0	0	0	95	7	0	16	0	24	0	0	0	235
5:45 PM	to	6:00 PM	1	10	68	0	0	0	90	4	0	6	0	29	0	0	0	208

HOURLY TOTALS																		
4:00 PM	to	5:00 PM	1	24	222	0	0	0	287	28	0	60	0	83	0	0	0	705
4:15 PM	to	5:15 PM	2	48	249	0	0	0	299	23	1	71	0	102	0	0	0	795
4:30 PM	to	5:30 PM	2	62	248	0	0	0	328	21	1	77	0	107	0	0	0	846
4:45 PM	to	5:45 PM	2	70	275	0	0	0	363	25	1	83	0	111	0	0	0	930
5:00 PM	to	6:00 PM	2	69	286	0	0	0	367	20	1	70	0	112	0	0	0	927

PEAK HOUR SUMMARY																			
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			2	70	275	0	0	0	363	25	1	83	0	111	0	0	0	0	930
			0.50	0.55	0.77	0.00	0.00	0.00	0.93	0.69	0.25	0.74	0.00	0.82	0.00	0.00	0.00	0.00	OVERALL
			PHF BY APPROACH				0.95				0.77				0.00				0.85
			BICYCLE				11				15				0				44
			PEDESTRIAN				24				1				3				50
			N-LEG				S-LEG				E-LEG				W-LEG				
			0				4				0				46				50

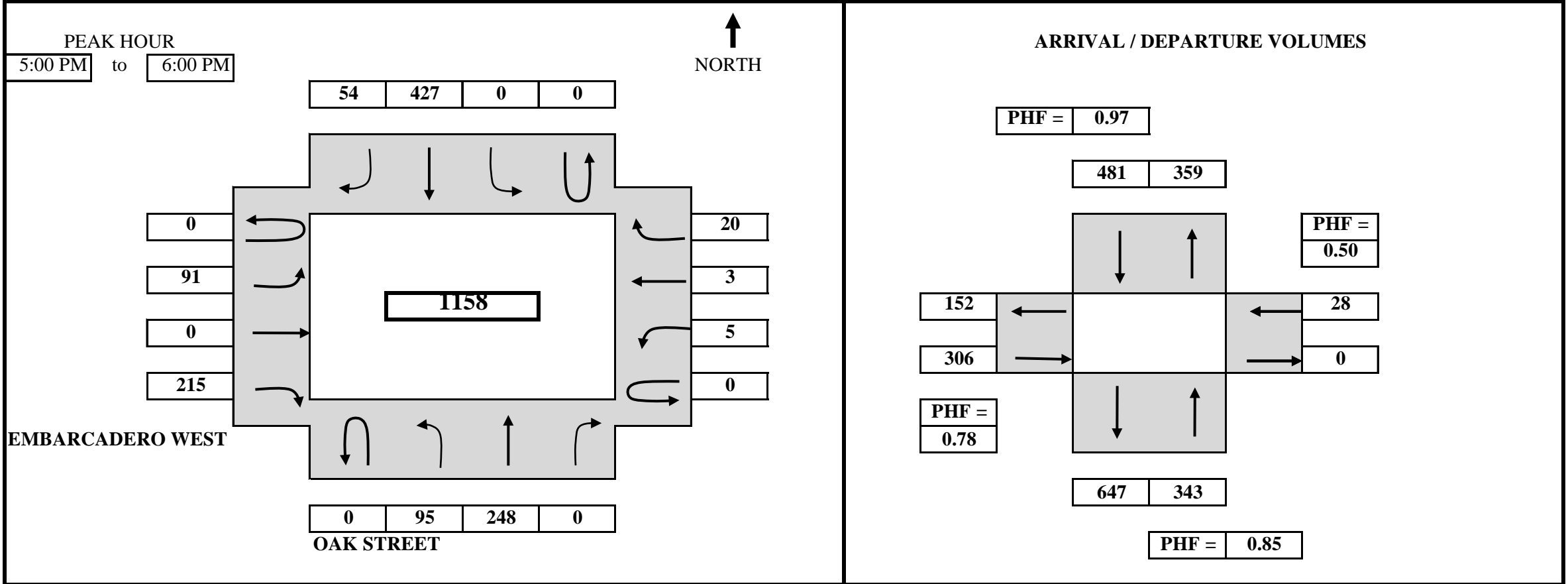
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>OAK STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>EMBARCADERO WEST</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(08)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	TOTAL
4:00 PM	to 4:15 PM	21	53	0	0	0	75	13	14	0	60	0	0	0	2	238		
4:15 PM	to 4:30 PM	43	88	0	0	0	151	25	26	0	98	2	0	6	439			
4:30 PM	to 4:45 PM	64	119	0	0	0	226	32	53	0	142	3	0	7	646			
4:45 PM	to 5:00 PM	90	168	0	1	1	332	39	71	0	184	7	0	9	901			
5:00 PM	to 5:15 PM	107	252	0	1	1	446	45	98	0	255	9	1	20	1234			
5:15 PM	to 5:30 PM	135	303	0	1	1	554	61	109	0	292	10	1	23	1489			
5:30 PM	to 5:45 PM	165	370	0	1	1	658	75	129	0	356	12	3	28	1797			
5:45 PM	to 6:00 PM	185	416	0	1	1	759	93	162	0	399	12	3	29	2059			

TOTAL BY PERIOD																		
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	TOTAL
4:00 PM	to 4:15 PM	0	21	53	0	0	0	75	13	0	14	0	60	0	0	0	2	238
4:15 PM	to 4:30 PM	0	22	35	0	0	0	76	12	0	12	0	38	0	2	0	4	201
4:30 PM	to 4:45 PM	0	21	31	0	0	0	75	7	0	27	0	44	0	1	0	1	207
4:45 PM	to 5:00 PM	0	26	49	0	0	1	106	7	0	18	0	42	0	4	0	2	255
5:00 PM	to 5:15 PM	0	17	84	0	0	0	114	6	0	27	0	71	0	2	1	11	333
5:15 PM	to 5:30 PM	0	28	51	0	0	0	108	16	0	11	0	37	0	1	0	3	255
5:30 PM	to 5:45 PM	0	30	67	0	0	0	104	14	0	20	0	64	0	2	2	5	308
5:45 PM	to 6:00 PM	0	20	46	0	0	0	101	18	0	33	0	43	0	0	0	1	262

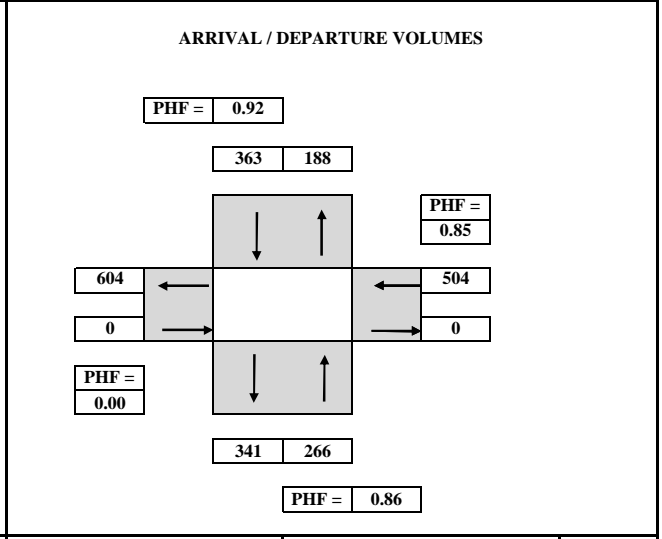
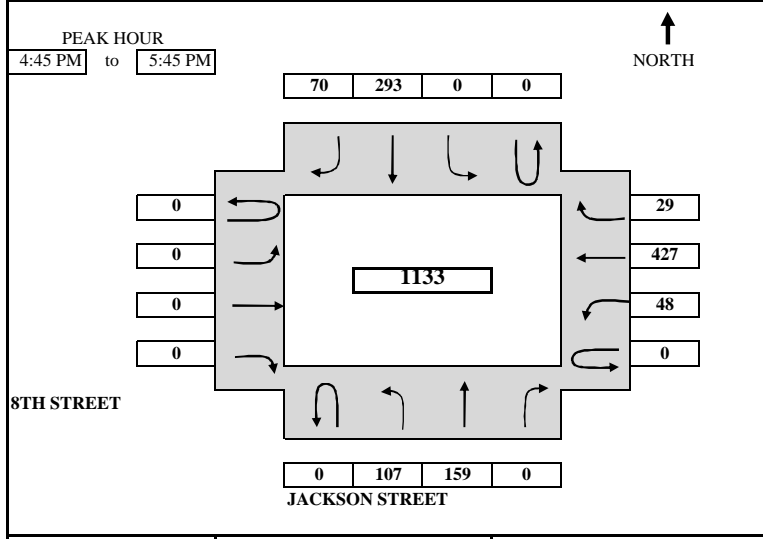
HOURLY TOTALS																		
From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	TOTAL
4:00 PM	to 5:00 PM	0	90	168	0	0	1	332	39	0	71	0	184	0	7	0	9	901
4:15 PM	to 5:15 PM	0	86	199	0	0	1	371	32	0	84	0	195	0	9	1	18	996
4:30 PM	to 5:30 PM	0	92	215	0	0	1	403	36	0	83	0	194	0	8	1	17	1050
4:45 PM	to 5:45 PM	0	101	251	0	0	1	432	43	0	76	0	214	0	9	3	21	1151
5:00 PM	to 6:00 PM	0	95	248	0	0	0	427	54	0	91	0	215	0	5	3	20	1158

PEAK HOUR SUMMARY																	
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	95	248	0	0	0	427	54	0	91	0	215	0	5	3	20	1158
PHF BY MOVEMENT	0.00	0.79	0.74	0.00	0.00	0.00	0.94	0.75	0.00	0.69	0.00	0.76	0.00	0.63	0.38	0.45	OVERALL
PHF BY APPROACH	0.85				0.97				0.78				0.50				0.87
BICYCLE	11				15				15				1				42
PEDESTRIAN	20				20				2				2				44
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	3				1				0				40				44

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>JACKSON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>8TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O10)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	15	28			76	14						11	84	8	236
4:15 PM	to	4:30 PM	34	49			157	33						24	171	16	484
4:30 PM	to	4:45 PM	59	77			220	48						34	282	21	741
4:45 PM	to	5:00 PM	90	114			287	69						44	379	32	1015
5:00 PM	to	5:15 PM	122	159			362	82						61	501	41	1328
5:15 PM	to	5:30 PM	140	194			445	98						75	604	47	1603
5:30 PM	to	5:45 PM	166	236			513	118						82	709	50	1874
5:45 PM	to	6:00 PM	191	275			577	134						91	821	58	2147

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	15	28	0	0	0	76	14	0	0	0	0	0	11	84	8	236
4:15 PM	to	4:30 PM	0	19	21	0	0	0	81	19	0	0	0	0	0	13	87	8	248
4:30 PM	to	4:45 PM	0	25	28	0	0	0	63	15	0	0	0	0	10	111	5	257	
4:45 PM	to	5:00 PM	0	31	37	0	0	0	67	21	0	0	0	0	10	97	11	274	
5:00 PM	to	5:15 PM	0	32	45	0	0	0	75	13	0	0	0	0	17	122	9	313	
5:15 PM	to	5:30 PM	0	18	35	0	0	0	83	16	0	0	0	0	14	103	6	275	
5:30 PM	to	5:45 PM	0	26	42	0	0	0	68	20	0	0	0	0	7	105	3	271	
5:45 PM	to	6:00 PM	0	25	39	0	0	0	64	16	0	0	0	0	9	112	8	273	

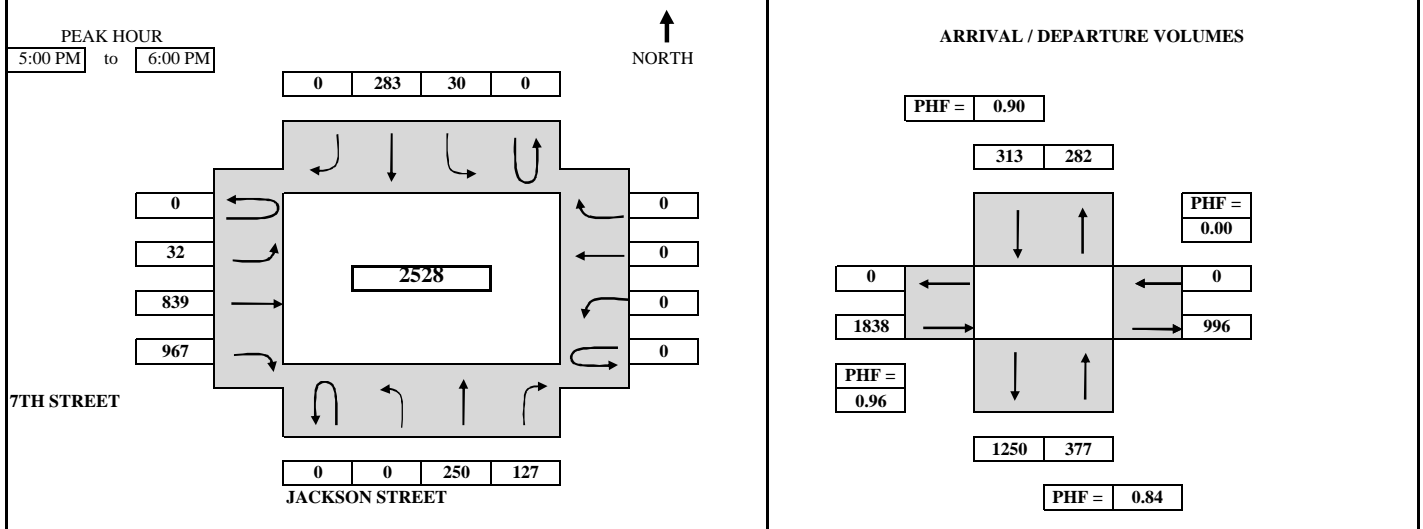
HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	90	114	0	0	0	287	69	0	0	0	0	44	379	32	1015
4:15 PM	to	5:15 PM	0	107	131	0	0	0	286	68	0	0	0	0	50	417	33	1092
4:30 PM	to	5:30 PM	0	106	145	0	0	0	288	65	0	0	0	0	51	433	31	1119
4:45 PM	to	5:45 PM	0	107	159	0	0	0	293	70	0	0	0	0	48	427	29	1133
5:00 PM	to	6:00 PM	0	101	161	0	0	0	290	65	0	0	0	0	47	442	26	1132

PEAK HOUR SUMMARY																				
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			0	107	159	0	0	0	293	70	0	0	0	0	0	48	427	29	1133	
			0.00	0.84	0.88	0.00	0.00	0.00	0.88	0.83	0.00	0.00	0.00	0.00	0.00	0.71	0.88	0.66	OVERALL	
			PHF BY APPROACH				0.86				0.92				0.00				0.85	0.90
			BICYCLE				1				4				9				8	22
			PEDESTRIAN				27				32				113				49	221
			N-LEG				S-LEG				E-LEG				W-LEG					
			PEDESTRIAN BY LEG:				80				82				30				29	221

# B. A. Y. M. E. T. R. I. C. S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>JACKSON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>7TH STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(011)PM</b>

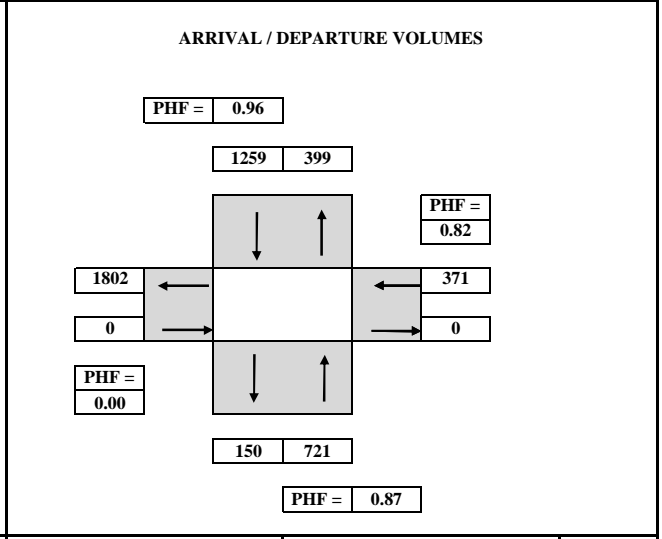
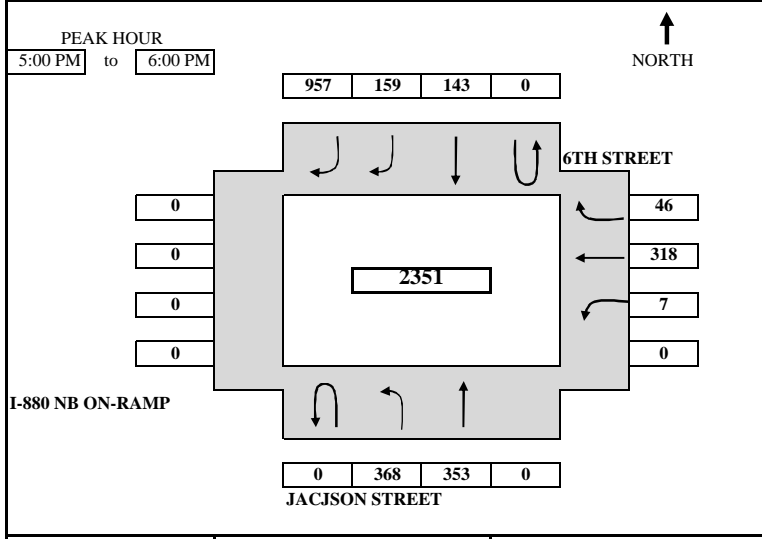


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU	RIGHT
<b>SURVEY DATA</b>																			
4:00 PM to 4:15 PM			41	27	9	70	7	186	253										593
4:15 PM to 4:30 PM			94	57	20	143	14	393	509										1230
4:30 PM to 4:45 PM			145	88	25	213	16	561	748										1796
4:45 PM to 5:00 PM			203	112	32	284	23	723	979										2356
5:00 PM to 5:15 PM			278	149	42	358	27	962	1216										3032
5:15 PM to 5:30 PM			340	181	51	436	39	1176	1461										3684
5:30 PM to 5:45 PM			398	214	56	506	48	1368	1696										4286
5:45 PM to 6:00 PM			453	239	62	567	55	1562	1946										4884
<b>TOTAL BY PERIOD</b>																			
4:00 PM to 4:15 PM	0	0	41	27	0	9	70	0	7	186	253	0	0	0	0	0	0	0	593
4:15 PM to 4:30 PM	0	0	53	30	0	11	73	0	7	207	256	0	0	0	0	0	0	0	637
4:30 PM to 4:45 PM	0	0	51	31	0	5	70	0	2	168	239	0	0	0	0	0	0	0	566
4:45 PM to 5:00 PM	0	0	58	24	0	7	71	0	7	162	231	0	0	0	0	0	0	0	560
5:00 PM to 5:15 PM	0	0	75	37	0	10	74	0	4	239	237	0	0	0	0	0	0	0	676
5:15 PM to 5:30 PM	0	0	62	32	0	9	78	0	12	214	245	0	0	0	0	0	0	0	652
5:30 PM to 5:45 PM	0	0	58	33	0	5	70	0	9	192	235	0	0	0	0	0	0	0	602
5:45 PM to 6:00 PM	0	0	55	25	0	6	61	0	7	194	250	0	0	0	0	0	0	0	598
<b>HOURLY TOTALS</b>																			
4:00 PM to 5:00 PM	0	0	203	112	0	32	284	0	0	23	723	979	0	0	0	0	0	0	2356
4:15 PM to 5:15 PM	0	0	237	122	0	33	288	0	0	20	776	963	0	0	0	0	0	0	2439
4:30 PM to 5:30 PM	0	0	246	124	0	31	293	0	0	25	783	952	0	0	0	0	0	0	2454
4:45 PM to 5:45 PM	0	0	253	126	0	31	293	0	0	32	807	948	0	0	0	0	0	0	2490
5:00 PM to 6:00 PM	0	0	250	127	0	30	283	0	0	32	839	967	0	0	0	0	0	0	2528
<b>PEAK HOUR SUMMARY</b>																			
5:00 PM to 6:00 PM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				<b>TOTAL</b>		
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR			
VOLUME	0	0	250	127	0	30	283	0	0	32	839	967	0	0	0	0			2528
PHF BY MOVEMENT	0.00	0.00	0.83	0.86	0.00	0.75	0.91	0.00	0.00	0.67	0.88	0.97	0.00	0.00	0.00	0.00			OVERALL
PHF BY APPROACH	0.84				0.90				0.96				0.00				0.93		
BICYCLE	0				0				0				0				0		
PEDESTRIAN	0				0				0				0				0		
PEDESTRIAN BY LEG:	<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>						
	0				0				0				0				0		

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>JACJSON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>I-880 NB ON-RAMP - 6TH STREET</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(O12)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	THRU	RIGHT	RT to Fy	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	78	63			26	53	235					1	81	10	547
4:15 PM	to	4:30 PM	164	140			71	93	491					4	164	18	1145
4:30 PM	to	4:45 PM	233	212			113	133	730					6	259	26	1712
4:45 PM	to	5:00 PM	311	285			155	166	961					7	319	39	2243
5:00 PM	to	5:15 PM	410	394			191	213	1198					10	398	48	2862
5:15 PM	to	5:30 PM	512	475			230	266	1433					11	495	63	3485
5:30 PM	to	5:45 PM	594	564			265	298	1668					13	563	72	4037
5:45 PM	to	6:00 PM	679	638			298	325	1918					14	637	85	4594

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	78	63	0	0	26	53	235	0	0	0	0	0	1	81	10	547
4:15 PM	to	4:30 PM	0	86	77	0	0	45	40	256	0	0	0	0	0	3	83	8	598
4:30 PM	to	4:45 PM	0	69	72	0	0	42	40	239	0	0	0	0	0	2	95	8	567
4:45 PM	to	5:00 PM	0	78	73	0	0	42	33	231	0	0	0	0	0	1	60	13	531
5:00 PM	to	5:15 PM	0	99	109	0	0	36	47	237	0	0	0	0	0	3	79	9	619
5:15 PM	to	5:30 PM	0	102	81	0	0	39	53	235	0	0	0	0	0	1	97	15	623
5:30 PM	to	5:45 PM	0	82	89	0	0	35	32	235	0	0	0	0	0	2	68	9	552
5:45 PM	to	6:00 PM	0	85	74	0	0	33	27	250	0	0	0	0	0	1	74	13	557

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	311	285	0	0	155	166	961	0	0	0	0	0	7	319	39	2243
4:15 PM	to	5:15 PM	0	332	331	0	0	165	160	963	0	0	0	0	0	9	317	38	2315
4:30 PM	to	5:30 PM	0	348	335	0	0	159	173	942	0	0	0	0	0	7	331	45	2340
4:45 PM	to	5:45 PM	0	361	352	0	0	152	165	938	0	0	0	0	0	7	304	46	2325
5:00 PM	to	6:00 PM	0	368	353	0	0	143	159	957	0	0	0	0	0	7	318	46	2351

PEAK HOUR SUMMARY																				
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			0	368	353	0	0	143	159	957	0	0	0	0	0	7	318	46	2351	
			0.00	0.90	0.81	0.00	0.00	0.92	0.75	0.96	0.00	0.00	0.00	0.00	0.00	0.58	0.82	0.77	OVERALL	
			PHF BY APPROACH				0.87				0.96				0.00				0.82	0.94
			BICYCLE				7				1				0				0	8
			PEDESTRIAN				17				11				1				0	29
			N-LEG				S-LEG				E-LEG				W-LEG					
			0				1				20				8				29	

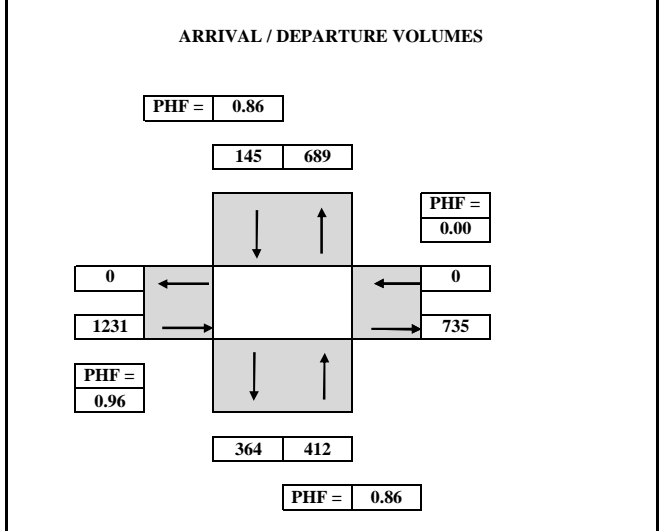
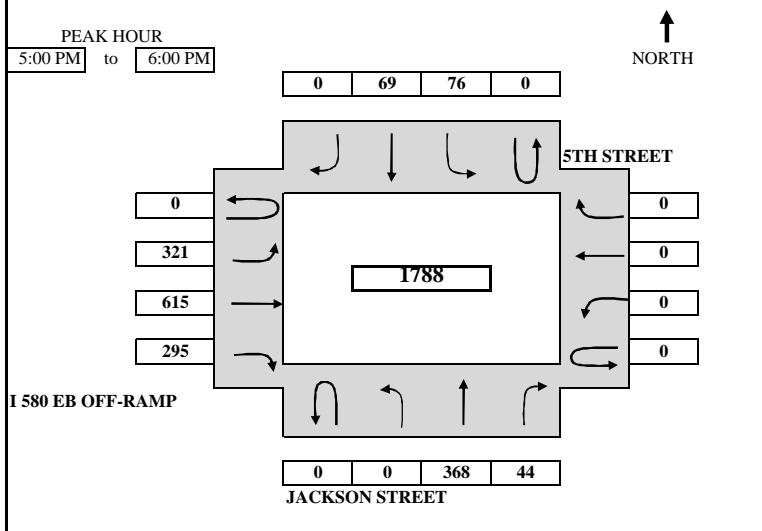
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/8/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>JACKSON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>5TH STREET - I 580 EB OFF-RAMP</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(09)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
4:00 PM	to	4:15 PM			68	8			15	14			74	98	75			352
4:15 PM	to	4:30 PM			140	15			40	35			158	246	159			793
4:30 PM	to	4:45 PM			210	25			67	50			228	401	218			1199
4:45 PM	to	5:00 PM			270	29			93	73			304	571	299			1639
5:00 PM	to	5:15 PM			381	38			110	89			385	714	365			2082
5:15 PM	to	5:30 PM			474	51			137	104			461	883	437			2547
5:30 PM	to	5:45 PM			559	54			152	122			538	1046	502			2973
5:45 PM	to	6:00 PM			638	73			169	142			625	1186	594			3427

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	68	8	0	15	14	0	0	74	98	75	0	0	0	0	352
4:15 PM	to	4:30 PM	0	0	72	7	0	25	21	0	0	84	148	84	0	0	0	0	441
4:30 PM	to	4:45 PM	0	0	70	10	0	27	15	0	0	70	155	59	0	0	0	0	406
4:45 PM	to	5:00 PM	0	0	60	4	0	26	23	0	0	76	170	81	0	0	0	0	440
5:00 PM	to	5:15 PM	0	0	111	9	0	17	16	0	0	81	143	66	0	0	0	0	443
5:15 PM	to	5:30 PM	0	0	93	13	0	27	15	0	0	76	169	72	0	0	0	0	465
5:30 PM	to	5:45 PM	0	0	85	3	0	15	18	0	0	77	163	65	0	0	0	0	426
5:45 PM	to	6:00 PM	0	0	79	19	0	17	20	0	0	87	140	92	0	0	0	0	454

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	0	270	29	0	93	73	0	0	304	571	299	0	0	0	0	1639
4:15 PM	to	5:15 PM	0	0	313	30	0	95	75	0	0	311	616	290	0	0	0	0	1730
4:30 PM	to	5:30 PM	0	0	334	36	0	97	69	0	0	303	637	278	0	0	0	0	1754
4:45 PM	to	5:45 PM	0	0	349	29	0	85	72	0	0	310	645	284	0	0	0	0	1774
5:00 PM	to	6:00 PM	0	0	368	44	0	76	69	0	0	321	615	295	0	0	0	0	1788

PEAK HOUR SUMMARY																							
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL				
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR					
			0	0	368	44	0	76	69	0	0	321	615	295	0	0	0	0	1788				
			0.00	0.00	0.83	0.58	0.00	0.70	0.86	0.00	0.00	0.92	0.91	0.80	0.00	0.00	0.00	0.00	OVERALL				
			PHF BY APPROACH				0.86				0.96				0.00				0.96				
			BICYCLE				7				1				0				9				
			PEDESTRIAN				36				15				14				70				
			N-LEG				S-LEG				E-LEG				W-LEG								
			PEDESTRIAN BY LEG:				2				17				36				15				70

TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

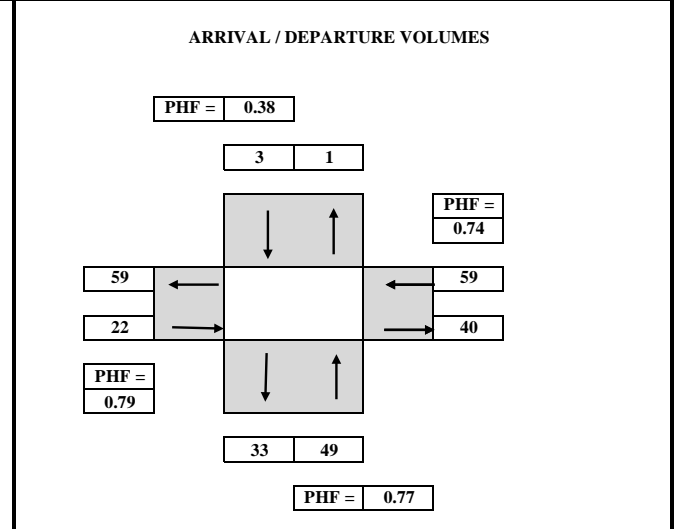
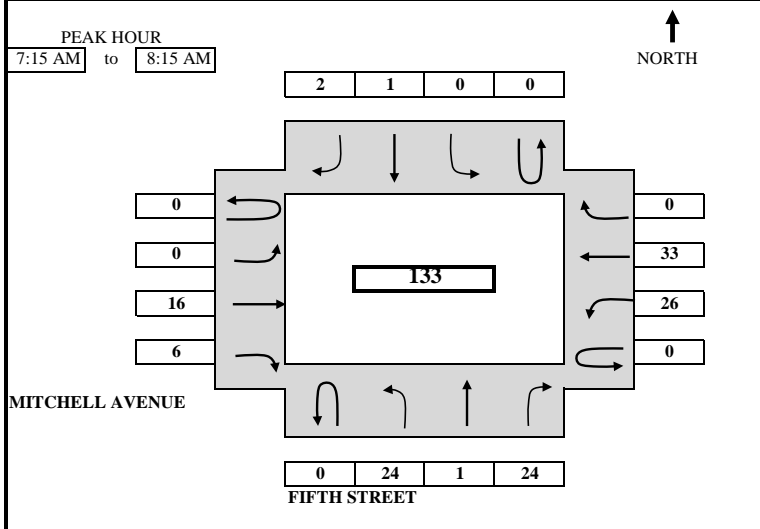
Crossing #1 Alameda

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# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	FIFTH STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MITCHELL AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A14)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	7	0	3	1	0	0	0	2	1	1	7	1	23	
7:15 AM	to	7:30 AM	0	19	0	7	1	0	0	0	8	1	4	15	1	56	
7:30 AM	to	7:45 AM	0	23	0	12	1	0	2	0	12	4	9	19	1	83	
7:45 AM	to	8:00 AM	0	27	0	20	1	0	2	0	15	6	18	30	1	120	
8:00 AM	to	8:15 AM	0	31	1	27	1	1	2	0	18	7	27	40	1	156	
8:15 AM	to	8:30 AM	0	32	1	36	1	1	3	0	19	7	31	44	1	176	
8:30 AM	to	8:45 AM	1	36	1	46	1	1	3	0	26	7	41	48	1	212	
8:45 AM	to	9:00 AM	1	39	1	53	1	1	3	0	28	10	46	50	1	234	

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	7	0	3	0	1	0	0	0	0	2	1	0	1	7	1	23
7:15 AM	to	7:30 AM	0	12	0	4	0	0	0	0	0	6	0	0	3	8	0	33	
7:30 AM	to	7:45 AM	0	4	0	5	0	0	0	2	0	4	3	0	5	4	0	27	
7:45 AM	to	8:00 AM	0	4	0	8	0	0	0	0	0	3	2	0	9	11	0	37	
8:00 AM	to	8:15 AM	0	4	1	7	0	0	1	0	0	3	1	0	9	10	0	36	
8:15 AM	to	8:30 AM	0	1	0	9	0	0	0	1	0	1	0	0	4	4	0	20	
8:30 AM	to	8:45 AM	1	4	0	10	0	0	0	0	0	7	0	0	10	4	0	36	
8:45 AM	to	9:00 AM	0	3	0	7	0	0	0	0	0	2	3	0	5	2	0	22	

HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	27	0	20	0	1	0	2	0	0	15	6	0	18	30	1	120
7:15 AM	to	8:15 AM	0	24	1	24	0	0	1	2	0	0	16	6	0	26	33	0	133
7:30 AM	to	8:30 AM	0	13	1	29	0	0	1	3	0	0	11	6	0	27	29	0	120
7:45 AM	to	8:45 AM	1	13	1	34	0	0	1	1	0	0	14	3	0	32	29	0	129
8:00 AM	to	9:00 AM	1	12	1	33	0	0	1	1	0	0	13	4	0	28	20	0	114

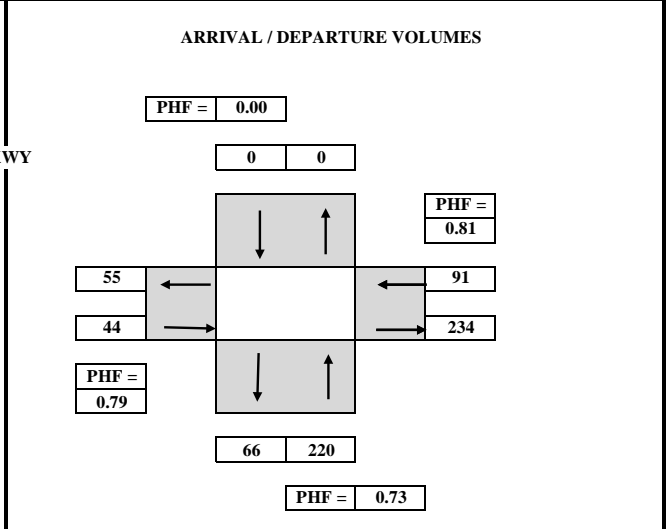
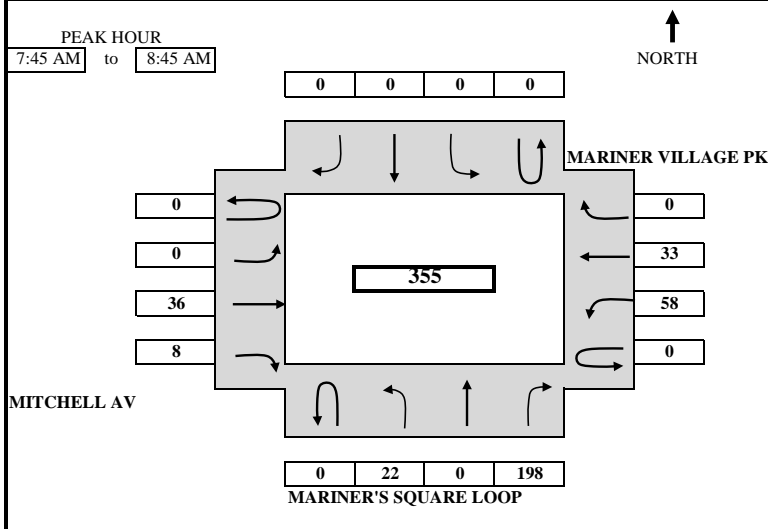
PEAK HOUR SUMMARY																			
7:15 AM	to	8:15 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	24	1	24	0	0	1	2	0	0	16	6	0	26	33	0	133
PHF BY MOVEMENT			0.00	0.50	0.25	0.75	0.00	0.00	0.25	0.25	0.00	0.00	0.67	0.50	0.00	0.72	0.75	0.00	OVERALL
PHF BY APPROACH			0.77				0.38				0.79				0.74				0.90
BICYCLE			2				0				0				4				6
PEDESTRIAN			1				0				1				0				2
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			1				0				0				1				2



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	MARINER'S SQUARE LOOP	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MITCHELL AV - MARINER VILLAGE PKWY	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A13)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	10		25							5	0		6	1	47
7:15 AM	to	7:30 AM	18		51							12	1		10	6	98
7:30 AM	to	7:45 AM	24		75							21	2		21	11	154
7:45 AM	to	8:00 AM	34		140							26	3		31	20	254
8:00 AM	to	8:15 AM	41		191							35	7		46	31	351
8:15 AM	to	8:30 AM	44		235							46	7		66	39	437
8:30 AM	to	8:45 AM	46		273							57	10		79	44	509
8:45 AM	to	9:00 AM	49		326							65	10		96	55	601

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	10	0	25	0	0	0	0	0	0	5	0	0	6	1	0	47
7:15 AM	to	7:30 AM	0	8	0	26	0	0	0	0	0	0	7	1	0	4	5	0	51
7:30 AM	to	7:45 AM	0	6	0	24	0	0	0	0	0	0	9	1	0	11	5	0	56
7:45 AM	to	8:00 AM	0	10	0	65	0	0	0	0	0	0	5	1	0	10	9	0	100
8:00 AM	to	8:15 AM	0	7	0	51	0	0	0	0	0	0	9	4	0	15	11	0	97
8:15 AM	to	8:30 AM	0	3	0	44	0	0	0	0	0	0	11	0	0	20	8	0	86
8:30 AM	to	8:45 AM	0	2	0	38	0	0	0	0	0	0	11	3	0	13	5	0	72
8:45 AM	to	9:00 AM	0	3	0	53	0	0	0	0	0	0	8	0	0	17	11	0	92

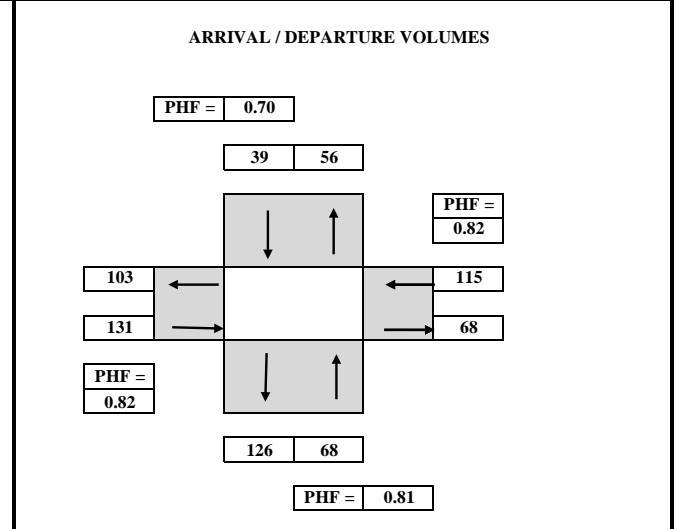
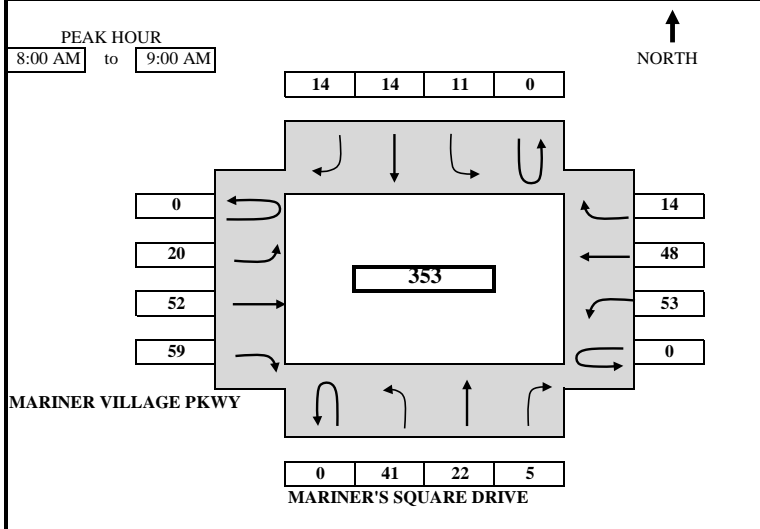
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	34	0	140	0	0	0	0	0	0	26	3	0	31	20	0	254
7:15 AM	to	8:15 AM	0	31	0	166	0	0	0	0	0	0	30	7	0	40	30	0	304
7:30 AM	to	8:30 AM	0	26	0	184	0	0	0	0	0	0	34	6	0	56	33	0	339
7:45 AM	to	8:45 AM	0	22	0	198	0	0	0	0	0	0	36	8	0	58	33	0	355
8:00 AM	to	9:00 AM	0	15	0	186	0	0	0	0	0	0	39	7	0	65	35	0	347

PEAK HOUR SUMMARY																			
7:45 AM	to	8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	22	0	198	0	0	0	0	0	0	36	8	0	58	33	0	355
PHF BY MOVEMENT			0.00	0.55	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.50	0.00	0.73	0.75	0.00	OVERALL
PHF BY APPROACH			0.73				0.00				0.79				0.81				0.89
BICYCLE			5				0				3				6				14
PEDESTRIAN			2				1				4				3				10
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			1				6				0				3				10

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	MARINER'S SQUARE DRIVE	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MARINER VILLAGE PKWY	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A1)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																		
7:00 AM to 7:15 AM			5	2	3		0	2	0		7	6	8		7	3	1	44
7:15 AM to 7:30 AM			9	4	4		2	3	2		13	12	17		12	10	2	90
7:30 AM to 7:45 AM			14	8	7		2	6	3		15	22	32		21	24	4	158
7:45 AM to 8:00 AM			23	9	9		2	10	3		20	33	41		26	38	7	221
8:00 AM to 8:15 AM			33	18	9		3	13	6		25	42	55		37	52	10	303
8:15 AM to 8:30 AM			46	22	11		4	16	8		28	57	77		53	65	16	403
8:30 AM to 8:45 AM			60	28	12		9	21	10		33	70	87		69	74	17	490
8:45 AM to 9:00 AM			64	31	14		13	24	17		40	85	100		79	86	21	

TOTAL BY PERIOD																						
7:00 AM to 7:15 AM			0	5	2	3		0	0	2	0		0	7	6	8		0	7	3	1	44
7:15 AM to 7:30 AM			0	4	2	1		0	2	1	2		0	6	6	9		0	5	7	1	46
7:30 AM to 7:45 AM			0	5	4	3		0	0	3	1		0	2	10	15		0	9	14	2	68
7:45 AM to 8:00 AM			0	9	1	2		0	0	4	0		0	5	11	9		0	5	14	3	63
8:00 AM to 8:15 AM			0	10	9	0		0	1	3	3		0	5	9	14		0	11	14	3	82
8:15 AM to 8:30 AM			0	13	4	2		0	1	3	2		0	3	15	22		0	16	13	6	100
8:30 AM to 8:45 AM			0	14	6	1		0	5	5	2		0	5	13	10		0	16	9	1	87
8:45 AM to 9:00 AM			0	4	3	2		0	4	3	7		0	7	15	13		0	10	12	4	84

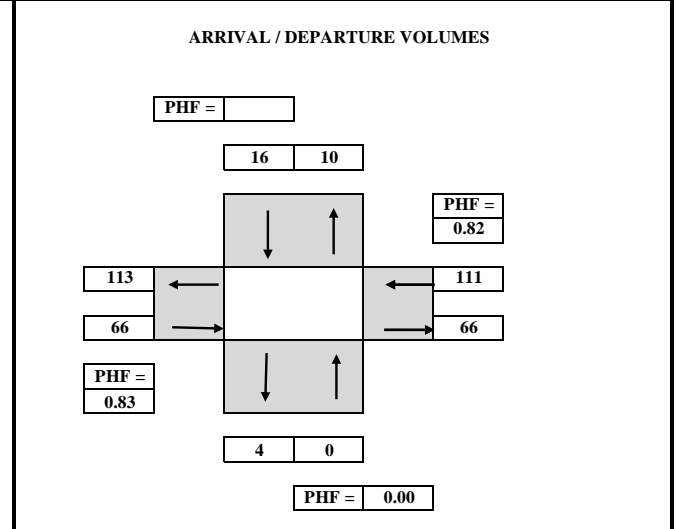
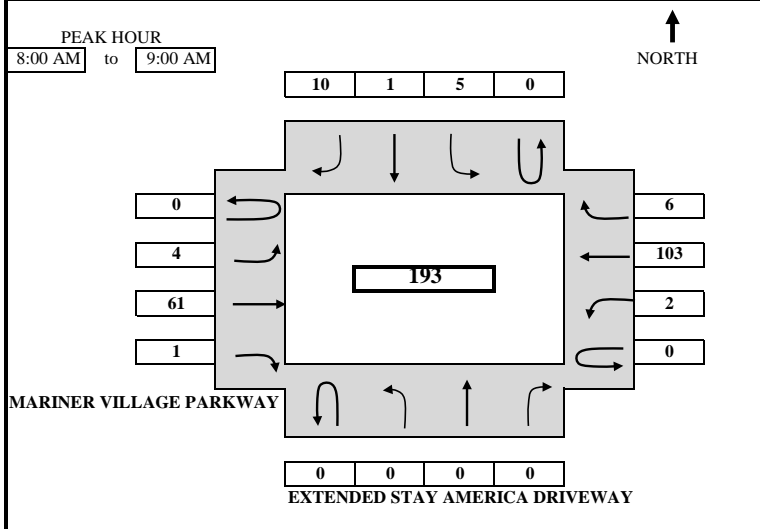
HOURLY TOTALS																						
7:00 AM to 8:00 AM			0	23	9	9		0	2	10	3		0	20	33	41		0	26	38	7	221
7:15 AM to 8:15 AM			0	28	16	6		0	3	11	6		0	18	36	47		0	30	49	9	259
7:30 AM to 8:30 AM			0	37	18	7		0	2	13	6		0	15	45	60		0	41	55	14	313
7:45 AM to 8:45 AM			0	46	20	5		0	7	15	7		0	18	48	55		0	48	50	13	332
8:00 AM to 9:00 AM			0	41	22	5		0	11	14	14		0	20	52	59		0	53	48	14	353

PEAK HOUR SUMMARY																		
8:00 AM to 9:00 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				<b>TOTAL</b>	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	41	22	5	0	11	14	14	0	20	52	59	0	53	48	14		353
PHF BY MOVEMENT	0.00	0.73	0.61	0.63	0.00	0.55	0.70	0.50	0.00	0.71	0.87	0.67	0.00	0.83	0.86	0.58		OVERALL
PHF BY APPROACH	0.81				0.70				0.82				0.82				0.88	
BICYCLE	0				1				4				2				7	
PEDESTRIAN	1				2				4				7				14	
	<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>					
PEDESTRIAN BY LEG:	5				6				2				1				14	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	EXTENDED STAY AMERICA DRIVEWAY	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MARINER VILLAGE PARKWAY	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A12)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	0	0	0	0	0	5	1	7	0	0	7	2	22	
7:15 AM	to	7:30 AM	0	0	0	1	0	7	2	14	0	0	0	16	2	42	
7:30 AM	to	7:45 AM	1	0	0	4	0	12	2	29	0	0	0	33	3	84	
7:45 AM	to	8:00 AM	1	0	0	5	0	13	2	40	0	0	0	53	5	119	
8:00 AM	to	8:15 AM	1	0	0	7	0	14	2	50	1	1	79	6	161		
8:15 AM	to	8:30 AM	1	0	0	7	1	17	3	65	1	1	111	8	215		
8:30 AM	to	8:45 AM	1	0	0	9	1	22	4	83	1	1	133	10	265		
8:45 AM	to	9:00 AM	1	0	0	10	1	23	6	101	1	2	156	11	312		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	0	0	0	0	0	5	0	1	7	0	0	0	7	2	22	
7:15 AM	to	7:30 AM	0	0	0	0	1	0	2	0	1	7	0	0	0	9	0	20	
7:30 AM	to	7:45 AM	0	1	0	0	0	3	0	5	0	0	15	0	0	17	1	42	
7:45 AM	to	8:00 AM	0	0	0	0	0	1	0	1	0	0	11	0	0	20	2	35	
8:00 AM	to	8:15 AM	0	0	0	0	0	2	0	1	0	0	10	1	0	1	26	1	42
8:15 AM	to	8:30 AM	0	0	0	0	0	0	1	3	0	1	15	0	0	0	32	2	54
8:30 AM	to	8:45 AM	0	0	0	0	0	2	0	5	0	1	18	0	0	0	22	2	50
8:45 AM	to	9:00 AM	0	0	0	0	0	1	0	1	0	2	18	0	0	1	23	1	47

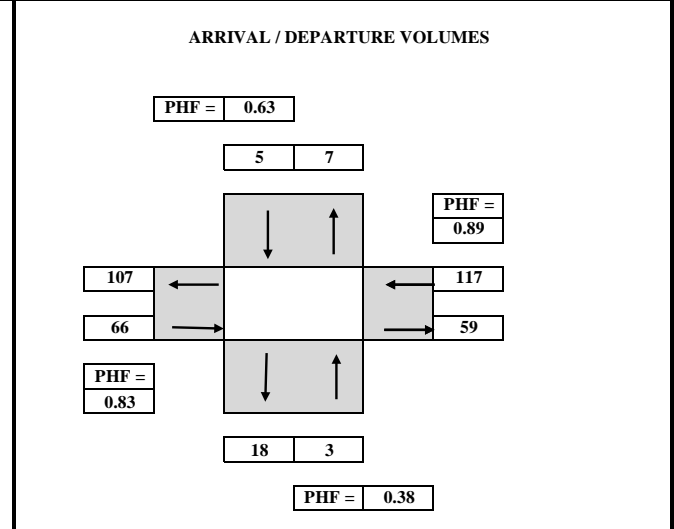
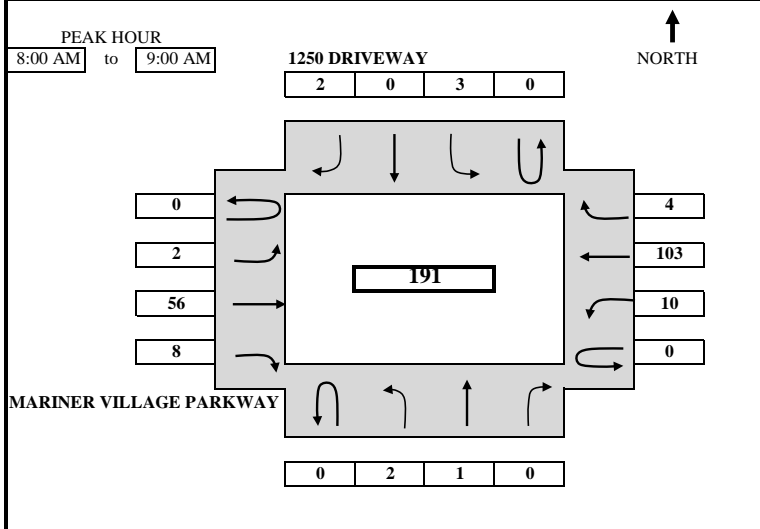
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	1	0	0	0	5	0	13	0	2	40	0	0	0	53	5	119
7:15 AM	to	8:15 AM	0	1	0	0	0	7	0	9	0	1	43	1	0	1	72	4	139
7:30 AM	to	8:30 AM	0	1	0	0	0	6	1	10	0	1	51	1	0	1	95	6	173
7:45 AM	to	8:45 AM	0	0	0	0	0	5	1	10	0	2	54	1	0	1	100	7	181
8:00 AM	to	9:00 AM	0	0	0	0	0	5	1	10	0	4	61	1	0	2	103	6	193

PEAK HOUR SUMMARY																			
8:00 AM	to	9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	0	0	0	0	5	1	10	0	4	61	1	0	2	103	6	193
PHF BY MOVEMENT			0.00	0.00	0.00	0.00	0.00	0.63	0.25	0.50	0.00	0.50	0.85	0.25	0.00	0.50	0.80	0.75	OVERALL
PHF BY APPROACH			0.00				0.57				0.83				0.82				0.89
BICYCLE			0				0				0				0				0
PEDESTRIAN			0				1				0				4				5
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			2				2				0				1				5

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	1250 DRIVEWAY	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MARINER VILLAGE PARKWAY	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A11)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM	0	0	0	0	0	0	0	0	0	6	1	0	0	9	0	0	16
7:15 AM to 7:30 AM	0	0	0	0	1	1	0	0	2	13	1	0	1	19	0	0	38
7:30 AM to 7:45 AM	0	0	0	0	2	1	0	0	6	25	2	0	4	36	0	0	76
7:45 AM to 8:00 AM	0	0	0	0	2	1	1	1	7	36	4	0	4	58	1	0	114
8:00 AM to 8:15 AM	0	1	0	0	3	1	2	2	8	44	6	0	7	84	4	0	160
8:15 AM to 8:30 AM	0	1	0	0	5	1	2	2	8	59	6	0	9	115	4	0	210
8:30 AM to 8:45 AM	0	1	0	0	5	1	3	3	8	76	9	0	12	138	5	0	258
8:45 AM to 9:00 AM	2	1	0	0	5	1	3	3	9	92	12	0	14	161	5	0	305

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	0	0	0	0	0	0	0	0	6	1	0	0	9	0	16
7:15 AM to 7:30 AM	0	0	0	0	0	1	1	0	0	2	7	0	0	1	10	0	22
7:30 AM to 7:45 AM	0	0	0	0	0	1	0	0	0	4	12	1	0	3	17	0	38
7:45 AM to 8:00 AM	0	0	0	0	0	0	0	1	0	1	11	2	0	0	22	1	38
8:00 AM to 8:15 AM	0	0	1	0	0	1	0	1	0	1	8	2	0	3	26	3	46
8:15 AM to 8:30 AM	0	0	0	0	0	2	0	0	0	0	15	0	0	2	31	0	50
8:30 AM to 8:45 AM	0	0	0	0	0	0	0	1	0	0	17	3	0	3	23	1	48
8:45 AM to 9:00 AM	0	2	0	0	0	0	0	0	0	1	16	3	0	2	23	0	47

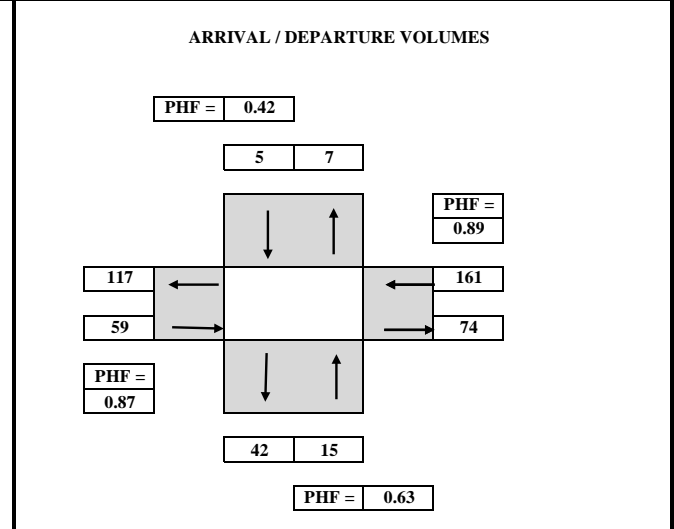
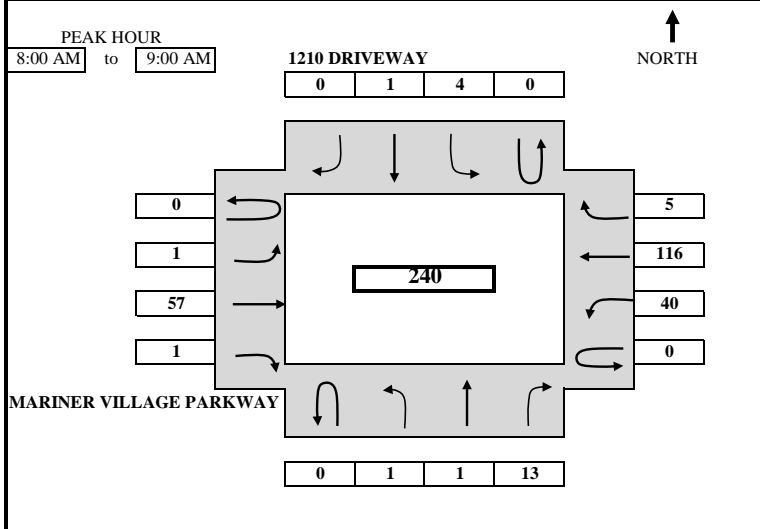
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	0	0	0	0	2	1	1	0	7	36	4	0	4	58	1	114
7:15 AM to 8:15 AM	0	0	1	0	0	3	1	2	0	8	38	5	0	7	75	4	144
7:30 AM to 8:30 AM	0	0	1	0	0	4	0	2	0	6	46	5	0	8	96	4	172
7:45 AM to 8:45 AM	0	0	1	0	0	3	0	3	0	2	51	7	0	8	102	5	182
8:00 AM to 9:00 AM	0	2	1	0	0	3	0	2	0	2	56	8	0	10	103	4	191

PEAK HOUR SUMMARY																	
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	2	1	0	0	3	0	2	0	2	56	8	0	10	103	4	191
PHF BY MOVEMENT	0.00	0.25	0.25	0.00	0.00	0.38	0.00	0.50	0.00	0.50	0.82	0.67	0.00	0.83	0.83	0.33	OVERALL
PHF BY APPROACH	0.38				0.63				0.83				0.89				0.96
BICYCLE	0				0				4				1				5
PEDESTRIAN	0				1				3				4				8
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	5				2				1				0				8

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	1210 DRIVEWAY	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MARINER VILLAGE PARKWAY	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A10)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM	0	0	1	0	0	0	0	0	0	6	1	0	1	9	2	20	
7:15 AM to 7:30 AM	0	0	1	0	0	0	0	0	0	13	1	0	2	20	2	39	
7:30 AM to 7:45 AM	0	0	1	0	0	0	0	0	0	26	1	1	6	40	4	79	
7:45 AM to 8:00 AM	0	0	2	0	3	0	0	0	0	36	2	1	10	63	4	121	
8:00 AM to 8:15 AM	0	1	4	1	3	0	0	0	0	44	3	1	14	95	7	173	
8:15 AM to 8:30 AM	0	1	7	3	4	0	0	0	1	60	3	1	25	129	7	241	
8:30 AM to 8:45 AM	1	1	9	3	4	0	0	0	1	77	3	1	43	154	8	305	
8:45 AM to 9:00 AM	1	1	15	4	4	0	0	0	1	93	3	1	50	179	9	361	

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	0	1	0	0	0	0	0	0	6	1	0	1	9	2	20
7:15 AM to 7:30 AM	0	0	0	0	0	0	0	0	0	0	7	0	0	1	11	0	19
7:30 AM to 7:45 AM	0	0	0	0	0	0	0	0	0	0	13	0	1	4	20	2	40
7:45 AM to 8:00 AM	0	0	0	1	0	0	3	0	0	0	10	1	0	4	23	0	42
8:00 AM to 8:15 AM	0	0	1	2	0	1	0	0	0	0	8	1	0	4	32	3	52
8:15 AM to 8:30 AM	0	0	0	3	0	2	1	0	0	1	16	0	0	11	34	0	68
8:30 AM to 8:45 AM	0	1	0	2	0	0	0	0	0	0	17	0	0	18	25	1	64
8:45 AM to 9:00 AM	0	0	0	6	0	1	0	0	0	0	16	0	0	7	25	1	56

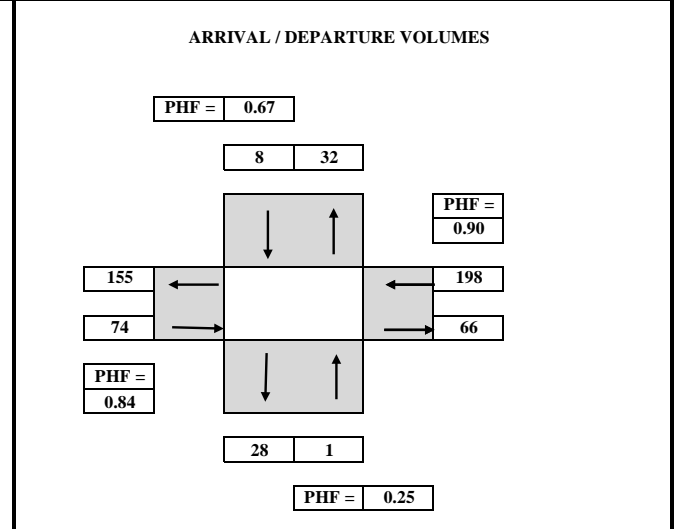
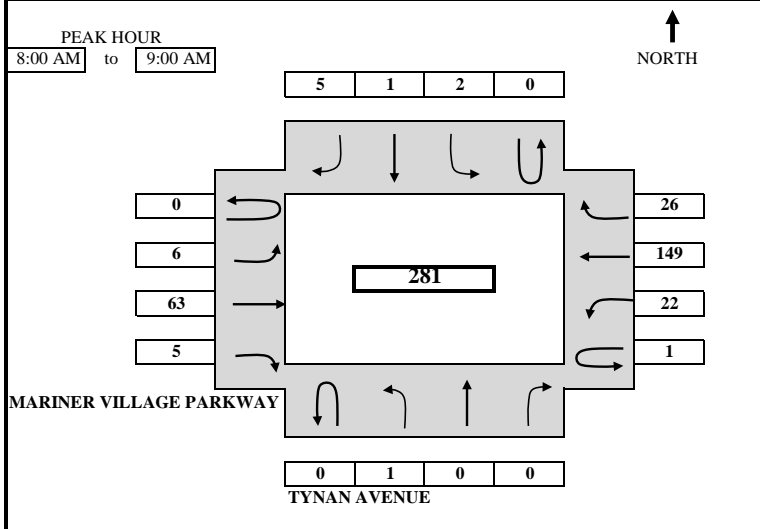
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	0	0	2	0	0	3	0	0	0	36	2	1	10	63	4	121
7:15 AM to 8:15 AM	0	0	1	3	0	1	3	0	0	0	38	2	1	13	86	5	153
7:30 AM to 8:30 AM	0	0	1	6	0	3	4	0	0	1	47	2	1	23	109	5	202
7:45 AM to 8:45 AM	0	1	1	8	0	3	4	0	0	1	51	2	0	37	114	4	226
8:00 AM to 9:00 AM	0	1	1	13	0	4	1	0	0	1	57	1	0	40	116	5	240

PEAK HOUR SUMMARY																	
8:00 AM to 9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	1	1	13	0	4	1	0	0	1	57	1	0	40	116	5	240
PHF BY MOVEMENT	0.00	0.25	0.25	0.54	0.00	0.50	0.25	0.00	0.00	0.25	0.84	0.25	0.00	0.56	0.85	0.42	OVERALL
PHF BY APPROACH	0.63				0.42				0.87				0.89				0.88
BICYCLE	0				0				4				2				6
PEDESTRIAN	0				1				3				4				8
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	7				0				1				0				8

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	TYNAN AVENUE	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MARINER VILLAGE PARKWAY	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A2)AM

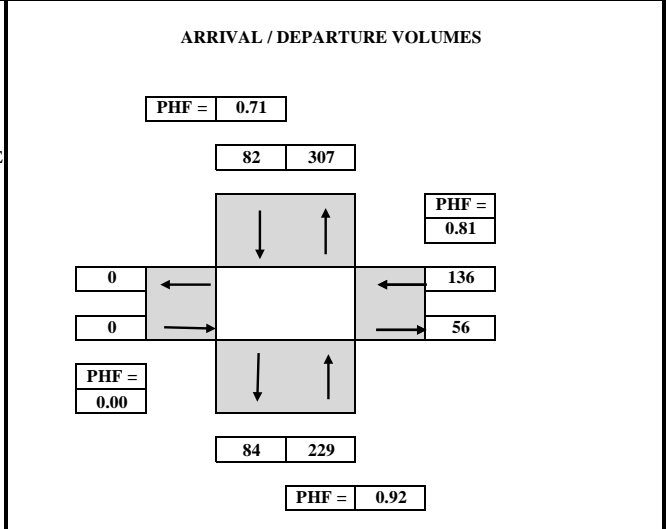
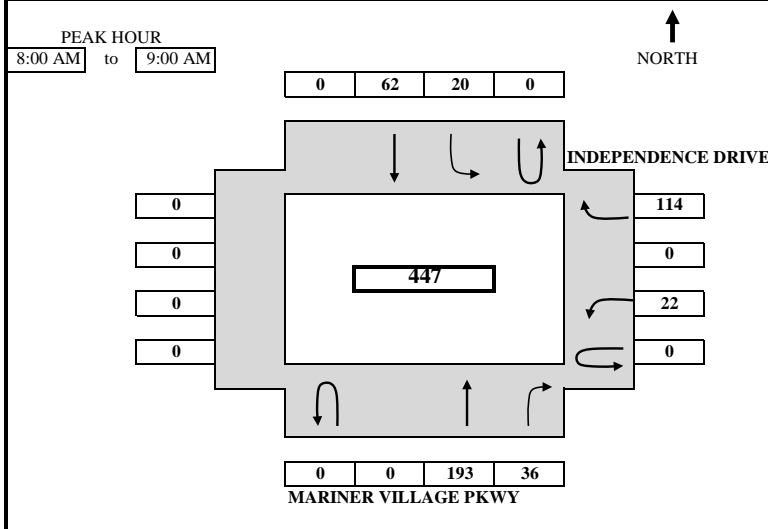


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU
<b>SURVEY DATA</b>																		
7:00 AM to 7:15 AM			0	0	0	0	0	0	0	0	6	1	0	2	11	3		23
7:15 AM to 7:30 AM			0	0	0	0	2	0	1	1	13	1	0	4	22	6		50
7:30 AM to 7:45 AM			0	0	0	0	3	0	2	2	25	1	0	6	47	7		93
7:45 AM to 8:00 AM			0	0	0	0	3	0	2	3	35	1	0	9	74	17		144
8:00 AM to 8:15 AM			0	0	0	0	3	1	3	3	47	1	1	14	110	23		206
8:15 AM to 8:30 AM			0	0	0	0	4	1	5	4	65	2	1	20	152	30		284
8:30 AM to 8:45 AM			0	0	0	0	5	1	7	7	81	3	1	25	193	36		359
8:45 AM to 9:00 AM			1	0	0	0	5	1	7	9	98	6	1	31	223	43		425
<b>TOTAL BY PERIOD</b>																		
7:00 AM to 7:15 AM			0	0	0	0	0	0	0	0	6	1	0	2	11	3		23
7:15 AM to 7:30 AM			0	0	0	0	0	2	0	1	7	0	0	2	11	3		27
7:30 AM to 7:45 AM			0	0	0	0	0	1	0	1	12	0	0	2	25	1		43
7:45 AM to 8:00 AM			0	0	0	0	0	0	0	0	10	0	0	3	27	10		51
8:00 AM to 8:15 AM			0	0	0	0	0	0	1	1	12	0	1	5	36	6		62
8:15 AM to 8:30 AM			0	0	0	0	0	1	0	2	18	1	0	6	42	7		78
8:30 AM to 8:45 AM			0	0	0	0	0	1	0	2	16	1	0	5	41	6		75
8:45 AM to 9:00 AM			0	1	0	0	0	0	0	2	17	3	0	6	30	7		66
<b>HOURLY TOTALS</b>																		
7:00 AM to 8:00 AM			0	0	0	0	0	3	0	2	3	35	1	0	9	74	17	144
7:15 AM to 8:15 AM			0	0	0	0	0	3	1	3	3	41	0	1	12	99	20	183
7:30 AM to 8:30 AM			0	0	0	0	0	2	1	4	3	52	1	1	16	130	24	234
7:45 AM to 8:45 AM			0	0	0	0	0	2	1	5	5	56	2	1	19	146	29	266
8:00 AM to 9:00 AM			0	1	0	0	0	2	1	5	6	63	5	1	22	149	26	281
<b>PEAK HOUR SUMMARY</b>																		
8:00 AM to 9:00 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	1	0	0	0	2	1	5	0	6	63	5	1	22	149	26	281	
PHF BY MOVEMENT	0.00	0.25	0.00	0.00	0.00	0.50	0.25	0.63	0.00	0.50	0.88	0.42	0.25	0.92	0.89	0.93	OVERALL	
PHF BY APPROACH	0.25				0.67				0.84				0.90				0.90	
BICYCLE	1				1				4				5				11	
PEDESTRIAN	2				0				1				1				4	
PEDESTRIAN BY LEG:	<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				4	
	1				1				1				1				4	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	MARINER VILLAGE PKWY	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	INDEPENDENCE DRIVE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A3)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM			16	3			2	6					9	6	42
7:15 AM	to	7:30 AM			38	7			6	17					17	18	103
7:30 AM	to	7:45 AM			73	15			11	22					23	36	180
7:45 AM	to	8:00 AM			110	24			14	34					31	60	273
8:00 AM	to	8:15 AM			160	32			16	42					38	85	373
8:15 AM	to	8:30 AM			210	38			24	63					45	120	500
8:30 AM	to	8:45 AM			259	51			28	80					51	153	622
8:45 AM	to	9:00 AM			303	60			34	96					53	174	720

TOTAL BY PERIOD																	
7:00 AM	to	7:15 AM	0	0	16	3	0	2	6	0	0	0	0	0	9	6	42
7:15 AM	to	7:30 AM	0	0	22	4	0	4	11	0	0	0	0	0	8	12	61
7:30 AM	to	7:45 AM	0	0	35	8	0	5	5	0	0	0	0	0	6	18	77
7:45 AM	to	8:00 AM	0	0	37	9	0	3	12	0	0	0	0	0	8	24	93
8:00 AM	to	8:15 AM	0	0	50	8	0	2	8	0	0	0	0	0	7	25	100
8:15 AM	to	8:30 AM	0	0	50	6	0	8	21	0	0	0	0	0	7	35	127
8:30 AM	to	8:45 AM	0	0	49	13	0	4	17	0	0	0	0	0	6	33	122
8:45 AM	to	9:00 AM	0	0	44	9	0	6	16	0	0	0	0	0	2	21	98

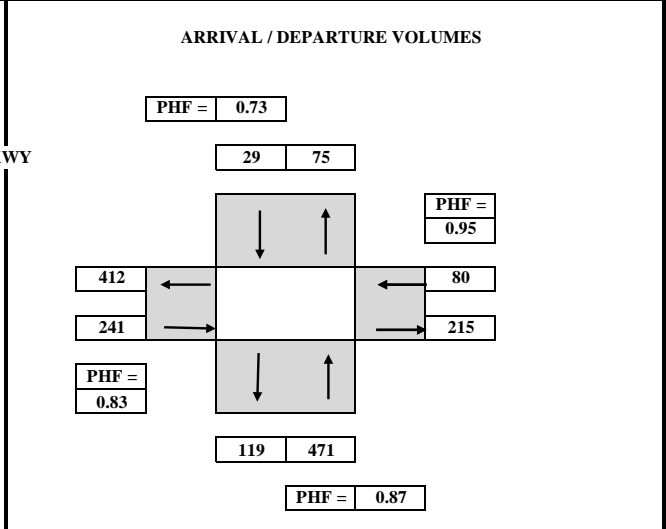
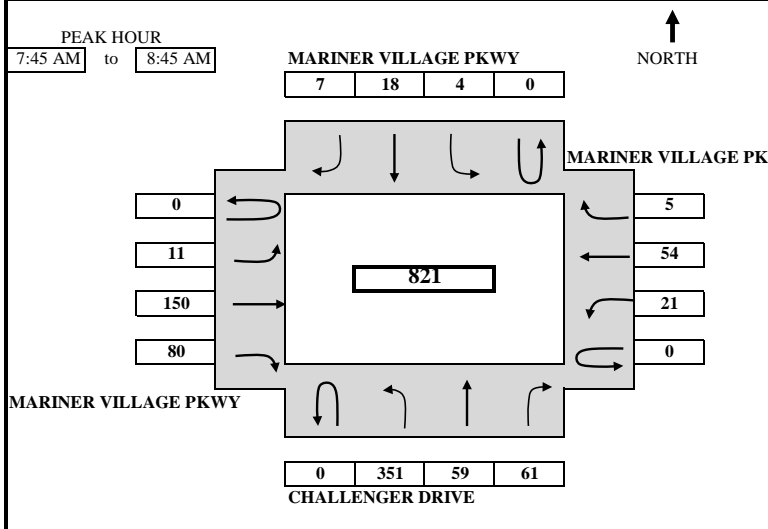
HOURLY TOTALS																	
7:00 AM	to	8:00 AM	0	0	110	24	0	14	34	0	0	0	0	0	31	60	273
7:15 AM	to	8:15 AM	0	0	144	29	0	14	36	0	0	0	0	0	29	79	331
7:30 AM	to	8:30 AM	0	0	172	31	0	18	46	0	0	0	0	0	28	102	397
7:45 AM	to	8:45 AM	0	0	186	36	0	17	58	0	0	0	0	0	28	117	442
8:00 AM	to	9:00 AM	0	0	193	36	0	20	62	0	0	0	0	0	22	114	447

PEAK HOUR SUMMARY																			
8:00 AM	to	9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	193	36	0	20	62	0	0	0	0	0	0	22	0	114	447
			PHF BY MOVEMENT				PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				OVERALL
			0.00	0.00	0.97	0.69	0.00	0.63	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.81	0.88
			BICYCLE				PEDESTRIAN				PEDESTRIAN BY LEG:				PEDESTRIAN BY LEG:				
			1				0				1				0				12
			1				0				0				0				1
			N-LEG				S-LEG				E-LEG				W-LEG				
			0				0				1				0				1

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	CHALLENGER DRIVE	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	MARINER VILLAGE PKWY	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A4)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	45	3	4	0	2	0	0	15	13	2	14	1	99		
7:15 AM	to	7:30 AM	91	4	6	0	2	6	1	39	27	8	25	3	212		
7:30 AM	to	7:45 AM	170	12	23	0	6	7	4	66	38	11	33	5	375		
7:45 AM	to	8:00 AM	259	26	35	1	7	10	6	103	58	16	46	6	573		
8:00 AM	to	8:15 AM	321	35	55	1	12	10	10	135	68	20	59	8	734		
8:15 AM	to	8:30 AM	413	55	72	3	18	11	12	168	96	24	74	10	956		
8:30 AM	to	8:45 AM	521	71	84	4	24	14	15	216	118	32	87	10	1196		
8:45 AM	to	9:00 AM	590	84	100	6	26	17	16	256	145	43	94	13	1390		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	45	3	4	0	0	2	0	0	0	15	13	0	2	14	1	99
7:15 AM	to	7:30 AM	0	46	1	2	0	0	0	6	0	1	24	14	0	6	11	2	113
7:30 AM	to	7:45 AM	0	79	8	17	0	0	4	1	0	3	27	11	0	3	8	2	163
7:45 AM	to	8:00 AM	0	89	14	12	0	1	1	3	0	2	37	20	0	5	13	1	198
8:00 AM	to	8:15 AM	0	62	9	20	0	0	5	0	0	4	32	10	0	4	13	2	161
8:15 AM	to	8:30 AM	0	92	20	17	0	2	6	1	0	2	33	28	0	4	15	2	222
8:30 AM	to	8:45 AM	0	108	16	12	0	1	6	3	0	3	48	22	0	8	13	0	240
8:45 AM	to	9:00 AM	0	69	13	16	0	2	2	3	0	1	40	27	0	11	7	3	194

HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	259	26	35	0	1	7	10	0	6	103	58	0	16	46	6	573
7:15 AM	to	8:15 AM	0	276	32	51	0	1	10	10	0	10	120	55	0	18	45	7	635
7:30 AM	to	8:30 AM	0	322	51	66	0	3	16	5	0	11	129	69	0	16	49	7	744
7:45 AM	to	8:45 AM	0	351	59	61	0	4	18	7	0	11	150	80	0	21	54	5	821
8:00 AM	to	9:00 AM	0	331	58	65	0	5	19	7	0	10	153	87	0	27	48	7	817

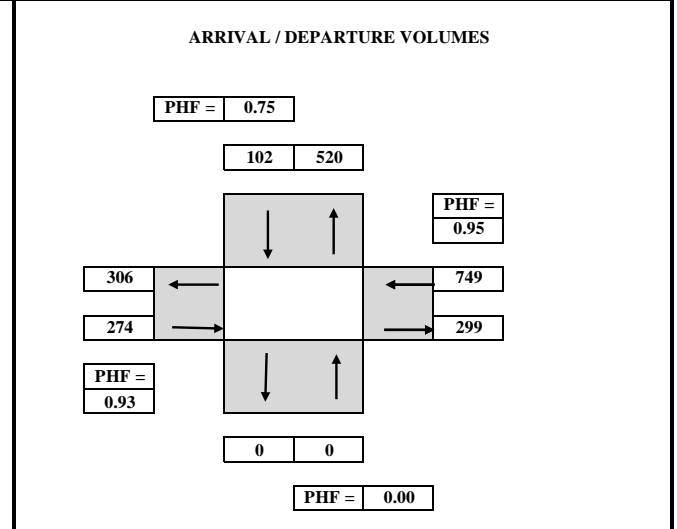
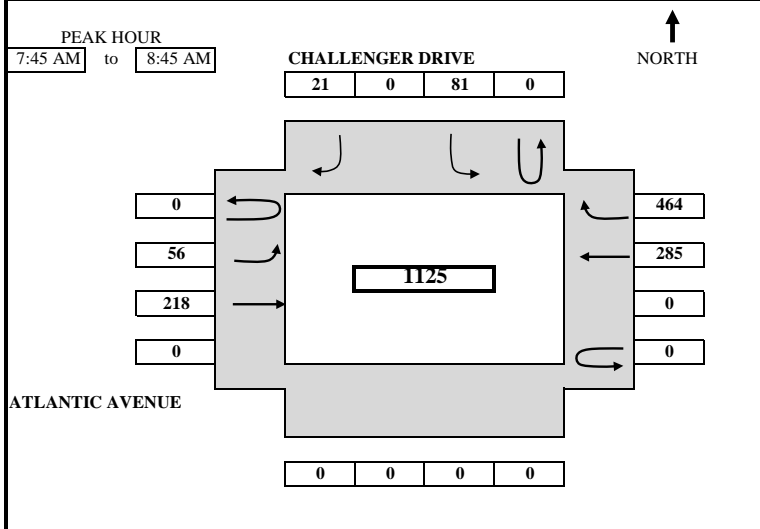
PEAK HOUR SUMMARY																							
7:45 AM	to	8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL				
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR					
			0	351	59	61	0	4	18	7	0	11	150	80	0	21	54	5	821				
			PHF BY MOVEMENT				0.00				0.81				0.74				0.76				OVERALL
			PHF BY APPROACH				0.87				0.73				0.83				0.95				0.86
			BICYCLE				4				0				1				5				
			PEDESTRIAN				8				2				3				18				
			N-LEG				S-LEG				E-LEG				W-LEG								
			PEDESTRIAN BY LEG:				3				5				5				18				



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	CHALLENGER DRIVE	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	ATLANTIC AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A5)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
7:00 AM	to	7:15 AM						10		3		3	16			30	52	114
7:15 AM	to	7:30 AM						20		5		5	41			65	100	236
7:30 AM	to	7:45 AM						36		7		15	74			129	187	448
7:45 AM	to	8:00 AM						49		9		31	122			220	293	724
8:00 AM	to	8:15 AM						63		15		41	186			310	400	1015
8:15 AM	to	8:30 AM						88		23		59	239			357	513	1279
8:30 AM	to	8:45 AM						117		28		71	292			414	651	1573
8:45 AM	to	9:00 AM						150		30		83	340			470	732	1805

TOTAL BY PERIOD																		
7:00 AM	to	7:15 AM	0	0	0	0	0	10	0	3	0	3	16	0	0	30	52	114
7:15 AM	to	7:30 AM	0	0	0	0	0	10	0	2	0	2	25	0	0	35	48	122
7:30 AM	to	7:45 AM	0	0	0	0	0	16	0	2	0	10	33	0	0	64	87	212
7:45 AM	to	8:00 AM	0	0	0	0	0	13	0	2	0	16	48	0	0	91	106	276
8:00 AM	to	8:15 AM	0	0	0	0	0	14	0	6	0	10	64	0	0	90	107	291
8:15 AM	to	8:30 AM	0	0	0	0	0	25	0	8	0	18	53	0	0	47	113	264
8:30 AM	to	8:45 AM	0	0	0	0	0	29	0	5	0	12	53	0	0	57	138	294
8:45 AM	to	9:00 AM	0	0	0	0	0	33	0	2	0	12	48	0	0	56	81	232

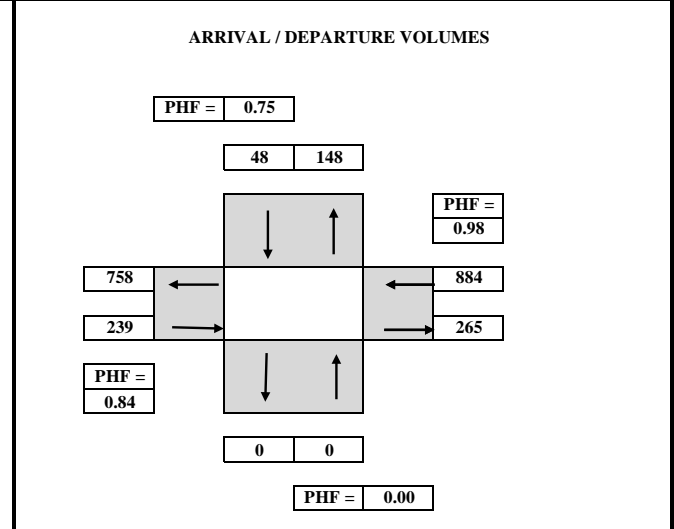
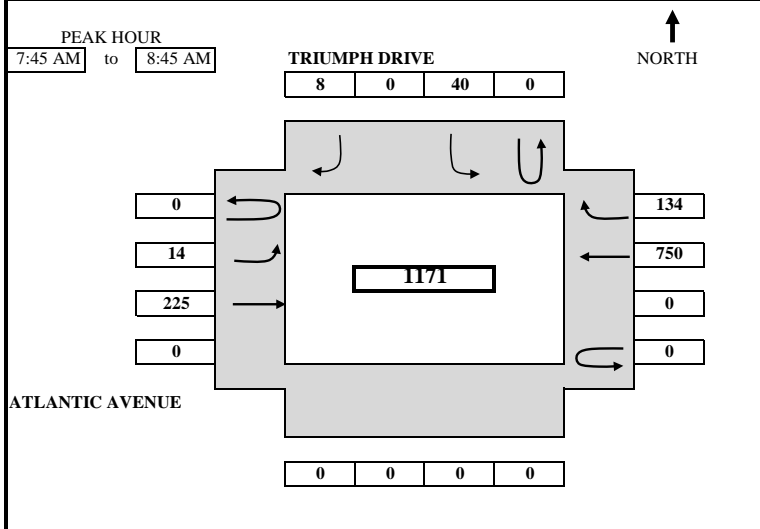
HOURLY TOTALS																		
7:00 AM	to	8:00 AM	0	0	0	0	0	49	0	9	0	31	122	0	0	220	293	724
7:15 AM	to	8:15 AM	0	0	0	0	0	53	0	12	0	38	170	0	0	280	348	901
7:30 AM	to	8:30 AM	0	0	0	0	0	68	0	18	0	54	198	0	0	292	413	1043
7:45 AM	to	8:45 AM	0	0	0	0	0	81	0	21	0	56	218	0	0	285	464	1125
8:00 AM	to	9:00 AM	0	0	0	0	0	101	0	21	0	52	218	0	0	250	439	1081

PEAK HOUR SUMMARY																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	0	0	0	0	81	0	21	0	56	218	0	0	0	285	464	1125
PHF BY MOVEMENT	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.66	0.00	0.78	0.85	0.00	0.00	0.00	0.78	0.84	OVERALL
PHF BY APPROACH	0.00				0.75				0.93				0.95				0.96
BICYCLE	0				0				3				13				16
PEDESTRIAN	1				3				4				2				10
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	6				0				3				1				10

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	TRIUMPH DRIVE	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	ATLANTIC AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A6)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																			
7:00 AM to 7:15 AM					5				4					80				8	118
7:15 AM to 7:30 AM					16				9					190				20	291
7:30 AM to 7:45 AM					26				11					335				34	506
7:45 AM to 8:00 AM					33				13					527				60	792
8:00 AM to 8:15 AM					44				16					719				93	1084
8:15 AM to 8:30 AM					52				17					902				129	1383
8:30 AM to 8:45 AM					66				19					1085				168	1677
8:45 AM to 9:00 AM					71				21					1223				191	1905

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	0	0	0	5	0	4	0	2	19	0	0	0	80	8	118
7:15 AM to 7:30 AM	0	0	0	0	0	11	0	5	0	2	33	0	0	0	110	12	173
7:30 AM to 7:45 AM	0	0	0	0	0	10	0	2	0	1	43	0	0	0	145	14	215
7:45 AM to 8:00 AM	0	0	0	0	0	7	0	2	0	5	54	0	0	0	192	26	286
8:00 AM to 8:15 AM	0	0	0	0	0	11	0	3	0	0	53	0	0	0	192	33	292
8:15 AM to 8:30 AM	0	0	0	0	0	8	0	1	0	4	67	0	0	0	183	36	299
8:30 AM to 8:45 AM	0	0	0	0	0	14	0	2	0	5	51	0	0	0	183	39	294
8:45 AM to 9:00 AM	0	0	0	0	0	5	0	2	0	5	55	0	0	0	138	23	228

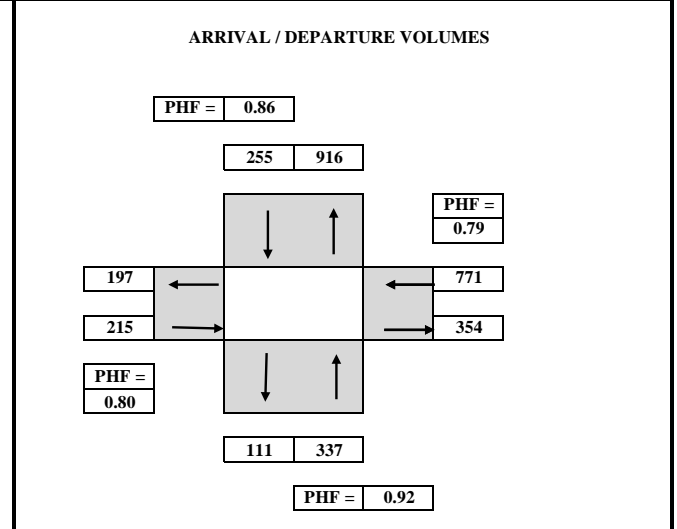
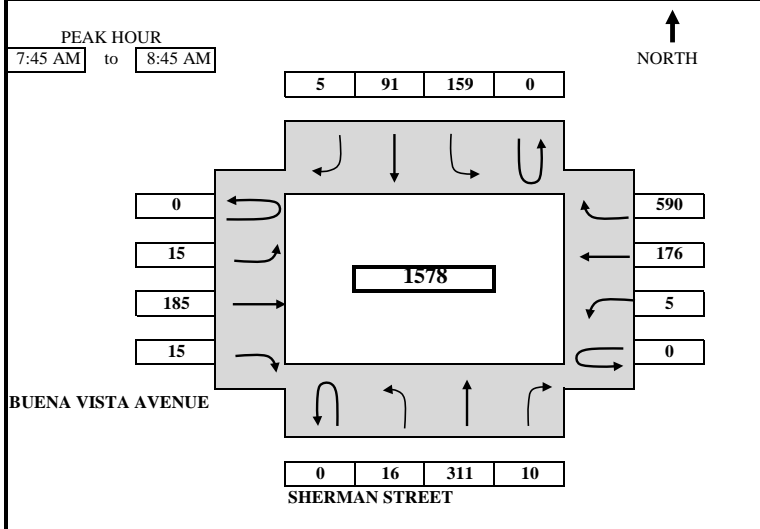
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	0	0	0	0	33	0	13	0	10	149	0	0	0	527	60	792
7:15 AM to 8:15 AM	0	0	0	0	0	39	0	12	0	8	183	0	0	0	639	85	966
7:30 AM to 8:30 AM	0	0	0	0	0	36	0	8	0	10	217	0	0	0	712	109	1092
7:45 AM to 8:45 AM	0	0	0	0	0	40	0	8	0	14	225	0	0	0	750	134	1171
8:00 AM to 9:00 AM	0	0	0	0	0	38	0	8	0	14	226	0	0	0	696	131	1113

PEAK HOUR SUMMARY																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	0	0	0	0	40	0	8	0	14	225	0	0	0	750	134	1171
PHF BY MOVEMENT	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.67	0.00	0.70	0.84	0.00	0.00	0.00	0.98	0.86	OVERALL
PHF BY APPROACH	0.00				0.75				0.84				0.98				0.98
BICYCLE	0				3				4				14				21
PEDESTRIAN	0				0				0				1				1
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	1				0				0				0				1

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	SHERMAN STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	BUENA VISTA AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A7)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
7:00 AM to 7:15 AM	0	22	0		13	9	1		0	25	1		1	16	76		164
7:15 AM to 7:30 AM	2	72	3		39	18	1		1	48	3		1	44	141		373
7:30 AM to 7:45 AM	5	136	6		64	39	5		4	75	4		3	76	247		664
7:45 AM to 8:00 AM	9	210	8		99	67	5		7	123	9		4	127	399		1067
8:00 AM to 8:15 AM	11	287	13		146	93	6		10	181	15		5	182	588		1537
8:15 AM to 8:30 AM	15	362	15		181	113	8		15	223	17		5	215	690		1859
8:30 AM to 8:45 AM	21	447	16		223	130	10		19	260	19		8	252	837		2242
8:45 AM to 9:00 AM	24	507	19		259	146	10		20	296	22		11	297	945		2556

<b>TOTAL BY PERIOD</b>																	
7:00 AM to 7:15 AM	0	0	22	0	0	13	9	1	0	0	25	1	0	1	16	76	164
7:15 AM to 7:30 AM	0	2	50	3	0	26	9	0	0	1	23	2	0	0	28	65	209
7:30 AM to 7:45 AM	0	3	64	3	0	25	21	4	0	3	27	1	0	2	32	106	291
7:45 AM to 8:00 AM	0	4	74	2	0	35	28	0	0	3	48	5	0	1	51	152	403
8:00 AM to 8:15 AM	0	2	77	5	0	47	26	1	0	3	58	6	0	1	55	189	470
8:15 AM to 8:30 AM	0	4	75	2	0	35	20	2	0	5	42	2	0	0	33	102	322
8:30 AM to 8:45 AM	0	6	85	1	0	42	17	2	0	4	37	2	0	3	37	147	383
8:45 AM to 9:00 AM	0	3	60	3	0	36	16	0	0	1	36	3	0	3	45	108	314

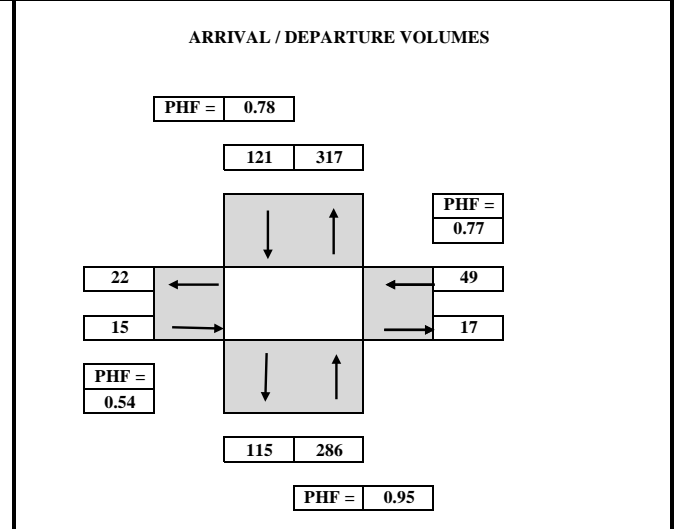
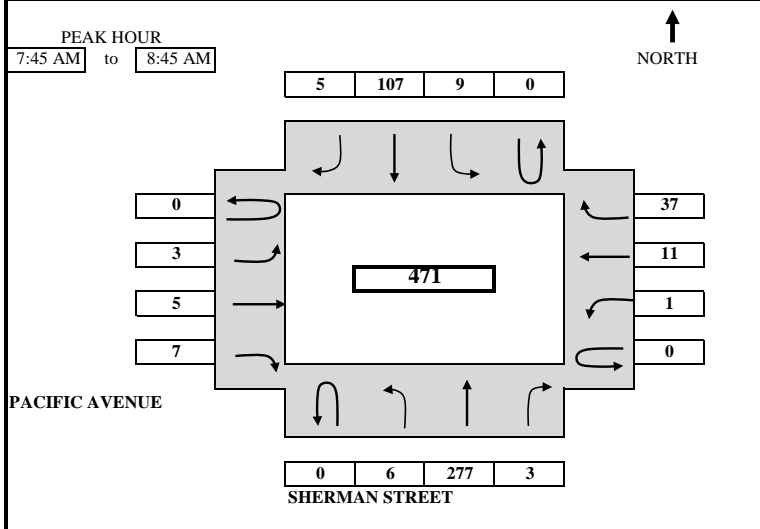
<b>HOURLY TOTALS</b>																	
7:00 AM to 8:00 AM	0	9	210	8	0	99	67	5	0	7	123	9	0	4	127	399	1067
7:15 AM to 8:15 AM	0	11	265	13	0	133	84	5	0	10	156	14	0	4	166	512	1373
7:30 AM to 8:30 AM	0	13	290	12	0	142	95	7	0	14	175	14	0	4	171	549	1486
7:45 AM to 8:45 AM	0	16	311	10	0	159	91	5	0	15	185	15	0	5	176	590	1578
8:00 AM to 9:00 AM	0	15	297	11	0	160	79	5	0	13	173	13	0	7	170	546	1489

<b>PEAK HOUR SUMMARY</b>																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	16	311	10	0	159	91	5	0	15	185	15	0	5	176	590	1578
PHF BY MOVEMENT	0.00	0.67	0.91	0.50	0.00	0.85	0.81	0.63	0.00	0.75	0.80	0.63	0.00	0.42	0.80	0.78	OVERALL
PHF BY APPROACH	0.92				0.86				0.80				0.79				0.84
BICYCLE	11				2				0				1				14
PEDESTRIAN	4				7				4				3				18
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	2				5				7				4				18

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (CROSSING #1)	<b>SURVEY DATE:</b>	10/7/2015	<b>DAY:</b>	WEDNESDAY
<b>N-S APPROACH:</b>	SHERMAN STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	PACIFIC AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A8)AM

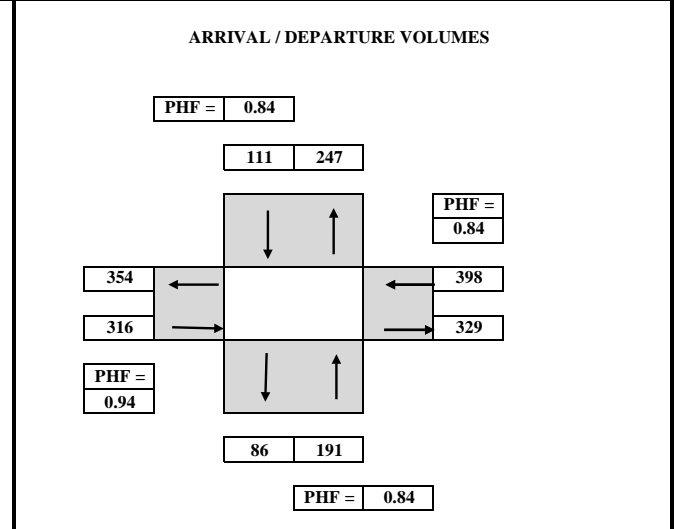
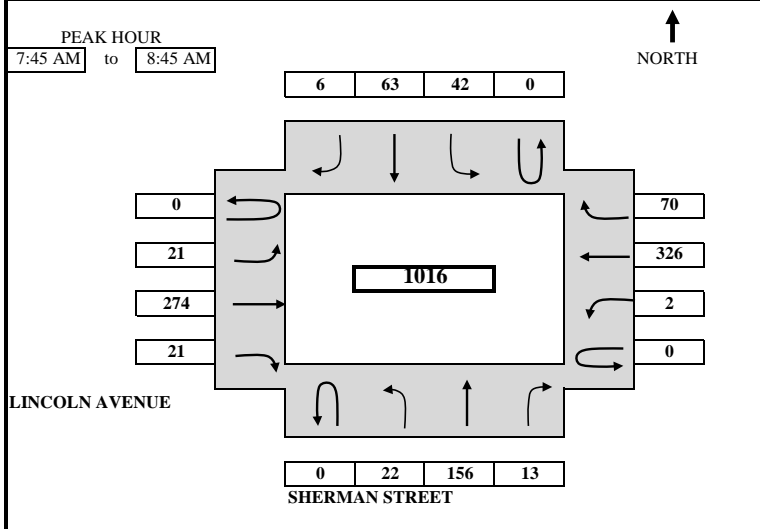


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU	RIGHT
<b>SURVEY DATA</b>																			
7:00 AM to 7:15 AM			1	21	0		3	5	1		3	3	1		0	0	3	41	
7:15 AM to 7:30 AM			2	69	1		4	17	1		3	3	3		1	0	8	112	
7:30 AM to 7:45 AM			2	134	3		5	33	1		3	4	9		2	3	12	211	
7:45 AM to 8:00 AM			4	202	3		10	66	2		4	6	13		2	4	19	335	
8:00 AM to 8:15 AM			7	269	5		12	98	3		4	6	14		2	5	30	455	
8:15 AM to 8:30 AM			7	337	6		14	120	5		6	8	14		2	11	37	567	
8:30 AM to 8:45 AM			8	411	6		14	140	6		6	9	16		3	14	49	682	
8:45 AM to 9:00 AM			8	473	6		18	158	7		7	11	18		4	19	54	783	
<b>TOTAL BY PERIOD</b>																			
7:00 AM to 7:15 AM			0	1	21	0	0	3	5	1	0	3	3	1	0	0	0	3	41
7:15 AM to 7:30 AM			0	1	48	1	0	1	12	0	0	0	0	2	0	1	0	5	71
7:30 AM to 7:45 AM			0	0	65	2	0	1	16	0	0	0	1	6	0	1	3	4	99
7:45 AM to 8:00 AM			0	2	68	0	0	5	33	1	0	1	2	4	0	0	1	7	124
8:00 AM to 8:15 AM			0	3	67	2	0	2	32	1	0	0	0	1	0	0	1	11	120
8:15 AM to 8:30 AM			0	0	68	1	0	2	22	2	0	2	2	0	0	0	6	7	112
8:30 AM to 8:45 AM			0	1	74	0	0	0	20	1	0	0	1	2	0	1	3	12	115
8:45 AM to 9:00 AM			0	0	62	0	0	4	18	1	0	1	2	2	0	1	5	5	101
<b>HOURLY TOTALS</b>																			
7:00 AM to 8:00 AM			0	4	202	3	0	10	66	2	0	4	6	13	0	2	4	19	335
7:15 AM to 8:15 AM			0	6	248	5	0	9	93	2	0	1	3	13	0	2	5	27	414
7:30 AM to 8:30 AM			0	5	268	5	0	10	103	4	0	3	5	11	0	1	11	29	455
7:45 AM to 8:45 AM			0	6	277	3	0	9	107	5	0	3	5	7	0	1	11	37	471
8:00 AM to 9:00 AM			0	4	271	3	0	8	92	5	0	3	5	5	0	2	15	35	448
<b>PEAK HOUR SUMMARY</b>																			
7:45 AM to 8:45 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL		
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR			
VOLUME		0	6	277	3	0	9	107	5	0	3	5	7	0	1	11	37	471	
PHF BY MOVEMENT		0.00	0.50	0.94	0.38	0.00	0.45	0.81	0.63	0.00	0.38	0.63	0.44	0.00	0.25	0.46	0.77	OVERALL	
PHF BY APPROACH		0.95				0.78				0.54				0.77				0.95	
BICYCLE		4				4				10				22				40	
PEDESTRIAN		6				5				9				15				35	
		<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>					
PEDESTRIAN BY LEG:		14				10				8				3				35	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>SHERMAN STREET</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>LINCOLN AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A9)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	2	18	3	0	6	0	2	19	1	0	35	2	88		
7:15 AM	to	7:30 AM	5	52	4	6	15	1	4	55	6	1	82	17	248		
7:30 AM	to	7:45 AM	12	100	6	17	28	3	8	106	13	5	142	28	468		
7:45 AM	to	8:00 AM	19	148	6	29	48	4	12	170	18	5	236	48	743		
8:00 AM	to	8:15 AM	28	184	11	41	67	6	21	235	28	5	334	68	1028		
8:15 AM	to	8:30 AM	31	206	15	50	78	7	28	309	31	6	391	79	1231		
8:30 AM	to	8:45 AM	34	256	19	59	91	9	29	380	34	7	468	98	1484		
8:45 AM	to	9:00 AM	41	290	23	66	103	14	35	444	41	8	556	112	1733		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	2	18	3	0	0	6	0	0	2	19	1	0	0	35	2	88
7:15 AM	to	7:30 AM	0	3	34	1	0	6	9	1	0	2	36	5	0	1	47	15	160
7:30 AM	to	7:45 AM	0	7	48	2	0	11	13	2	0	4	51	7	0	4	60	11	220
7:45 AM	to	8:00 AM	0	7	48	0	0	12	20	1	0	4	64	5	0	0	94	20	275
8:00 AM	to	8:15 AM	0	9	36	5	0	12	19	2	0	9	65	10	0	0	98	20	285
8:15 AM	to	8:30 AM	0	3	22	4	0	9	11	1	0	7	74	3	0	1	57	11	203
8:30 AM	to	8:45 AM	0	3	50	4	0	9	13	2	0	1	71	3	0	1	77	19	253
8:45 AM	to	9:00 AM	0	7	34	4	0	7	12	5	0	6	64	7	0	1	88	14	249

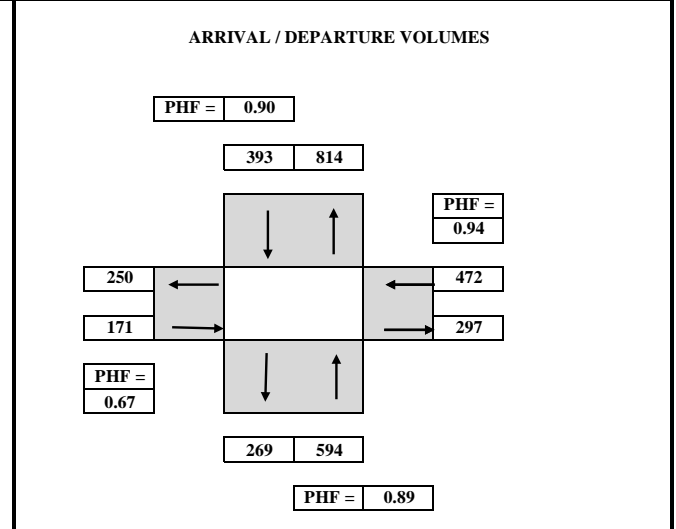
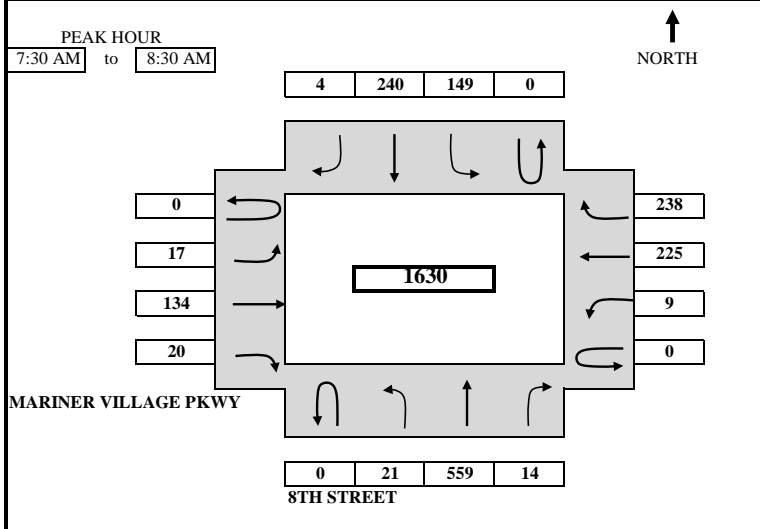
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	19	148	6	0	29	48	4	0	12	170	18	0	5	236	48	743
7:15 AM	to	8:15 AM	0	26	166	8	0	41	61	6	0	19	216	27	0	5	299	66	940
7:30 AM	to	8:30 AM	0	26	154	11	0	44	63	6	0	24	254	25	0	5	309	62	983
7:45 AM	to	8:45 AM	0	22	156	13	0	42	63	6	0	21	274	21	0	2	326	70	1016
8:00 AM	to	9:00 AM	0	22	142	17	0	37	55	10	0	23	274	23	0	3	320	64	990

PEAK HOUR SUMMARY																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	22	156	13	0	42	63	6	0	21	274	21	0	2	326	70	1016
PHF BY MOVEMENT	0.00	0.61	0.78	0.65	0.00	0.88	0.79	0.75	0.00	0.58	0.93	0.53	0.00	0.50	0.83	0.88	OVERALL
PHF BY APPROACH	0.84				0.84				0.94				0.84				0.89
BICYCLE	3				8				5				9				25
PEDESTRIAN	3				5				6				1				15
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	4				3				7				1				15

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b> EBMUD	<b>SURVEY DATE:</b> 10/7/2015	<b>DAY:</b> WEDNESDAY
<b>N-S APPROACH:</b> 8TH STREET - CONSTITUTION WAY	<b>SURVEY TIME:</b> 7:00 AM	<b>TO</b> 9:00 AM
<b>E-W APPROACH:</b> MARINER VILLAGE PKWY	<b>JURISDICTION:</b> ALAMEDA	<b>FILE:</b> 3510117-(A15)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	7	105	0	18	30	0	0	6	1	1	18	43	229		
7:15 AM	to	7:30 AM	9	229	4	35	68	1	3	23	4	5	34	81	496		
7:30 AM	to	7:45 AM	13	389	7	66	115	3	7	44	7	8	70	154	883		
7:45 AM	to	8:00 AM	18	531	8	102	175	3	8	68	10	9	136	210	1278		
8:00 AM	to	8:15 AM	26	653	11	145	238	5	12	107	18	9	202	270	1696		
8:15 AM	to	8:30 AM	30	788	18	184	308	5	20	157	24	14	259	319	2126		
8:30 AM	to	8:45 AM	36	926	22	213	358	7	24	193	27	20	306	366	2498		
8:45 AM	to	9:00 AM	40	1047	33	252	427	12	31	237	32	22	362	398	2893		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	7	105	0	0	18	30	0	0	0	6	1	0	1	18	43	229
7:15 AM	to	7:30 AM	0	2	124	4	0	17	38	1	0	3	17	3	0	4	16	38	267
7:30 AM	to	7:45 AM	0	4	160	3	0	31	47	2	0	4	21	3	0	3	36	73	387
7:45 AM	to	8:00 AM	0	5	142	1	0	36	60	0	0	1	24	3	0	1	66	56	395
8:00 AM	to	8:15 AM	0	8	122	3	0	43	63	2	0	4	39	8	0	0	66	60	418
8:15 AM	to	8:30 AM	0	4	135	7	0	39	70	0	0	8	50	6	0	5	57	49	430
8:30 AM	to	8:45 AM	0	6	138	4	0	29	50	2	0	4	36	3	0	6	47	47	372
8:45 AM	to	9:00 AM	0	4	121	11	0	39	69	5	0	7	44	5	0	2	56	32	395

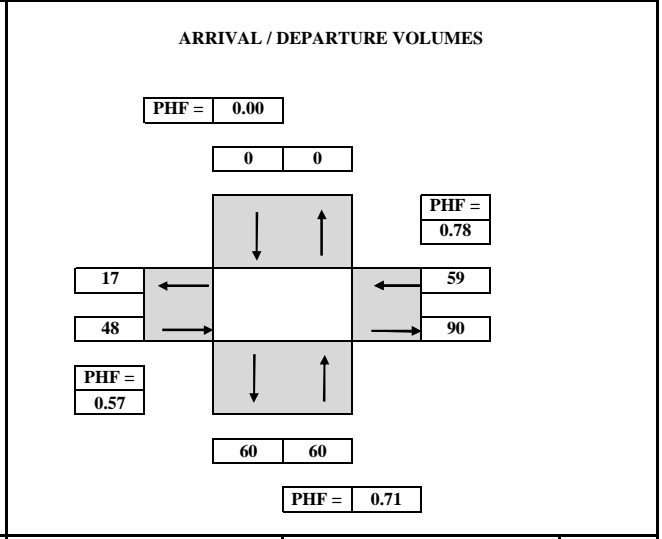
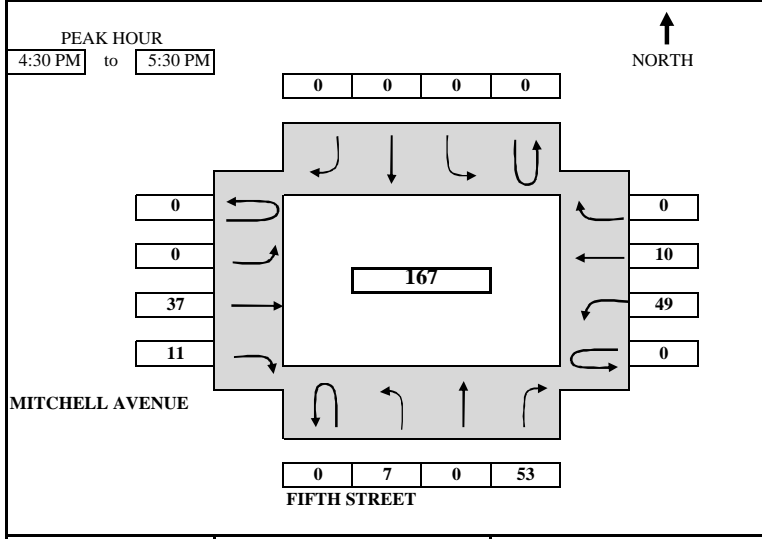
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	18	531	8	0	102	175	3	0	8	68	10	0	9	136	210	1278
7:15 AM	to	8:15 AM	0	19	548	11	0	127	208	5	0	12	101	17	0	8	184	227	1467
7:30 AM	to	8:30 AM	0	21	559	14	0	149	240	4	0	17	134	20	0	9	225	238	1630
7:45 AM	to	8:45 AM	0	23	537	15	0	147	243	4	0	17	149	20	0	12	236	212	1615
8:00 AM	to	9:00 AM	0	22	516	25	0	150	252	9	0	23	169	22	0	13	226	188	1615

PEAK HOUR SUMMARY																	
7:30 AM to 8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	21	559	14	0	149	240	4	0	17	134	20	0	9	225	238	1630
PHF BY MOVEMENT	0.00	0.66	0.87	0.50	0.00	0.87	0.86	0.50	0.00	0.53	0.67	0.63	0.00	0.45	0.85	0.82	OVERALL
PHF BY APPROACH	0.89				0.90				0.67				0.94				0.95
BICYCLE	4				0				3				5				12
PEDESTRIAN	16				31				2				5				54
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	0				7				32				15				54

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>FIFTH STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MITCHELL AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A14)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																
4:00 PM	to	4:15 PM	2	1	19	1	0	0	0	0	4	5	10	5	0	47
4:15 PM	to	4:30 PM	3	2	35	1	0	0	0	0	7	8	18	6	0	80
4:30 PM	to	4:45 PM	3	2	50	1	0	0	0	0	11	10	31	9	0	117
4:45 PM	to	5:00 PM	4	2	62	1	0	0	0	0	19	14	46	13	0	161
5:00 PM	to	5:15 PM	4	2	73	1	0	0	0	0	38	16	56	14	0	204
5:15 PM	to	5:30 PM	10	2	88	1	0	0	0	0	44	19	67	16	0	247
5:30 PM	to	5:45 PM	10	2	95	1	0	0	0	0	48	20	83	17	0	276
5:45 PM	to	6:00 PM	14	2	108	1	0	0	0	0	49	24	95	20	0	313

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	2	1	19	0	1	0	0	0	0	4	5	0	47		
4:15 PM	to	4:30 PM	0	1	1	16	0	0	0	0	0	3	3	0	8	1	0	33
4:30 PM	to	4:45 PM	0	0	0	15	0	0	0	0	0	4	2	0	13	3	0	37
4:45 PM	to	5:00 PM	0	1	0	12	0	0	0	0	0	8	4	0	15	4	0	44
5:00 PM	to	5:15 PM	0	0	0	11	0	0	0	0	0	19	2	0	10	1	0	43
5:15 PM	to	5:30 PM	0	6	0	15	0	0	0	0	0	6	3	0	11	2	0	43
5:30 PM	to	5:45 PM	0	0	0	7	0	0	0	0	0	4	1	0	16	1	0	29
5:45 PM	to	6:00 PM	0	4	0	13	0	0	0	0	0	1	4	0	12	3	0	37

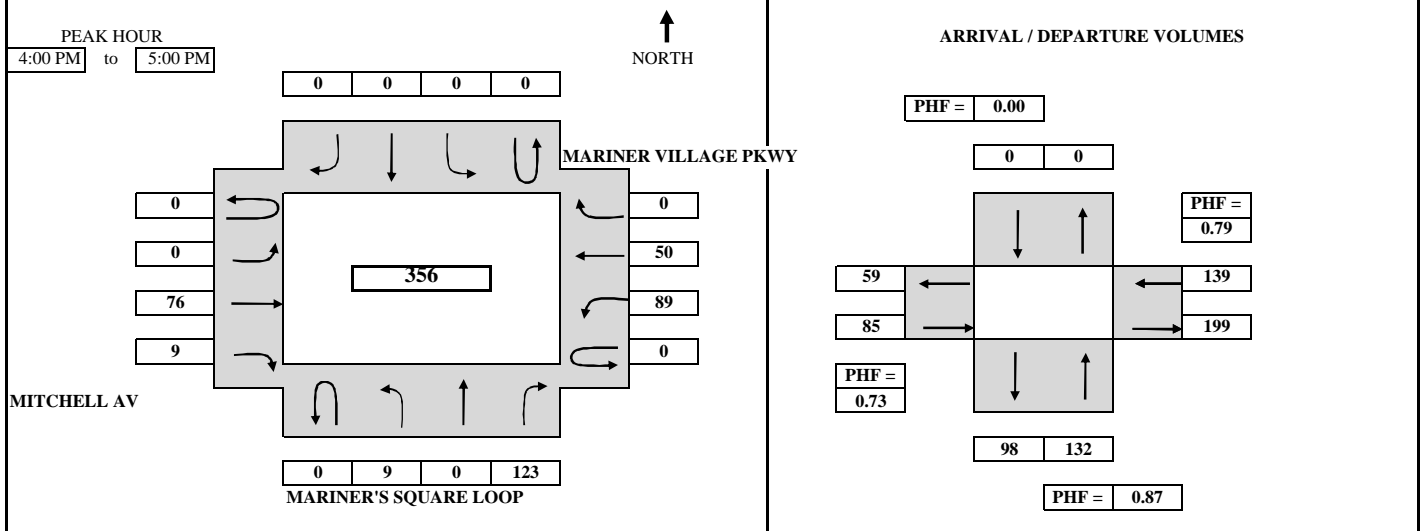
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	4	2	62	0	1	0	0	0	0	19	14	0	46	13	0	161
4:15 PM	to	5:15 PM	0	2	1	54	0	0	0	0	0	34	11	0	46	9	0	157	
4:30 PM	to	5:30 PM	0	7	0	53	0	0	0	0	0	37	11	0	49	10	0	167	
4:45 PM	to	5:45 PM	0	7	0	45	0	0	0	0	0	37	10	0	52	8	0	159	
5:00 PM	to	6:00 PM	0	10	0	46	0	0	0	0	0	30	10	0	49	7	0	152	

PEAK HOUR SUMMARY																			
4:30 PM	to	5:30 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	7	0	53	0	0	0	0	0	0	37	11	0	49	10	0	167
			0.00	0.29	0.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.69	0.00	0.82	0.63	0.00	OVERALL
			PHF BY APPROACH				0.00				0.57				0.78				0.95
			BICYCLE				0				1				3				5
			PEDESTRIAN				1				0				1				3
			N-LEG				S-LEG				E-LEG				W-LEG				
			1				0				1				1				3

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>MARINER'S SQUARE LOOP</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MITCHELL AV - MARINER VILLAGE PKWY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A13)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																					
4:00 PM to 4:15 PM			2			36										26	3		23	14	104
4:15 PM to 4:30 PM			3			71										41	6		38	22	181
4:30 PM to 4:45 PM			5			97										58	8		68	36	272
4:45 PM to 5:00 PM			9			123										76	9		89	50	356
5:00 PM to 5:15 PM			9			156										105	11		116	62	459
5:15 PM to 5:30 PM			11			181										123	12		136	72	535
5:30 PM to 5:45 PM			11			215										136	12		160	89	623
5:45 PM to 6:00 PM			12			245										148	13		182	103	703

TOTAL BY PERIOD																			
4:00 PM to 4:15 PM	0	2	0	36	0	0	0	0	0	0	0	26	3	0	23	14	0	0	104
4:15 PM to 4:30 PM	0	1	0	35	0	0	0	0	0	0	0	15	3	0	15	8	0	0	77
4:30 PM to 4:45 PM	0	2	0	26	0	0	0	0	0	0	0	17	2	0	30	14	0	0	91
4:45 PM to 5:00 PM	0	4	0	26	0	0	0	0	0	0	0	18	1	0	21	14	0	0	84
5:00 PM to 5:15 PM	0	0	0	33	0	0	0	0	0	0	0	29	2	0	27	12	0	0	103
5:15 PM to 5:30 PM	0	2	0	25	0	0	0	0	0	0	0	18	1	0	20	10	0	0	76
5:30 PM to 5:45 PM	0	0	0	34	0	0	0	0	0	0	0	13	0	0	24	17	0	0	88
5:45 PM to 6:00 PM	0	1	0	30	0	0	0	0	0	0	0	12	1	0	22	14	0	0	80

HOURLY TOTALS																			
4:00 PM to 5:00 PM	0	9	0	123	0	0	0	0	0	0	0	76	9	0	89	50	0	0	356
4:15 PM to 5:15 PM	0	7	0	120	0	0	0	0	0	0	0	79	8	0	93	48	0	0	355
4:30 PM to 5:30 PM	0	8	0	110	0	0	0	0	0	0	0	82	6	0	98	50	0	0	354
4:45 PM to 5:45 PM	0	6	0	118	0	0	0	0	0	0	0	78	4	0	92	53	0	0	351
5:00 PM to 6:00 PM	0	3	0	122	0	0	0	0	0	0	0	72	4	0	93	53	0	0	347

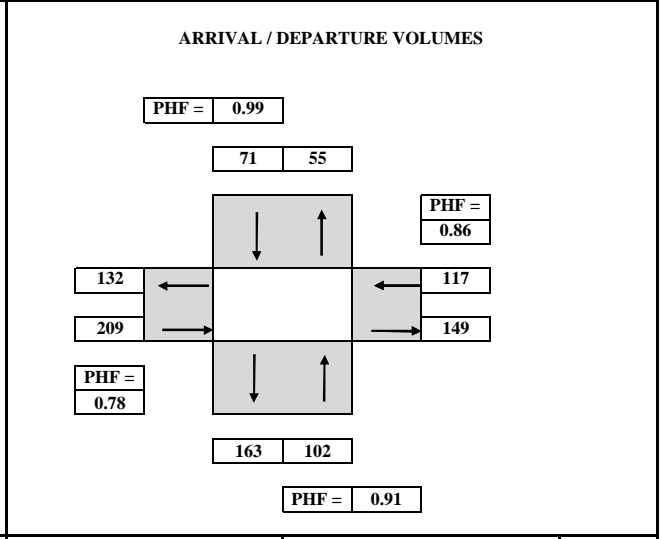
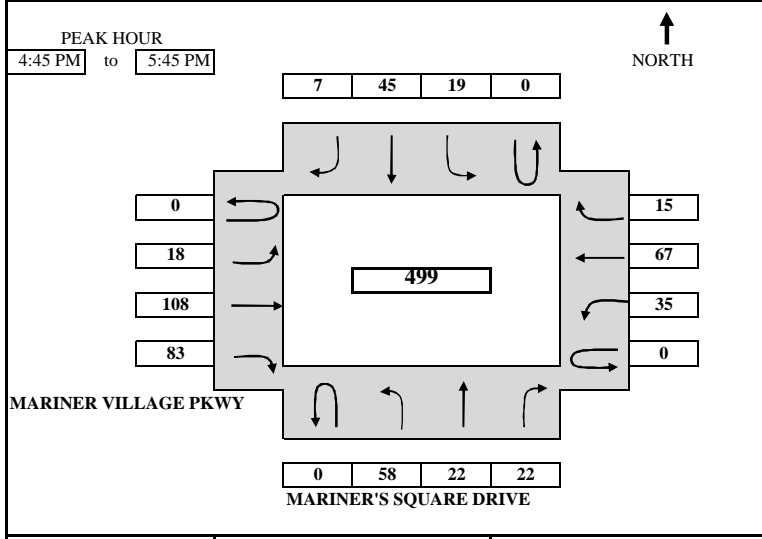
PEAK HOUR SUMMARY																		
4:00 PM to 5:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	9	0	123	0	0	0	0	0	0	76	9	0	89	50	0	356	
PHF BY MOVEMENT	0.00	0.56	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.75	0.00	0.74	0.89	0.00	OVERALL	
PHF BY APPROACH	0.87				0.00				0.73				0.79				0.86	
BICYCLE	2				0				1				4				7	
PEDESTRIAN	1				1				5				6				13	
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG					
	4				7				0				2				13	



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>MARINER'S SQUARE DRIVE</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MARINER VILLAGE PKWY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A1)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																
4:00 PM to 4:15 PM	18	5	4	7	13	4	3	28	29	10	14	6	141			
4:15 PM to 4:30 PM	30	9	10	14	16	7	6	54	52	19	30	7	254			
4:30 PM to 4:45 PM	51	11	13	22	25	9	14	77	72	26	49	11	380			
4:45 PM to 5:00 PM	66	15	20	24	39	11	19	98	88	33	65	14	492			
5:00 PM to 5:15 PM	83	19	27	30	50	12	22	135	115	43	83	20	639			
5:15 PM to 5:30 PM	95	26	29	36	59	15	28	160	132	52	97	22	751			
5:30 PM to 5:45 PM	109	33	35	41	70	16	32	185	155	61	116	26	879			
5:45 PM to 6:00 PM	124	35	35	44	71	18	32	207	175	67	132	30	970			

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	0	18	5	4	0	7	13	4	0	3	28	29	0	10	14	6	141
4:15 PM to 4:30 PM	0	12	4	6	0	7	3	3	0	3	26	23	0	9	16	1	113
4:30 PM to 4:45 PM	0	21	2	3	0	8	9	2	0	8	23	20	0	7	19	4	126
4:45 PM to 5:00 PM	0	15	4	7	0	2	14	2	0	5	21	16	0	7	16	3	112
5:00 PM to 5:15 PM	0	17	4	7	0	6	11	1	0	3	37	27	0	10	18	6	147
5:15 PM to 5:30 PM	0	12	7	2	0	6	9	3	0	6	25	17	0	9	14	2	112
5:30 PM to 5:45 PM	0	14	7	6	0	5	11	1	0	4	25	23	0	9	19	4	128
5:45 PM to 6:00 PM	0	15	2	0	0	3	1	2	0	0	22	20	0	6	16	4	91

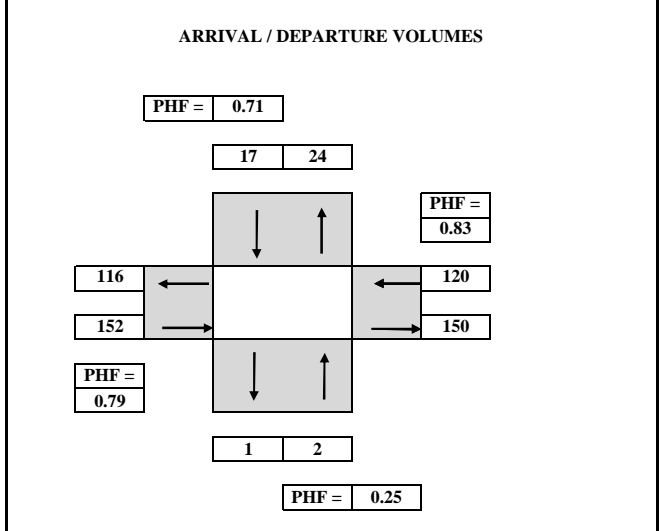
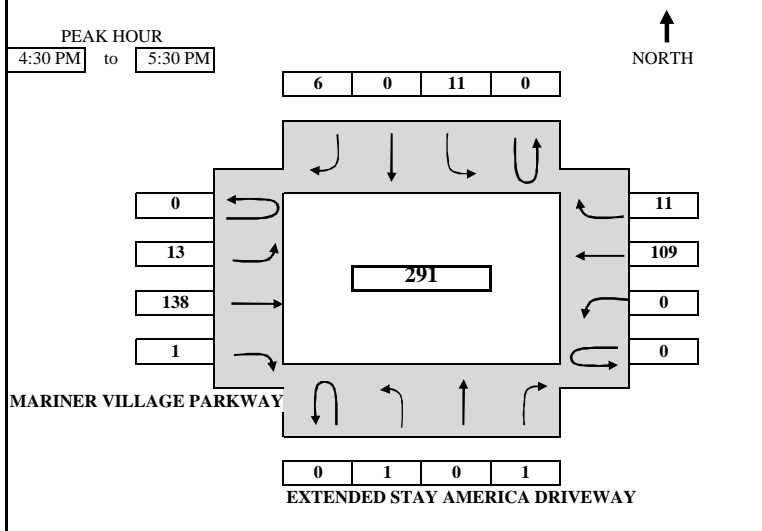
HOURLY TOTALS																	
4:00 PM to 5:00 PM	0	66	15	20	0	24	39	11	0	19	98	88	0	33	65	14	492
4:15 PM to 5:15 PM	0	65	14	23	0	23	37	8	0	19	107	86	0	33	69	14	498
4:30 PM to 5:30 PM	0	65	17	19	0	22	43	8	0	22	106	80	0	33	67	15	497
4:45 PM to 5:45 PM	0	58	22	22	0	19	45	7	0	18	108	83	0	35	67	15	499
5:00 PM to 6:00 PM	0	58	20	15	0	20	32	7	0	13	109	87	0	34	67	16	478

PEAK HOUR SUMMARY																	
4:45 PM to 5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	58	22	22	0	19	45	7	0	18	108	83	0	35	67	15	499
PHF BY MOVEMENT	0.00	0.85	0.79	0.79	0.00	0.79	0.80	0.58	0.00	0.75	0.73	0.77	0.00	0.88	0.88	0.63	OVERALL
PHF BY APPROACH	0.91				0.99				0.78				0.86				0.85
BICYCLE	0				1				1				2				4
PEDESTRIAN	2				2				8				2				14
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	7				3				2				2				14

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>EXTENDED STAY AMERICA DRIVEWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MARINER VILLAGE PARKWAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A12)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM to 4:15 PM	0	0	0	0	1	1	0	0	2	38	0	0	0	28	3	0	73
4:15 PM to 4:30 PM	0	0	0	0	2	2	0	0	5	69	0	0	0	54	6	0	138
4:30 PM to 4:45 PM	0	0	0	0	4	4	0	0	8	105	0	0	0	83	8	0	212
4:45 PM to 5:00 PM	0	0	0	0	8	6	0	0	11	132	0	0	0	107	12	0	276
5:00 PM to 5:15 PM	0	0	0	0	9	8	0	0	13	178	0	0	0	139	16	0	363
5:15 PM to 5:30 PM	1	0	1	0	13	8	0	0	18	207	1	0	0	163	17	0	429
5:30 PM to 5:45 PM	1	0	1	0	14	9	0	0	19	242	1	0	1	196	18	0	502
5:45 PM to 6:00 PM	2	8	1	0	15	10	0	0	20	265	1	0	1	219	20	0	562

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	0	0	0	0	0	1	0	1	0	2	38	0	0	0	28	3	73
4:15 PM to 4:30 PM	0	0	0	0	0	1	0	1	0	3	31	0	0	0	26	3	65
4:30 PM to 4:45 PM	0	0	0	0	0	2	0	2	0	3	36	0	0	0	29	2	74
4:45 PM to 5:00 PM	0	0	0	0	0	4	0	2	0	3	27	0	0	0	24	4	64
5:00 PM to 5:15 PM	0	0	0	0	0	1	0	2	0	2	46	0	0	0	32	4	87
5:15 PM to 5:30 PM	0	1	0	1	0	4	0	0	0	5	29	1	0	0	24	1	66
5:30 PM to 5:45 PM	0	0	0	0	0	1	0	1	0	1	35	0	0	1	33	1	73
5:45 PM to 6:00 PM	0	1	8	0	0	1	0	1	0	1	23	0	0	0	23	2	60

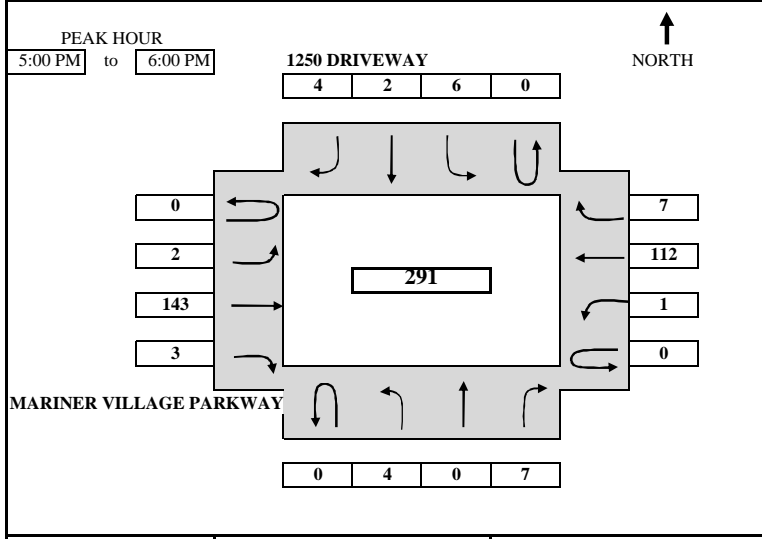
HOURLY TOTALS																	
4:00 PM to 5:00 PM	0	0	0	0	0	8	0	6	0	11	132	0	0	0	107	12	276
4:15 PM to 5:15 PM	0	0	0	0	0	8	0	7	0	11	140	0	0	0	111	13	290
4:30 PM to 5:30 PM	0	1	0	1	0	11	0	6	0	13	138	1	0	0	109	11	291
4:45 PM to 5:45 PM	0	1	0	1	0	10	0	5	0	11	137	1	0	1	113	10	290
5:00 PM to 6:00 PM	0	2	8	1	0	7	0	4	0	9	133	1	0	1	112	8	286

PEAK HOUR SUMMARY																	
4:30 PM to 5:30 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	1	0	1	0	11	0	6	0	13	138	1	0	0	109	11	291
PHF BY MOVEMENT	0.00	0.25	0.00	0.25	0.00	0.69	0.00	0.75	0.00	0.65	0.75	0.25	0.00	0.00	0.85	0.69	OVERALL
PHF BY APPROACH	0.25				0.71				0.79				0.83				0.84
BICYCLE	0				0				3				3				6
PEDESTRIAN	2				0				5				1				8
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	4				2				1				1				8

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>1250 DRIVEWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MARINER VILLAGE PARKWAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A11)PM</b>



**ARRIVAL / DEPARTURE VOLUMES**

PHF = 0.75	
12	9
PHF = 0.86	
120	120
148	156
PHF = 0.71	
6	11
PHF = 0.69	

TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

**SURVEY DATA**

4:00 PM to 4:15 PM	2	0	1	1	0	0	2	32	3	1	30	2	74
4:15 PM to 4:30 PM	4	1	3	1	0	0	2	65	5	1	55	2	139
4:30 PM to 4:45 PM	7	1	5	1	0	0	2	100	7	1	82	2	208
4:45 PM to 5:00 PM	9	1	5	2	0	1	2	127	8	1	108	4	268
5:00 PM to 5:15 PM	9	1	7	3	1	2	3	177	9	1	137	4	354
5:15 PM to 5:30 PM	9	1	9	5	1	2	3	211	10	1	164	6	422
5:30 PM to 5:45 PM	11	1	11	6	1	4	3	244	11	2	196	8	498
5:45 PM to 6:00 PM	13	1	12	8	2	5	4	270	11	2	220	11	559

**TOTAL BY PERIOD**

4:00 PM to 4:15 PM	0	2	0	1	0	1	0	0	0	2	32	3	0	1	30	2	74
4:15 PM to 4:30 PM	0	2	1	2	0	0	0	0	0	0	33	2	0	0	25	0	65
4:30 PM to 4:45 PM	0	3	0	2	0	0	0	0	0	0	35	2	0	0	27	0	69
4:45 PM to 5:00 PM	0	2	0	0	0	1	0	1	0	0	27	1	0	0	26	2	60
5:00 PM to 5:15 PM	0	0	0	2	0	1	1	1	0	1	50	1	0	0	29	0	86
5:15 PM to 5:30 PM	0	0	0	2	0	2	0	0	0	0	34	1	0	0	27	2	68
5:30 PM to 5:45 PM	0	2	0	2	0	1	0	2	0	0	33	1	0	1	32	2	76
5:45 PM to 6:00 PM	0	2	0	1	0	2	1	1	0	1	26	0	0	0	24	3	61

**HOURLY TOTALS**

4:00 PM to 5:00 PM	0	9	1	5	0	2	0	1	0	2	127	8	0	1	108	4	268
4:15 PM to 5:15 PM	0	7	1	6	0	2	1	2	0	1	145	6	0	0	107	2	280
4:30 PM to 5:30 PM	0	5	0	6	0	4	1	2	0	1	146	5	0	0	109	4	283
4:45 PM to 5:45 PM	0	4	0	6	0	5	1	4	0	1	144	4	0	1	114	6	290
5:00 PM to 6:00 PM	0	4	0	7	0	6	2	4	0	2	143	3	0	1	112	7	291

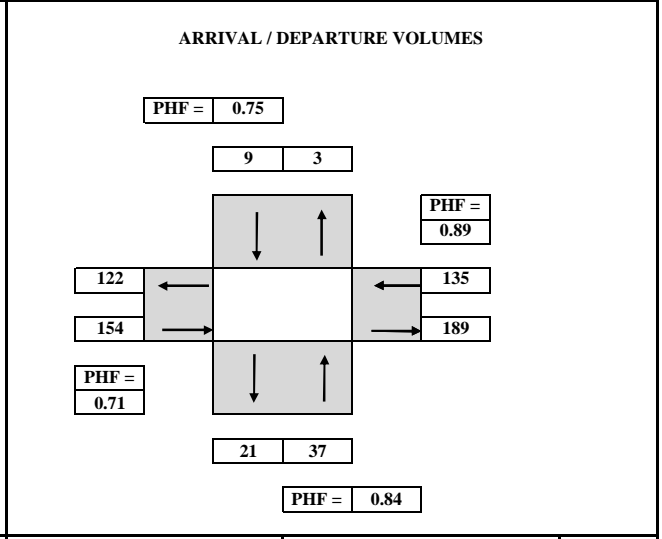
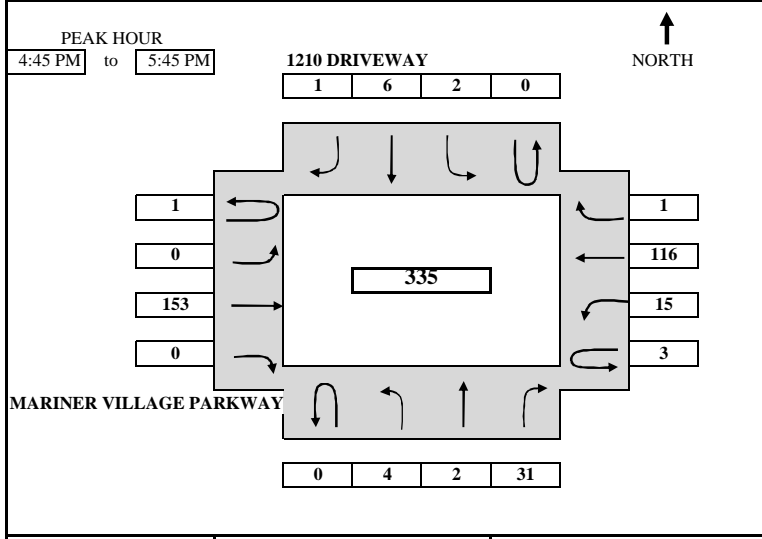
**PEAK HOUR SUMMARY**

5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	4	0	7	0	6	2	4	0	2	143	3	0	1	112	7	291
PHF BY MOVEMENT	0.00	0.50	0.00	0.88	0.00	0.75	0.50	0.50	0.00	0.50	0.72	0.75	0.00	0.25	0.88	0.58	OVERALL
PHF BY APPROACH	0.69				0.75				0.71				0.86				0.85
BICYCLE	1				0				3				4				8
PEDESTRIAN	0				0				7				0				7
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	5				2				0				0				7

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>1210 DRIVEWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MARINER VILLAGE PARKWAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A10)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	0	0	2	3	0	1	0	0	33	1	1	2	33	3	79
4:15 PM	to	4:30 PM	0	0	4	5	1	1	0	0	67	2	1	5	56	3	145
4:30 PM	to	4:45 PM	0	0	9	6	4	1	0	0	104	3	2	8	83	3	223
4:45 PM	to	5:00 PM	1	0	15	6	5	1	0	0	131	3	3	10	110	3	288
5:00 PM	to	5:15 PM	1	0	25	7	6	2	1	0	184	3	4	14	138	3	388
5:15 PM	to	5:30 PM	1	2	32	8	8	2	1	0	221	3	5	18	166	4	471
5:30 PM	to	5:45 PM	4	2	40	8	10	2	1	0	257	3	5	23	199	4	558
5:45 PM	to	6:00 PM	8	3	47	8	10	2	1	0	285	3	5	24	220	4	620

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	0	2	0	3	0	1	0	0	33	1	1	2	33	3	79
4:15 PM	to	4:30 PM	0	0	0	2	0	2	1	0	0	0	34	1	0	3	23	0	66
4:30 PM	to	4:45 PM	0	0	0	5	0	1	3	0	0	0	37	1	1	3	27	0	78
4:45 PM	to	5:00 PM	0	1	0	6	0	0	1	0	0	0	27	0	1	2	27	0	65
5:00 PM	to	5:15 PM	0	0	0	10	0	1	1	1	1	0	53	0	1	4	28	0	100
5:15 PM	to	5:30 PM	0	0	2	7	0	1	2	0	0	0	37	0	1	4	28	1	83
5:30 PM	to	5:45 PM	0	3	0	8	0	0	2	0	0	0	36	0	0	5	33	0	87
5:45 PM	to	6:00 PM	0	4	1	7	0	0	0	0	0	0	28	0	0	1	21	0	62

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	1	0	15	0	6	5	1	0	0	131	3	3	10	110	3	288
4:15 PM	to	5:15 PM	0	1	0	23	0	4	6	1	1	0	151	2	3	12	105	0	309
4:30 PM	to	5:30 PM	0	1	2	28	0	3	7	1	1	0	154	1	4	13	110	1	326
4:45 PM	to	5:45 PM	0	4	2	31	0	2	6	1	1	0	153	0	3	15	116	1	335
5:00 PM	to	6:00 PM	0	7	3	32	0	2	5	1	1	0	154	0	2	14	110	1	332

PEAK HOUR SUMMARY																			
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	4	2	31	0	2	6	1	1	0	153	0	3	15	116	1	335
			PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				OVERALL
			0.00	0.33	0.25	0.78	0.00	0.50	0.75	0.25	0.25	0.00	0.72	0.00	0.75	0.75	0.88	0.25	
			PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				
			0.84				0.75				0.71				0.89				0.84
			BICYCLE				BICYCLE				BICYCLE				BICYCLE				
			0				0				2				2				4
			PEDESTRIAN				PEDESTRIAN				PEDESTRIAN				PEDESTRIAN				
			3				0				7				2				12
			N-LEG				S-LEG				E-LEG				W-LEG				
			6				3				1				2				12

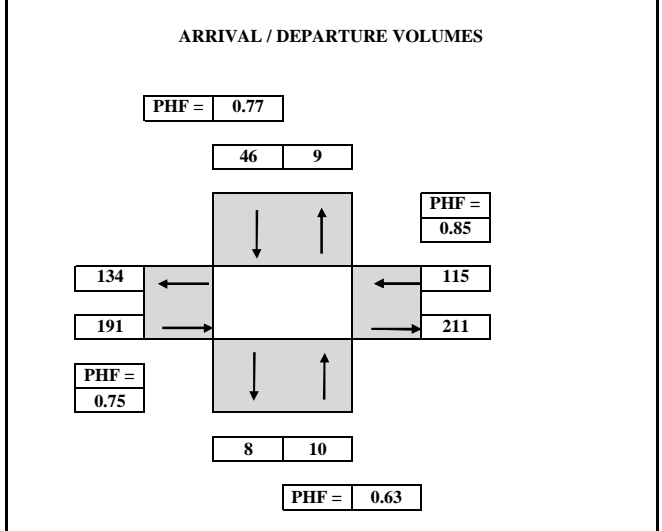
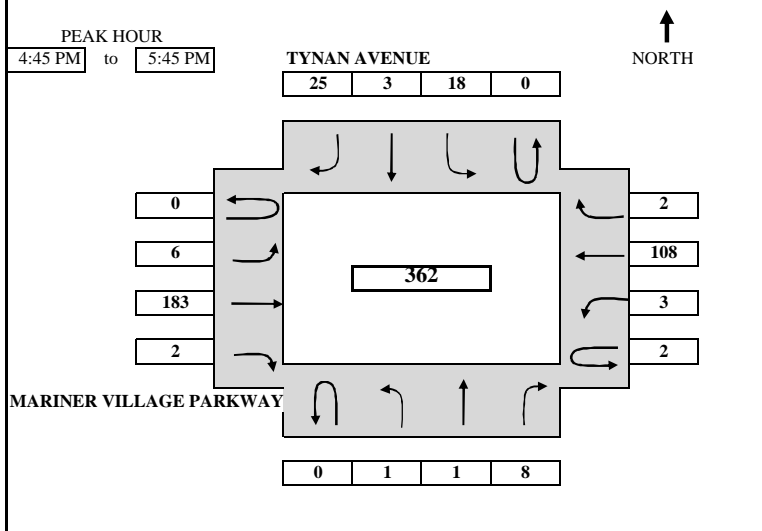
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>TYNAN AVENUE</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MARINER VILLAGE PARKWAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A2)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																
4:00 PM to 4:15 PM	1	0	0	2	1	2	1	37	0	0	0	34	0	78		
4:15 PM to 4:30 PM	2	0	0	3	1	9	3	74	0	1	1	52	0	146		
4:30 PM to 4:45 PM	2	0	1	8	1	13	4	116	0	1	1	79	1	227		
4:45 PM to 5:00 PM	2	0	2	10	3	20	4	151	0	3	1	102	1	299		
5:00 PM to 5:15 PM	2	0	6	17	3	28	6	213	0	3	2	127	1	408		
5:15 PM to 5:30 PM	3	1	7	21	4	34	9	257	1	3	3	154	3	500		
5:30 PM to 5:45 PM	3	1	9	26	4	38	10	299	2	3	4	187	3	589		
5:45 PM to 6:00 PM	3	1	9	29	4	39	10	335	2	3	4	208	3	650		

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	0	1	0	0	0	2	1	2	0	1	37	0	0	0	34	0	78
4:15 PM to 4:30 PM	0	1	0	0	0	1	0	7	0	2	37	0	1	1	18	0	68
4:30 PM to 4:45 PM	0	0	0	1	0	5	0	4	0	1	42	0	0	0	27	1	81
4:45 PM to 5:00 PM	0	0	0	1	0	2	2	7	0	0	35	0	2	0	23	0	72
5:00 PM to 5:15 PM	0	0	0	4	0	7	0	8	0	2	62	0	0	1	25	0	109
5:15 PM to 5:30 PM	0	1	1	1	0	4	1	6	0	3	44	1	0	1	27	2	92
5:30 PM to 5:45 PM	0	0	0	2	0	5	0	4	0	1	42	1	0	1	33	0	89
5:45 PM to 6:00 PM	0	0	0	0	0	3	0	1	0	0	36	0	0	0	21	0	61

HOURLY TOTALS																	
4:00 PM to 5:00 PM	0	2	0	2	0	10	3	20	0	4	151	0	3	1	102	1	299
4:15 PM to 5:15 PM	0	1	0	6	0	15	2	26	0	5	176	0	3	2	93	1	330
4:30 PM to 5:30 PM	0	1	1	7	0	18	3	25	0	6	183	1	2	2	102	3	354
4:45 PM to 5:45 PM	0	1	1	8	0	18	3	25	0	6	183	2	2	3	108	2	362
5:00 PM to 6:00 PM	0	1	1	7	0	19	1	19	0	6	184	2	0	3	106	2	351

PEAK HOUR SUMMARY																	
4:45 PM to 5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	1	1	8	0	18	3	25	0	6	183	2	2	3	108	2	362
PHF BY MOVEMENT	0.00	0.25	0.25	0.50	0.00	0.64	0.38	0.78	0.00	0.50	0.74	0.50	0.25	0.75	0.82	0.25	OVERALL
PHF BY APPROACH	0.63				0.77				0.75				0.85				0.83
BICYCLE	1				1				3				3				8
PEDESTRIAN	5				0				5				1				11
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	3				3				3				2				11

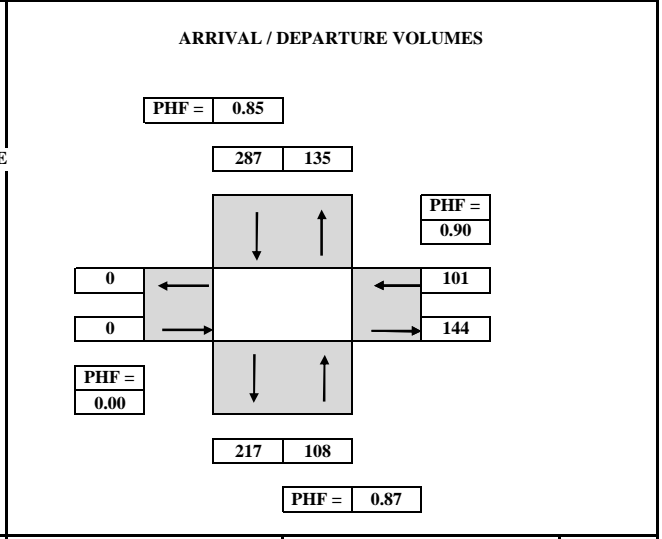
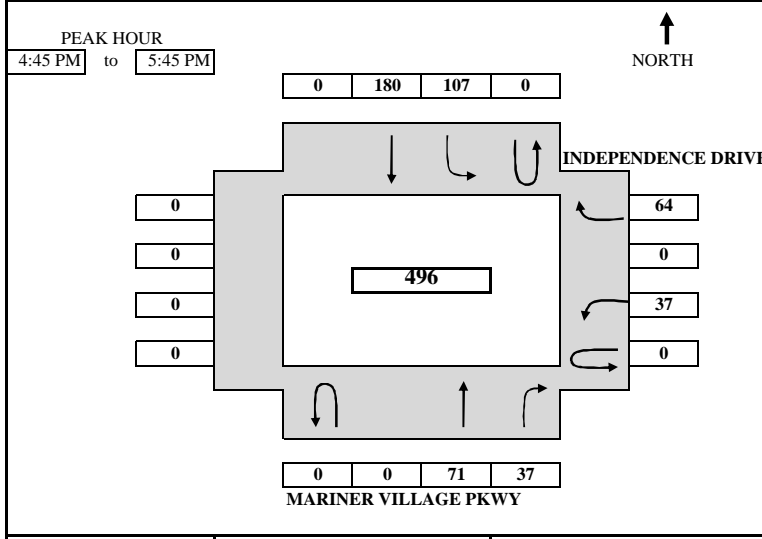
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>MARINER VILLAGE PKWY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>INDEPENDENCE DRIVE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A3)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM			21	3			19	26					10	9	88
4:15 PM	to	4:30 PM			38	16			33	68					14	14	183
4:30 PM	to	4:45 PM			49	26			59	104					22	24	284
4:45 PM	to	5:00 PM			63	35			83	139					33	41	394
5:00 PM	to	5:15 PM			85	44			114	192					43	59	537
5:15 PM	to	5:30 PM			102	51			139	241					51	69	653
5:30 PM	to	5:45 PM			120	63			166	284					59	88	780
5:45 PM	to	6:00 PM			144	68			194	314					69	98	887

TOTAL BY PERIOD																	
4:00 PM	to	4:15 PM	0	0	21	3	0	19	26	0	0	0	0	0	10	9	88
4:15 PM	to	4:30 PM	0	0	17	13	0	14	42	0	0	0	0	0	4	5	95
4:30 PM	to	4:45 PM	0	0	11	10	0	26	36	0	0	0	0	0	8	10	101
4:45 PM	to	5:00 PM	0	0	14	9	0	24	35	0	0	0	0	0	11	17	110
5:00 PM	to	5:15 PM	0	0	22	9	0	31	53	0	0	0	0	0	10	18	143
5:15 PM	to	5:30 PM	0	0	17	7	0	25	49	0	0	0	0	0	8	10	116
5:30 PM	to	5:45 PM	0	0	18	12	0	27	43	0	0	0	0	0	8	19	127
5:45 PM	to	6:00 PM	0	0	24	5	0	28	30	0	0	0	0	0	10	10	107

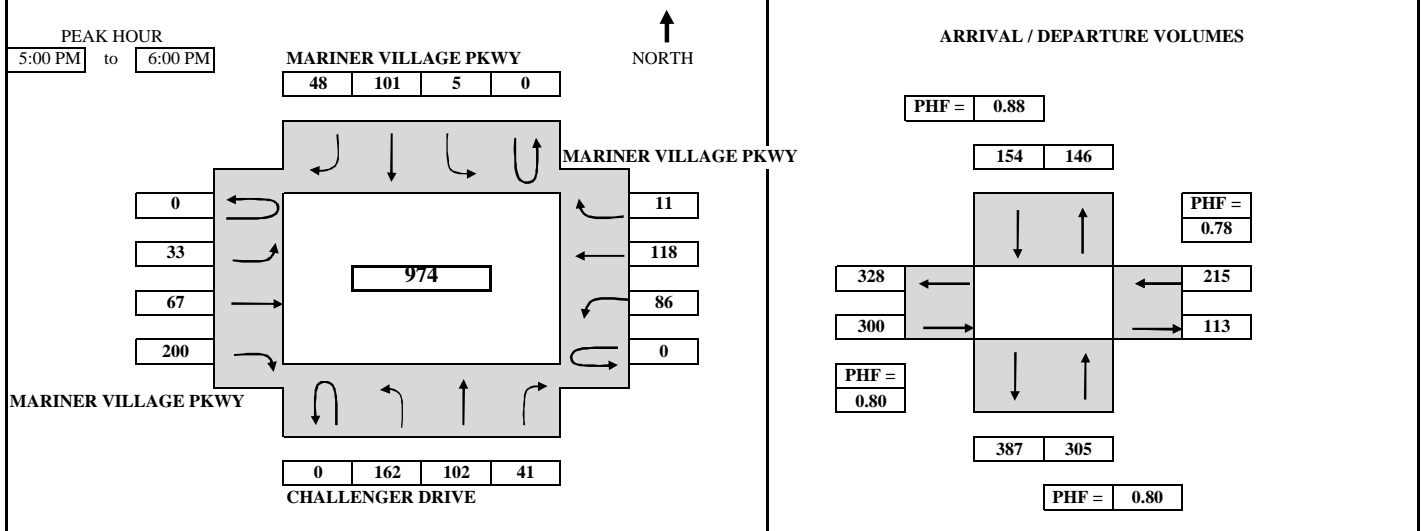
HOURLY TOTALS																	
4:00 PM	to	5:00 PM	0	0	63	35	0	83	139	0	0	0	0	0	33	41	394
4:15 PM	to	5:15 PM	0	0	64	41	0	95	166	0	0	0	0	0	33	50	449
4:30 PM	to	5:30 PM	0	0	64	35	0	106	173	0	0	0	0	0	37	55	470
4:45 PM	to	5:45 PM	0	0	71	37	0	107	180	0	0	0	0	0	37	64	496
5:00 PM	to	6:00 PM	0	0	81	33	0	111	175	0	0	0	0	0	36	57	493

PEAK HOUR SUMMARY																							
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL				
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR					
			0	0	71	37	0	107	180	0	0	0	0	0	0	37	0	64	496				
			0.00	0.00	0.81	0.77	0.00	0.86	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.84	OVERALL				
			PHF BY APPROACH				0.87				0.85				0.90				0.87				
			BICYCLE				2				5				1				8				
			PEDESTRIAN				0				5				1				6				
			N-LEG				S-LEG				E-LEG				W-LEG								
			PEDESTRIAN BY LEG:				0				1				5				0				6

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>CHALLENGER DRIVE</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MARINER VILLAGE PKWY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A4)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																				
4:00 PM to 4:15 PM			34	27	13			2	16	18			3	12	28		12	23	2	190
4:15 PM to 4:30 PM			56	53	24			4	39	26			11	31	79		30	50	3	406
4:30 PM to 4:45 PM			100	77	32			4	69	40			15	46	108		53	69	7	620
4:45 PM to 5:00 PM			135	96	42			6	90	45			21	58	165		69	89	10	826
5:00 PM to 5:15 PM			190	127	51			7	112	60			28	76	205		100	125	12	1093
5:15 PM to 5:30 PM			221	145	64			9	140	74			40	89	274		125	158	15	1354
5:30 PM to 5:45 PM			252	180	74			10	167	85			47	109	320		145	182	19	1590
5:45 PM to 6:00 PM			297	198	83			11	191	93			54	125	365		155	207	21	1800

TOTAL BY PERIOD																						
4:00 PM to 4:15 PM			0	34	27	13		0	2	16	18		0	3	12	28		0	12	23	2	190
4:15 PM to 4:30 PM			0	22	26	11		0	2	23	8		0	8	19	51		0	18	27	1	216
4:30 PM to 4:45 PM			0	44	24	8		0	0	30	14		0	4	15	29		0	23	19	4	214
4:45 PM to 5:00 PM			0	35	19	10		0	2	21	5		0	6	12	57		0	16	20	3	206
5:00 PM to 5:15 PM			0	55	31	9		0	1	22	15		0	7	18	40		0	31	36	2	267
5:15 PM to 5:30 PM			0	31	18	13		0	2	28	14		0	12	13	69		0	25	33	3	261
5:30 PM to 5:45 PM			0	31	35	10		0	1	27	11		0	7	20	46		0	20	24	4	236
5:45 PM to 6:00 PM			0	45	18	9		0	1	24	8		0	7	16	45		0	10	25	2	210

HOURLY TOTALS																						
4:00 PM to 5:00 PM			0	135	96	42		0	6	90	45		0	21	58	165		0	69	89	10	826
4:15 PM to 5:15 PM			0	156	100	38		0	5	96	42		0	25	64	177		0	88	102	10	903
4:30 PM to 5:30 PM			0	165	92	40		0	5	101	48		0	29	58	195		0	95	108	12	948
4:45 PM to 5:45 PM			0	152	103	42		0	6	98	45		0	32	63	212		0	92	113	12	970
5:00 PM to 6:00 PM			0	162	102	41		0	5	101	48		0	33	67	200		0	86	118	11	974

PEAK HOUR SUMMARY																				
5:00 PM to 6:00 PM			NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			0	162	102	41	0	5	101	48	0	33	67	200	0	86	118	11		974
			PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				OVERALL	
			0.00	0.74	0.73	0.79	0.00	0.63	0.90	0.80	0.00	0.69	0.84	0.72	0.00	0.69	0.82	0.69		
			PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH					
			0.80				0.88				0.80				0.78				0.91	
			BICYCLE				BICYCLE				BICYCLE				BICYCLE					
			1				5				1				2				9	
			PEDESTRIAN				PEDESTRIAN				PEDESTRIAN				PEDESTRIAN					
			2				5				3				7				17	
			PEDESTRIAN BY LEG:				PEDESTRIAN BY LEG:				PEDESTRIAN BY LEG:				PEDESTRIAN BY LEG:					
			N-LEG				S-LEG				E-LEG				W-LEG					
			2				8				3				4				17	

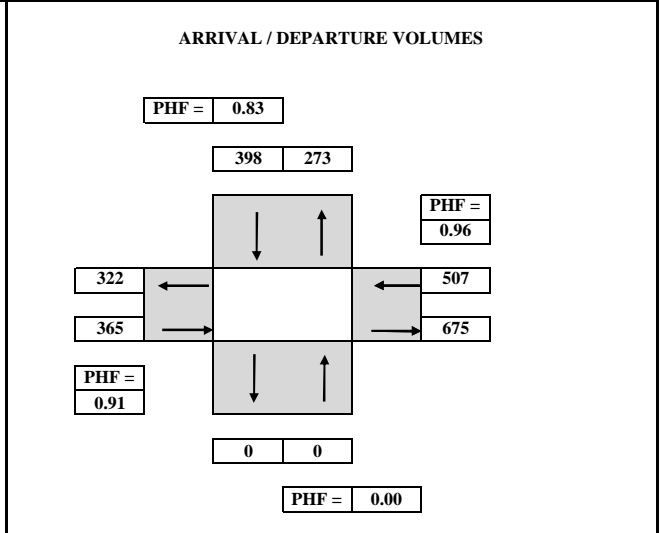
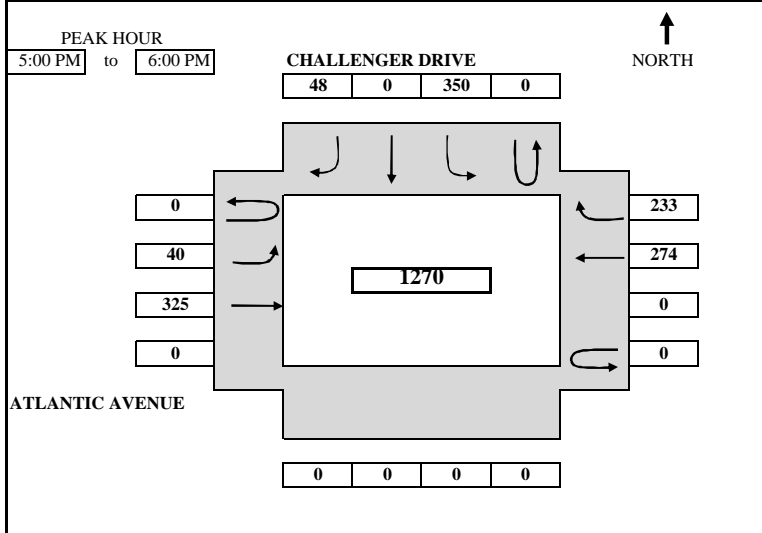
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>CHALLENGER DRIVE</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>ATLANTIC AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A5)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																			
4:00 PM	to	4:15 PM						49		2			18	56			61	54	240
4:15 PM	to	4:30 PM						139		15			31	117			118	96	516
4:30 PM	to	4:45 PM						208		28			45	171			162	150	764
4:45 PM	to	5:00 PM						295		36			54	239			217	195	1036
5:00 PM	to	5:15 PM						386		46			66	324			274	265	1361
5:15 PM	to	5:30 PM						492		60			68	413			350	314	1697
5:30 PM	to	5:45 PM						571		72			76	482			415	372	1988
5:45 PM	to	6:00 PM						645		84			94	564			491	428	2306

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	0	0	0	49	0	2	0	18	56	0	0	0	61	54	240
4:15 PM	to	4:30 PM	0	0	0	0	0	90	0	13	0	13	61	0	0	0	57	42	276
4:30 PM	to	4:45 PM	0	0	0	0	0	69	0	13	0	14	54	0	0	0	44	54	248
4:45 PM	to	5:00 PM	0	0	0	0	0	87	0	8	0	9	68	0	0	0	55	45	272
5:00 PM	to	5:15 PM	0	0	0	0	0	91	0	10	0	12	85	0	0	0	57	70	325
5:15 PM	to	5:30 PM	0	0	0	0	0	106	0	14	0	2	89	0	0	0	76	49	336
5:30 PM	to	5:45 PM	0	0	0	0	0	79	0	12	0	8	69	0	0	0	65	58	291
5:45 PM	to	6:00 PM	0	0	0	0	0	74	0	12	0	18	82	0	0	0	76	56	318

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	0	0	0	0	295	0	36	0	54	239	0	0	0	217	195	1036
4:15 PM	to	5:15 PM	0	0	0	0	0	337	0	44	0	48	268	0	0	0	213	211	1121
4:30 PM	to	5:30 PM	0	0	0	0	0	353	0	45	0	37	296	0	0	0	232	218	1181
4:45 PM	to	5:45 PM	0	0	0	0	0	363	0	44	0	31	311	0	0	0	253	222	1224
5:00 PM	to	6:00 PM	0	0	0	0	0	350	0	48	0	40	325	0	0	0	274	233	1270

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	0	0	0	350	0	48	0	40	325	0	0	0	274	233	1270
			0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.86	0.00	0.56	0.91	0.00	0.00	0.00	0.90	0.83	OVERALL
			PHF BY APPROACH				0.83				0.91				0.96				0.94
			BICYCLE				2				2				6				10
			PEDESTRIAN				5				3				6				14
			N-LEG				S-LEG				E-LEG				W-LEG				
			9				0				2				3				14

TEL: (510) 232 - 1271

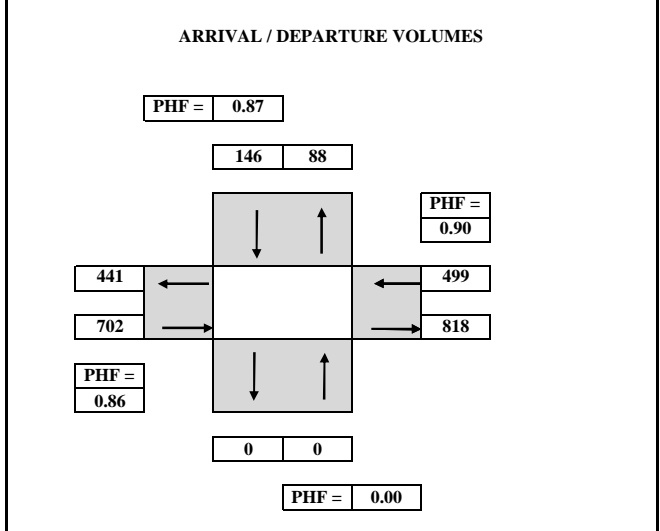
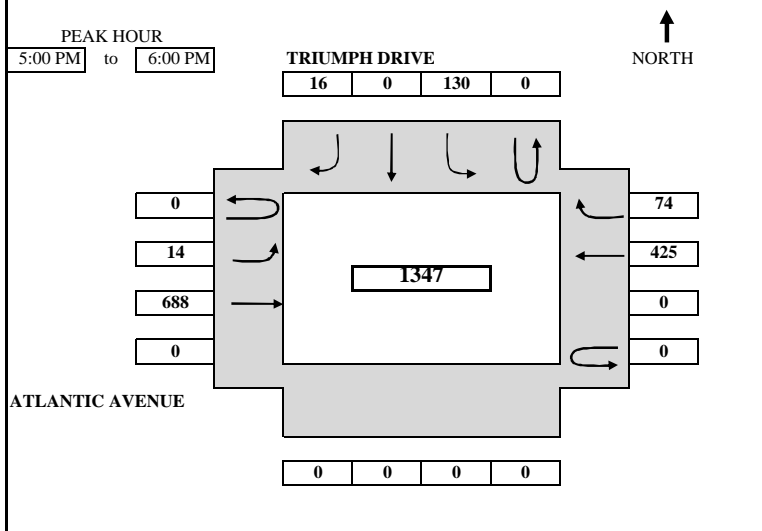
FAX: (510) 232 - 1272



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>TRIUMPH DRIVE</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>ATLANTIC AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A6)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																			
4:00 PM	to	4:15 PM						16		1			5	114			101	13	250
4:15 PM	to	4:30 PM						33		5			5	259			191	23	516
4:30 PM	to	4:45 PM						62		9			7	380			293	38	789
4:45 PM	to	5:00 PM						93		14			11	532			354	56	1060
5:00 PM	to	5:15 PM						131		18			15	733			458	76	1431
5:15 PM	to	5:30 PM						157		22			17	919			547	93	1755
5:30 PM	to	5:45 PM						190		27			21	1072			667	111	2088
5:45 PM	to	6:00 PM						223		30			25	1220			779	130	2407

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	0	0	0	16	0	1	0	5	114	0	0	0	101	13	250
4:15 PM	to	4:30 PM	0	0	0	0	0	17	0	4	0	0	145	0	0	0	90	10	266
4:30 PM	to	4:45 PM	0	0	0	0	0	29	0	4	0	2	121	0	0	0	102	15	273
4:45 PM	to	5:00 PM	0	0	0	0	0	31	0	5	0	4	152	0	0	0	61	18	271
5:00 PM	to	5:15 PM	0	0	0	0	0	38	0	4	0	4	201	0	0	0	104	20	371
5:15 PM	to	5:30 PM	0	0	0	0	0	26	0	4	0	2	186	0	0	0	89	17	324
5:30 PM	to	5:45 PM	0	0	0	0	0	33	0	5	0	4	153	0	0	0	120	18	333
5:45 PM	to	6:00 PM	0	0	0	0	0	33	0	3	0	4	148	0	0	0	112	19	319

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	0	0	0	0	93	0	14	0	11	532	0	0	0	354	56	1060
4:15 PM	to	5:15 PM	0	0	0	0	0	115	0	17	0	10	619	0	0	0	357	63	1181
4:30 PM	to	5:30 PM	0	0	0	0	0	124	0	17	0	12	660	0	0	0	356	70	1239
4:45 PM	to	5:45 PM	0	0	0	0	0	128	0	18	0	14	692	0	0	0	374	73	1299
5:00 PM	to	6:00 PM	0	0	0	0	0	130	0	16	0	14	688	0	0	0	425	74	1347

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	0	0	0	130	0	16	0	14	688	0	0	0	425	74	1347
			0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.80	0.00	0.88	0.86	0.00	0.00	0.00	0.89	0.93	OVERALL
			PHF BY APPROACH				0.87				0.86				0.90				0.91
			BICYCLE				6				5				15				26
			PEDESTRIAN				0				0				0				1
			N-LEG				S-LEG				E-LEG				W-LEG				
			0				0				0				1				1

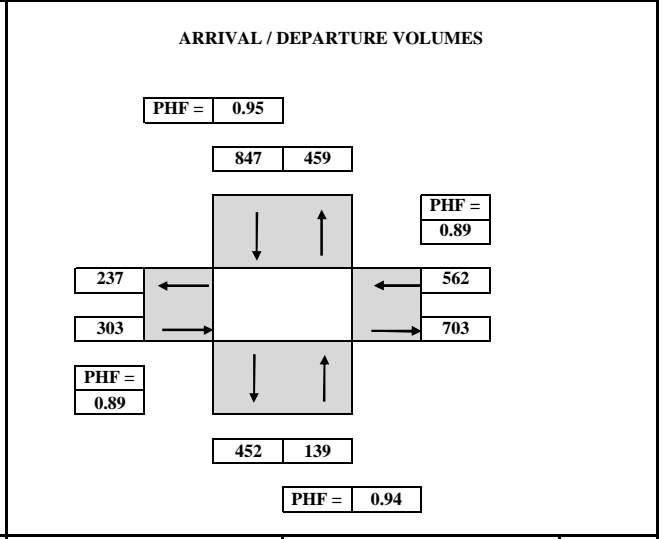
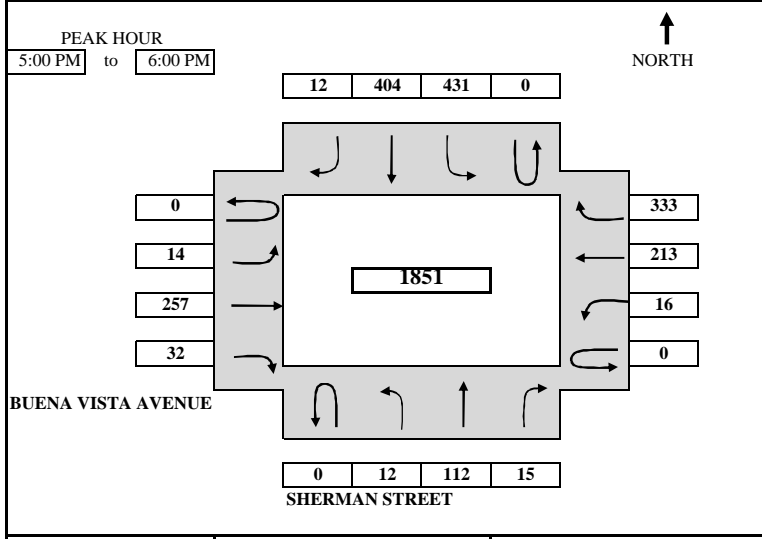
TEL: (510) 232 - 1271

FAX: (510) 232 - 1272

# B. A. Y. M. E. T. R. I. C. S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>SHERMAN STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>BUENA VISTA AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A7)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																
4:00 PM	to	4:15 PM	4	28	2	77	56	1	1	52	2	2	47	78	350	
4:15 PM	to	4:30 PM	5	52	5	172	124	5	5	106	5	7	81	141	708	
4:30 PM	to	4:45 PM	6	77	7	268	203	10	8	162	7	11	118	204	1081	
4:45 PM	to	5:00 PM	6	94	11	374	283	11	9	218	9	14	152	279	1460	
5:00 PM	to	5:15 PM	10	121	17	491	385	14	11	276	16	16	208	352	1917	
5:15 PM	to	5:30 PM	14	149	19	590	506	15	16	345	27	19	256	427	2383	
5:30 PM	to	5:45 PM	14	180	22	704	594	18	19	413	32	24	306	519	2845	
5:45 PM	to	6:00 PM	18	206	26	805	687	23	23	475	41	30	365	612	3311	

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	4	28	2	0	77	56	1	0	1	52	2	0	2	47	78	350
4:15 PM	to	4:30 PM	0	1	24	3	0	95	68	4	0	4	54	3	0	5	34	63	358
4:30 PM	to	4:45 PM	0	1	25	2	0	96	79	5	0	3	56	2	0	4	37	63	373
4:45 PM	to	5:00 PM	0	0	17	4	0	106	80	1	0	1	56	2	0	3	34	75	379
5:00 PM	to	5:15 PM	0	4	27	6	0	117	102	3	0	2	58	7	0	2	56	73	457
5:15 PM	to	5:30 PM	0	4	28	2	0	99	121	1	0	5	69	11	0	3	48	75	466
5:30 PM	to	5:45 PM	0	0	31	3	0	114	88	3	0	3	68	5	0	5	50	92	462
5:45 PM	to	6:00 PM	0	4	26	4	0	101	93	5	0	4	62	9	0	6	59	93	466

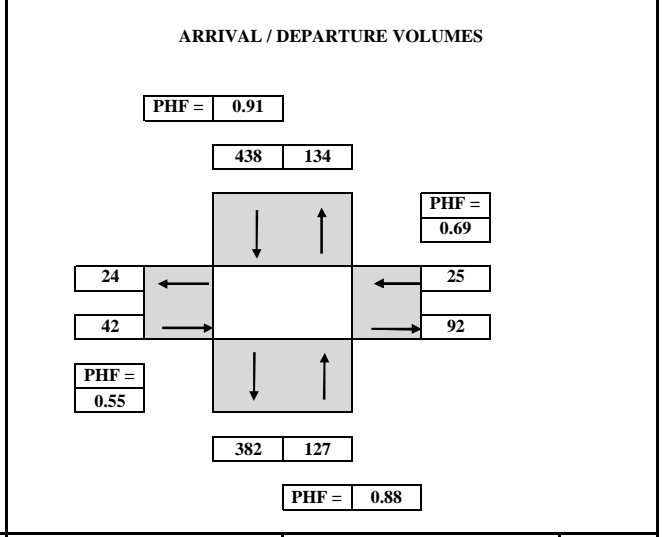
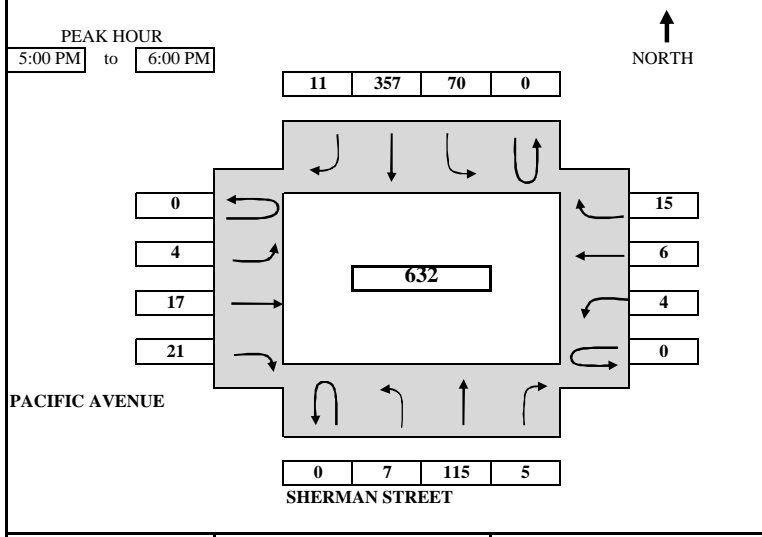
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	6	94	11	0	374	283	11	0	9	218	9	0	14	152	279	1460
4:15 PM	to	5:15 PM	0	6	93	15	0	414	329	13	0	10	224	14	0	14	161	274	1567
4:30 PM	to	5:30 PM	0	9	97	14	0	418	382	10	0	11	239	22	0	12	175	286	1675
4:45 PM	to	5:45 PM	0	8	103	15	0	436	391	8	0	11	251	25	0	13	188	315	1764
5:00 PM	to	6:00 PM	0	12	112	15	0	431	404	12	0	14	257	32	0	16	213	333	1851

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	12	112	15	0	431	404	12	0	14	257	32	0	16	213	333	1851
			PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				PHF BY MOVEMENT				OVERALL
			0.00	0.75	0.90	0.63	0.00	0.92	0.83	0.60	0.00	0.70	0.93	0.73	0.00	0.67	0.90	0.90	
			PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				PHF BY APPROACH				
			0.94				0.95				0.89				0.89				0.99
			BICYCLE				BICYCLE				BICYCLE				BICYCLE				
			4				7				3				5				19
			PEDESTRIAN				PEDESTRIAN				PEDESTRIAN				PEDESTRIAN				
			6				18				13				8				45
			PEDESTRIAN BY LEG:				PEDESTRIAN BY LEG:				PEDESTRIAN BY LEG:				PEDESTRIAN BY LEG:				
			N-LEG				S-LEG				E-LEG				W-LEG				
			3				18				9				15				45

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>SHERMAN STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>PACIFIC AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A8)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																
4:00 PM to 4:15 PM	3	30	2	7	55	0	1	5	4	3	2	7	119			
4:15 PM to 4:30 PM	6	53	3	13	125	4	3	8	9	3	4	11	242			
4:30 PM to 4:45 PM	8	78	5	21	185	5	3	11	10	3	6	12	347			
4:45 PM to 5:00 PM	8	100	5	26	268	10	3	12	19	3	9	17	480			
5:00 PM to 5:15 PM	9	132	8	37	373	12	5	21	27	6	11	18	659			
5:15 PM to 5:30 PM	10	154	9	64	463	15	5	24	31	6	11	27	819			
5:30 PM to 5:45 PM	15	184	10	83	544	18	6	26	37	6	12	30	971			
5:45 PM to 6:00 PM	15	215	10	96	625	21	7	29	40	7	15	32	1112			

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	0	3	30	2	0	7	55	0	0	1	5	4	0	3	2	7	119
4:15 PM to 4:30 PM	0	3	23	1	0	6	70	4	0	2	3	5	0	0	2	4	123
4:30 PM to 4:45 PM	0	2	25	2	0	8	60	1	0	0	3	1	0	0	2	1	105
4:45 PM to 5:00 PM	0	0	22	0	0	5	83	5	0	0	1	9	0	0	3	5	133
5:00 PM to 5:15 PM	0	1	32	3	0	11	105	2	0	2	9	8	0	3	2	1	179
5:15 PM to 5:30 PM	0	1	22	1	0	27	90	3	0	0	3	4	0	0	0	9	160
5:30 PM to 5:45 PM	0	5	30	1	0	19	81	3	0	1	2	6	0	0	1	3	152
5:45 PM to 6:00 PM	0	0	31	0	0	13	81	3	0	1	3	3	0	1	3	2	141

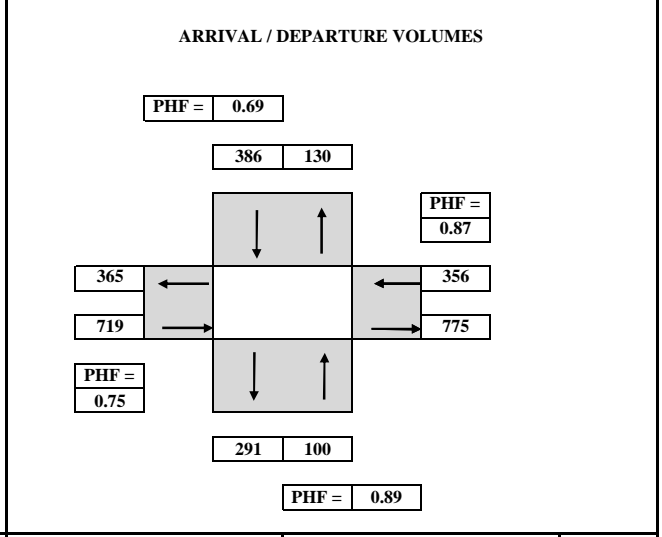
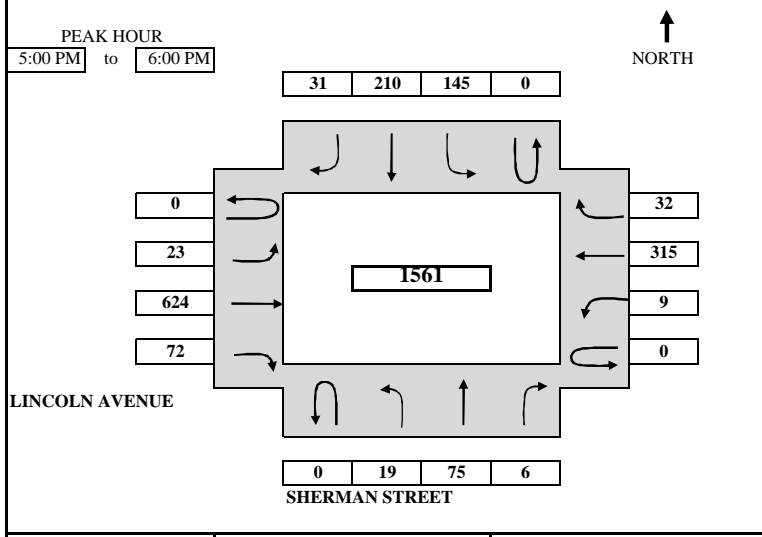
HOURLY TOTALS																	
4:00 PM to 5:00 PM	0	8	100	5	0	26	268	10	0	3	12	19	0	3	9	17	480
4:15 PM to 5:15 PM	0	6	102	6	0	30	318	12	0	4	16	23	0	3	9	11	540
4:30 PM to 5:30 PM	0	4	101	6	0	51	338	11	0	2	16	22	0	3	7	16	577
4:45 PM to 5:45 PM	0	7	106	5	0	62	359	13	0	3	15	27	0	3	6	18	624
5:00 PM to 6:00 PM	0	7	115	5	0	70	357	11	0	4	17	21	0	4	6	15	632

PEAK HOUR SUMMARY																	
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
VOLUME	0	7	115	5	0	70	357	11	0	4	17	21	0	4	6	15	632
PHF BY MOVEMENT	0.00	0.35	0.90	0.42	0.00	0.65	0.85	0.92	0.00	0.50	0.47	0.66	0.00	0.33	0.50	0.42	OVERALL
PHF BY APPROACH	0.88				0.91				0.55				0.69				0.88
BICYCLE	2				10				6				12				30
PEDESTRIAN	9				10				15				7				41
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	5				17				15				4				41

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (CROSSING #1)</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>SHERMAN STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>LINCOLN AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A9)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM to 4:15 PM	4	16	2		14	32	5		5	90	12		2	43	8		233
4:15 PM to 4:30 PM	5	36	4		38	77	11		7	176	19		4	127	12		516
4:30 PM to 4:45 PM	9	48	7		65	116	14		12	290	35		8	78	25		707
4:45 PM to 5:00 PM	11	63	8		104	154	28		13	286	46		9	232	29		983
5:00 PM to 5:15 PM	17	82	11		147	209	33		19	500	66		10	313	38		1445
5:15 PM to 5:30 PM	24	100	14		181	218	42		25	698	84		14	405	44		1849
5:30 PM to 5:45 PM	28	120	14		213	314	53		30	779	101		14	478	54		2198
5:45 PM to 6:00 PM	30	138	14		249	364	59		36	910	118		18	547	61		2544

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	0	4	16	2	0	14	32	5	0	5	90	12	0	2	43	8	233
4:15 PM to 4:30 PM	0	1	20	2	0	24	45	6	0	2	86	7	0	2	84	4	283
4:30 PM to 4:45 PM	0	4	12	3	0	27	39	3	0	5	114	16	0	4	-49	13	191
4:45 PM to 5:00 PM	0	2	15	1	0	39	38	14	0	1	-4	11	0	1	154	4	276
5:00 PM to 5:15 PM	0	6	19	3	0	43	55	5	0	6	214	20	0	1	81	9	462
5:15 PM to 5:30 PM	0	7	18	3	0	34	9	9	0	6	198	18	0	4	92	6	404
5:30 PM to 5:45 PM	0	4	20	0	0	32	96	11	0	5	81	17	0	0	73	10	349
5:45 PM to 6:00 PM	0	2	18	0	0	36	50	6	0	6	131	17	0	4	69	7	346

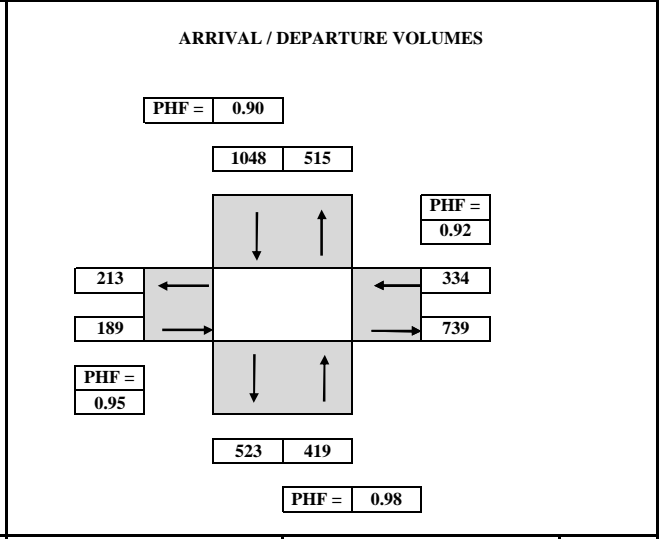
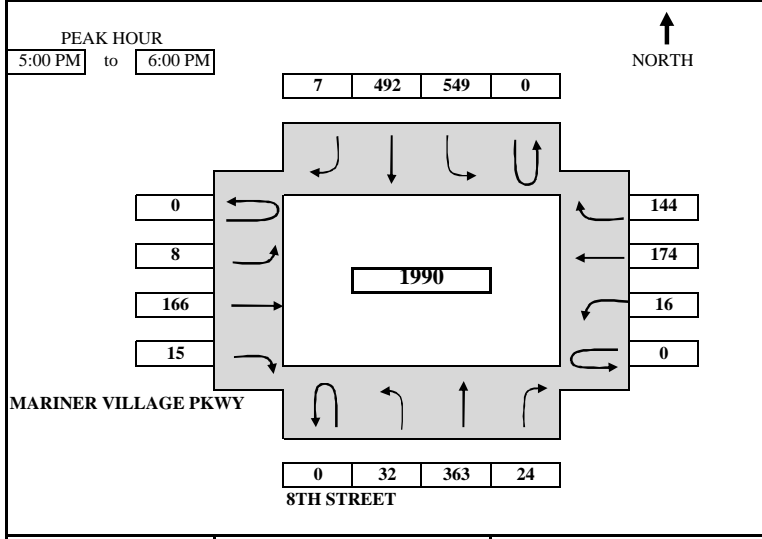
HOURLY TOTALS																	
4:00 PM to 5:00 PM	0	11	63	8	0	104	154	28	0	13	286	46	0	9	232	29	983
4:15 PM to 5:15 PM	0	13	66	9	0	133	177	28	0	14	410	54	0	8	270	30	1212
4:30 PM to 5:30 PM	0	19	64	10	0	143	141	31	0	18	522	65	0	10	278	32	1333
4:45 PM to 5:45 PM	0	19	72	7	0	148	198	39	0	18	489	66	0	6	400	29	1491
5:00 PM to 6:00 PM	0	19	75	6	0	145	210	31	0	23	624	72	0	9	315	32	1561

PEAK HOUR SUMMARY																	
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	19	75	6	0	145	210	31	0	23	624	72	0	9	315	32	1561
PHF BY MOVEMENT	0.00	0.68	0.94	0.50	0.00	0.84	0.55	0.70	0.00	0.96	0.73	0.90	0.00	0.56	0.86	0.80	OVERALL
PHF BY APPROACH	0.89				0.69				0.75				0.87				0.84
BICYCLE	5				5				8				5				23
PEDESTRIAN	13				9				6				5				33
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	4				7				5				17				33

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD</b>	<b>SURVEY DATE:</b>	<b>10/7/2015</b>	<b>DAY:</b>	<b>WEDNESDAY</b>
<b>N-S APPROACH:</b>	<b>8TH STREET - CONSTITUTION WAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>MARINER VILLAGE PKWY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A15)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																
4:00 PM to 4:15 PM	8	81	6	85	116	4	2	42	5	4	32	21	406			
4:15 PM to 4:30 PM	10	152	11	168	232	6	5	78	8	6	75	54	805			
4:30 PM to 4:45 PM	15	234	14	274	370	9	6	122	11	10	107	87	1259			
4:45 PM to 5:00 PM	20	341	19	371	469	12	6	163	15	16	127	112	1671			
5:00 PM to 5:15 PM	24	438	24	514	612	16	7	206	17	23	169	154	2204			
5:15 PM to 5:30 PM	31	530	28	664	748	17	9	242	24	25	210	192	2720			
5:30 PM to 5:45 PM	43	616	37	789	853	18	12	287	26	28	257	222	3188			
5:45 PM to 6:00 PM	52	704	43	920	961	19	14	329	30	32	301	256	3661			

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	0	8	81	6	0	85	116	4	0	2	42	5	0	4	32	21	406
4:15 PM to 4:30 PM	0	2	71	5	0	83	116	2	0	3	36	3	0	2	43	33	399
4:30 PM to 4:45 PM	0	5	82	3	0	106	138	3	0	1	44	3	0	4	32	33	454
4:45 PM to 5:00 PM	0	5	107	5	0	97	99	3	0	0	41	4	0	6	20	25	412
5:00 PM to 5:15 PM	0	4	97	5	0	143	143	4	0	1	43	2	0	7	42	42	533
5:15 PM to 5:30 PM	0	7	92	4	0	150	136	1	0	2	36	7	0	2	41	38	516
5:30 PM to 5:45 PM	0	12	86	9	0	125	105	1	0	3	45	2	0	3	47	30	468
5:45 PM to 6:00 PM	0	9	88	6	0	131	108	1	0	2	42	4	0	4	44	34	473

HOURLY TOTALS																	
4:00 PM to 5:00 PM	0	20	341	19	0	371	469	12	0	6	163	15	0	16	127	112	1671
4:15 PM to 5:15 PM	0	16	357	18	0	429	496	12	0	5	164	12	0	19	137	133	1798
4:30 PM to 5:30 PM	0	21	378	17	0	496	516	11	0	4	164	16	0	19	135	138	1915
4:45 PM to 5:45 PM	0	28	382	23	0	515	483	9	0	6	165	15	0	18	150	135	1929
5:00 PM to 6:00 PM	0	32	363	24	0	549	492	7	0	8	166	15	0	16	174	144	1990

PEAK HOUR SUMMARY																	
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	32	363	24	0	549	492	7	0	8	166	15	0	16	174	144	1990
PHF BY MOVEMENT	0.00	0.67	0.94	0.67	0.00	0.92	0.86	0.44	0.00	0.67	0.92	0.54	0.00	0.57	0.93	0.86	OVERALL
PHF BY APPROACH	0.98				0.90				0.95				0.92				0.93
BICYCLE	0				0				0				1				1
PEDESTRIAN	3				4				14				7				28
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	0				21				5				2				28

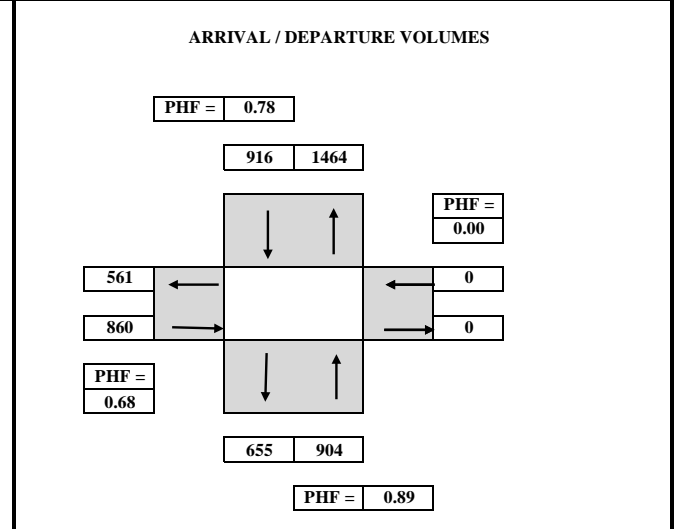
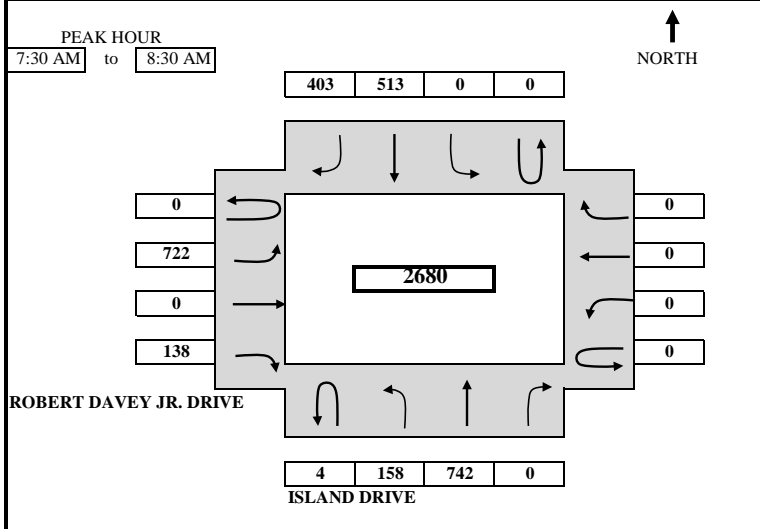
Crossing #2 (Alameda Only)

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# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (# 2 CROSSING)</b>	<b>SURVEY DATE:</b>	<b>10/15/2015</b>	<b>DAY:</b>	<b>THURSSDAY</b>
<b>N-S APPROACH:</b>	<b>ISLAND DRIVE</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>ROBERT DAVEY JR. DRIVE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A1)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	6	114			76	31		100	7					334
7:15 AM	to	7:30 AM	0	12	362			156	83		241	24					878
7:30 AM	to	7:45 AM	0	20	579			225	141		442	34					1441
7:45 AM	to	8:00 AM	1	49	776			352	237		582	47					2044
8:00 AM	to	8:15 AM	1	133	945			519	365		726	84					2773
8:15 AM	to	8:30 AM	4	170	1104			669	486		963	162					3558
8:30 AM	to	8:45 AM	4	185	1248			801	570		1116	192					4116
8:45 AM	to	9:00 AM	4	192	1418			915	641		1252	215					4637

TOTAL BY PERIOD																		
7:00 AM	to	7:15 AM	0	6	114	0	0	76	31	0	100	0	7	0	0	0	0	334
7:15 AM	to	7:30 AM	0	6	248	0	0	80	52	0	141	0	17	0	0	0	0	544
7:30 AM	to	7:45 AM	0	8	217	0	0	69	58	0	201	0	10	0	0	0	0	563
7:45 AM	to	8:00 AM	1	29	197	0	0	127	96	0	140	0	13	0	0	0	0	603
8:00 AM	to	8:15 AM	0	84	169	0	0	167	128	0	144	0	37	0	0	0	0	729
8:15 AM	to	8:30 AM	3	37	159	0	0	150	121	0	237	0	78	0	0	0	0	785
8:30 AM	to	8:45 AM	0	15	144	0	0	132	84	0	153	0	30	0	0	0	0	558
8:45 AM	to	9:00 AM	0	7	170	0	0	114	71	0	136	0	23	0	0	0	0	521

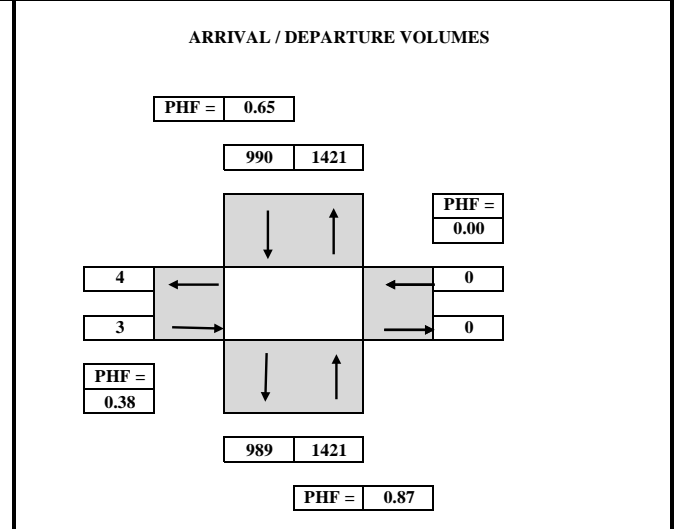
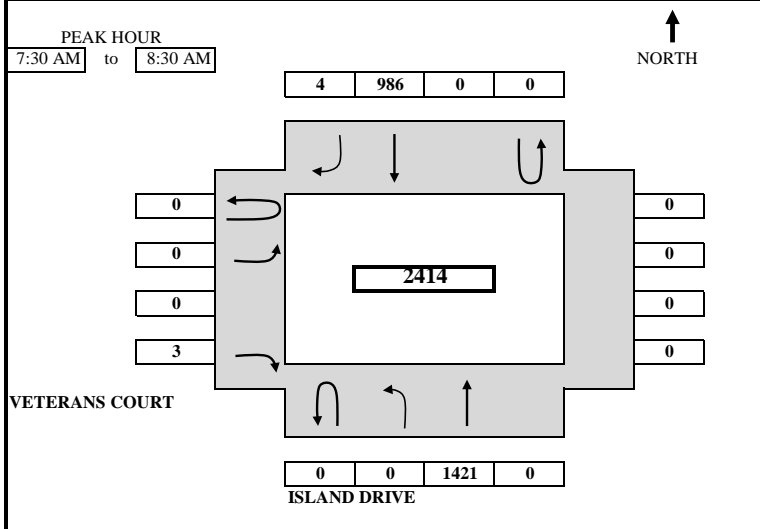
HOURLY TOTALS																		
7:00 AM	to	8:00 AM	1	49	776	0	0	352	237	0	582	0	47	0	0	0	0	2044
7:15 AM	to	8:15 AM	1	127	831	0	0	443	334	0	626	0	77	0	0	0	0	2439
7:30 AM	to	8:30 AM	4	158	742	0	0	513	403	0	722	0	138	0	0	0	0	2680
7:45 AM	to	8:45 AM	4	165	669	0	0	576	429	0	674	0	158	0	0	0	0	2675
8:00 AM	to	9:00 AM	3	143	642	0	0	563	404	0	670	0	168	0	0	0	0	2593

PEAK HOUR SUMMARY																			
7:30 AM	to	8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			4	158	742	0	0	0	513	403	0	722	0	138	0	0	0	0	2680
PHF BY MOVEMENT			0.33	0.47	0.85	0.00	0.00	0.77	0.79	0.00	0.76	0.00	0.44	0.00	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH			0.89				0.78				0.68				0.00				0.85
BICYCLE			2				5				0				0				7
PEDESTRIAN			88				8				1				0				97
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			0				1				0				96				97

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b> EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b> 10/15/2015	<b>DAY:</b> THURSSDAY
<b>N-S APPROACH:</b> ISLAND DRIVE	<b>SURVEY TIME:</b> 7:00 AM	<b>TO</b> 9:00 AM
<b>E-W APPROACH:</b> VETERANS COURT	<b>JURISDICTION:</b> ALAMEDA	<b>FILE:</b> 3510117-(A2)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	221			113	1			0						335
7:15 AM	to	7:30 AM	0	633			275	2			0						910
7:30 AM	to	7:45 AM	0	1040			423	2			1						1466
7:45 AM	to	8:00 AM	0	1377			646	3			1						2027
8:00 AM	to	8:15 AM	0	1683			1025	5			3						2716
8:15 AM	to	8:30 AM	0	2054			1261	6			3						3324
8:30 AM	to	8:45 AM	0	2372			1483	8			4						3867
8:45 AM	to	9:00 AM	0	2679			1681	10			4						4374

TOTAL BY PERIOD																	
7:00 AM	to	7:15 AM	0	0	221	0	0	0	113	1	0	0	0	0	0	0	335
7:15 AM	to	7:30 AM	0	0	412	0	0	0	162	1	0	0	0	0	0	0	575
7:30 AM	to	7:45 AM	0	0	407	0	0	0	148	0	0	0	0	1	0	0	556
7:45 AM	to	8:00 AM	0	0	337	0	0	0	223	1	0	0	0	0	0	0	561
8:00 AM	to	8:15 AM	0	0	306	0	0	0	379	2	0	0	0	2	0	0	689
8:15 AM	to	8:30 AM	0	0	371	0	0	0	236	1	0	0	0	0	0	0	608
8:30 AM	to	8:45 AM	0	0	318	0	0	0	222	2	0	0	0	1	0	0	543
8:45 AM	to	9:00 AM	0	0	307	0	0	0	198	2	0	0	0	0	0	0	507

HOURLY TOTALS																	
7:00 AM	to	8:00 AM	0	0	1377	0	0	0	646	3	0	0	0	1	0	0	2027
7:15 AM	to	8:15 AM	0	0	1462	0	0	0	912	4	0	0	0	3	0	0	2381
7:30 AM	to	8:30 AM	0	0	1421	0	0	0	986	4	0	0	0	3	0	0	2414
7:45 AM	to	8:45 AM	0	0	1332	0	0	0	1060	6	0	0	0	3	0	0	2401
8:00 AM	to	9:00 AM	0	0	1302	0	0	0	1035	7	0	0	0	3	0	0	2347

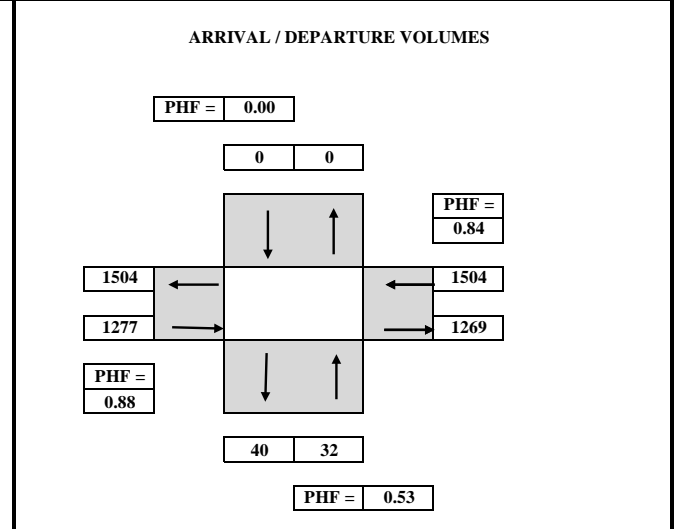
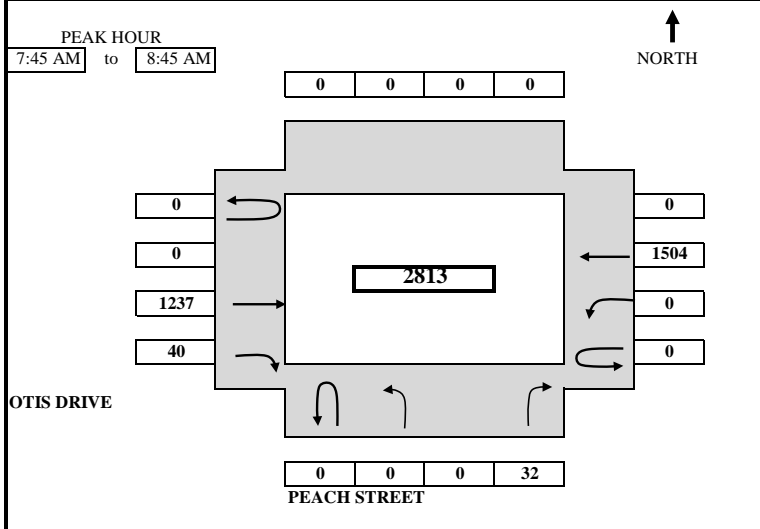
PEAK HOUR SUMMARY																			
7:30 AM	to	8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	0	1421	0	0	0	986	4	0	0	0	3	0	0	0	0	2414
PHF BY MOVEMENT			0.00	0.00	0.87	0.00	0.00	0.00	0.65	0.50	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH			0.87				0.65				0.38				0.00				0.88
BICYCLE			60				1				10				0				71
PEDESTRIAN			1				2				0				0				3
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			0				0				0				3				3



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b> EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b> 10/15/2015	<b>DAY:</b> THURSSDAY
<b>N-S APPROACH:</b> PEACH STREET	<b>SURVEY TIME:</b> 7:00 AM	<b>TO</b> 9:00 AM
<b>E-W APPROACH:</b> OTIS DRIVE	<b>JURISDICTION:</b> ALAMEDA	<b>FILE:</b> 3510117-(A3)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																			
7:00 AM to 7:15 AM					4														367
7:15 AM to 7:30 AM					5														877
7:30 AM to 7:45 AM					7														1545
7:45 AM to 8:00 AM					12														2325
8:00 AM to 8:15 AM					20														3005
8:15 AM to 8:30 AM					24														3636
8:30 AM to 8:45 AM					39														4358
8:45 AM to 9:00 AM					46														4945

TOTAL BY PERIOD																			
7:00 AM to 7:15 AM	0	0	0	0	4	0	0	0	0	0	0	0	175	3	0	0	185	0	367
7:15 AM to 7:30 AM	0	0	0	0	1	0	0	0	0	0	0	0	178	3	0	0	328	0	510
7:30 AM to 7:45 AM	0	0	0	0	2	0	0	0	0	0	0	0	226	3	0	0	437	0	668
7:45 AM to 8:00 AM	0	0	0	0	5	0	0	0	0	0	0	0	320	6	0	0	449	0	780
8:00 AM to 8:15 AM	0	0	0	0	8	0	0	0	0	0	0	0	356	7	0	0	309	0	680
8:15 AM to 8:30 AM	0	0	0	0	4	0	0	0	0	0	0	0	287	11	0	0	329	0	631
8:30 AM to 8:45 AM	0	0	0	0	15	0	0	0	0	0	0	0	274	16	0	0	417	0	722
8:45 AM to 9:00 AM	0	0	0	0	7	0	0	0	0	0	0	0	232	5	0	0	343	0	587

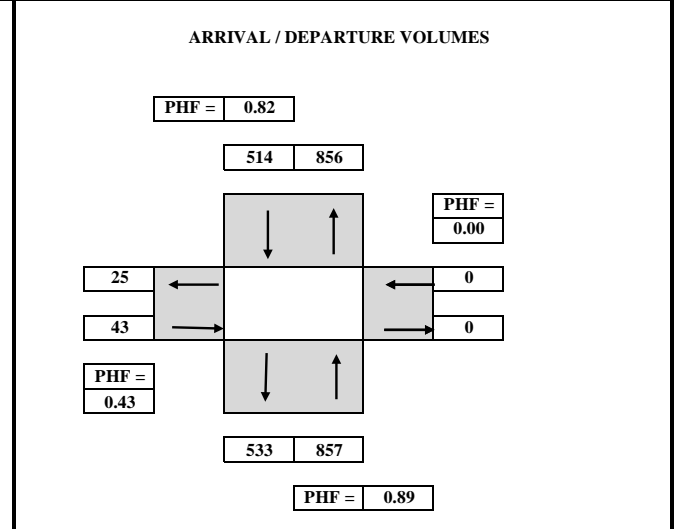
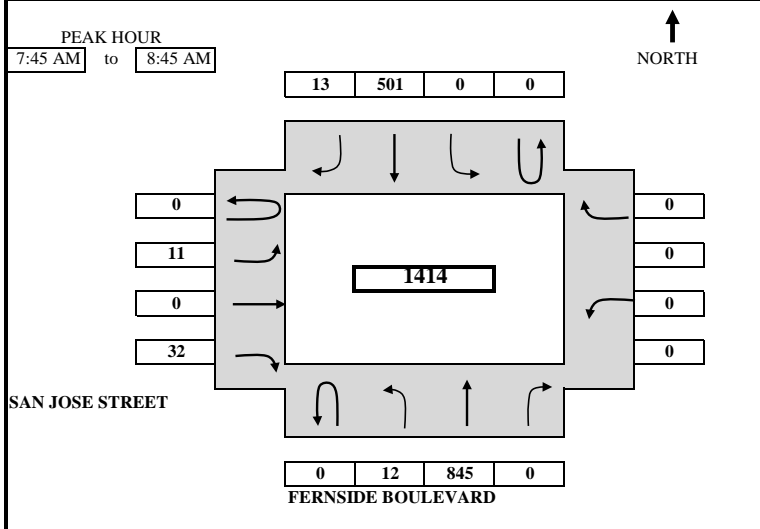
HOURLY TOTALS																			
7:00 AM to 8:00 AM	0	0	0	0	12	0	0	0	0	0	0	0	899	15	0	0	1399	0	2325
7:15 AM to 8:15 AM	0	0	0	0	16	0	0	0	0	0	0	0	1080	19	0	0	1523	0	2638
7:30 AM to 8:30 AM	0	0	0	0	19	0	0	0	0	0	0	0	1189	27	0	0	1524	0	2759
7:45 AM to 8:45 AM	0	0	0	0	32	0	0	0	0	0	0	0	1237	40	0	0	1504	0	2813
8:00 AM to 9:00 AM	0	0	0	0	34	0	0	0	0	0	0	0	1149	39	0	0	1398	0	2620

PEAK HOUR SUMMARY																		
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	0	0	32	0	0	0	0	0	0	1237	40	0	0	1504	0	2813	
PHF BY MOVEMENT	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.63	0.00	0.00	0.84	0.00	OVERALL	
PHF BY APPROACH	0.53				0.00				0.88				0.84				0.90	
BICYCLE	0				0				3				2				5	
PEDESTRIAN	0				0				1				2				3	
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG					
	0				3				0				0				3	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (#2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	FERNside BOULEVARD	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	SAN JOSE STREET	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A10)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM	0	151	0		79	1			1	2			0	0	0	0	234
7:15 AM to 7:30 AM	3	337	1		167	2			2	4			0	0	0	0	516
7:30 AM to 7:45 AM	5	520	1		262	7			4	8			0	0	0	1	808
7:45 AM to 8:00 AM	7	722	1		413	13			6	15			0	0	0	1	1178
8:00 AM to 8:15 AM	10	903	1		546	18			15	31			0	0	0	1	1525
8:15 AM to 8:30 AM	12	1143	1		647	20			15	36			0	0	0	1	1875
8:30 AM to 8:45 AM	17	1365	1		763	20			15	40			0	0	0	1	2222
8:45 AM to 9:00 AM	21	1577	1		887	20			15	47			0	0	0	1	2569

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	151	0	0	0	79	1	0	1	0	2	0	0	0	0	234
7:15 AM to 7:30 AM	0	3	186	1	0	0	88	1	0	1	0	2	0	0	0	0	282
7:30 AM to 7:45 AM	0	2	183	0	0	0	95	5	0	2	0	4	0	0	0	1	292
7:45 AM to 8:00 AM	0	2	202	0	0	0	151	6	0	2	0	7	0	0	0	0	370
8:00 AM to 8:15 AM	0	3	181	0	0	0	133	5	0	9	0	16	0	0	0	0	347
8:15 AM to 8:30 AM	0	2	240	0	0	0	101	2	0	0	0	5	0	0	0	0	350
8:30 AM to 8:45 AM	0	5	222	0	0	0	116	0	0	0	0	4	0	0	0	0	347
8:45 AM to 9:00 AM	0	4	212	0	0	0	124	0	0	0	0	7	0	0	0	0	347

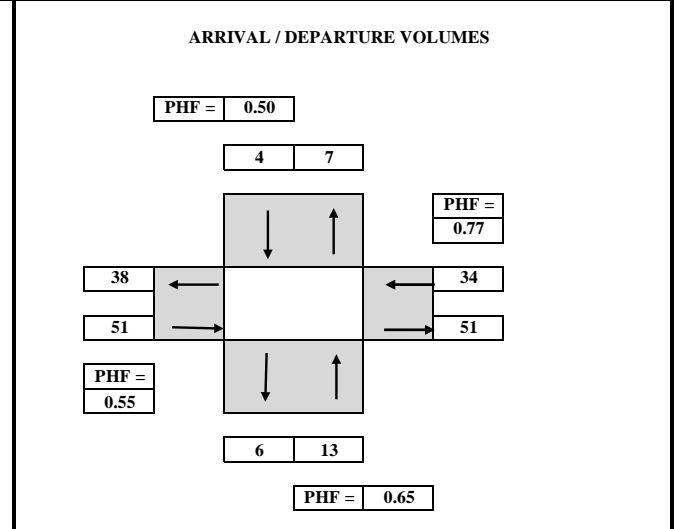
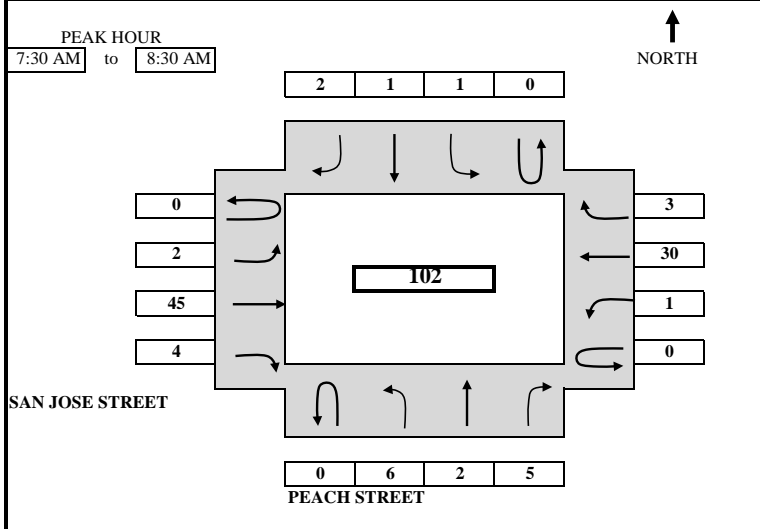
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	7	722	1	0	0	413	13	0	6	0	15	0	0	0	1	1178
7:15 AM to 8:15 AM	0	10	752	1	0	0	467	17	0	14	0	29	0	0	0	1	1291
7:30 AM to 8:30 AM	0	9	806	0	0	0	480	18	0	13	0	32	0	0	0	1	1359
7:45 AM to 8:45 AM	0	12	845	0	0	0	501	13	0	11	0	32	0	0	0	0	1414
8:00 AM to 9:00 AM	0	14	855	0	0	0	474	7	0	9	0	32	0	0	0	0	1391

PEAK HOUR SUMMARY																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	12	845	0	0	0	501	13	0	11	0	32	0	0	0	0	1414
PHF BY MOVEMENT	0.00	0.60	0.88	0.00	0.00	0.00	0.83	0.54	0.00	0.31	0.00	0.50	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH	0.89				0.82				0.43				0.00				0.96
BICYCLE	11				18				2				1				32
PEDESTRIAN	4				42				181				5				232
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	0				186				0				46				232

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (#2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	PEACH STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	SAN JOSE STREET	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A4)AM

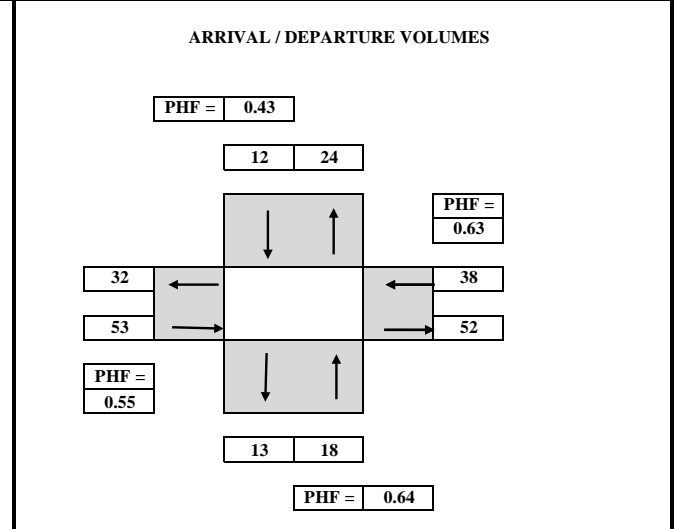
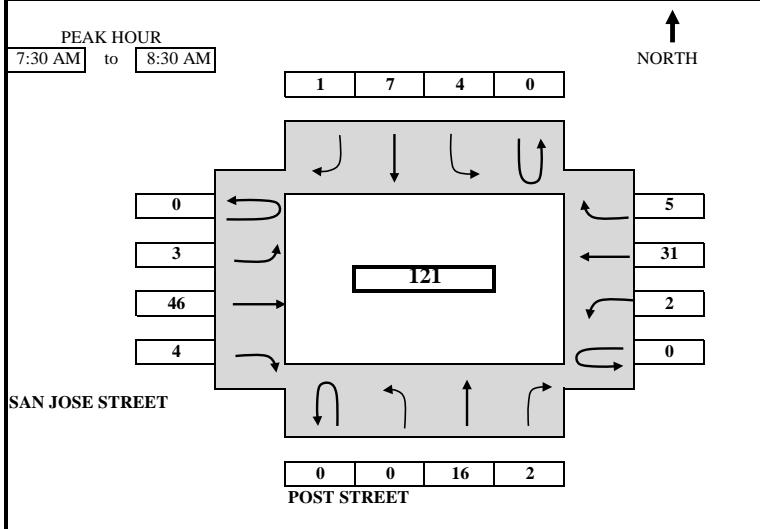


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
7:00 AM to 7:15 AM	2	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	6
7:15 AM to 7:30 AM	4	0	1	0	0	0	0	0	1	4	0	0	0	3	0	0	13
7:30 AM to 7:45 AM	5	1	1	0	0	0	0	0	2	4	2	0	0	10	2	0	27
7:45 AM to 8:00 AM	9	1	2	0	0	1	1	1	2	25	4	0	1	19	3	0	68
8:00 AM to 8:15 AM	10	2	3	0	1	1	2	2	3	44	4	0	1	29	3	0	103
8:15 AM to 8:30 AM	10	2	6	0	1	1	2	2	3	49	4	0	1	33	3	0	115
8:30 AM to 8:45 AM	11	2	6	0	1	1	3	3	3	56	4	0	1	36	3	0	127
8:45 AM to 9:00 AM	11	2	6	0	1	2	3	3	3	58	4	0	1	41	3	0	135
<b>TOTAL BY PERIOD</b>																	
7:00 AM to 7:15 AM	0	2	0	0	0	0	0	0	0	0	2	0	0	0	2	0	6
7:15 AM to 7:30 AM	0	2	0	1	0	0	0	0	0	1	2	0	0	0	1	0	7
7:30 AM to 7:45 AM	0	1	1	0	0	0	0	0	0	1	0	2	0	0	7	2	14
7:45 AM to 8:00 AM	0	4	0	1	0	0	1	1	0	0	21	2	0	1	9	1	41
8:00 AM to 8:15 AM	0	1	1	1	0	1	0	1	0	1	19	0	0	0	10	0	35
8:15 AM to 8:30 AM	0	0	0	3	0	0	0	0	0	0	5	0	0	0	4	0	12
8:30 AM to 8:45 AM	0	1	0	0	0	0	0	1	0	0	7	0	0	0	3	0	12
8:45 AM to 9:00 AM	0	0	0	0	0	0	1	0	0	0	2	0	0	0	5	0	8
<b>HOURLY TOTALS</b>																	
7:00 AM to 8:00 AM	0	9	1	2	0	0	1	1	0	2	25	4	0	1	19	3	68
7:15 AM to 8:15 AM	0	8	2	3	0	1	1	2	0	3	42	4	0	1	27	3	97
7:30 AM to 8:30 AM	0	6	2	5	0	1	1	2	0	2	45	4	0	1	30	3	102
7:45 AM to 8:45 AM	0	6	1	5	0	1	1	3	0	1	52	2	0	1	26	1	100
8:00 AM to 9:00 AM	0	2	1	4	0	1	1	2	0	1	33	0	0	0	22	0	67
<b>PEAK HOUR SUMMARY</b>																	
7:30 AM to 8:30 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	6	2	5	0	1	1	2	0	2	45	4	0	1	30	3	102
PHF BY MOVEMENT	0.00	0.38	0.50	0.42	0.00	0.25	0.25	0.50	0.00	0.50	0.54	0.50	0.00	0.25	0.75	0.38	OVERALL
PHF BY APPROACH	0.65				0.50				0.55				0.77				0.62
BICYCLE	5				9				20				4				38
PEDESTRIAN	1				3				64				5				73
	<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				
PEDESTRIAN BY LEG:	15				54				3				1				73

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b> EBMUD (#2 CROSSING)	<b>SURVEY DATE:</b> 10/15/2015	<b>DAY:</b> THURSSDAY
<b>N-S APPROACH:</b> POST STREET	<b>SURVEY TIME:</b> 7:00 AM	<b>TO:</b> 9:00 AM
<b>E-W APPROACH:</b> SAN JOSE STREET	<b>JURISDICTION:</b> ALAMEDA	<b>FILE:</b> 3510117-(A9)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
7:00 AM to 7:15 AM	0	1	0		0	0	0		0	1	0		0	4	0		6
7:15 AM to 7:30 AM	0	3	1		0	0	0		0	4	0		0	7	0		15
7:30 AM to 7:45 AM	0	8	1		1	0	0		2	6	1		0	14	0		33
7:45 AM to 8:00 AM	0	11	1		2	3	0		2	28	3		0	26	3		79
8:00 AM to 8:15 AM	0	18	1		4	7	1		2	46	4		2	34	5		124
8:15 AM to 8:30 AM	0	19	3		4	7	1		3	50	4		2	38	5		136
8:30 AM to 8:45 AM	0	19	3		4	7	1		3	56	4		2	42	5		146
8:45 AM to 9:00 AM	0	19	4		4	9	1		3	57	4		3	46	5		155

<b>TOTAL BY PERIOD</b>																	
7:00 AM to 7:15 AM	0	0	1	0	0	0	0	0	0	0	1	0	0	0	4	0	6
7:15 AM to 7:30 AM	0	0	2	1	0	0	0	0	0	0	3	0	0	0	3	0	9
7:30 AM to 7:45 AM	0	0	5	0	0	1	0	0	0	2	2	1	0	0	7	0	18
7:45 AM to 8:00 AM	0	0	3	0	0	1	3	0	0	0	22	2	0	0	12	3	46
8:00 AM to 8:15 AM	0	0	7	0	0	2	4	1	0	0	18	1	0	2	8	2	45
8:15 AM to 8:30 AM	0	0	1	2	0	0	0	0	0	1	4	0	0	0	4	0	12
8:30 AM to 8:45 AM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	4	0	10
8:45 AM to 9:00 AM	0	0	0	1	0	0	2	0	0	0	1	0	0	1	4	0	9

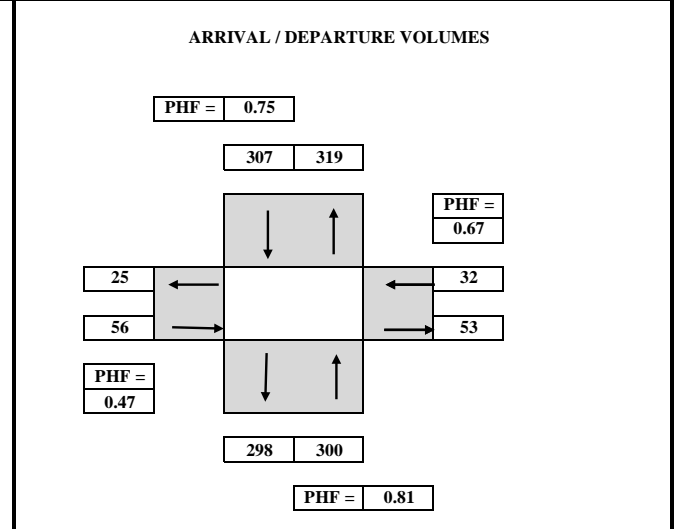
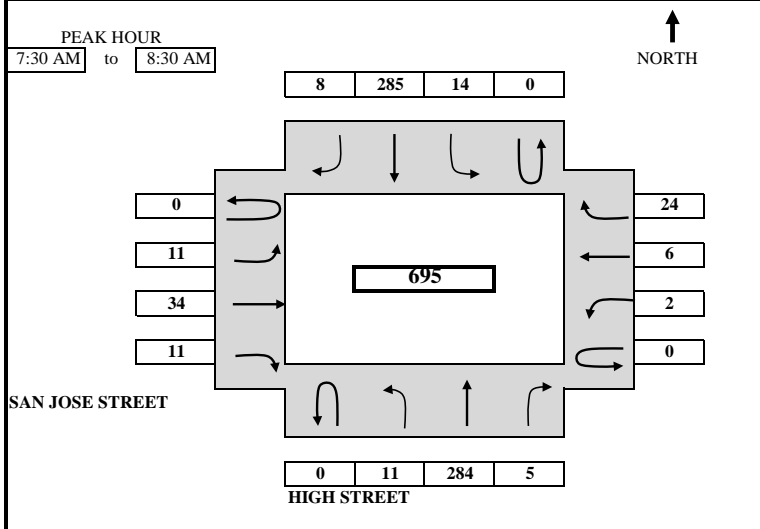
<b>HOURLY TOTALS</b>																	
7:00 AM to 8:00 AM	0	0	11	1	0	2	3	0	0	2	28	3	0	0	26	3	79
7:15 AM to 8:15 AM	0	0	17	1	0	4	7	1	0	2	45	4	0	2	30	5	118
7:30 AM to 8:30 AM	0	0	16	2	0	4	7	1	0	3	46	4	0	2	31	5	121
7:45 AM to 8:45 AM	0	0	11	2	0	3	7	1	0	1	50	3	0	2	28	5	113
8:00 AM to 9:00 AM	0	0	8	3	0	2	6	1	0	1	29	1	0	3	20	2	76

<b>PEAK HOUR SUMMARY</b>																	
7:30 AM to 8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	0	16	2	0	4	7	1	0	3	46	4	0	2	31	5	121
PHF BY MOVEMENT	0.00	0.00	0.57	0.25	0.00	0.50	0.44	0.25	0.00	0.38	0.52	0.50	0.00	0.25	0.65	0.42	OVERALL
PHF BY APPROACH	0.64				0.43				0.55				0.63				0.66
BICYCLE	1				2				14				4				21
PEDESTRIAN	2				3				47				1				53
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	8				40				2				3				53

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b> EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b> 10/15/2015	<b>DAY:</b> THURSSDAY
<b>N-S APPROACH:</b> HIGH STREET	<b>SURVEY TIME:</b> 7:00 AM	<b>TO</b> 9:00 AM
<b>E-W APPROACH:</b> SAN JOSE STREET	<b>JURISDICTION:</b> ALAMEDA	<b>FILE:</b> 3510117-(A5)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU	RIGHT
<b>SURVEY DATA</b>																			
7:00 AM to 7:15 AM			0	31	0		1	33	0		1	0	3		0	1	2		72
7:15 AM to 7:30 AM			0	71	0		1	73	1		3	3	3		0	2	5		162
7:30 AM to 7:45 AM			7	133	0		2	134	2		4	7	4		0	4	10		307
7:45 AM to 8:00 AM			7	203	1		8	204	5		10	25	10		1	6	19		499
8:00 AM to 8:15 AM			8	293	3		14	297	8		12	35	14		2	7	26		719
8:15 AM to 8:30 AM			11	355	5		15	358	9		14	37	14		2	8	29		857
8:30 AM to 8:45 AM			12	404	5		17	419	9		17	41	15		2	9	32		982
8:45 AM to 9:00 AM			15	460	5		17	461	11		19	42	19		3	10	34		1096

<b>TOTAL BY PERIOD</b>																						
7:00 AM to 7:15 AM			0	0	31	0		0	1	33	0		0	1	0	3		0	0	1	2	72
7:15 AM to 7:30 AM			0	0	40	0		0	0	40	1		0	2	3	0		0	0	1	3	90
7:30 AM to 7:45 AM			0	7	62	0		0	1	61	1		0	1	4	1		0	0	2	5	145
7:45 AM to 8:00 AM			0	0	70	1		0	6	70	3		0	6	18	6		0	1	2	9	192
8:00 AM to 8:15 AM			0	1	90	2		0	6	93	3		0	2	10	4		0	1	1	7	220
8:15 AM to 8:30 AM			0	3	62	2		0	1	61	1		0	2	2	0		0	0	1	3	138
8:30 AM to 8:45 AM			0	1	49	0		0	2	61	0		0	3	4	1		0	0	1	3	125
8:45 AM to 9:00 AM			0	3	56	0		0	0	42	2		0	2	1	4		0	1	1	2	114

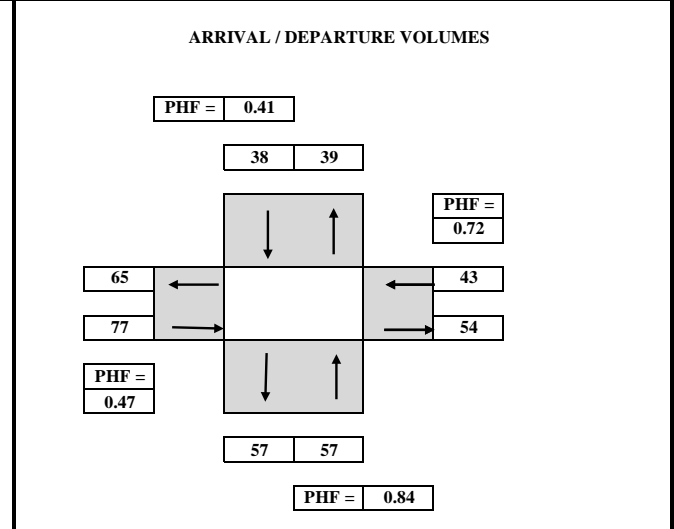
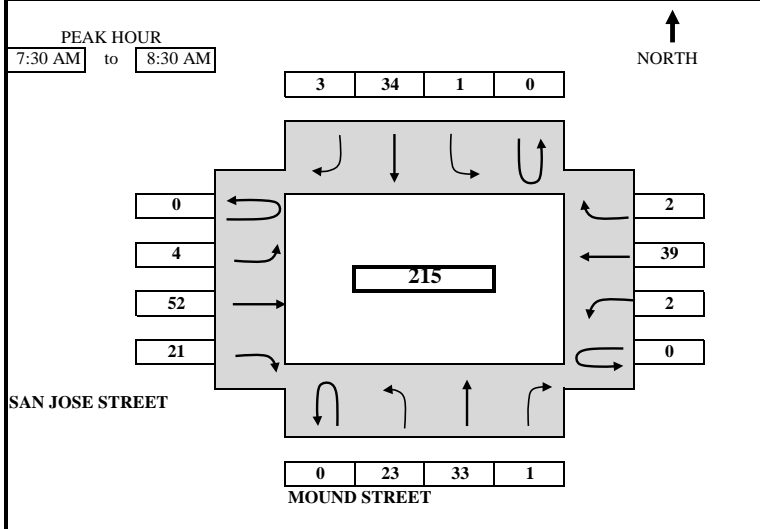
<b>HOURLY TOTALS</b>																						
7:00 AM to 8:00 AM			0	7	203	1		0	8	204	5		0	10	25	10		0	1	6	19	499
7:15 AM to 8:15 AM			0	8	262	3		0	13	264	8		0	11	35	11		0	2	6	24	647
7:30 AM to 8:30 AM			0	11	284	5		0	14	285	8		0	11	34	11		0	2	6	24	695
7:45 AM to 8:45 AM			0	5	271	5		0	15	285	7		0	13	34	11		0	2	5	22	675
8:00 AM to 9:00 AM			0	8	257	4		0	9	257	6		0	9	17	9		0	2	4	15	597

<b>PEAK HOUR SUMMARY</b>																		
7:30 AM to 8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	11	284	5	0	14	285	8	0	11	34	11	0	2	6	24	695	
PHF BY MOVEMENT	0.00	0.39	0.79	0.63	0.00	0.58	0.77	0.67	0.00	0.46	0.47	0.46	0.00	0.50	0.75	0.67	OVERALL	
PHF BY APPROACH	0.81				0.75				0.47				0.67				0.79	
BICYCLE	0				1				8				4				13	
PEDESTRIAN	11				37				51				0				99	
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG					
	7				44				35				13				99	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b> EBMUD (#2 CROSSING)	<b>SURVEY DATE:</b> 10/15/2015	<b>DAY:</b> THURSSDAY
<b>N-S APPROACH:</b> MOUND STREET	<b>SURVEY TIME:</b> 7:00 AM	<b>TO</b> 9:00 AM
<b>E-W APPROACH:</b> SAN JOSE STREET	<b>JURISDICTION:</b> ALAMEDA	<b>FILE:</b> 3510117-(A6)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	1	0	0	0	0	0	0	5	0	0	3	0	9	
7:15 AM	to	7:30 AM	1	3	0	0	1	0	1	10	0	0	8	1	25		
7:30 AM	to	7:45 AM	11	10	0	0	2	1	5	14	0	0	21	1	65		
7:45 AM	to	8:00 AM	14	17	0	0	9	2	5	26	2	1	27	1	104		
8:00 AM	to	8:15 AM	19	26	1	0	31	3	5	54	15	2	33	2	191		
8:15 AM	to	8:30 AM	24	36	1	1	35	3	5	62	21	2	47	3	240		
8:30 AM	to	8:45 AM	27	47	3	1	36	3	6	68	21	2	51	4	269		
8:45 AM	to	9:00 AM	28	53	3	2	36	4	6	74	21	2	55	4	288		

TOTAL BY PERIOD																		
7:00 AM	to	7:15 AM	0	0	1	0	0	0	0	0	5	0	0	0	3	0	9	
7:15 AM	to	7:30 AM	0	1	2	0	0	0	1	0	1	5	0	0	0	5	1	
7:30 AM	to	7:45 AM	0	10	7	0	0	0	1	1	4	4	0	0	0	13	0	
7:45 AM	to	8:00 AM	0	3	7	0	0	0	7	1	0	0	12	2	0	1	6	0
8:00 AM	to	8:15 AM	0	5	9	1	0	0	22	1	0	0	28	13	0	1	6	1
8:15 AM	to	8:30 AM	0	5	10	0	0	1	4	0	0	0	8	6	0	0	14	1
8:30 AM	to	8:45 AM	0	3	11	2	0	0	1	0	0	1	6	0	0	0	4	1
8:45 AM	to	9:00 AM	0	1	6	0	0	1	0	1	0	0	6	0	0	0	4	0

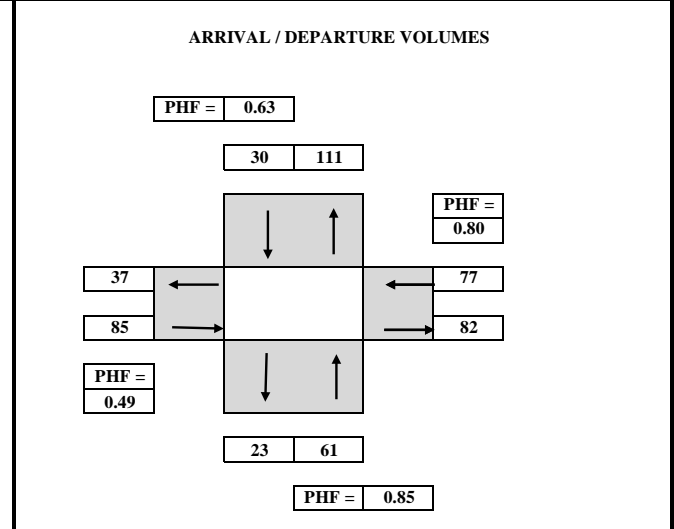
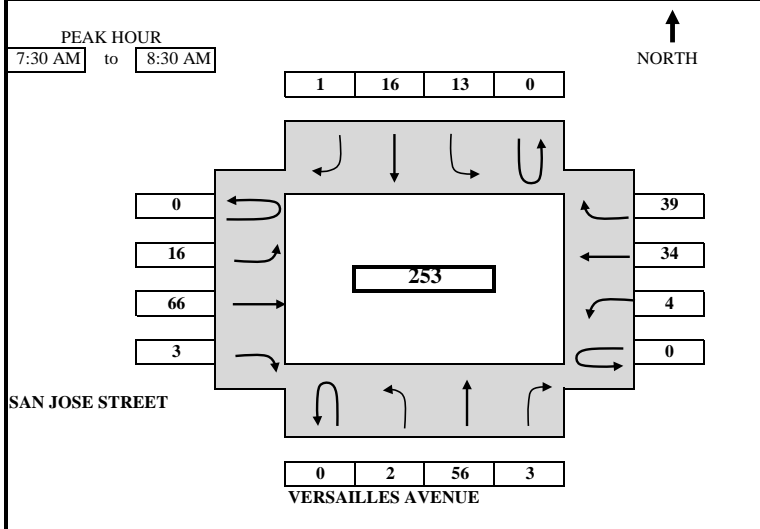
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	14	17	0	0	0	9	2	0	5	26	2	0	1	27	1	104
7:15 AM	to	8:15 AM	0	19	25	1	0	0	31	3	0	5	49	15	0	2	30	2	182
7:30 AM	to	8:30 AM	0	23	33	1	0	1	34	3	0	4	52	21	0	2	39	2	215
7:45 AM	to	8:45 AM	0	16	37	3	0	1	34	2	0	1	54	21	0	2	30	3	204
8:00 AM	to	9:00 AM	0	14	36	3	0	2	27	2	0	1	48	19	0	1	28	3	184

PEAK HOUR SUMMARY																			
7:30 AM	to	8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	23	33	1	0	1	34	3	0	4	52	21	0	2	39	2	215
			PHF BY MOVEMENT				0.00				0.25				0.50				OVERALL
			0.84				0.41				0.47				0.72				0.62
			3				0				24				3				30
			8				14				41				7				70
			N-LEG				S-LEG				E-LEG				W-LEG				
			9				39				9				13				70

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (#2 CROSSING)</b>	<b>SURVEY DATE:</b>	<b>10/15/2015</b>	<b>DAY:</b>	<b>THURSSDAY</b>
<b>N-S APPROACH:</b>	<b>VERSAILLES AVENUE</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>SAN JOSE STREET</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A7)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	2	3	0	0	1	1	0	3	0	0	2	3	15		
7:15 AM	to	7:30 AM	3	8	0	2	4	1	0	6	0	0	5	10	39		
7:30 AM	to	7:45 AM	4	16	0	4	7	1	7	11	0	1	15	21	87		
7:45 AM	to	8:00 AM	4	31	2	9	14	1	13	24	1	2	22	30	153		
8:00 AM	to	8:15 AM	5	47	3	12	17	2	15	63	3	3	27	38	235		
8:15 AM	to	8:30 AM	5	64	3	15	20	2	16	72	3	4	39	49	292		
8:30 AM	to	8:45 AM	7	74	5	15	23	2	17	75	5	5	42	57	327		
8:45 AM	to	9:00 AM	8	81	5	16	25	2	19	80	6	5	53	62	362		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	2	3	0	0	0	1	1	0	0	3	0	0	0	2	3	15
7:15 AM	to	7:30 AM	0	1	5	0	0	2	3	0	0	0	3	0	0	0	3	7	24
7:30 AM	to	7:45 AM	0	1	8	0	0	2	3	0	0	7	5	0	0	1	10	11	48
7:45 AM	to	8:00 AM	0	0	15	2	0	5	7	0	0	6	13	1	0	1	7	9	66
8:00 AM	to	8:15 AM	0	1	16	1	0	3	3	1	0	2	39	2	0	1	5	8	82
8:15 AM	to	8:30 AM	0	0	17	0	0	3	3	0	0	1	9	0	0	1	12	11	57
8:30 AM	to	8:45 AM	0	2	10	2	0	0	3	0	0	1	3	2	0	1	3	8	35
8:45 AM	to	9:00 AM	0	1	7	0	0	1	2	0	0	2	5	1	0	0	11	5	35

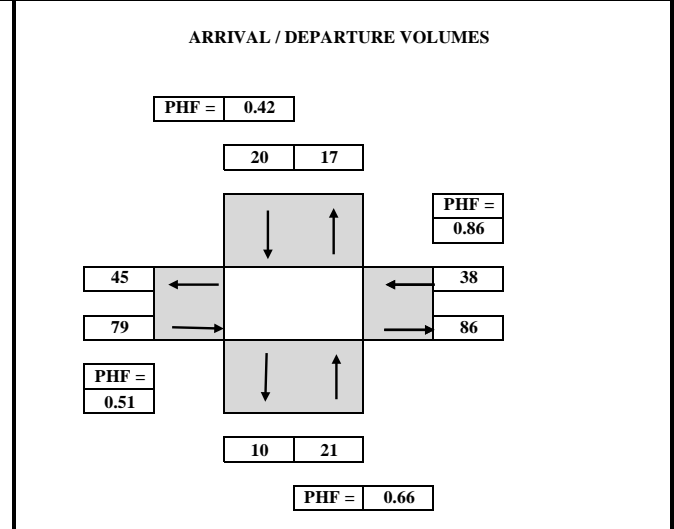
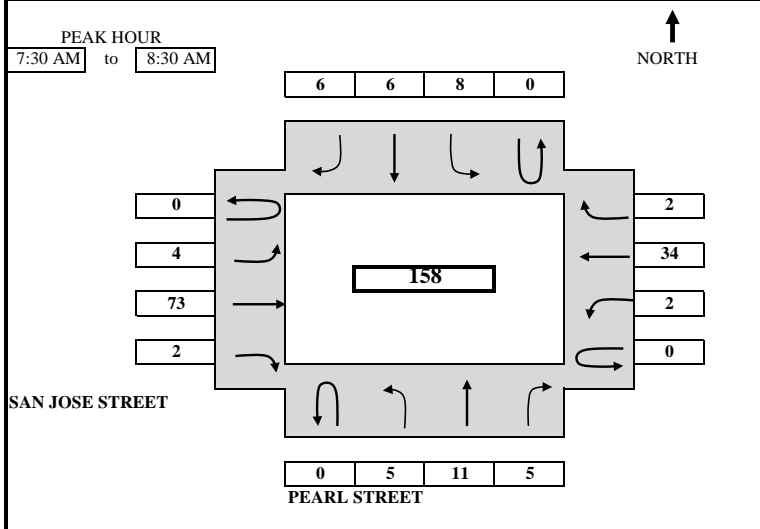
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	4	31	2	0	9	14	1	0	13	24	1	0	2	22	30	153
7:15 AM	to	8:15 AM	0	3	44	3	0	12	16	1	0	15	60	3	0	3	25	35	220
7:30 AM	to	8:30 AM	0	2	56	3	0	13	16	1	0	16	66	3	0	4	34	39	253
7:45 AM	to	8:45 AM	0	3	58	5	0	11	16	1	0	10	64	5	0	4	27	36	240
8:00 AM	to	9:00 AM	0	4	50	3	0	7	11	1	0	6	56	5	0	3	31	32	209

PEAK HOUR SUMMARY																				
7:30 AM	to	8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	0	2	56	3	0	13	16	1	0	16	66	3	0	4	34	39	253
			PHF BY MOVEMENT	0.00	0.50	0.82	0.38	0.00	0.65	0.57	0.25	0.00	0.57	0.42	0.38	0.00	1.00	0.71	0.89	OVERALL
			PHF BY APPROACH	0.85				0.63				0.49				0.80				0.77
			BICYCLE	5				0				7				7				19
			PEDESTRIAN	7				14				58				12				91
			PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
				27				43				5				16				91

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	PEARL STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	SAN JOSE STREET	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A8)AM



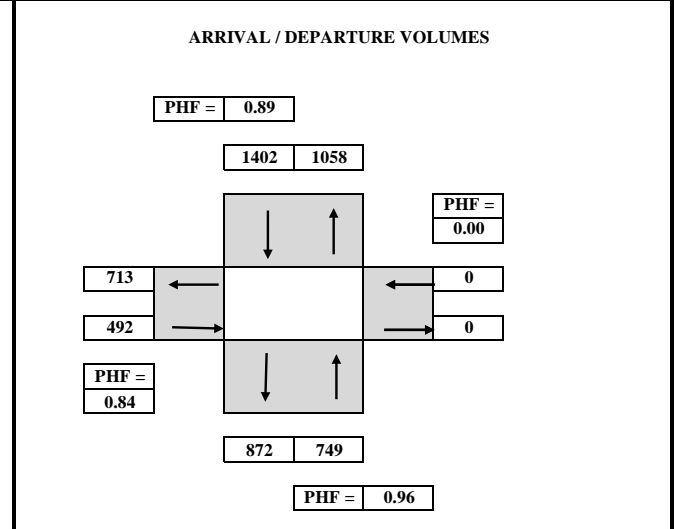
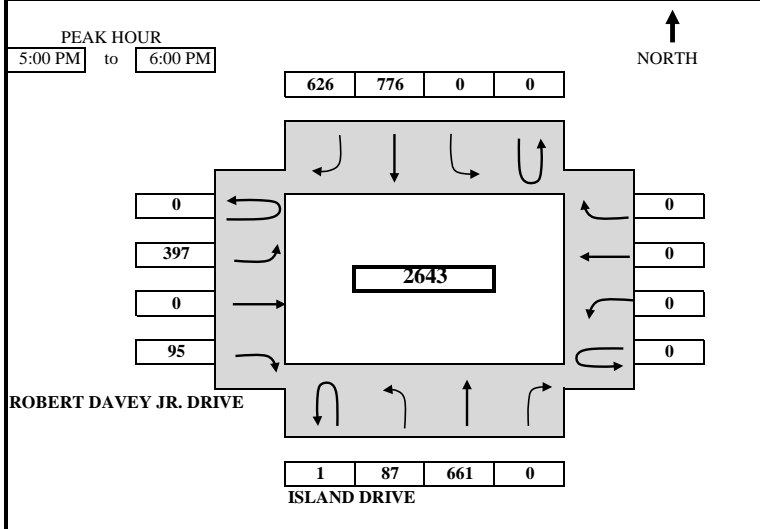
TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU	RIGHT
<b>SURVEY DATA</b>																			
7:00 AM to 7:15 AM			0	0	0		1	0	0		0	2	0		0	5	0		8
7:15 AM to 7:30 AM			1	2	1		1	0	1		0	4	0		0	9	0		19
7:30 AM to 7:45 AM			2	3	1		1	1	3		0	16	0		0	19	0		46
7:45 AM to 8:00 AM			3	5	3		3	1	5		2	32	0		0	27	0		81
8:00 AM to 8:15 AM			4	9	4		9	5	7		3	68	2		1	34	1		147
8:15 AM to 8:30 AM			6	13	6		9	6	7		4	77	2		2	43	2		177
8:30 AM to 8:45 AM			9	18	6		9	9	7		4	82	2		2	49	2		199
8:45 AM to 9:00 AM			10	24	8		11	11	8		4	86	2		3	58	3		228
<b>TOTAL BY PERIOD</b>																			
7:00 AM to 7:15 AM			0	0	0	0	0	1	0	0	0	0	2	0	0	0	5	0	8
7:15 AM to 7:30 AM			0	1	2	1	0	0	1	0	0	2	0	0	0	4	0	0	11
7:30 AM to 7:45 AM			0	1	1	0	0	0	1	2	0	0	12	0	0	0	10	0	27
7:45 AM to 8:00 AM			0	1	2	2	0	2	0	2	0	2	16	0	0	0	8	0	35
8:00 AM to 8:15 AM			0	1	4	1	0	6	4	2	0	1	36	2	0	1	7	1	66
8:15 AM to 8:30 AM			0	2	4	2	0	0	1	0	0	1	9	0	0	1	9	1	30
8:30 AM to 8:45 AM			0	3	5	0	0	0	3	0	0	0	5	0	0	0	6	0	22
8:45 AM to 9:00 AM			0	1	6	2	0	2	2	1	0	0	4	0	0	1	9	1	29
<b>HOURLY TOTALS</b>																			
7:00 AM to 8:00 AM			0	3	5	3	0	3	1	5	0	2	32	0	0	0	27	0	81
7:15 AM to 8:15 AM			0	4	9	4	0	8	5	7	0	3	66	2	0	1	29	1	139
7:30 AM to 8:30 AM			0	5	11	5	0	8	6	6	0	4	73	2	0	2	34	2	158
7:45 AM to 8:45 AM			0	7	15	5	0	8	8	4	0	4	66	2	0	2	30	2	153
8:00 AM to 9:00 AM			0	7	19	5	0	8	10	3	0	2	54	2	0	3	31	3	147
<b>PEAK HOUR SUMMARY</b>																			
7:30 AM to 8:30 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL		
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR			
VOLUME		0	5	11	5	0	8	6	6	0	4	73	2	0	2	34	2	158	
PHF BY MOVEMENT		0.00	0.63	0.69	0.63	0.00	0.33	0.38	0.75	0.00	0.50	0.51	0.25	0.00	0.50	0.85	0.50	OVERALL	
PHF BY APPROACH		0.66				0.42				0.51				0.86				0.60	
BICYCLE		1				0				7				7				15	
PEDESTRIAN		5				6				46				15				72	
		<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>					
PEDESTRIAN BY LEG:		28				33				3				8				72	



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	ISLAND DRIVE	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	ROBERT DAVEY JR. DRIVE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A1)PM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	0	13	133			159	138	0	80	17					540
4:15 PM	to	4:30 PM	0	31	280			311	243	0	148	46					1059
4:30 PM	to	4:45 PM	0	50	417			466	364	0	242	60					1599
4:45 PM	to	5:00 PM	1	74	533			653	492	1	321	73					2148
5:00 PM	to	5:15 PM	1	94	707			841	646	1	440	98					2828
5:15 PM	to	5:30 PM	1	125	871			1017	778	1	528	123					3444
5:30 PM	to	5:45 PM	2	146	1016			1210	945	1	641	156					4117
5:45 PM	to	6:00 PM	2	161	1194			1429	1118	1	718	168					4791

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	13	133	0	0	0	159	138	0	80	0	17	0	0	0	540
4:15 PM	to	4:30 PM	0	18	147	0	0	0	152	105	0	68	0	29	0	0	0	519
4:30 PM	to	4:45 PM	0	19	137	0	0	0	155	121	0	94	0	14	0	0	0	540
4:45 PM	to	5:00 PM	1	24	116	0	0	0	187	128	1	79	0	13	0	0	0	549
5:00 PM	to	5:15 PM	0	20	174	0	0	0	188	154	0	119	0	25	0	0	0	680
5:15 PM	to	5:30 PM	0	31	164	0	0	0	176	132	0	88	0	25	0	0	0	616
5:30 PM	to	5:45 PM	1	21	145	0	0	0	193	167	0	113	0	33	0	0	0	673
5:45 PM	to	6:00 PM	0	15	178	0	0	0	219	173	0	77	0	12	0	0	0	674

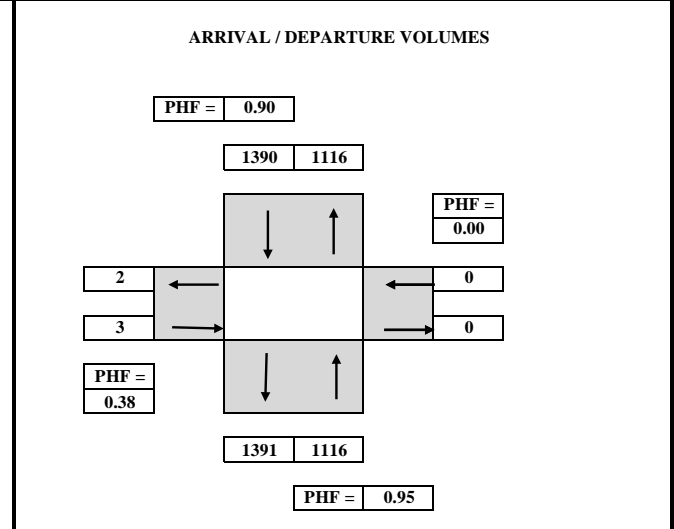
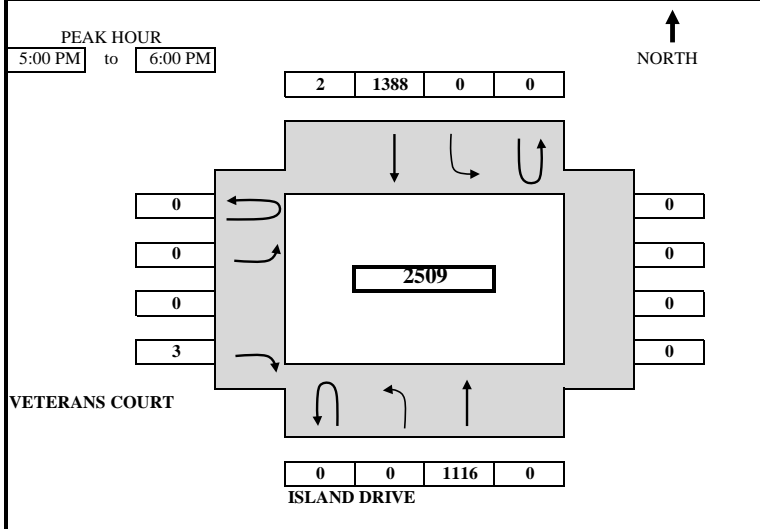
HOURLY TOTALS																		
4:00 PM	to	5:00 PM	1	74	533	0	0	0	653	492	1	321	0	73	0	0	0	2148
4:15 PM	to	5:15 PM	1	81	574	0	0	0	682	508	1	360	0	81	0	0	0	2288
4:30 PM	to	5:30 PM	1	94	591	0	0	0	706	535	1	380	0	77	0	0	0	2385
4:45 PM	to	5:45 PM	2	96	599	0	0	0	744	581	1	399	0	96	0	0	0	2518
5:00 PM	to	6:00 PM	1	87	661	0	0	0	776	626	0	397	0	95	0	0	0	2643

PEAK HOUR SUMMARY																				
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	1	87	661	0	0	0	776	626	0	397	0	95	0	0	0	0	2643
			PHF BY MOVEMENT	0.25	0.70	0.93	0.00	0.00	0.00	0.89	0.90	0.00	0.83	0.00	0.72	0.00	0.00	0.00	0.00	OVERALL
			PHF BY APPROACH	0.96				0.89				0.84				0.00				0.97
			BICYCLE	4				1				1				0				6
			PEDESTRIAN	10				10				0				1				21
			PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
				0				1				0				20				21

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	ISLAND DRIVE	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	VETERANS COURT	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A2)PM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	0	215			313	3			2						533
4:15 PM	to	4:30 PM	0	406			543	3			2						954
4:30 PM	to	4:45 PM	0	690			850	5			3						1548
4:45 PM	to	5:00 PM	0	912			1179	6			6						2103
5:00 PM	to	5:15 PM	0	1205			1505	7			6						2723
5:15 PM	to	5:30 PM	0	1471			1834	8			7						3320
5:30 PM	to	5:45 PM	0	1750			2182	8			9						3949
5:45 PM	to	6:00 PM	0	2028			2567	8			9						4612

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	215	0	0	0	313	3	0	0	0	2	0	0	0	0	533
4:15 PM	to	4:30 PM	0	0	191	0	0	0	230	0	0	0	0	0	0	0	0	0	421
4:30 PM	to	4:45 PM	0	0	284	0	0	0	307	2	0	0	0	1	0	0	0	0	594
4:45 PM	to	5:00 PM	0	0	222	0	0	0	329	1	0	0	0	3	0	0	0	0	555
5:00 PM	to	5:15 PM	0	0	293	0	0	0	326	1	0	0	0	0	0	0	0	0	620
5:15 PM	to	5:30 PM	0	0	266	0	0	0	329	1	0	0	0	1	0	0	0	0	597
5:30 PM	to	5:45 PM	0	0	279	0	0	0	348	0	0	0	0	2	0	0	0	0	629
5:45 PM	to	6:00 PM	0	0	278	0	0	0	385	0	0	0	0	0	0	0	0	0	663

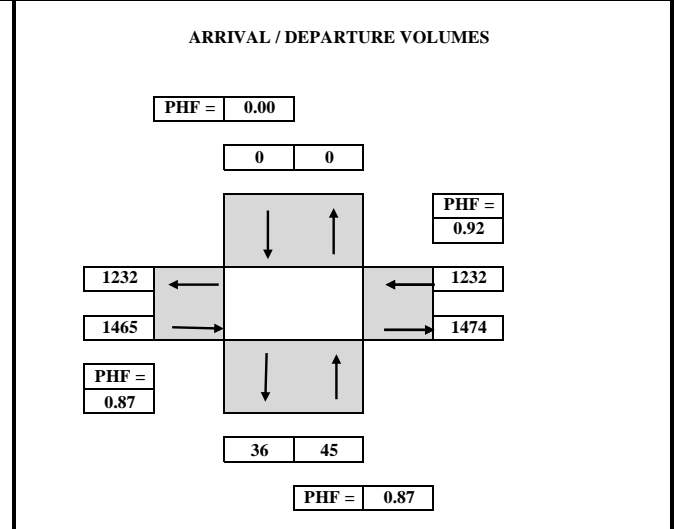
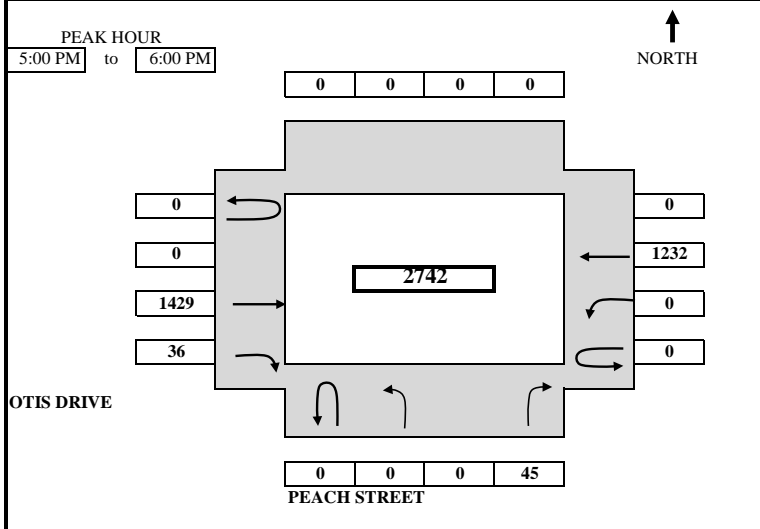
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	0	912	0	0	0	1179	6	0	0	0	6	0	0	0	0	2103
4:15 PM	to	5:15 PM	0	0	990	0	0	0	1192	4	0	0	0	4	0	0	0	0	2190
4:30 PM	to	5:30 PM	0	0	1065	0	0	0	1291	5	0	0	0	5	0	0	0	0	2366
4:45 PM	to	5:45 PM	0	0	1060	0	0	0	1332	3	0	0	0	6	0	0	0	0	2401
5:00 PM	to	6:00 PM	0	0	1116	0	0	0	1388	2	0	0	0	3	0	0	0	0	2509

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	0	1116	0	0	0	1388	2	0	0	0	3	0	0	0	0	2509
			PHF BY MOVEMENT				PHF BY APPROACH				BICYCLE				PEDESTRIAN				OVERALL
			0.00	0.00	0.95	0.00	0.00	0.00	0.90	0.50	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.95
			N-LEG				S-LEG				E-LEG				W-LEG				
			PEDESTRIAN BY LEG:																
			0				0				0				4				4

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	PEACH STREET	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	OTIS DRIVE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A3)PM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
4:00 PM	to	4:15 PM				3							313	5			264	585
4:15 PM	to	4:30 PM				6							597	8			474	1085
4:30 PM	to	4:45 PM				12							905	16			759	1692
4:45 PM	to	5:00 PM				19							1224	20			1035	2298
5:00 PM	to	5:15 PM				30							1579	33			1338	2980
5:15 PM	to	5:30 PM				39							1907	38			1627	3611
5:30 PM	to	5:45 PM				51							2238	50			1961	4300
5:45 PM	to	6:00 PM				64							2653	56			2267	5040

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	0	0	3	0	0	0	0	0	0	313	5	0	0	264	585
4:15 PM	to	4:30 PM	0	0	0	3	0	0	0	0	0	0	284	3	0	0	210	500
4:30 PM	to	4:45 PM	0	0	0	6	0	0	0	0	0	0	308	8	0	0	285	607
4:45 PM	to	5:00 PM	0	0	0	7	0	0	0	0	0	0	319	4	0	0	276	606
5:00 PM	to	5:15 PM	0	0	0	11	0	0	0	0	0	0	355	13	0	0	303	682
5:15 PM	to	5:30 PM	0	0	0	9	0	0	0	0	0	0	328	5	0	0	289	631
5:30 PM	to	5:45 PM	0	0	0	12	0	0	0	0	0	0	331	12	0	0	334	689
5:45 PM	to	6:00 PM	0	0	0	13	0	0	0	0	0	0	415	6	0	0	306	740

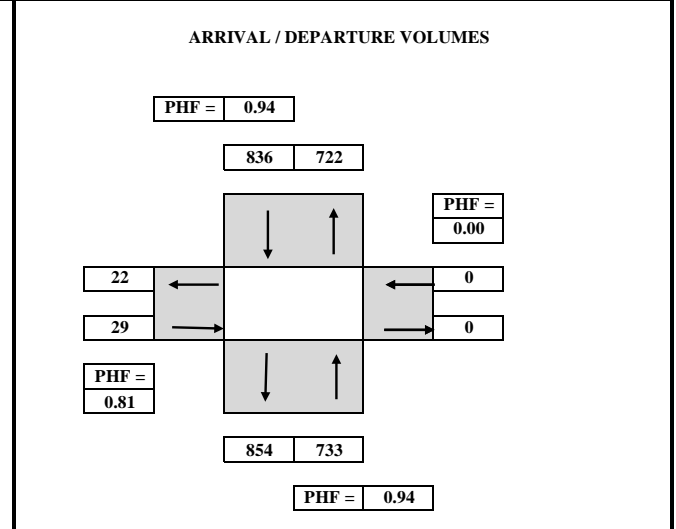
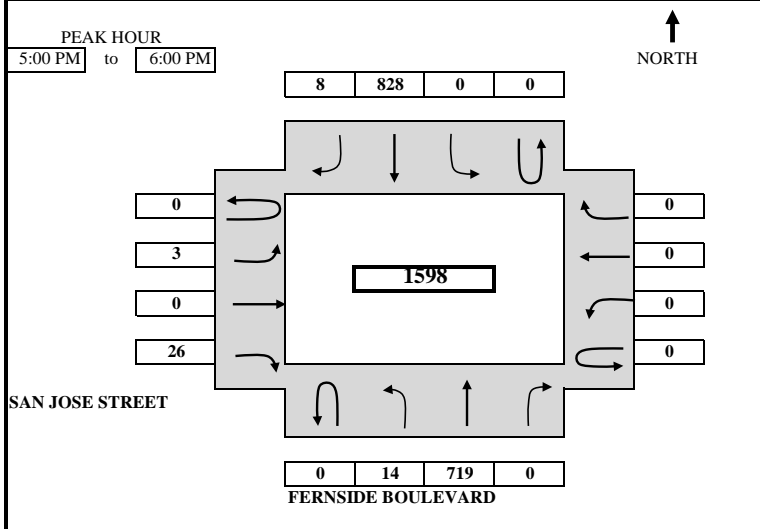
HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	0	0	19	0	0	0	0	0	0	1224	20	0	0	1035	2298
4:15 PM	to	5:15 PM	0	0	0	27	0	0	0	0	0	0	1266	28	0	0	1074	2395
4:30 PM	to	5:30 PM	0	0	0	33	0	0	0	0	0	0	1310	30	0	0	1153	2526
4:45 PM	to	5:45 PM	0	0	0	39	0	0	0	0	0	0	1333	34	0	0	1202	2608
5:00 PM	to	6:00 PM	0	0	0	45	0	0	0	0	0	0	1429	36	0	0	1232	2742

PEAK HOUR SUMMARY																				
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	0	0	0	45	0	0	0	0	0	0	1429	36	0	0	1232	0	2742
			PHF BY MOVEMENT	0.00	0.00	0.00	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.69	0.00	0.00	0.92	0.00	OVERALL
			PHF BY APPROACH	0.87				0.00				0.87				0.92				0.93
			BICYCLE	0				0				1				0				1
			PEDESTRIAN	0				0				1				3				4
			PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
				0				4				0				0				4

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (# 2 CROSSING)</b>	<b>SURVEY DATE:</b>	<b>10/15/2015</b>	<b>DAY:</b>	<b>THURSSDAY</b>
<b>N-S APPROACH:</b>	<b>FERNside BOULEVARD</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>SAN JOSE STREET</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A10)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	1	159			144	1		1	3						309
4:15 PM	to	4:30 PM	5	315			336	1		1	7						665
4:30 PM	to	4:45 PM	7	501			486	1		1	12						1008
4:45 PM	to	5:00 PM	9	653			652	2		3	19						1338
5:00 PM	to	5:15 PM	12	844			842	5		4	25						1732
5:15 PM	to	5:30 PM	15	1020			1056	7		5	30						2133
5:30 PM	to	5:45 PM	19	1206			1258	9		5	39						2536
5:45 PM	to	6:00 PM	23	1372			1480	10		6	45						2936

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	1	159	0	0	144	1	0	1	0	3	0	0	0	0	309
4:15 PM	to	4:30 PM	0	4	156	0	0	192	0	0	0	0	4	0	0	0	0	356
4:30 PM	to	4:45 PM	0	2	186	0	0	150	0	0	0	0	5	0	0	0	0	343
4:45 PM	to	5:00 PM	0	2	152	0	0	166	1	0	2	0	7	0	0	0	0	330
5:00 PM	to	5:15 PM	0	3	191	0	0	190	3	0	1	0	6	0	0	0	0	394
5:15 PM	to	5:30 PM	0	3	176	0	0	214	2	0	1	0	5	0	0	0	0	401
5:30 PM	to	5:45 PM	0	4	186	0	0	202	2	0	0	0	9	0	0	0	0	403
5:45 PM	to	6:00 PM	0	4	166	0	0	222	1	0	1	0	6	0	0	0	0	400

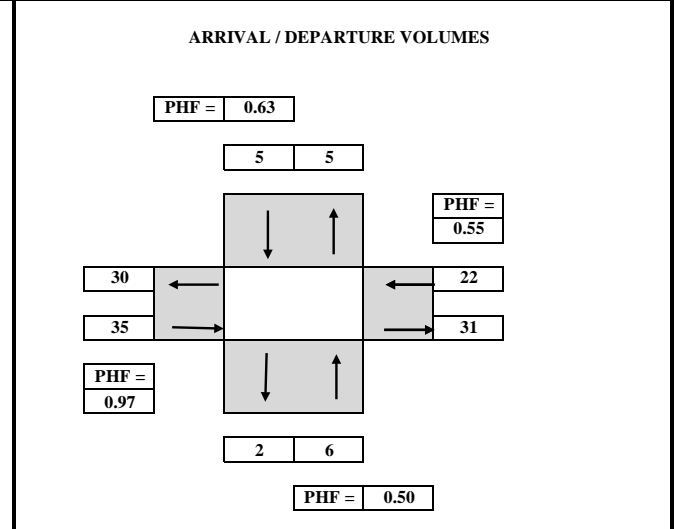
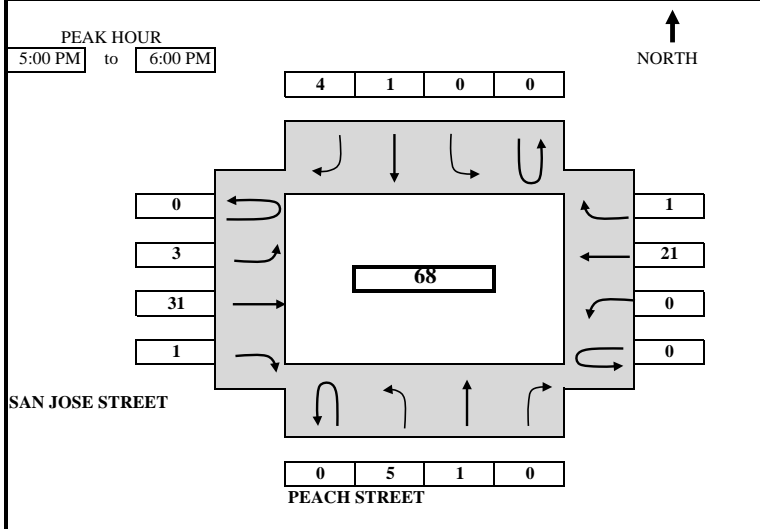
HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	9	653	0	0	652	2	0	3	0	19	0	0	0	0	1338
4:15 PM	to	5:15 PM	0	11	685	0	0	698	4	0	3	0	22	0	0	0	0	1423
4:30 PM	to	5:30 PM	0	10	705	0	0	720	6	0	4	0	23	0	0	0	0	1468
4:45 PM	to	5:45 PM	0	12	705	0	0	772	8	0	4	0	27	0	0	0	0	1528
5:00 PM	to	6:00 PM	0	14	719	0	0	828	8	0	3	0	26	0	0	0	0	1598

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	14	719	0	0	0	828	8	0	3	0	26	0	0	0	0	1598
			PHF BY MOVEMENT				PHF BY APPROACH				BICYCLE				PEDESTRIAN				OVERALL
			0.00	0.88	0.94	0.00	0.00	0.00	0.93	0.67	0.00	0.75	0.00	0.72	0.00	0.00	0.00	0.00	0.99
			N-LEG				S-LEG				E-LEG				W-LEG				
			PEDESTRIAN BY LEG:																
			0				20				0				17				37

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	PEACH STREET	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	SAN JOSE STREET	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A4)PM

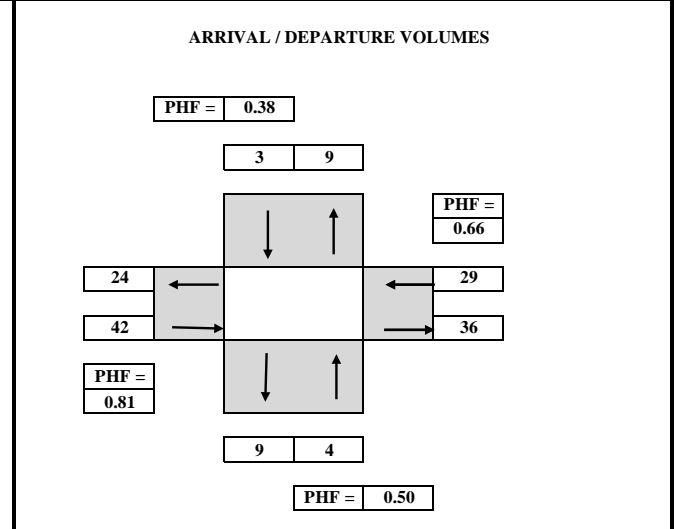
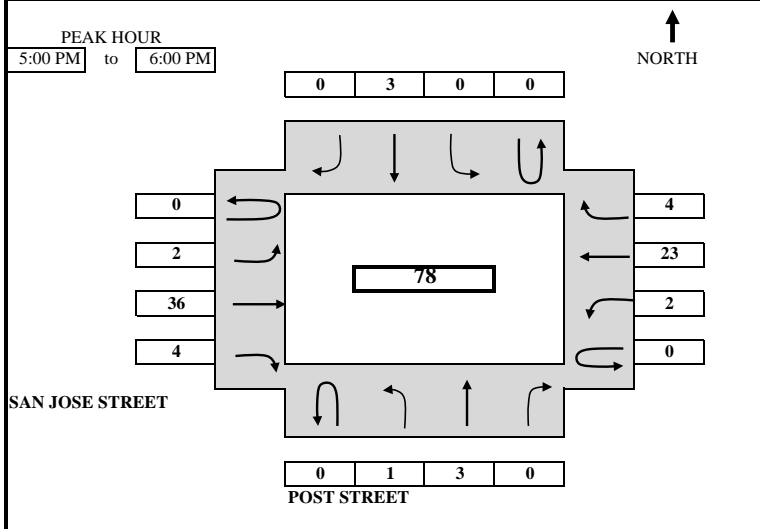


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
4:00 PM to 4:15 PM	0	0	0	0	0	0	0	0	0	9	1	0	0	4	0	0	14
4:15 PM to 4:30 PM	0	0	0	0	0	0	0	0	0	17	1	0	0	7	0	0	25
4:30 PM to 4:45 PM	2	1	0	0	0	0	0	0	0	25	3	0	0	11	0	0	42
4:45 PM to 5:00 PM	5	2	1	0	0	1	0	0	0	28	6	0	0	14	0	0	57
5:00 PM to 5:15 PM	8	2	1	0	0	2	0	0	0	37	6	0	0	17	1	0	74
5:15 PM to 5:30 PM	8	2	1	0	0	2	2	0	2	44	6	0	0	21	1	0	89
5:30 PM to 5:45 PM	8	3	1	0	0	2	3	0	3	51	6	0	0	31	1	0	109
5:45 PM to 6:00 PM	10	3	1	0	0	2	4	0	3	59	7	0	0	35	1	0	125
<b>TOTAL BY PERIOD</b>																	
4:00 PM to 4:15 PM	0	0	0	0	0	0	0	0	0	0	9	1	0	0	4	0	14
4:15 PM to 4:30 PM	0	0	0	0	0	0	0	0	0	0	8	0	0	0	3	0	11
4:30 PM to 4:45 PM	0	2	1	0	0	0	0	0	0	0	8	2	0	0	4	0	17
4:45 PM to 5:00 PM	0	3	1	1	0	0	1	0	0	0	3	3	0	0	3	0	15
5:00 PM to 5:15 PM	0	3	0	0	0	0	1	0	0	0	9	0	0	0	3	1	17
5:15 PM to 5:30 PM	0	0	0	0	0	0	0	2	0	2	7	0	0	0	4	0	15
5:30 PM to 5:45 PM	0	0	1	0	0	0	0	1	0	1	7	0	0	0	10	0	20
5:45 PM to 6:00 PM	0	2	0	0	0	0	0	1	0	0	8	1	0	0	4	0	16
<b>HOURLY TOTALS</b>																	
4:00 PM to 5:00 PM	0	5	2	1	0	0	1	0	0	0	28	6	0	0	14	0	57
4:15 PM to 5:15 PM	0	8	2	1	0	0	2	0	0	0	28	5	0	0	13	1	60
4:30 PM to 5:30 PM	0	8	2	1	0	0	2	2	0	2	27	5	0	0	14	1	64
4:45 PM to 5:45 PM	0	6	2	1	0	0	2	3	0	3	26	3	0	0	20	1	67
5:00 PM to 6:00 PM	0	5	1	0	0	0	1	4	0	3	31	1	0	0	21	1	68
<b>PEAK HOUR SUMMARY</b>																	
5:00 PM to 6:00 PM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	5	1	0	0	0	1	4	0	3	31	1	0	0	21	1	68
PHF BY MOVEMENT	0.00	0.42	0.25	0.00	0.00	0.00	0.25	0.50	0.00	0.38	0.86	0.25	0.00	0.00	0.53	0.25	OVERALL
PHF BY APPROACH	0.50				0.63				0.97				0.55				0.85
BICYCLE	0				0				2				7				9
PEDESTRIAN	0				0				0				1				1
PEDESTRIAN BY LEG:	<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				
	0				1				0				0				1

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (# 2 CROSSING)</b>	<b>SURVEY DATE:</b>	<b>10/15/2015</b>	<b>DAY:</b>	<b>THURSSDAY</b>
<b>N-S APPROACH:</b>	<b>POST STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>SAN JOSE STREET</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A9)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	0	1	0	0	0	0	0	0	10	2	1	3	0	17	
4:15 PM	to	4:30 PM	0	1	0	0	0	0	0	1	18	4	1	5	0	30	
4:30 PM	to	4:45 PM	1	1	0	0	0	0	0	2	29	4	2	10	0	49	
4:45 PM	to	5:00 PM	1	1	0	0	0	0	0	3	34	4	2	16	0	61	
5:00 PM	to	5:15 PM	1	2	0	0	2	0	0	3	43	5	2	20	2	80	
5:15 PM	to	5:30 PM	1	2	0	0	2	0	0	5	52	5	2	24	4	97	
5:30 PM	to	5:45 PM	2	3	0	0	3	0	0	5	60	5	3	34	4	119	
5:45 PM	to	6:00 PM	2	4	0	0	3	0	0	5	70	8	4	39	4	139	

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	0	1	0	0	0	0	0	0	10	2	0	1	3	0	17
4:15 PM	to	4:30 PM	0	0	0	0	0	0	0	0	1	8	2	0	0	2	0	13
4:30 PM	to	4:45 PM	0	1	0	0	0	0	0	0	1	11	0	0	1	5	0	19
4:45 PM	to	5:00 PM	0	0	0	0	0	0	0	0	1	5	0	0	0	6	0	12
5:00 PM	to	5:15 PM	0	0	1	0	0	0	2	0	0	9	1	0	0	4	2	19
5:15 PM	to	5:30 PM	0	0	0	0	0	0	0	0	2	9	0	0	0	4	2	17
5:30 PM	to	5:45 PM	0	1	1	0	0	0	1	0	0	8	0	0	1	10	0	22
5:45 PM	to	6:00 PM	0	0	1	0	0	0	0	0	0	10	3	0	1	5	0	20

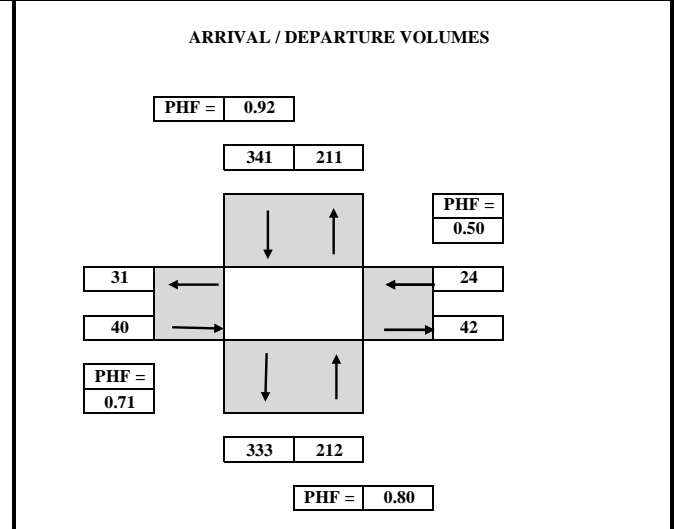
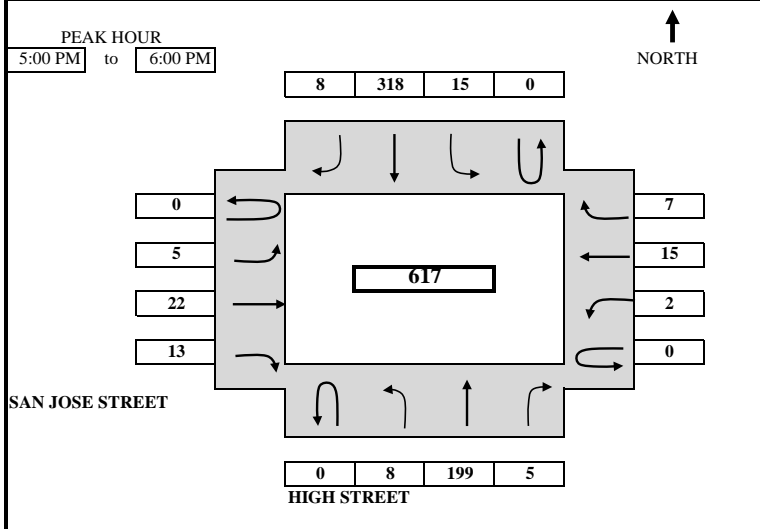
HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	1	1	0	0	0	0	0	3	34	4	0	2	16	0	61
4:15 PM	to	5:15 PM	0	1	1	0	0	0	2	0	0	33	3	0	1	17	2	63
4:30 PM	to	5:30 PM	0	1	1	0	0	0	2	0	0	34	1	0	1	19	4	67
4:45 PM	to	5:45 PM	0	1	2	0	0	0	3	0	0	31	1	0	1	24	4	70
5:00 PM	to	6:00 PM	0	1	3	0	0	0	3	0	0	36	4	0	2	23	4	78

PEAK HOUR SUMMARY																				
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	0	1	3	0	0	0	3	0	0	2	36	4	0	2	23	4	78
			PHF BY MOVEMENT	0.00	0.25	0.75	0.00	0.00	0.00	0.38	0.00	0.00	0.25	0.90	0.33	0.00	0.50	0.58	0.50	OVERALL
			PHF BY APPROACH	0.50				0.38				0.81				0.66				0.89
			BICYCLE	0				2				7				11				
			PEDESTRIAN	4				1				2				4				11
				N-LEG				S-LEG				E-LEG				W-LEG				
			PEDESTRIAN BY LEG:	5				1				3				2				11

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD (# 2 CROSSING)</b>	<b>SURVEY DATE:</b>	<b>10/15/2015</b>	<b>DAY:</b>	<b>THURSSDAY</b>
<b>N-S APPROACH:</b>	<b>HIGH STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>SAN JOSE STREET</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A5)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM to 4:15 PM	0	46	2		5	71	4		2	6	0		1	1	1		139
4:15 PM to 4:30 PM	0	99	2		11	139	5		6	10	0		2	1	2		277
4:30 PM to 4:45 PM	2	135	3		17	215	5		9	15	3		2	5	3		414
4:45 PM to 5:00 PM	2	176	3		20	289	7		9	18	4		2	8	7		545
5:00 PM to 5:15 PM	6	238	3		23	374	8		10	25	10		2	11	8		718
5:15 PM to 5:30 PM	7	281	7		28	460	10		11	28	12		2	13	9		868
5:30 PM to 5:45 PM	10	330	7		30	537	13		12	33	15		2	20	14		1023
5:45 PM to 6:00 PM	10	375	8		35	607	15		14	40	17		4	23	14		1162

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	0	0	46	2	0	5	71	4	0	2	6	0	0	1	1	1	139
4:15 PM to 4:30 PM	0	0	53	0	0	6	68	1	0	4	4	0	0	1	0	1	138
4:30 PM to 4:45 PM	0	2	36	1	0	6	76	0	0	3	5	3	0	0	4	1	137
4:45 PM to 5:00 PM	0	0	41	0	0	3	74	2	0	0	3	1	0	0	3	4	131
5:00 PM to 5:15 PM	0	4	62	0	0	3	85	1	0	1	7	6	0	0	3	1	173
5:15 PM to 5:30 PM	0	1	43	4	0	5	86	2	0	1	3	2	0	0	2	1	150
5:30 PM to 5:45 PM	0	3	49	0	0	2	77	3	0	1	5	3	0	0	7	5	155
5:45 PM to 6:00 PM	0	0	45	1	0	5	70	2	0	2	7	2	0	2	3	0	139

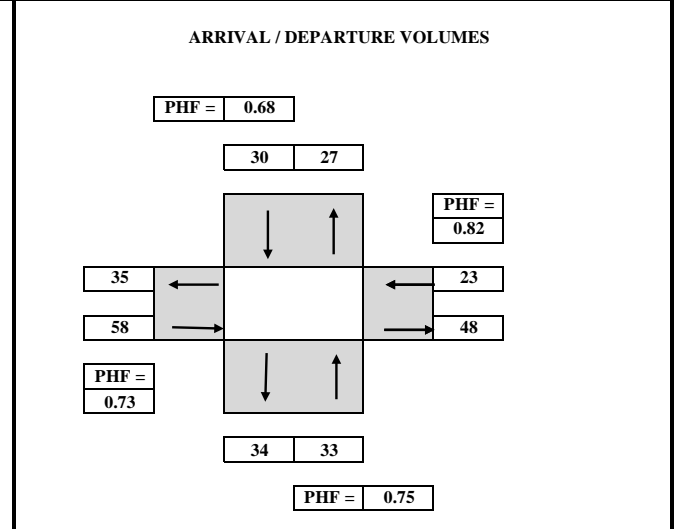
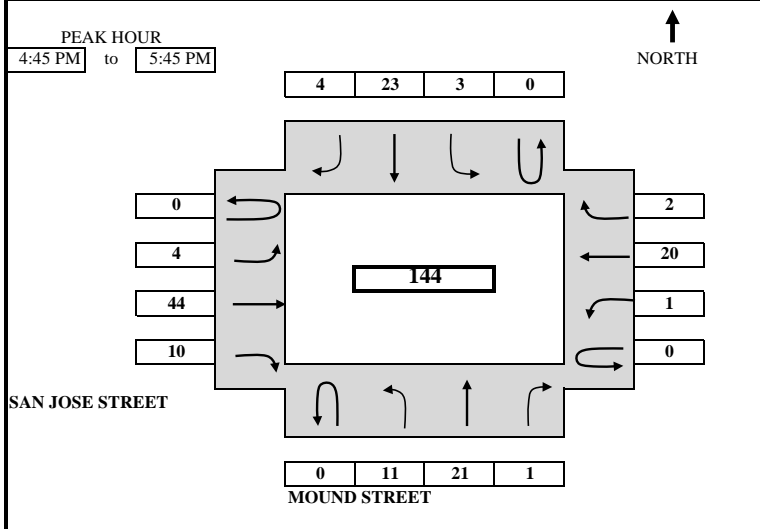
HOURLY TOTALS																	
4:00 PM to 5:00 PM	0	2	176	3	0	20	289	7	0	9	18	4	0	2	8	7	545
4:15 PM to 5:15 PM	0	6	192	1	0	18	303	4	0	8	19	10	0	1	10	7	579
4:30 PM to 5:30 PM	0	7	182	5	0	17	321	5	0	5	18	12	0	0	12	7	591
4:45 PM to 5:45 PM	0	8	195	4	0	13	322	8	0	3	18	12	0	0	15	11	609
5:00 PM to 6:00 PM	0	8	199	5	0	15	318	8	0	5	22	13	0	2	15	7	617

PEAK HOUR SUMMARY																	
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	8	199	5	0	15	318	8	0	5	22	13	0	2	15	7	617
PHF BY MOVEMENT	0.00	0.50	0.80	0.31	0.00	0.75	0.92	0.67	0.00	0.63	0.79	0.54	0.00	0.25	0.54	0.35	OVERALL
PHF BY APPROACH	0.80				0.92				0.71				0.50				0.89
BICYCLE	0				0				2				8				10
PEDESTRIAN	6				5				3				2				16
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	2				3				4				7				16

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	MOUND STREET	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	SAN JOSE STREET	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A6)PM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	4	6	1	0	3	0	2	3	2	1	3	0	25		
4:15 PM	to	4:30 PM	5	12	2	0	7	0	2	7	6	1	9	0	51		
4:30 PM	to	4:45 PM	7	15	2	0	12	1	2	17	7	1	13	1	78		
4:45 PM	to	5:00 PM	8	20	2	0	16	1	2	24	9	1	17	1	101		
5:00 PM	to	5:15 PM	9	27	3	1	25	2	2	38	11	1	23	1	143		
5:15 PM	to	5:30 PM	14	33	3	2	29	2	5	43	16	1	29	2	179		
5:30 PM	to	5:45 PM	18	36	3	3	35	5	6	61	17	2	33	3	222		
5:45 PM	to	6:00 PM	18	39	4	3	40	5	8	67	19	2	35	3	243		

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	4	6	1	0	0	3	0	0	2	3	2	0	1	3	0	25
4:15 PM	to	4:30 PM	0	1	6	1	0	0	4	0	0	0	4	4	0	0	6	0	26
4:30 PM	to	4:45 PM	0	2	3	0	0	0	5	1	0	0	10	1	0	0	4	1	27
4:45 PM	to	5:00 PM	0	1	5	0	0	0	4	0	0	0	7	2	0	0	4	0	23
5:00 PM	to	5:15 PM	0	1	7	1	0	1	9	1	0	0	14	2	0	0	6	0	42
5:15 PM	to	5:30 PM	0	5	6	0	0	1	4	0	0	3	5	5	0	0	6	1	36
5:30 PM	to	5:45 PM	0	4	3	0	0	1	6	3	0	1	18	1	0	1	4	1	43
5:45 PM	to	6:00 PM	0	0	3	1	0	0	5	0	0	2	6	2	0	0	2	0	21

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	8	20	2	0	0	16	1	0	2	24	9	0	1	17	1	101
4:15 PM	to	5:15 PM	0	5	21	2	0	1	22	2	0	0	35	9	0	0	20	1	118
4:30 PM	to	5:30 PM	0	9	21	1	0	2	22	2	0	3	36	10	0	0	20	2	128
4:45 PM	to	5:45 PM	0	11	21	1	0	3	23	4	0	4	44	10	0	1	20	2	144
5:00 PM	to	6:00 PM	0	10	19	2	0	3	24	4	0	6	43	10	0	1	18	2	142

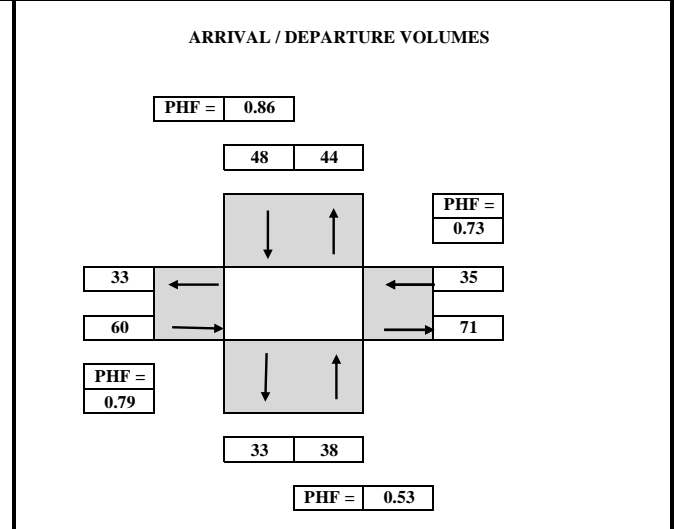
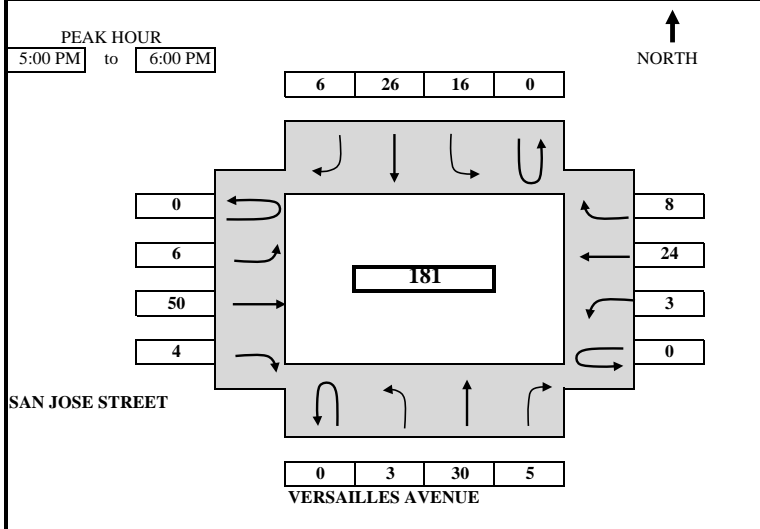
PEAK HOUR SUMMARY																			
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	11	21	1	0	3	23	4	0	4	44	10	0	1	20	2	144
PHF BY MOVEMENT			0.00	0.55	0.75	0.25	0.00	0.75	0.64	0.33	0.00	0.33	0.61	0.50	0.00	0.25	0.83	0.50	OVERALL
PHF BY APPROACH			0.75				0.68				0.73				0.82				0.84
BICYCLE			5				1				4				11				
PEDESTRIAN			3				8				7				26				
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				26
			5				10				7				4				



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	VERSAILLES AVENUE	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	SAN JOSE STREET	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A7)PM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	0	2	0	2	3	0	2	5	0	0	5	0	19		
4:15 PM	to	4:30 PM	0	12	0	4	7	0	3	12	3	2	9	0	52		
4:30 PM	to	4:45 PM	0	15	0	7	14	5	4	22	4	2	17	3	93		
4:45 PM	to	5:00 PM	0	21	0	10	17	11	5	32	4	2	21	5	128		
5:00 PM	to	5:15 PM	1	25	1	14	22	13	7	43	4	2	27	7	166		
5:15 PM	to	5:30 PM	1	31	3	18	31	14	9	54	7	3	35	10	216		
5:30 PM	to	5:45 PM	2	35	4	20	38	15	10	72	7	4	43	10	260		
5:45 PM	to	6:00 PM	3	51	5	26	43	17	11	82	8	5	45	13	309		

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	2	0	0	2	3	0	0	2	5	0	0	0	5	0	19
4:15 PM	to	4:30 PM	0	0	10	0	0	2	4	0	0	1	7	3	0	2	4	0	33
4:30 PM	to	4:45 PM	0	0	3	0	0	3	7	5	0	1	10	1	0	0	8	3	41
4:45 PM	to	5:00 PM	0	0	6	0	0	3	3	6	0	1	10	0	0	0	4	2	35
5:00 PM	to	5:15 PM	0	1	4	1	0	4	5	2	0	2	11	0	0	0	6	2	38
5:15 PM	to	5:30 PM	0	0	6	2	0	4	9	1	0	2	11	3	0	1	8	3	50
5:30 PM	to	5:45 PM	0	1	4	1	0	2	7	1	0	1	18	0	0	1	8	0	44
5:45 PM	to	6:00 PM	0	1	16	1	0	6	5	2	0	1	10	1	0	1	2	3	49

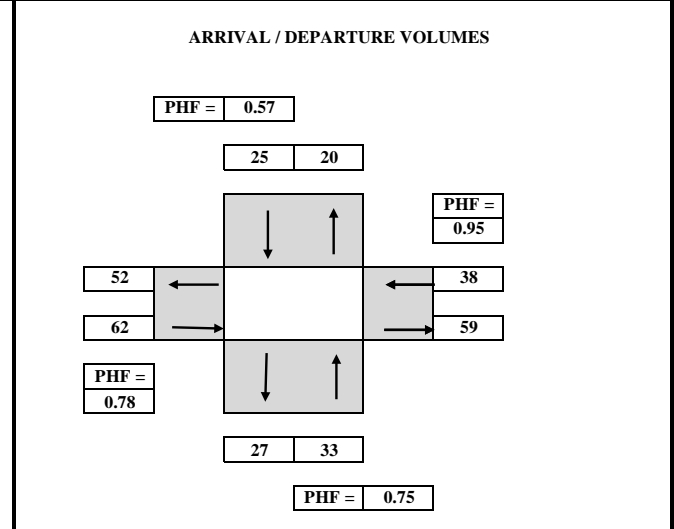
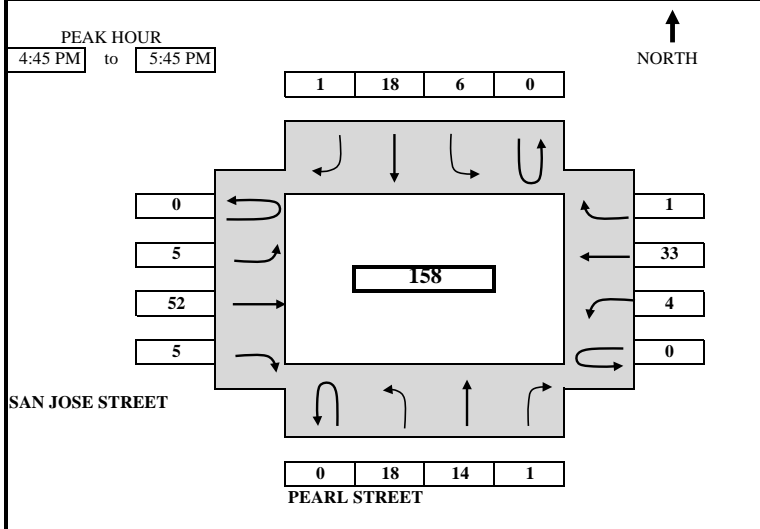
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	0	21	0	0	10	17	11	0	5	32	4	0	2	21	5	128
4:15 PM	to	5:15 PM	0	1	23	1	0	12	19	13	0	5	38	4	0	2	22	7	147
4:30 PM	to	5:30 PM	0	1	19	3	0	14	24	14	0	6	42	4	0	1	26	10	164
4:45 PM	to	5:45 PM	0	2	20	4	0	13	24	10	0	6	50	3	0	2	26	7	167
5:00 PM	to	6:00 PM	0	3	30	5	0	16	26	6	0	6	50	4	0	3	24	8	181

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	3	30	5	0	16	26	6	0	6	50	4	0	3	24	8	181
PHF BY MOVEMENT			0.00	0.75	0.47	0.63	0.00	0.67	0.72	0.75	0.00	0.75	0.69	0.33	0.00	0.75	0.75	0.67	OVERALL
PHF BY APPROACH			0.53				0.86				0.79				0.73				0.91
BICYCLE			0				4				5				6				15
PEDESTRIAN			7				15				3				10				35
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			7				6				4				18				35

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD (# 2 CROSSING)	<b>SURVEY DATE:</b>	10/15/2015	<b>DAY:</b>	THURSSDAY
<b>N-S APPROACH:</b>	PEARL STREET	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	SAN JOSE STREET	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A8)PM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
4:00 PM to 4:15 PM	3	6	0		0	0	2		0	8	0		0	5	0		24
4:15 PM to 4:30 PM	3	10	0		2	2	4		1	16	1		1	9	0		49
4:30 PM to 4:45 PM	3	11	0		2	6	4		3	27	1		1	20	1		79
4:45 PM to 5:00 PM	11	14	0		3	8	4		3	38	3		3	28	1		116
5:00 PM to 5:15 PM	14	18	0		4	11	5		4	50	4		3	37	1		151
5:15 PM to 5:30 PM	18	21	0		8	18	5		6	62	5		4	45	1		193
5:30 PM to 5:45 PM	21	25	1		8	24	5		8	79	6		5	53	2		237
5:45 PM to 6:00 PM	25	27	2		10	28	5		11	88	6		6	58	2		268

<b>TOTAL BY PERIOD</b>																	
4:00 PM to 4:15 PM	0	3	6	0	0	0	0	2	0	0	8	0	0	0	5	0	24
4:15 PM to 4:30 PM	0	0	4	0	0	2	2	2	0	1	8	1	0	1	4	0	25
4:30 PM to 4:45 PM	0	0	1	0	0	0	4	0	0	2	11	0	0	0	11	1	30
4:45 PM to 5:00 PM	0	8	3	0	0	1	2	0	0	0	11	2	0	2	8	0	37
5:00 PM to 5:15 PM	0	3	4	0	0	1	3	1	0	1	12	1	0	0	9	0	35
5:15 PM to 5:30 PM	0	4	3	0	0	4	7	0	0	2	12	1	0	1	8	0	42
5:30 PM to 5:45 PM	0	3	4	1	0	0	6	0	0	2	17	1	0	1	8	1	44
5:45 PM to 6:00 PM	0	4	2	1	0	2	4	0	0	3	9	0	0	1	5	0	31

<b>HOURLY TOTALS</b>																	
4:00 PM to 5:00 PM	0	11	14	0	0	3	8	4	0	3	38	3	0	3	28	1	116
4:15 PM to 5:15 PM	0	11	12	0	0	4	11	3	0	4	42	4	0	3	32	1	127
4:30 PM to 5:30 PM	0	15	11	0	0	6	16	1	0	5	46	4	0	3	36	1	144
4:45 PM to 5:45 PM	0	18	14	1	0	6	18	1	0	5	52	5	0	4	33	1	158
5:00 PM to 6:00 PM	0	14	13	2	0	7	20	1	0	8	50	3	0	3	30	1	152

<b>PEAK HOUR SUMMARY</b>																	
4:45 PM to 5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	18	14	1	0	6	18	1	0	5	52	5	0	4	33	1	158
PHF BY MOVEMENT	0.00	0.56	0.88	0.25	0.00	0.38	0.64	0.25	0.00	0.63	0.76	0.63	0.00	0.50	0.92	0.25	OVERALL
PHF BY APPROACH	0.75				0.57				0.78				0.95				0.90
BICYCLE	1				3				4				5				13
PEDESTRIAN	5				3				5				6				19
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	4				7				4				4				19

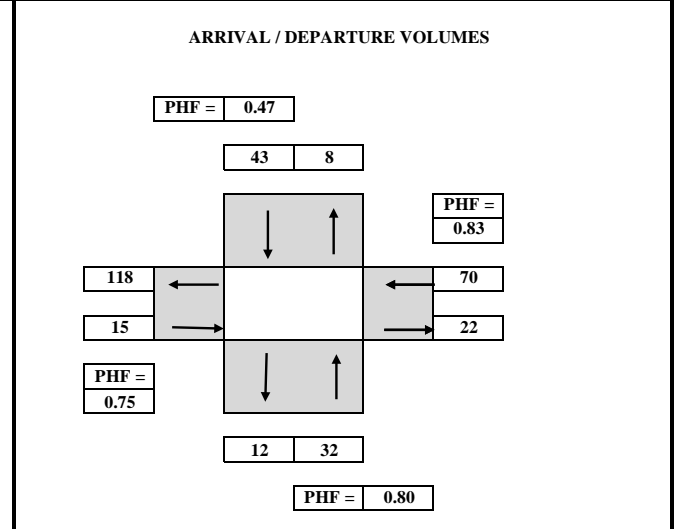
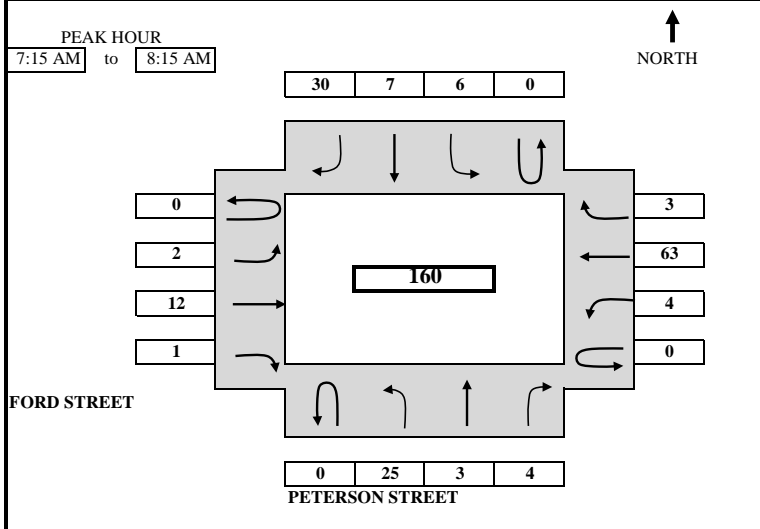
Crossing #3 Oakland

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# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/20/2015	<b>DAY:</b>	TUESDAY
<b>N-S APPROACH:</b>	PETERSON STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	FORD STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(O-2)AM

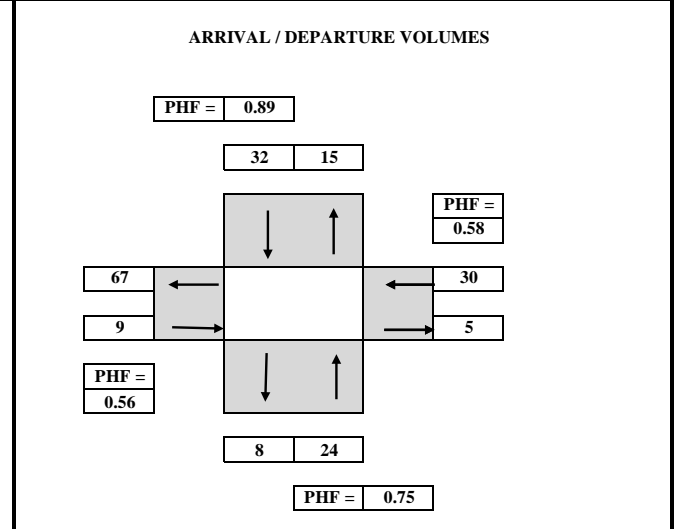
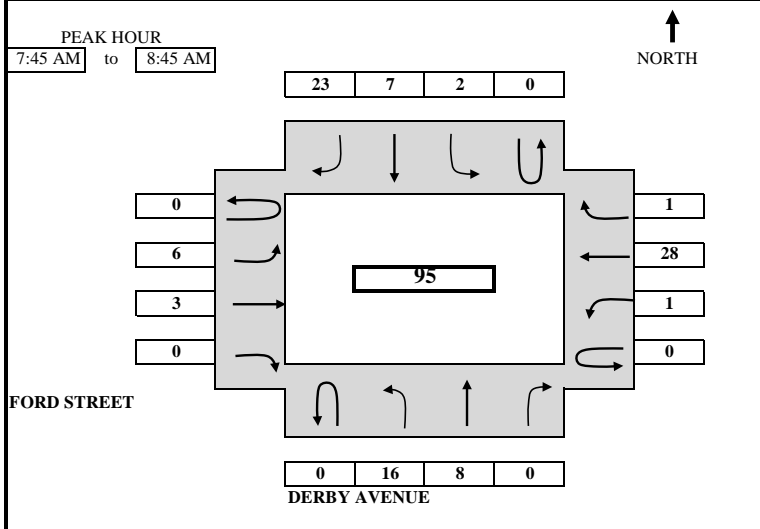


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
7:00 AM to 7:15 AM	0	0	0	0	0	0	0	3	1	1	0	0	1	6	1	0	13
7:15 AM to 7:30 AM	2	1	0	0	0	0	0	5	3	3	0	0	2	22	1	0	39
7:30 AM to 7:45 AM	8	1	3	0	0	0	0	15	3	8	0	0	3	36	2	0	79
7:45 AM to 8:00 AM	17	1	4	0	1	2	20	0	3	11	0	0	5	55	2	0	121
8:00 AM to 8:15 AM	25	3	4	0	6	7	33	0	3	13	1	0	5	69	4	0	173
8:15 AM to 8:30 AM	26	3	4	0	6	8	37	0	3	14	3	0	5	80	4	0	193
8:30 AM to 8:45 AM	30	3	4	0	7	8	44	0	3	14	3	0	8	100	4	0	228
8:45 AM to 9:00 AM	35	7	5	0	7	9	48	0	7	16	4	0	8	113	5	0	264
<b>TOTAL BY PERIOD</b>																	
7:00 AM to 7:15 AM	0	0	0	0	0	0	0	3	0	1	1	0	0	1	6	1	13
7:15 AM to 7:30 AM	0	2	1	0	0	0	0	2	0	2	2	0	0	1	16	0	26
7:30 AM to 7:45 AM	0	6	0	3	0	0	0	10	0	0	5	0	0	1	14	1	40
7:45 AM to 8:00 AM	0	9	0	1	0	1	2	5	0	0	3	0	0	2	19	0	42
8:00 AM to 8:15 AM	0	8	2	0	0	5	5	13	0	0	2	1	0	0	14	2	52
8:15 AM to 8:30 AM	0	1	0	0	0	0	1	4	0	0	1	2	0	0	11	0	20
8:30 AM to 8:45 AM	0	4	0	0	0	1	0	7	0	0	0	0	0	3	20	0	35
8:45 AM to 9:00 AM	0	5	4	1	0	0	1	4	0	4	2	1	0	0	13	1	36
<b>HOURLY TOTALS</b>																	
7:00 AM to 8:00 AM	0	17	1	4	0	1	2	20	0	3	11	0	0	5	55	2	121
7:15 AM to 8:15 AM	0	25	3	4	0	6	7	30	0	2	12	1	0	4	63	3	160
7:30 AM to 8:30 AM	0	24	2	4	0	6	8	32	0	0	11	3	0	3	58	3	154
7:45 AM to 8:45 AM	0	22	2	1	0	7	8	29	0	0	6	3	0	5	64	2	149
8:00 AM to 9:00 AM	0	18	6	1	0	6	7	28	0	4	5	4	0	3	58	3	143
<b>PEAK HOUR SUMMARY</b>																	
7:15 AM to 8:15 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	25	3	4	0	6	7	30	0	2	12	1	0	4	63	3	160
PHF BY MOVEMENT	0.00	0.69	0.38	0.33	0.00	0.30	0.35	0.58	0.00	0.25	0.60	0.25	0.00	0.50	0.83	0.38	OVERALL
PHF BY APPROACH	0.80				0.47				0.75				0.83				0.77
BICYCLE	0				0				5				0				5
PEDESTRIAN	2				2				2				5				11
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	3				4				3				1				11

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>DERBY AVENUE</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>FORD STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O-3)AM</b>

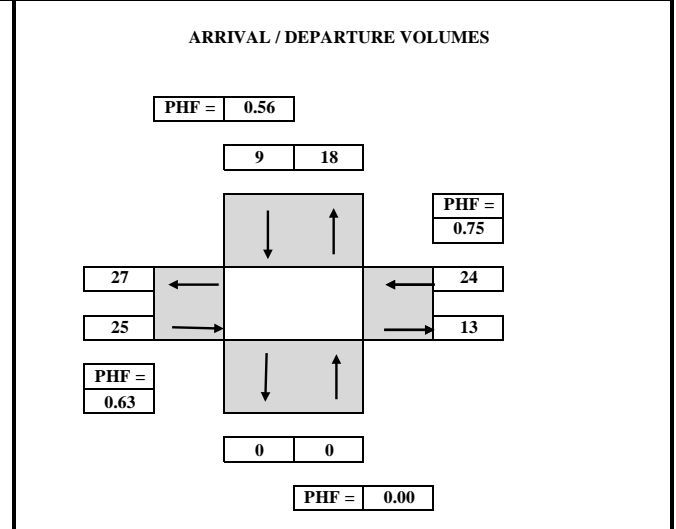
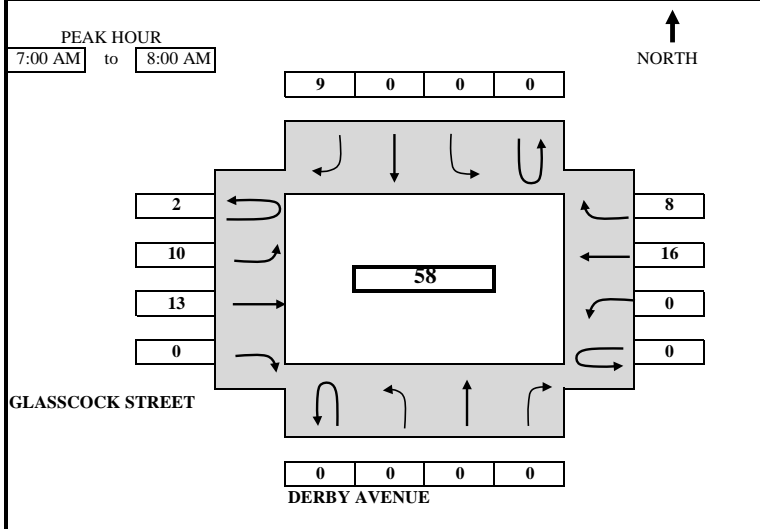


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU	RIGHT
<b>SURVEY DATA</b>																			
7:00 AM to 7:15 AM			0	1	0	0	6	6	1	0	0	0	5	2					21
7:15 AM to 7:30 AM			1	4	0	0	7	14	2	1	0	0	9	2					40
7:30 AM to 7:45 AM			2	6	0	1	7	23	4	1	1	0	13	3					61
7:45 AM to 8:00 AM			8	7	0	1	9	30	6	3	1	0	17	4					86
8:00 AM to 8:15 AM			14	9	0	1	10	35	8	3	1	0	23	4					108
8:15 AM to 8:30 AM			16	10	0	1	13	40	8	4	1	0	29	4					126
8:30 AM to 8:45 AM			18	14	0	3	14	46	10	4	1	1	41	4					156
8:45 AM to 9:00 AM			20	15	0	3	17	57	12	5	1	1	45	4					180
<b>TOTAL BY PERIOD</b>																			
7:00 AM to 7:15 AM			0	0	1	0	0	6	6	0	1	0	0	0	0	5	2		21
7:15 AM to 7:30 AM			0	1	3	0	0	1	8	0	1	1	0	0	0	4	0		19
7:30 AM to 7:45 AM			0	1	2	0	0	1	9	0	2	0	1	0	0	4	1		21
7:45 AM to 8:00 AM			0	6	1	0	0	0	2	7	0	2	2	0	0	0	4	1	25
8:00 AM to 8:15 AM			0	6	2	0	0	0	1	5	0	2	0	0	0	0	6	0	22
8:15 AM to 8:30 AM			0	2	1	0	0	0	3	5	0	0	1	0	0	0	6	0	18
8:30 AM to 8:45 AM			0	2	4	0	0	2	1	6	0	2	0	0	0	1	12	0	30
8:45 AM to 9:00 AM			0	2	1	0	0	0	3	11	0	2	1	0	0	0	4	0	24
<b>HOURLY TOTALS</b>																			
7:00 AM to 8:00 AM			0	8	7	0	0	1	9	30	0	6	3	1	0	0	17	4	86
7:15 AM to 8:15 AM			0	14	8	0	0	1	4	29	0	7	3	1	0	0	18	2	87
7:30 AM to 8:30 AM			0	15	6	0	0	1	6	26	0	6	3	1	0	0	20	2	86
7:45 AM to 8:45 AM			0	16	8	0	0	2	7	23	0	6	3	0	0	1	28	1	95
8:00 AM to 9:00 AM			0	12	8	0	0	2	8	27	0	6	2	0	0	1	28	0	94
<b>PEAK HOUR SUMMARY</b>																			
7:45 AM to 8:45 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL		
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR			
VOLUME		0	16	8	0	0	2	7	23	0	6	3	0	0	1	28	1	95	
PHF BY MOVEMENT		0.00	0.67	0.50	0.00	0.00	0.25	0.58	0.82	0.00	0.75	0.38	0.00	0.00	0.25	0.58	0.25	OVERALL	
PHF BY APPROACH		0.75				0.89				0.56				0.58				0.79	
BICYCLE		0				0				5				0				5	
PEDESTRIAN		6				4				2				2				14	
		<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>					
PEDESTRIAN BY LEG:		2				2				8				2				14	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>DERBY AVENUE</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>GLASSCOCK STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O-4)AM</b>

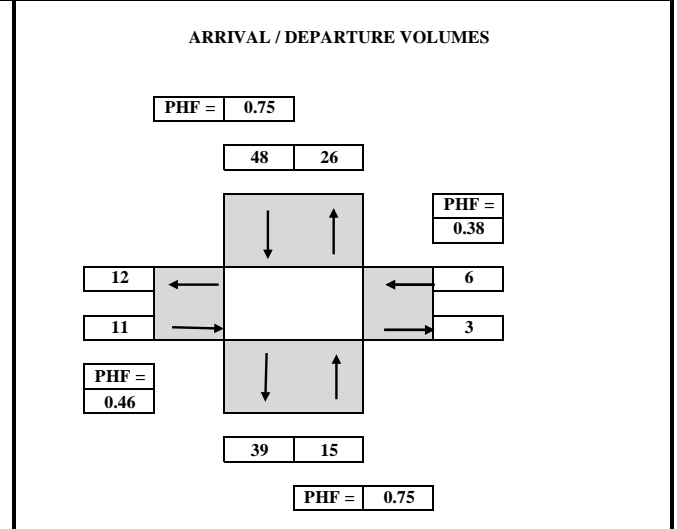
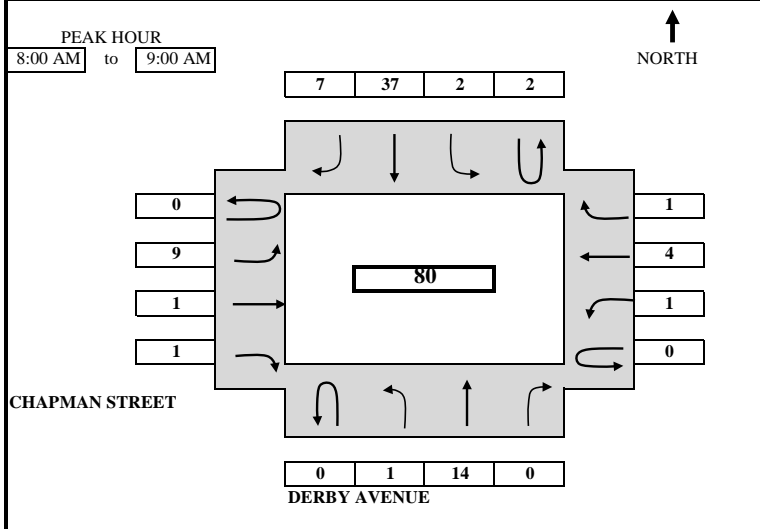


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU
<b>SURVEY DATA</b>																		
7:00 AM to 7:15 AM			0	0	0	0	0	0	4	0	3	7	0	0	0	6	1	21
7:15 AM to 7:30 AM			0	0	0	0	0	0	5	1	5	9	0	0	0	9	2	31
7:30 AM to 7:45 AM			0	0	0	0	0	0	7	1	7	12	0	0	0	13	3	43
7:45 AM to 8:00 AM			0	0	0	0	0	0	9	2	10	13	0	0	0	16	8	58
8:00 AM to 8:15 AM			0	0	0	0	0	0	10	2	13	15	0	0	0	20	12	72
8:15 AM to 8:30 AM			0	0	0	0	0	0	13	2	13	15	0	0	0	23	15	81
8:30 AM to 8:45 AM			6	0	0	0	0	0	15	2	15	17	1	0	0	26	17	99
8:45 AM to 9:00 AM			7	3	0	0	0	0	17	2	15	20	2	0	0	31	17	114
<b>TOTAL BY PERIOD</b>																		
7:00 AM to 7:15 AM			0	0	0	0	0	0	4	0	3	7	0	0	0	6	1	21
7:15 AM to 7:30 AM			0	0	0	0	0	0	1	1	2	2	0	0	0	3	1	10
7:30 AM to 7:45 AM			0	0	0	0	0	0	2	0	2	3	0	0	0	4	1	12
7:45 AM to 8:00 AM			0	0	0	0	0	0	2	1	3	1	0	0	0	3	5	15
8:00 AM to 8:15 AM			0	0	0	0	0	0	1	0	3	2	0	0	0	4	4	14
8:15 AM to 8:30 AM			0	0	0	0	0	0	3	0	0	0	0	0	0	3	3	9
8:30 AM to 8:45 AM			0	6	0	0	0	0	2	0	2	2	1	0	0	3	2	18
8:45 AM to 9:00 AM			0	1	3	0	0	0	2	0	0	3	1	0	0	5	0	15
<b>HOURLY TOTALS</b>																		
7:00 AM to 8:00 AM			0	0	0	0	0	0	9	2	10	13	0	0	0	16	8	58
7:15 AM to 8:15 AM			0	0	0	0	0	0	6	2	10	8	0	0	0	14	11	51
7:30 AM to 8:30 AM			0	0	0	0	0	0	8	1	8	6	0	0	0	14	13	50
7:45 AM to 8:45 AM			0	6	0	0	0	0	8	1	8	5	1	0	0	13	14	56
8:00 AM to 9:00 AM			0	7	3	0	0	0	8	0	5	7	2	0	0	15	9	56
<b>PEAK HOUR SUMMARY</b>																		
7:00 AM to 8:00 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME		0	0	0	0	0	0	9	2	10	13	0	0	0	16	8	58	
PHF BY MOVEMENT		0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.50	0.83	0.46	0.00	0.00	0.00	0.67	0.40	OVERALL	
PHF BY APPROACH		0.00				0.56				0.63				0.75				0.69
BICYCLE		0				1				0				0				1
PEDESTRIAN		0				2				1				3				6
		<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				
PEDESTRIAN BY LEG:		2				2				2				0				6

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>DERBY AVENUE</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>CHAPMAN STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O-6)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	3	0	0	0	12	1	0	0	0	0	0	1	0	17
7:15 AM	to	7:30 AM	0	6	0	1	1	22	2	2	0	0	0	0	2	0	36
7:30 AM	to	7:45 AM	0	11	0	1	2	33	3	4	1	1	0	2	0	58	
7:45 AM	to	8:00 AM	0	16	0	1	2	40	4	4	2	1	0	2	1	73	
8:00 AM	to	8:15 AM	1	20	0	1	2	47	6	6	2	1	0	2	1	89	
8:15 AM	to	8:30 AM	1	22	0	1	3	56	6	8	2	1	0	3	1	104	
8:30 AM	to	8:45 AM	1	27	0	2	4	68	8	9	2	1	1	5	2	130	
8:45 AM	to	9:00 AM	1	30	0	3	4	77	11	13	3	2	1	6	2	153	

TOTAL BY PERIOD																	
7:00 AM	to	7:15 AM	0	0	3	0	0	0	12	1	0	0	0	0	1	0	17
7:15 AM	to	7:30 AM	0	0	3	0	1	1	10	1	0	2	0	0	0	0	19
7:30 AM	to	7:45 AM	0	0	5	0	0	1	11	1	0	2	1	1	0	0	22
7:45 AM	to	8:00 AM	0	0	5	0	0	0	7	1	0	0	1	0	0	0	15
8:00 AM	to	8:15 AM	0	1	4	0	0	0	7	2	0	2	0	0	0	0	16
8:15 AM	to	8:30 AM	0	0	2	0	0	1	9	0	0	2	0	0	0	0	15
8:30 AM	to	8:45 AM	0	0	5	0	1	1	12	2	0	1	0	0	0	1	26
8:45 AM	to	9:00 AM	0	0	3	0	1	0	9	3	0	4	1	1	0	0	23

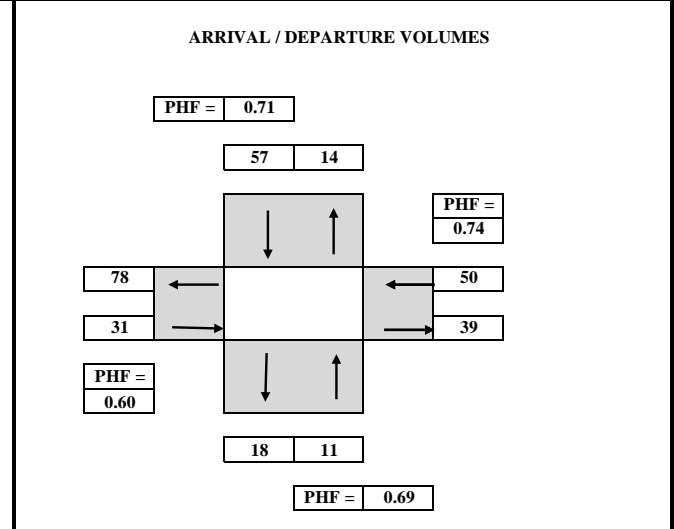
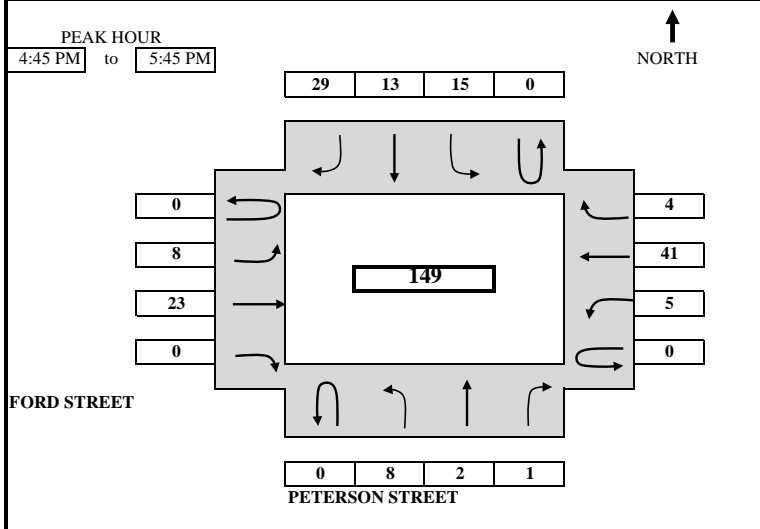
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	0	16	0	1	2	40	4	0	4	2	1	0	0	2	1	73
7:15 AM	to	8:15 AM	0	1	17	0	1	2	35	5	0	6	2	1	0	0	1	1	72
7:30 AM	to	8:30 AM	0	1	16	0	0	2	34	4	0	6	2	1	0	0	1	1	68
7:45 AM	to	8:45 AM	0	1	16	0	1	2	35	5	0	5	1	0	0	1	3	2	72
8:00 AM	to	9:00 AM	0	1	14	0	2	2	37	7	0	9	1	1	0	1	4	1	80

PEAK HOUR SUMMARY																			
8:00 AM	to	9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	1	14	0	2	2	37	7	0	9	1	1	0	1	4	1	80
PHF BY MOVEMENT			0.00	0.25	0.70	0.00	0.50	0.50	0.77	0.58	0.00	0.56	0.25	0.25	0.00	0.25	0.50	0.25	OVERALL
PHF BY APPROACH			0.75				0.75				0.46				0.38				0.77
BICYCLE			1				1				1				1				4
PEDESTRIAN			5				3				2				2				12
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				12
			4				0				4				4				12

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>PETERSON STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>FORD STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O-2)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	2	1	2	1	1	8	2	11	0	1	4	2	35		
4:15 PM	to	4:30 PM	3	2	2	4	3	18	2	16	0	2	12	3	67		
4:30 PM	to	4:45 PM	3	3	3	9	7	24	2	25	0	2	20	4	102		
4:45 PM	to	5:00 PM	4	3	3	14	9	31	5	30	0	3	30	7	139		
5:00 PM	to	5:15 PM	6	4	4	15	10	38	7	35	0	6	43	8	176		
5:15 PM	to	5:30 PM	8	4	4	20	14	43	10	45	0	6	50	8	212		
5:30 PM	to	5:45 PM	11	5	4	24	20	53	10	48	0	7	61	8	251		
5:45 PM	to	6:00 PM	11	5	5	28	24	59	13	49	1	7	70	8	280		

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	2	1	2	0	1	1	8	0	2	11	0	0	1	4	2	35
4:15 PM	to	4:30 PM	0	1	1	0	0	3	2	10	0	0	5	0	0	1	8	1	32
4:30 PM	to	4:45 PM	0	0	1	1	0	5	4	6	0	0	9	0	0	0	8	1	35
4:45 PM	to	5:00 PM	0	1	0	0	0	5	2	7	0	3	5	0	0	1	10	3	37
5:00 PM	to	5:15 PM	0	2	1	1	0	1	1	7	0	2	5	0	0	3	13	1	37
5:15 PM	to	5:30 PM	0	2	0	0	0	5	4	5	0	3	10	0	0	0	7	0	36
5:30 PM	to	5:45 PM	0	3	1	0	0	4	6	10	0	0	3	0	0	1	11	0	39
5:45 PM	to	6:00 PM	0	0	0	1	0	4	4	6	0	3	1	1	0	0	9	0	29

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	4	3	3	0	14	9	31	0	5	30	0	0	3	30	7	139
4:15 PM	to	5:15 PM	0	4	3	2	0	14	9	30	0	5	24	0	0	5	39	6	141
4:30 PM	to	5:30 PM	0	5	2	2	0	16	11	25	0	8	29	0	0	4	38	5	145
4:45 PM	to	5:45 PM	0	8	2	1	0	15	13	29	0	8	23	0	0	5	41	4	149
5:00 PM	to	6:00 PM	0	7	2	2	0	14	15	28	0	8	19	1	0	4	40	1	141

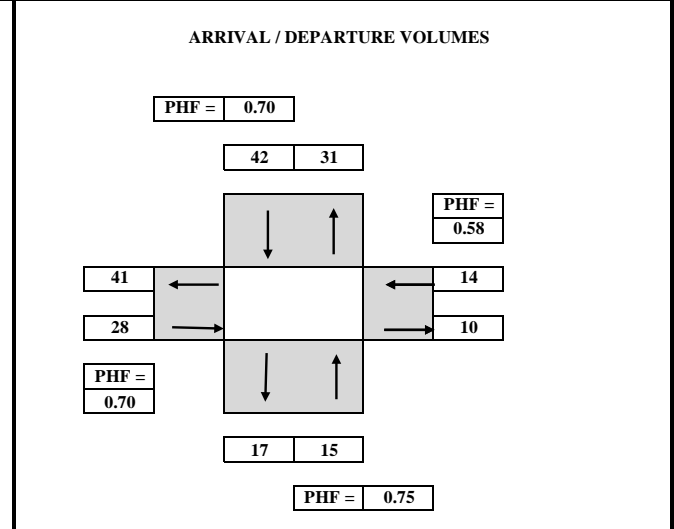
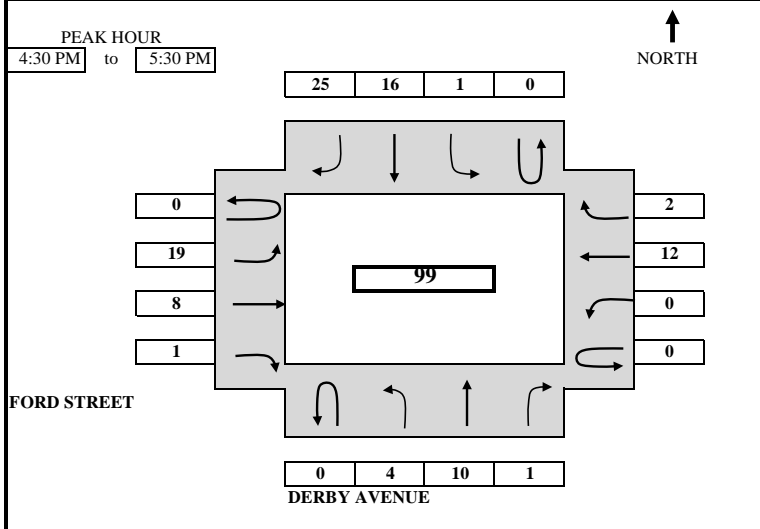
PEAK HOUR SUMMARY																			
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	8	2	1	0	15	13	29	0	8	23	0	0	5	41	4	149
PHF BY MOVEMENT			0.00	0.67	0.50	0.25	0.00	0.75	0.54	0.73	0.00	0.67	0.58	0.00	0.00	0.42	0.79	0.33	OVERALL
PHF BY APPROACH			0.69				0.71				0.60				0.74				0.96
BICYCLE			1				1				0				2				4
PEDESTRIAN			6				1				2				2				11
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			4				0				5				2				11



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>DERBY AVENUE</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>FORD STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O-3)PM</b>

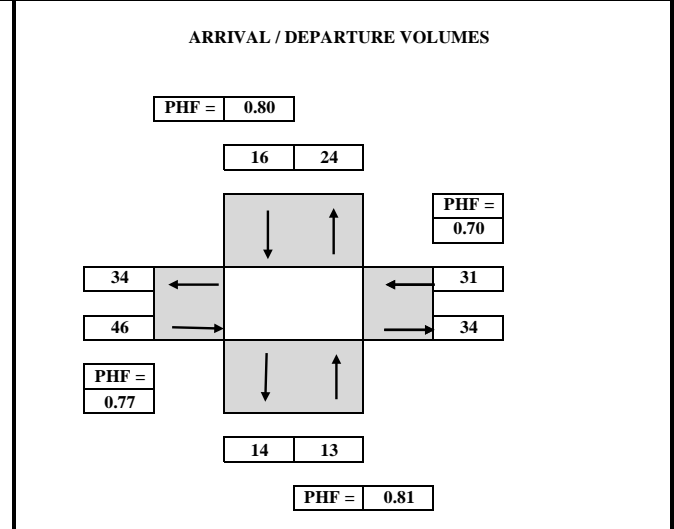
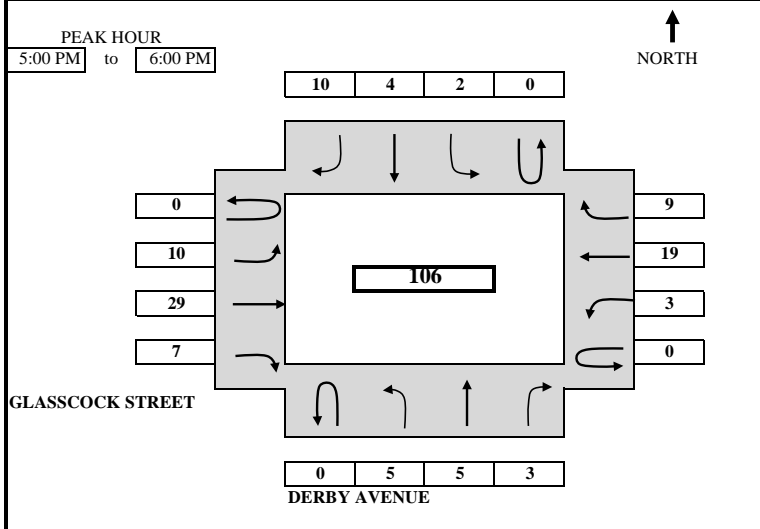


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT		
<b>SURVEY DATA</b>																		
4:00 PM to 4:15 PM	0	1	0		0	6	2		4	5	1		0	3	0		22	
4:15 PM to 4:30 PM	2	4	0		0	9	4		7	6	1		0	5	1		39	
4:30 PM to 4:45 PM	3	8	0		0	15	9		15	8	1		0	8	1		68	
4:45 PM to 5:00 PM	3	10	1		1	19	13		17	10	1		0	12	3		90	
5:00 PM to 5:15 PM	4	11	1		1	22	25		20	12	2		0	16	3		117	
5:15 PM to 5:30 PM	6	14	1		1	25	29		26	14	2		0	17	3		138	
5:30 PM to 5:45 PM	10	17	1		2	31	33		28	16	2		0	20	5		165	
5:45 PM to 6:00 PM	11	22	2		2	35	41		30	16	2		0	21	5		187	
<b>TOTAL BY PERIOD</b>																		
4:00 PM to 4:15 PM	0	0	1	0	0	0	6	2	0	4	5	1	0	0	3	0	22	
4:15 PM to 4:30 PM	0	2	3	0	0	0	3	2	0	3	1	0	0	0	2	1	17	
4:30 PM to 4:45 PM	0	1	4	0	0	0	6	5	0	8	2	0	0	0	3	0	29	
4:45 PM to 5:00 PM	0	0	2	1	0	1	4	4	0	2	2	0	0	0	4	2	22	
5:00 PM to 5:15 PM	0	1	1	0	0	0	3	12	0	3	2	1	0	0	4	0	27	
5:15 PM to 5:30 PM	0	2	3	0	0	0	3	4	0	6	2	0	0	0	1	0	21	
5:30 PM to 5:45 PM	0	4	3	0	0	1	6	4	0	2	2	0	0	0	3	2	27	
5:45 PM to 6:00 PM	0	1	5	1	0	0	4	8	0	2	0	0	0	0	1	0	22	
<b>HOURLY TOTALS</b>																		
4:00 PM to 5:00 PM	0	3	10	1	0	1	19	13	0	17	10	1	0	0	12	3	90	
4:15 PM to 5:15 PM	0	4	10	1	0	1	16	23	0	16	7	1	0	0	13	3	95	
4:30 PM to 5:30 PM	0	4	10	1	0	1	16	25	0	19	8	1	0	0	12	2	99	
4:45 PM to 5:45 PM	0	7	9	1	0	2	16	24	0	13	8	1	0	0	12	4	97	
5:00 PM to 6:00 PM	0	8	12	1	0	1	16	28	0	13	6	1	0	0	9	2	97	
<b>PEAK HOUR SUMMARY</b>																		
4:30 PM to 5:30 PM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME		0	4	10	1	0	1	16	25	0	19	8	1	0	0	12	2	99
PHF BY MOVEMENT		0.00	0.50	0.63	0.25	0.00	0.25	0.67	0.52	0.00	0.59	1.00	0.25	0.00	0.00	0.75	0.25	OVERALL
PHF BY APPROACH		0.75				0.70				0.70				0.58				0.85
BICYCLE		0				3				0				0				3
PEDESTRIAN		6				0				3				1				10
PEDESTRIAN BY LEG:		<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				
		4				0				1				5				10

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>DERBY AVENUE</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>GLASSCOCK STREET</b>	<b>JURISDICTION:</b>	<b>OAKLAND</b>	<b>FILE:</b>	<b>3510117-(O-4)PM</b>

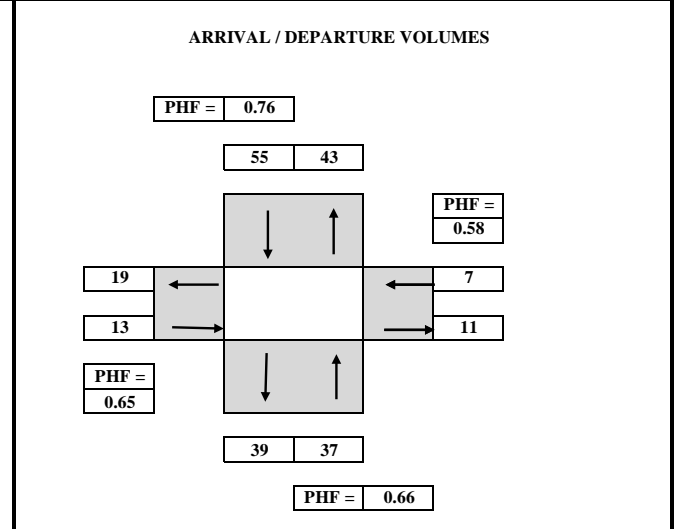
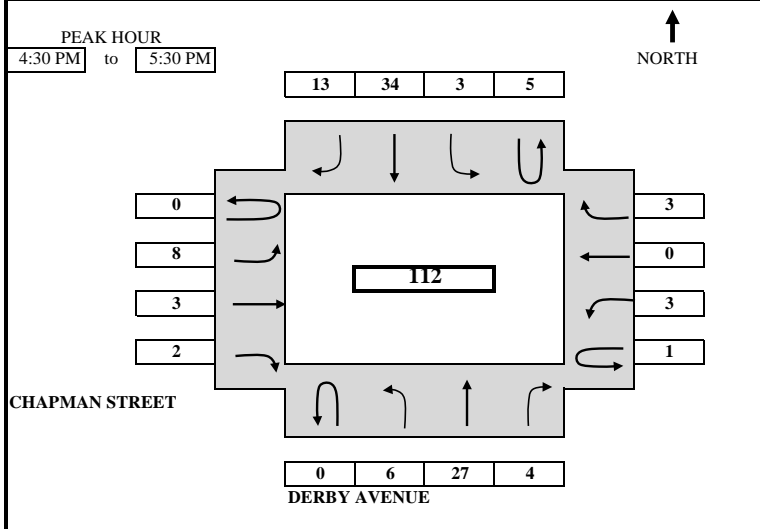


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
4:00 PM to 4:15 PM	1	0	0	0	0	0	5	0	1	4	0	0	1	11	0	0	23
4:15 PM to 4:30 PM	1	0	0	0	1	0	7	0	4	6	0	0	2	12	2	0	35
4:30 PM to 4:45 PM	1	0	0	0	3	1	10	0	8	14	0	0	2	18	3	0	60
4:45 PM to 5:00 PM	1	1	0	0	4	2	11	0	10	18	1	0	2	23	4	0	77
5:00 PM to 5:15 PM	3	1	1	1	5	3	14	0	11	21	4	0	2	28	5	0	98
5:15 PM to 5:30 PM	3	1	3	0	6	3	16	0	14	32	4	0	4	33	9	0	128
5:30 PM to 5:45 PM	4	4	3	0	6	5	19	0	16	42	7	0	5	36	13	0	160
5:45 PM to 6:00 PM	6	6	3	0	6	6	21	0	20	47	8	0	5	42	13	0	183
<b>TOTAL BY PERIOD</b>																	
4:00 PM to 4:15 PM	0	1	0	0	0	0	0	5	0	1	4	0	0	1	11	0	23
4:15 PM to 4:30 PM	0	0	0	0	0	1	0	2	0	3	2	0	0	1	1	2	12
4:30 PM to 4:45 PM	0	0	0	0	0	2	1	3	0	4	8	0	0	0	6	1	25
4:45 PM to 5:00 PM	0	0	1	0	0	1	1	1	0	2	4	1	0	0	5	1	17
5:00 PM to 5:15 PM	0	2	0	1	0	1	1	3	0	1	3	3	0	0	5	1	21
5:15 PM to 5:30 PM	0	0	0	2	0	1	0	2	0	3	11	0	0	2	5	4	30
5:30 PM to 5:45 PM	0	1	3	0	0	0	2	3	0	2	10	3	0	1	3	4	32
5:45 PM to 6:00 PM	0	2	2	0	0	0	1	2	0	4	5	1	0	0	6	0	23
<b>HOURLY TOTALS</b>																	
4:00 PM to 5:00 PM	0	1	1	0	0	4	2	11	0	10	18	1	0	2	23	4	77
4:15 PM to 5:15 PM	0	2	1	1	0	5	3	9	0	10	17	4	0	1	17	5	75
4:30 PM to 5:30 PM	0	2	1	3	0	5	3	9	0	10	26	4	0	2	21	7	93
4:45 PM to 5:45 PM	0	3	4	3	0	3	4	9	0	8	28	7	0	3	18	10	100
5:00 PM to 6:00 PM	0	5	5	3	0	2	4	10	0	10	29	7	0	3	19	9	106
<b>PEAK HOUR SUMMARY</b>																	
5:00 PM to 6:00 PM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	5	5	3	0	2	4	10	0	10	29	7	0	3	19	9	106
PHF BY MOVEMENT	0.00	0.63	0.42	0.38	0.00	0.50	0.50	0.83	0.00	0.63	0.66	0.58	0.00	0.38	0.79	0.56	OVERALL
PHF BY APPROACH	0.81				0.80				0.77				0.70				0.83
BICYCLE	0				1				5				2				8
PEDESTRIAN	9				5				6				6				26
PEDESTRIAN BY LEG:	<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				
	9				3				5				9				26

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/20/2015	<b>DAY:</b>	TUESDAY
<b>N-S APPROACH:</b>	DERBY AVENUE	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	CHAPMAN STREET	<b>JURISDICTION:</b>	OAKLAND	<b>FILE:</b>	3510117-(O-6)PM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
4:00 PM	to	4:15 PM	1	8	0	0	0	12	4	2	0	0	0	0	0	0	1	28
4:15 PM	to	4:30 PM	1	16	0	0	0	19	7	2	0	0	0	0	1	1	2	49
4:30 PM	to	4:45 PM	4	25	1	1	2	26	9	4	0	0	1	1	1	4	79	
4:45 PM	to	5:00 PM	6	29	2	3	2	34	14	5	0	1	1	2	1	4	104	
5:00 PM	to	5:15 PM	6	32	2	5	3	45	18	7	2	2	1	4	1	5	133	
5:15 PM	to	5:30 PM	7	43	4	5	3	53	20	10	3	2	1	4	1	5	161	
5:30 PM	to	5:45 PM	9	47	5	5	3	63	23	10	3	3	1	4	2	6	184	
5:45 PM	to	6:00 PM	9	54	5	5	5	74	24	12	5	3	1	4	3	6	210	

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	1	8	0	0	0	12	4	0	2	0	0	0	0	1	28
4:15 PM	to	4:30 PM	0	0	8	0	0	0	7	3	0	0	0	0	0	1	1	21
4:30 PM	to	4:45 PM	0	3	9	1	1	2	7	2	0	2	0	0	1	0	2	30
4:45 PM	to	5:00 PM	0	2	4	1	2	0	8	5	0	1	0	1	0	1	0	25
5:00 PM	to	5:15 PM	0	0	3	0	2	1	11	4	0	2	2	1	0	2	0	29
5:15 PM	to	5:30 PM	0	1	11	2	0	0	8	2	0	3	1	0	0	0	0	28
5:30 PM	to	5:45 PM	0	2	4	1	0	0	10	3	0	0	0	1	0	0	1	23
5:45 PM	to	6:00 PM	0	0	7	0	0	2	11	1	0	2	2	0	0	0	1	26

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	6	29	2	3	2	34	14	0	5	0	1	1	2	1	4	104
4:15 PM	to	5:15 PM	0	5	24	2	5	3	33	14	0	5	2	2	1	4	1	4	105
4:30 PM	to	5:30 PM	0	6	27	4	5	3	34	13	0	8	3	2	1	3	0	3	112
4:45 PM	to	5:45 PM	0	5	22	4	4	1	37	14	0	6	3	3	0	3	1	2	105
5:00 PM	to	6:00 PM	0	3	25	3	2	3	40	10	0	7	5	2	0	2	2	2	106

PEAK HOUR SUMMARY																			
4:30 PM	to	5:30 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	6	27	4	5	3	34	13	0	8	3	2	1	3	0	3	112
PHF BY MOVEMENT			0.00	0.50	0.61	0.50	0.63	0.38	0.77	0.65	0.00	0.67	0.38	0.50	0.25	0.38	0.00	0.38	OVERALL
PHF BY APPROACH			0.66				0.76				0.65				0.58				0.93
BICYCLE			0				5				1				1				7
PEDESTRIAN			2				1				0				0				3
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			0				0				2				1				3

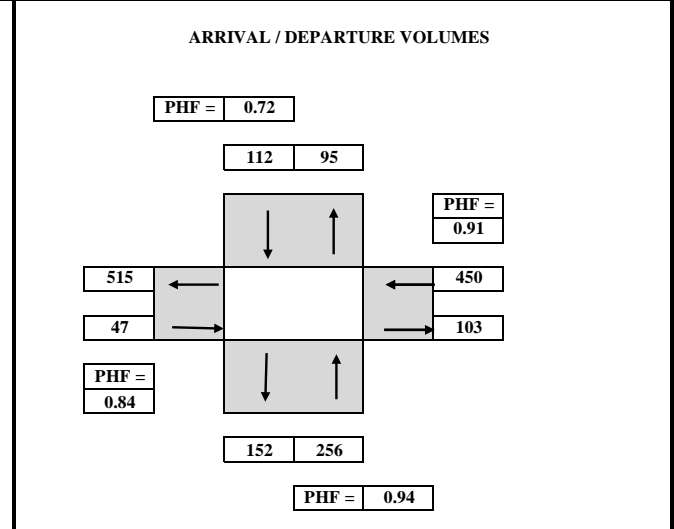
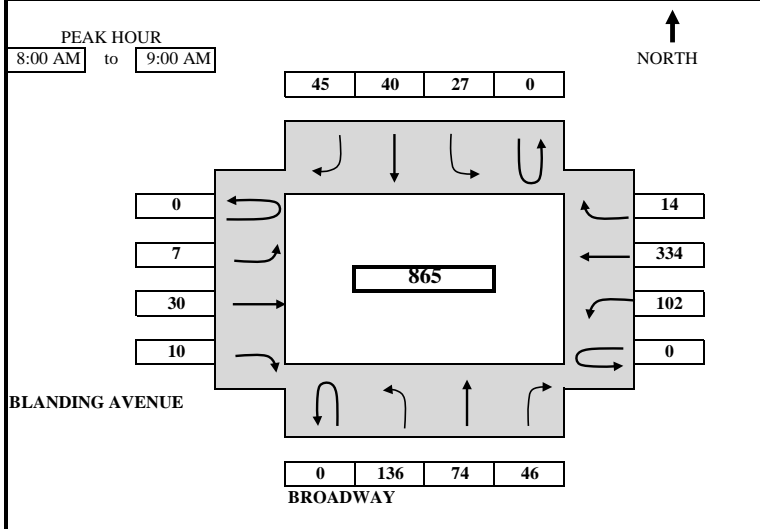
Crossing #3 Alameda

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# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>BLANDING AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-1)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	12	6	7	4	6	5	3	5	1	20	41	4	114		
7:15 AM	to	7:30 AM	31	17	13	7	10	15	6	8	2	38	104	12	263		
7:30 AM	to	7:45 AM	66	35	22	13	15	34	10	14	4	59	187	16	475		
7:45 AM	to	8:00 AM	90	47	34	16	26	40	13	19	10	83	258	17	653		
8:00 AM	to	8:15 AM	123	70	45	19	36	49	13	25	12	107	341	21	861		
8:15 AM	to	8:30 AM	153	87	55	26	44	56	15	32	14	133	437	22	1074		
8:30 AM	to	8:45 AM	194	105	64	32	53	70	17	39	19	157	518	29	1297		
8:45 AM	to	9:00 AM	226	121	80	43	66	85	20	49	20	185	592	31	1518		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	12	6	7	0	4	6	5	0	3	5	1	0	20	41	4	114
7:15 AM	to	7:30 AM	0	19	11	6	0	3	4	10	0	3	3	1	0	18	63	8	149
7:30 AM	to	7:45 AM	0	35	18	9	0	6	5	19	0	4	6	2	0	21	83	4	212
7:45 AM	to	8:00 AM	0	24	12	12	0	3	11	6	0	3	5	6	0	24	71	1	178
8:00 AM	to	8:15 AM	0	33	23	11	0	3	10	9	0	0	6	2	0	24	83	4	208
8:15 AM	to	8:30 AM	0	30	17	10	0	7	8	7	0	2	7	2	0	26	96	1	213
8:30 AM	to	8:45 AM	0	41	18	9	0	6	9	14	0	2	7	5	0	24	81	7	223
8:45 AM	to	9:00 AM	0	32	16	16	0	11	13	15	0	3	10	1	0	28	74	2	221

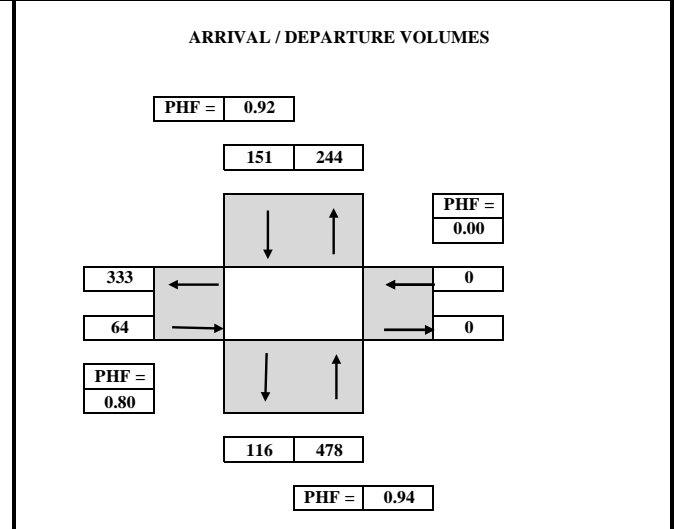
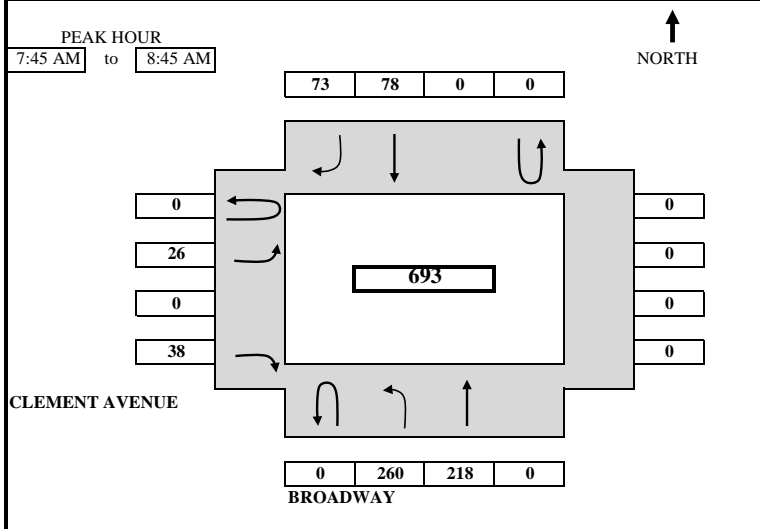
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	90	47	34	0	16	26	40	0	13	19	10	0	83	258	17	653
7:15 AM	to	8:15 AM	0	111	64	38	0	15	30	44	0	10	20	11	0	87	300	17	747
7:30 AM	to	8:30 AM	0	122	70	42	0	19	34	41	0	9	24	12	0	95	333	10	811
7:45 AM	to	8:45 AM	0	128	70	42	0	19	38	36	0	7	25	15	0	98	331	13	822
8:00 AM	to	9:00 AM	0	136	74	46	0	27	40	45	0	7	30	10	0	102	334	14	865

PEAK HOUR SUMMARY																			
8:00 AM	to	9:00 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	136	74	46	0	27	40	45	0	7	30	10	0	102	334	14	865
PHF BY MOVEMENT			0.00	0.83	0.80	0.72	0.00	0.61	0.77	0.75	0.00	0.58	0.75	0.50	0.00	0.91	0.87	0.50	OVERALL
PHF BY APPROACH			0.94				0.72				0.84				0.91				0.97
BICYCLE			7				1				3				21				32
PEDESTRIAN			9				6				5				11				31
			N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:			15				1				7				8				31

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>CLEMENT AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-2)AM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																			
7:00 AM to 7:15 AM			28	23				15	11			4	7						88
7:15 AM to 7:30 AM			66	58				26	23			5	9						187
7:30 AM to 7:45 AM			120	113				36	44			10	20						343
7:45 AM to 8:00 AM			189	160				48	73			18	31						519
8:00 AM to 8:15 AM			253	219				71	85			24	38						690
8:15 AM to 8:30 AM			316	268				92	100			32	50						858
8:30 AM to 8:45 AM			380	331				114	117			36	58						1036
8:45 AM to 9:00 AM			423	392				135	138			44	63						1195

TOTAL BY PERIOD																			
7:00 AM to 7:15 AM	0	28	23	0	0	0	15	11	0	4	0	7	0	0	0	0	0	0	88
7:15 AM to 7:30 AM	0	38	35	0	0	0	11	12	0	1	0	2	0	0	0	0	0	0	99
7:30 AM to 7:45 AM	0	54	55	0	0	0	10	21	0	5	0	11	0	0	0	0	0	0	156
7:45 AM to 8:00 AM	0	69	47	0	0	0	12	29	0	8	0	11	0	0	0	0	0	0	176
8:00 AM to 8:15 AM	0	64	59	0	0	0	23	12	0	6	0	7	0	0	0	0	0	0	171
8:15 AM to 8:30 AM	0	63	49	0	0	0	21	15	0	8	0	12	0	0	0	0	0	0	168
8:30 AM to 8:45 AM	0	64	63	0	0	0	22	17	0	4	0	8	0	0	0	0	0	0	178
8:45 AM to 9:00 AM	0	43	61	0	0	0	21	21	0	8	0	5	0	0	0	0	0	0	159

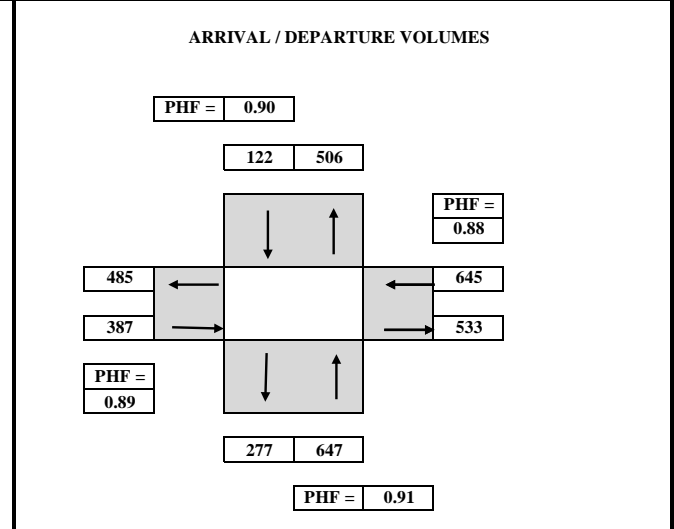
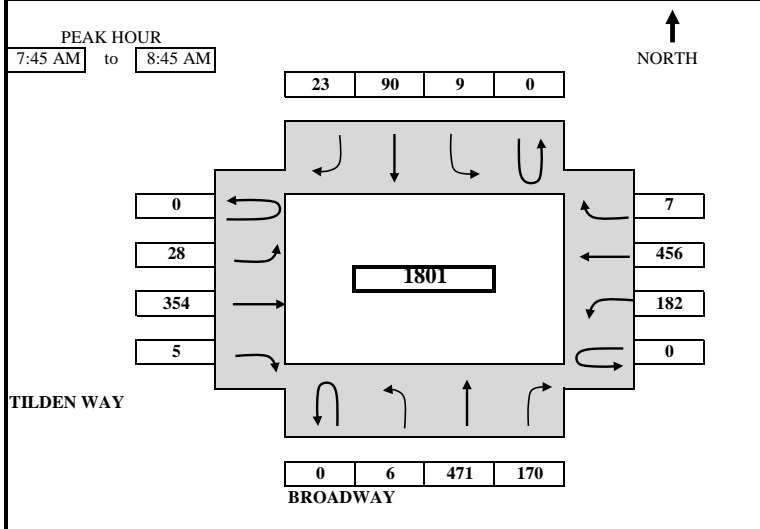
HOURLY TOTALS																			
7:00 AM to 8:00 AM	0	189	160	0	0	0	48	73	0	18	0	31	0	0	0	0	0	0	519
7:15 AM to 8:15 AM	0	225	196	0	0	0	56	74	0	20	0	31	0	0	0	0	0	0	602
7:30 AM to 8:30 AM	0	250	210	0	0	0	66	77	0	27	0	41	0	0	0	0	0	0	671
7:45 AM to 8:45 AM	0	260	218	0	0	0	78	73	0	26	0	38	0	0	0	0	0	0	693
8:00 AM to 9:00 AM	0	234	232	0	0	0	87	65	0	26	0	32	0	0	0	0	0	0	676

PEAK HOUR SUMMARY																			
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR			
VOLUME	0	260	218	0	0	0	78	73	0	26	0	38	0	0	0	0	0	0	693
PHF BY MOVEMENT	0.00	0.94	0.87	0.00	0.00	0.00	0.85	0.63	0.00	0.81	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH	0.94				0.92				0.80				0.00				0.97		
BICYCLE	8				2				0				0				10		
PEDESTRIAN	0				0				1				0				1		
	N-LEG				S-LEG				E-LEG				W-LEG						
PEDESTRIAN BY LEG:	0				1				0				0				1		

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>TILDEN WAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-3)AM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM	0	48	20		6	15	2		3	42	0		7	45	3		191
7:15 AM to 7:30 AM	0	111	46		9	29	5		4	83	0		35	108	3		433
7:30 AM to 7:45 AM	1	214	80		11	43	6		10	128	0		77	246	4		820
7:45 AM to 8:00 AM	1	320	119		14	65	10		16	218	1		113	390	7		1274
8:00 AM to 8:15 AM	2	444	156		15	92	14		21	301	1		154	504	8		1712
8:15 AM to 8:30 AM	5	556	203		18	110	20		27	387	2		211	604	11		2154
8:30 AM to 8:45 AM	7	685	250		20	133	29		38	482	5		259	702	11		2621
8:45 AM to 9:00 AM	10	780	288		24	150	34		44	575	5		302	811	17		3040

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	48	20	0	6	15	2	0	3	42	0	0	7	45	3	191
7:15 AM to 7:30 AM	0	0	63	26	0	3	14	3	0	1	41	0	0	28	63	0	242
7:30 AM to 7:45 AM	0	1	103	34	0	2	14	1	0	6	45	0	0	42	138	1	387
7:45 AM to 8:00 AM	0	0	106	39	0	3	22	4	0	6	90	1	0	36	144	3	454
8:00 AM to 8:15 AM	0	1	124	37	0	1	27	4	0	5	83	0	0	41	114	1	438
8:15 AM to 8:30 AM	0	3	112	47	0	3	18	6	0	6	86	1	0	57	100	3	442
8:30 AM to 8:45 AM	0	2	129	47	0	2	23	9	0	11	95	3	0	48	98	0	467
8:45 AM to 9:00 AM	0	3	95	38	0	4	17	5	0	6	93	0	0	43	109	6	419

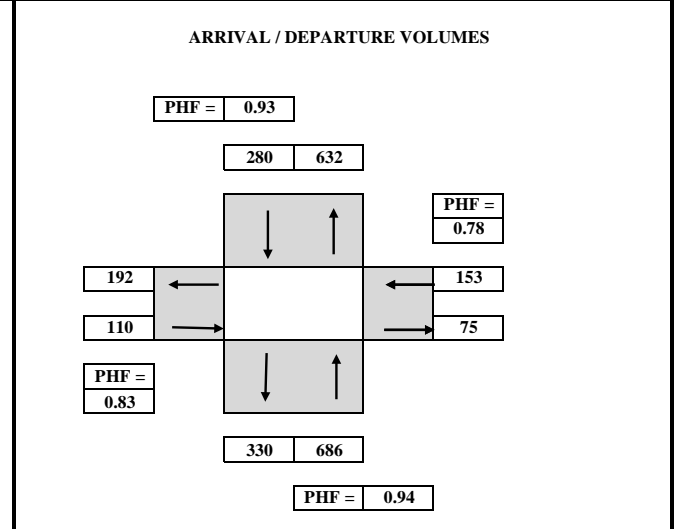
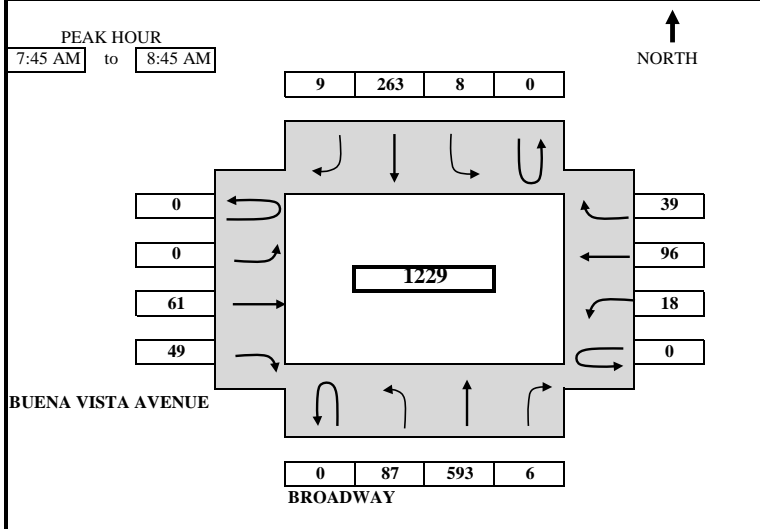
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	1	320	119	0	14	65	10	0	16	218	1	0	113	390	7	1274
7:15 AM to 8:15 AM	0	2	396	136	0	9	77	12	0	18	259	1	0	147	459	5	1521
7:30 AM to 8:30 AM	0	5	445	157	0	9	81	15	0	23	304	2	0	176	496	8	1721
7:45 AM to 8:45 AM	0	6	471	170	0	9	90	23	0	28	354	5	0	182	456	7	1801
8:00 AM to 9:00 AM	0	9	460	169	0	10	85	24	0	28	357	4	0	189	421	10	1766

PEAK HOUR SUMMARY																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	6	471	170	0	9	90	23	0	28	354	5	0	182	456	7	1801
PHF BY MOVEMENT	0.00	0.50	0.91	0.90	0.00	0.75	0.83	0.64	0.00	0.64	0.93	0.42	0.00	0.80	0.79	0.58	OVERALL
PHF BY APPROACH	0.91				0.90				0.89				0.88				0.96
BICYCLE	18				1				5				4				28
PEDESTRIAN	5				10				11				7				33
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	10				8				6				9				33

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>BUENA VISTA AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-4)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	10	75	0	1	27	0	1	1	3	1	9	4	132		
7:15 AM	to	7:30 AM	18	151	3	1	66	0	1	8	7	1	16	7	279		
7:30 AM	to	7:45 AM	39	295	7	3	121	0	1	21	16	6	30	14	553		
7:45 AM	to	8:00 AM	57	432	8	5	179	1	1	34	36	8	55	22	838		
8:00 AM	to	8:15 AM	78	592	9	11	245	4	1	55	37	10	76	29	1147		
8:15 AM	to	8:30 AM	98	745	12	11	314	6	1	72	52	20	104	40	1475		
8:30 AM	to	8:45 AM	126	888	13	11	384	9	1	82	65	24	126	53	1782		
8:45 AM	to	9:00 AM	147	1027	16	13	437	11	1	96	72	25	141	60	2046		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	10	75	0	0	1	27	0	0	1	1	3	0	1	9	4	132
7:15 AM	to	7:30 AM	0	8	76	3	0	0	39	0	0	0	7	4	0	0	7	3	147
7:30 AM	to	7:45 AM	0	21	144	4	0	2	55	0	0	0	13	9	0	5	14	7	274
7:45 AM	to	8:00 AM	0	18	137	1	0	2	58	1	0	0	13	20	0	2	25	8	285
8:00 AM	to	8:15 AM	0	21	160	1	0	6	66	3	0	0	21	1	0	2	21	7	309
8:15 AM	to	8:30 AM	0	20	153	3	0	0	69	2	0	0	17	15	0	10	28	11	328
8:30 AM	to	8:45 AM	0	28	143	1	0	0	70	3	0	0	10	13	0	4	22	13	307
8:45 AM	to	9:00 AM	0	21	139	3	0	2	53	2	0	0	14	7	0	1	15	7	264

HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	57	432	8	0	5	179	1	0	1	34	36	0	8	55	22	838
7:15 AM	to	8:15 AM	0	68	517	9	0	10	218	4	0	0	54	34	0	9	67	25	1015
7:30 AM	to	8:30 AM	0	80	594	9	0	10	248	6	0	0	64	45	0	19	88	33	1196
7:45 AM	to	8:45 AM	0	87	593	6	0	8	263	9	0	0	61	49	0	18	96	39	1229
8:00 AM	to	9:00 AM	0	90	595	8	0	8	258	10	0	0	62	36	0	17	86	38	1208

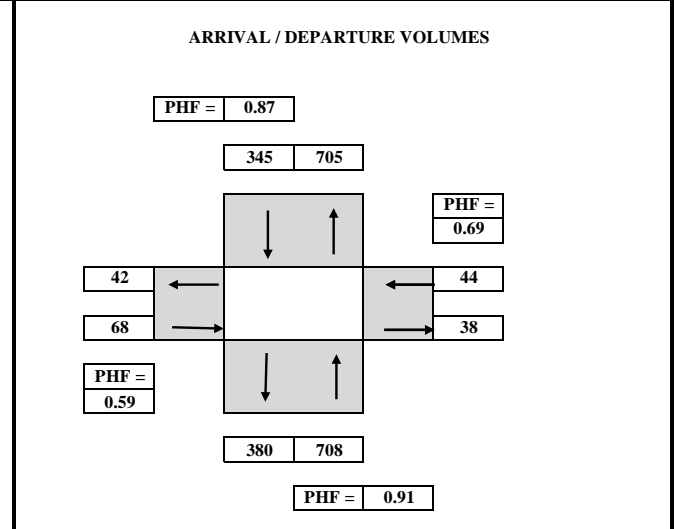
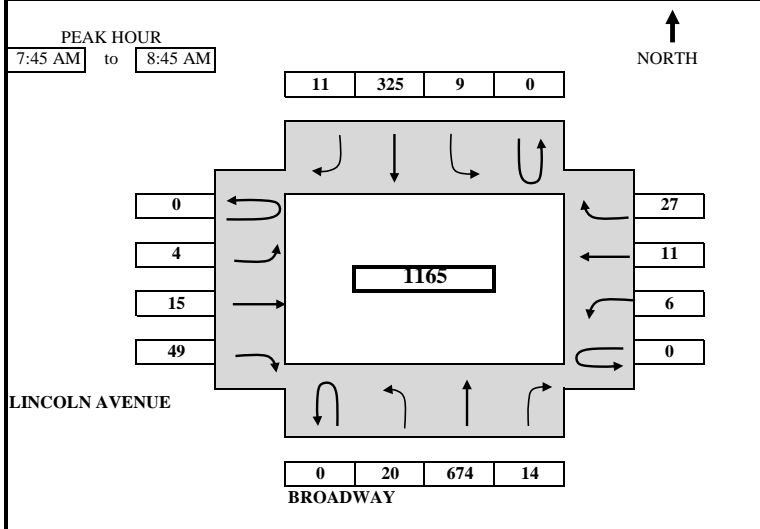
PEAK HOUR SUMMARY																			
7:45 AM	to	8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	87	593	6	0	8	263	9	0	0	61	49	0	18	96	39	1229
PHF BY MOVEMENT			0.00	0.78	0.93	0.50	0.00	0.33	0.94	0.75	0.00	0.00	0.73	0.61	0.00	0.45	0.86	0.75	OVERALL
PHF BY APPROACH			0.94				0.93				0.83				0.78				0.94
BICYCLE			19				5				0				0				24
PEDESTRIAN			9				3				26				19				57
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			13				32				5				7				57



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>LINCOLN AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-5)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	1	84	1	1	30	0	1	0	3	2	2	4	129		
7:15 AM	to	7:30 AM	1	163	3	1	74	1	3	1	10	4	3	6	270		
7:30 AM	to	7:45 AM	3	311	4	4	134	3	6	5	18	5	5	13	511		
7:45 AM	to	8:00 AM	7	467	5	6	198	7	7	11	40	6	6	17	777		
8:00 AM	to	8:15 AM	11	628	10	9	273	8	9	17	50	9	10	24	1058		
8:15 AM	to	8:30 AM	17	810	16	10	366	11	9	17	55	9	15	35	1370		
8:30 AM	to	8:45 AM	23	985	18	13	459	14	10	20	67	11	16	40	1676		
8:45 AM	to	9:00 AM	24	1125	20	13	522	15	11	21	78	13	21	41	1904		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	1	84	1	0	1	30	0	0	1	0	3	0	2	2	4	129
7:15 AM	to	7:30 AM	0	0	79	2	0	0	44	1	0	2	1	7	0	2	1	2	141
7:30 AM	to	7:45 AM	0	2	148	1	0	3	60	2	0	3	4	8	0	1	2	7	241
7:45 AM	to	8:00 AM	0	4	156	1	0	2	64	4	0	1	6	22	0	1	1	4	266
8:00 AM	to	8:15 AM	0	4	161	5	0	3	75	1	0	2	6	10	0	3	4	7	281
8:15 AM	to	8:30 AM	0	6	182	6	0	1	93	3	0	0	0	5	0	0	5	11	312
8:30 AM	to	8:45 AM	0	6	175	2	0	3	93	3	0	1	3	12	0	2	1	5	306
8:45 AM	to	9:00 AM	0	1	140	2	0	0	63	1	0	1	1	11	0	2	5	1	228

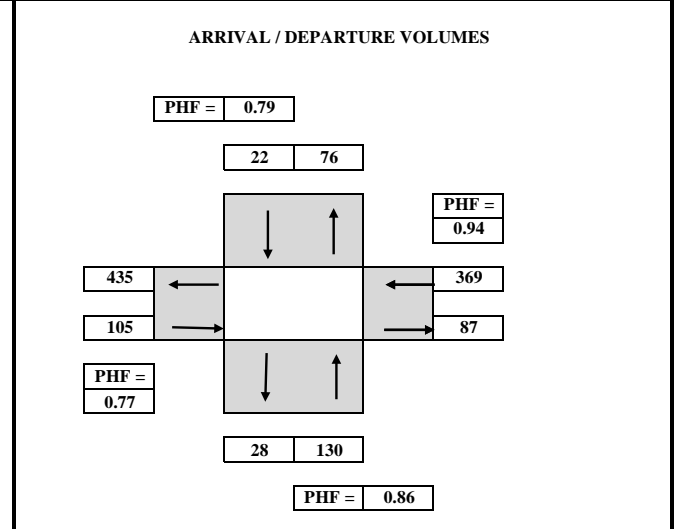
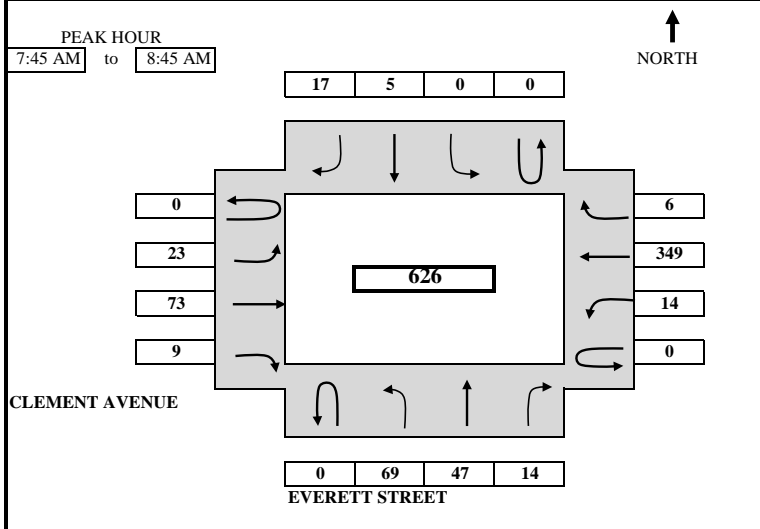
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	7	467	5	0	6	198	7	0	7	11	40	0	6	6	17	777
8:15 AM	to	8:15 AM	0	10	544	9	0	8	243	8	0	8	17	47	0	7	8	20	929
7:30 AM	to	8:30 AM	0	16	647	13	0	9	292	10	0	6	16	45	0	5	12	29	1100
7:45 AM	to	8:45 AM	0	20	674	14	0	9	325	11	0	4	15	49	0	6	11	27	1165
8:00 AM	to	9:00 AM	0	17	658	15	0	7	324	8	0	4	10	38	0	7	15	24	1127

PEAK HOUR SUMMARY																			
7:45 AM	to	8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	20	674	14	0	9	325	11	0	4	15	49	0	6	11	27	1165
PHF BY MOVEMENT			0.00	0.83	0.93	0.58	0.00	0.75	0.87	0.69	0.00	0.50	0.63	0.56	0.00	0.50	0.55	0.61	OVERALL
PHF BY APPROACH			0.91				0.87				0.59				0.69				0.93
BICYCLE			17				6				1				0				24
PEDESTRIAN			13				5				23				7				48
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				
			30				0				1				17				48

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/20/2015	<b>DAY:</b>	TUESDAY
<b>N-S APPROACH:</b>	EVERETT STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	CLEMENT AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-6)AM

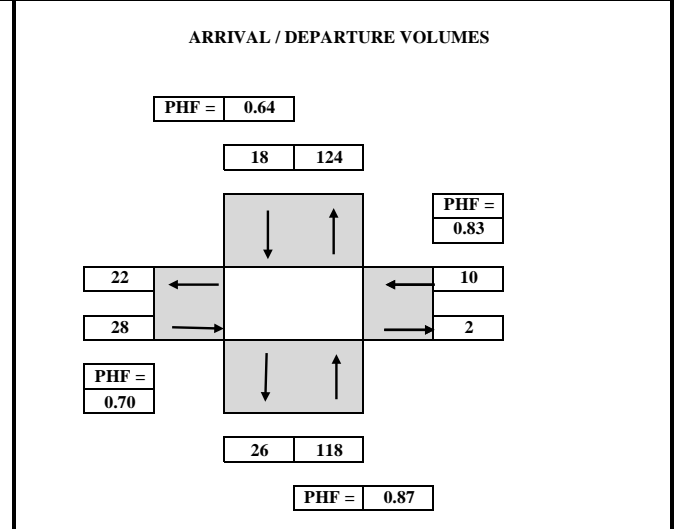
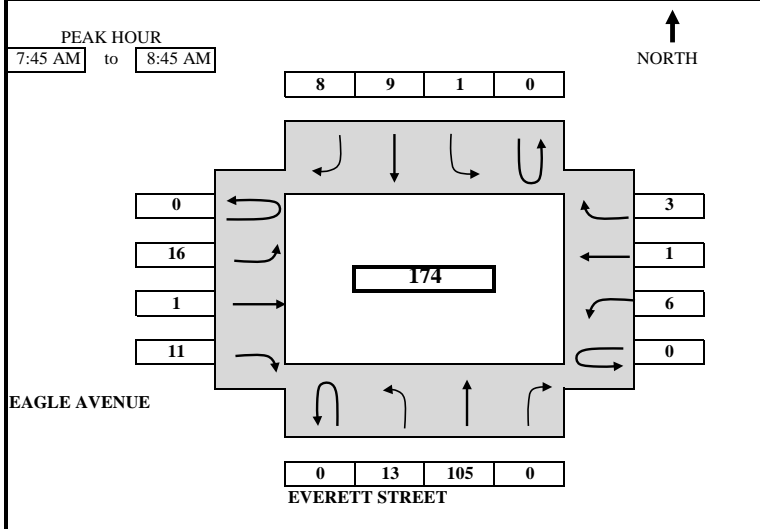


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU	RIGHT
<b>SURVEY DATA</b>																			
7:00 AM to 7:15 AM			3	1	0	0	0	4	5	15	1	0	45	2					76
7:15 AM to 7:30 AM			5	3	0	1	1	5	9	23	3	0	96	2					148
7:30 AM to 7:45 AM			10	10	2	1	3	8	14	39	5	0	167	3					262
7:45 AM to 8:00 AM			24	19	5	1	5	12	24	59	9	6	254	8					426
8:00 AM to 8:15 AM			42	27	11	1	6	14	29	74	11	8	347	8					578
8:15 AM to 8:30 AM			61	40	13	1	8	19	34	93	11	11	428	9					728
8:30 AM to 8:45 AM			79	57	16	1	8	25	37	112	14	14	516	9					888
8:45 AM to 9:00 AM			86	69	19	1	9	31	40	127	14	15	582	9					1002
<b>TOTAL BY PERIOD</b>																			
7:00 AM to 7:15 AM			0	3	1	0	0	0	4	0	5	15	1	0	0	45	2		76
7:15 AM to 7:30 AM			0	2	2	0	0	1	1	1	0	4	8	2	0	0	51	0	72
7:30 AM to 7:45 AM			0	5	7	2	0	0	2	3	0	5	16	2	0	0	71	1	114
7:45 AM to 8:00 AM			0	14	9	3	0	0	2	4	0	10	20	4	0	6	87	5	164
8:00 AM to 8:15 AM			0	18	8	6	0	0	1	2	0	5	15	2	0	2	93	0	152
8:15 AM to 8:30 AM			0	19	13	2	0	0	2	5	0	5	19	0	0	3	81	1	150
8:30 AM to 8:45 AM			0	18	17	3	0	0	0	6	0	3	19	3	0	3	88	0	160
8:45 AM to 9:00 AM			0	7	12	3	0	0	1	6	0	3	15	0	0	1	66	0	114
<b>HOURLY TOTALS</b>																			
7:00 AM to 8:00 AM			0	24	19	5	0	1	5	12	0	24	59	9	0	6	254	8	426
7:15 AM to 8:15 AM			0	39	26	11	0	1	6	10	0	24	59	10	0	8	302	6	502
7:30 AM to 8:30 AM			0	56	37	13	0	0	7	14	0	25	70	8	0	11	332	7	580
7:45 AM to 8:45 AM			0	69	47	14	0	0	5	17	0	23	73	9	0	14	349	6	626
8:00 AM to 9:00 AM			0	62	50	14	0	0	4	19	0	16	68	5	0	9	328	1	576
<b>PEAK HOUR SUMMARY</b>																			
7:45 AM to 8:45 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL		
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR			
VOLUME		0	69	47	14	0	0	5	17	0	23	73	9	0	14	349	6	626	
PHF BY MOVEMENT		0.00	0.91	0.69	0.58	0.00	0.00	0.63	0.71	0.00	0.58	0.91	0.56	0.00	0.58	0.94	0.30	OVERALL	
PHF BY APPROACH		0.86				0.79				0.77				0.94				0.95	
BICYCLE		3				0				0				2				5	
PEDESTRIAN		5				0				5				5				15	
PEDESTRIAN BY LEG:		<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>					
		0				10				3				2				15	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/20/2015	<b>DAY:</b>	TUESDAY
<b>N-S APPROACH:</b>	EVERETT STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	EAGLE AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-7)AM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	0	3	0	0	2	0	0	0	2	1	0	1	9		
7:15 AM	to	7:30 AM	2	5	0	3	2	0	2	0	3	3	2	2	24		
7:30 AM	to	7:45 AM	5	15	0	3	4	0	3	0	3	3	2	2	40		
7:45 AM	to	8:00 AM	5	33	0	3	7	4	6	0	5	5	2	3	73		
8:00 AM	to	8:15 AM	9	63	0	3	7	5	11	1	9	7	3	3	121		
8:15 AM	to	8:30 AM	14	91	0	3	9	8	14	1	11	9	3	3	166		
8:30 AM	to	8:45 AM	18	120	0	4	13	8	19	1	14	9	3	5	214		
8:45 AM	to	9:00 AM	19	137	0	4	15	10	23	1	16	10	4	5	244		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	0	3	0	0	0	2	0	0	0	0	2	0	1	0	1	9
7:15 AM	to	7:30 AM	0	2	2	0	0	3	0	0	0	0	2	0	1	0	2	2	15
7:30 AM	to	7:45 AM	0	3	10	0	0	0	2	0	0	0	0	0	0	0	0	0	16
7:45 AM	to	8:00 AM	0	0	18	0	0	0	3	4	0	0	3	0	2	0	2	0	33
8:00 AM	to	8:15 AM	0	4	30	0	0	0	0	1	0	5	1	4	0	2	1	0	48
8:15 AM	to	8:30 AM	0	5	28	0	0	0	2	3	0	3	0	2	0	2	0	0	45
8:30 AM	to	8:45 AM	0	4	29	0	0	1	4	0	0	5	0	3	0	0	0	2	48
8:45 AM	to	9:00 AM	0	1	17	0	0	0	2	2	0	4	0	2	0	1	1	0	30

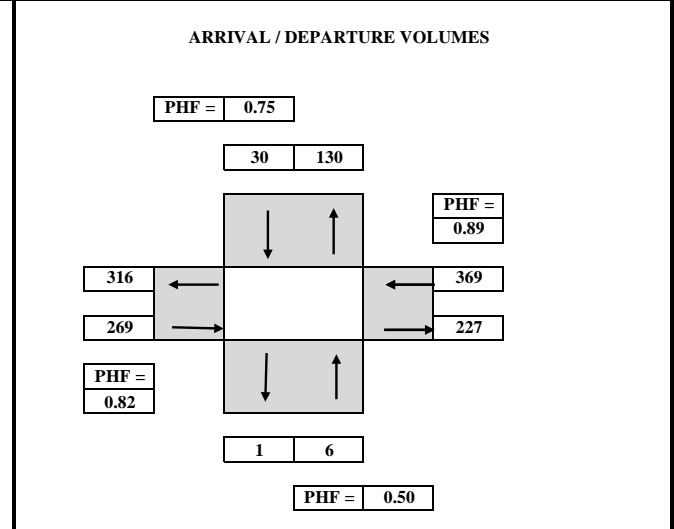
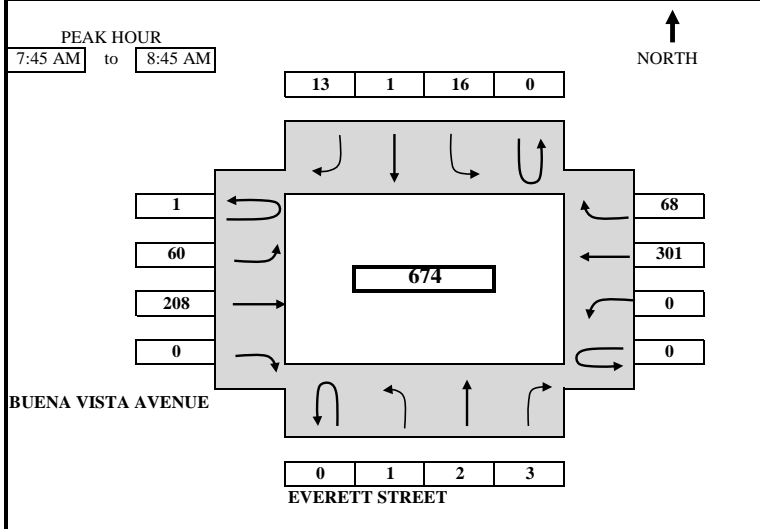
HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	5	33	0	0	3	7	4	0	6	0	5	0	5	2	3	73
7:15 AM	to	8:15 AM	0	9	60	0	0	3	5	5	0	11	1	7	0	6	3	2	112
7:30 AM	to	8:30 AM	0	12	86	0	0	0	7	8	0	12	1	8	0	6	1	1	142
7:45 AM	to	8:45 AM	0	13	105	0	0	1	9	8	0	16	1	11	0	6	1	3	174
8:00 AM	to	9:00 AM	0	14	104	0	0	1	8	6	0	17	1	11	0	5	2	2	171

PEAK HOUR SUMMARY																			
7:45 AM	to	8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	13	105	0	0	1	9	8	0	16	1	11	0	6	1	3	174
PHF BY MOVEMENT			0.00	0.65	0.88	0.00	0.00	0.25	0.56	0.50	0.00	0.80	0.25	0.69	0.00	0.75	0.25	0.38	OVERALL
PHF BY APPROACH			0.87				0.64				0.70				0.83				0.91
BICYCLE			1				1				1				1				4
PEDESTRIAN			4				0				1				2				7
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				7
			2				1				0				4				7

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/20/2015	<b>DAY:</b>	TUESDAY
<b>N-S APPROACH:</b>	EVERETT STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	BUENA VISTA AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-8)AM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM to 7:15 AM	0	0	3		3	0	3		0	2	20	0	0	32	3		66
7:15 AM to 7:30 AM	1	0	3		4	0	4		0	5	39	0	0	71	3		130
7:30 AM to 7:45 AM	2	0	3		6	0	5		0	11	68	0	0	125	11		231
7:45 AM to 8:00 AM	2	0	3		12	0	6		0	21	106	0	0	206	22		378
8:00 AM to 8:15 AM	3	0	5		15	0	11		0	35	163	0	0	289	43		564
8:15 AM to 8:30 AM	3	0	5		20	1	15		0	52	214	0	0	346	65		721
8:30 AM to 8:45 AM	3	2	6		22	1	18		1	71	276	0	0	426	79		905
8:45 AM to 9:00 AM	3	2	7		24	1	22		1	80	317	0	1	500	91		1049

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	0	0	0	3	0	3	0	3	0	2	20	0	0	0	32	3	66
7:15 AM to 7:30 AM	0	1	0	0	0	1	0	1	0	3	19	0	0	0	39	0	64
7:30 AM to 7:45 AM	0	1	0	0	0	2	0	1	0	6	29	0	0	0	54	8	101
7:45 AM to 8:00 AM	0	0	0	0	0	6	0	1	0	10	38	0	0	0	81	11	147
8:00 AM to 8:15 AM	0	1	0	2	0	3	0	5	0	14	57	0	0	0	83	21	186
8:15 AM to 8:30 AM	0	0	0	0	0	5	1	4	0	17	51	0	0	0	57	22	157
8:30 AM to 8:45 AM	0	0	2	1	0	2	0	3	1	19	62	0	0	0	80	14	184
8:45 AM to 9:00 AM	0	0	0	1	0	2	0	4	0	9	41	0	0	1	74	12	144

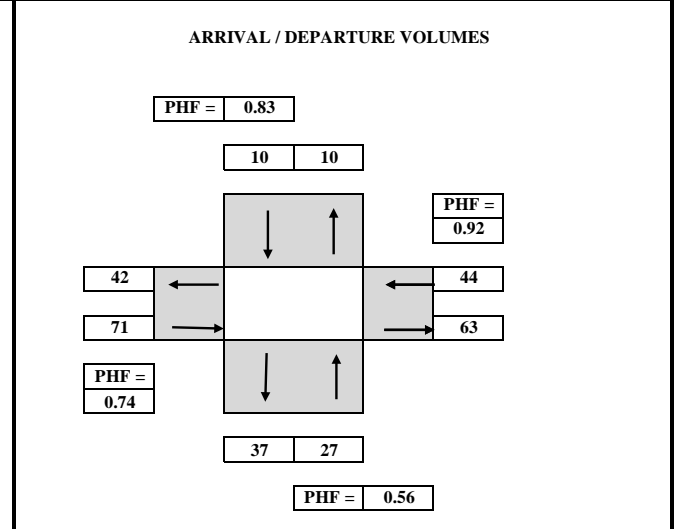
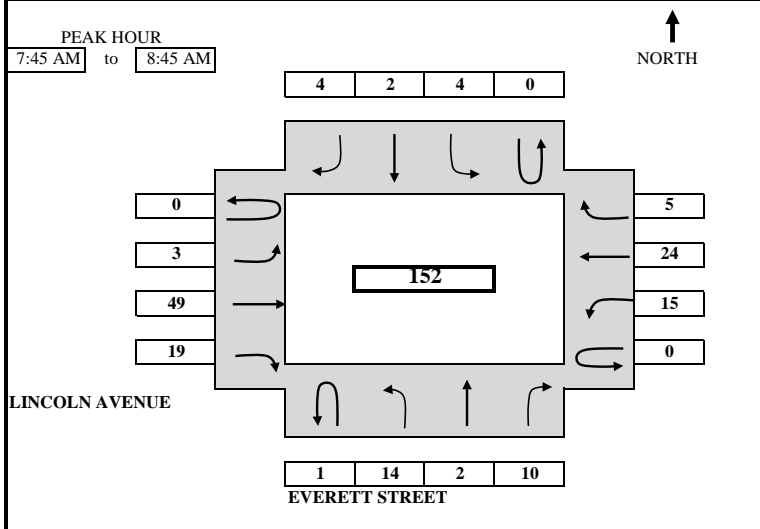
HOURLY TOTALS																	
7:00 AM to 8:00 AM	0	2	0	3	0	12	0	6	0	21	106	0	0	0	206	22	378
7:15 AM to 8:15 AM	0	3	0	2	0	12	0	8	0	33	143	0	0	0	257	40	498
7:30 AM to 8:30 AM	0	2	0	2	0	16	1	11	0	47	175	0	0	0	275	62	591
7:45 AM to 8:45 AM	0	1	2	3	0	16	1	13	1	60	208	0	0	0	301	68	674
8:00 AM to 9:00 AM	0	1	2	4	0	12	1	16	1	59	211	0	0	1	294	69	671

PEAK HOUR SUMMARY																	
7:45 AM to 8:45 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	1	2	3	0	16	1	13	1	60	208	0	0	0	301	68	674
PHF BY MOVEMENT	0.00	0.25	0.25	0.38	0.00	0.67	0.25	0.65	0.25	0.79	0.84	0.00	0.00	0.00	0.91	0.77	OVERALL
PHF BY APPROACH	0.50				0.75				0.82				0.89				0.91
BICYCLE	0				1				3				3				7
PEDESTRIAN	3				1				10				11				25
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	14				7				0				4				25

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/20/2015	<b>DAY:</b>	TUESDAY
<b>N-S APPROACH:</b>	EVERETT STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	LINCOLN AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-9)AM

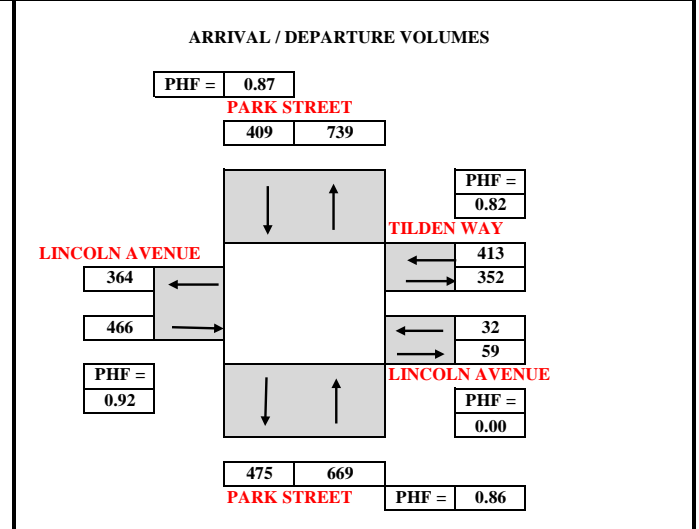
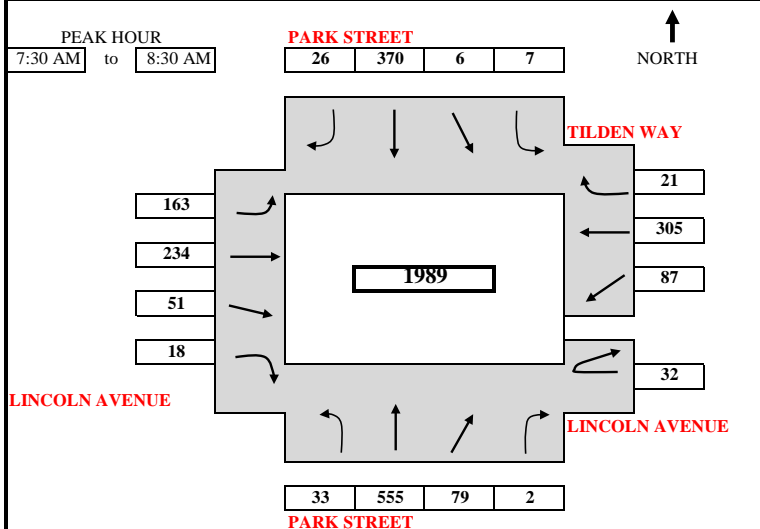


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT		
<b>SURVEY DATA</b>																		
7:00 AM to 7:15 AM	0	0	1	0	0	0	0	0	0	3	0	0	3	0	1	0	8	
7:15 AM to 7:30 AM	0	1	1	1	0	0	0	0	0	11	1	0	5	3	1	0	24	
7:30 AM to 7:45 AM	0	2	1	5	0	1	0	0	1	19	5	0	8	6	3	0	51	
7:45 AM to 8:00 AM	0	3	1	5	1	2	0	0	1	40	8	0	11	12	4	0	88	
8:00 AM to 8:15 AM	0	8	1	12	1	2	2	2	1	51	10	2	18	17	4	0	127	
8:15 AM to 8:30 AM	0	14	1	14	1	3	4	4	1	57	16	6	21	24	6	0	162	
8:30 AM to 8:45 AM	1	16	3	15	4	3	4	4	4	68	24	8	23	30	8	0	203	
8:45 AM to 9:00 AM	1	18	3	15	4	3	5	5	7	77	30	10	29	32	9	0	233	
<b>TOTAL BY PERIOD</b>																		
7:00 AM to 7:15 AM	0	0	1	0	0	0	0	0	0	0	3	0	0	3	0	1	8	
7:15 AM to 7:30 AM	0	1	0	1	0	0	0	0	0	0	8	1	0	2	3	0	16	
7:30 AM to 7:45 AM	0	1	0	4	0	0	1	0	0	1	8	4	0	3	3	2	27	
7:45 AM to 8:00 AM	0	1	0	0	0	1	1	0	0	0	21	3	0	3	6	1	37	
8:00 AM to 8:15 AM	0	5	0	7	0	0	0	2	0	0	11	2	0	7	5	0	39	
8:15 AM to 8:30 AM	0	6	0	2	0	0	1	2	0	0	6	6	0	3	7	2	35	
8:30 AM to 8:45 AM	1	2	2	1	0	3	0	0	0	3	11	8	0	2	6	2	41	
8:45 AM to 9:00 AM	0	2	0	0	0	0	0	1	0	3	9	6	0	6	2	1	30	
<b>HOURLY TOTALS</b>																		
7:00 AM to 8:00 AM	0	3	1	5	0	1	2	0	0	1	40	8	0	11	12	4	88	
7:15 AM to 8:15 AM	0	8	0	12	0	1	2	2	0	1	48	10	0	15	17	3	119	
7:30 AM to 8:30 AM	0	13	0	13	0	1	3	4	0	1	46	15	0	16	21	5	138	
7:45 AM to 8:45 AM	1	14	2	10	0	4	2	4	0	3	49	19	0	15	24	5	152	
8:00 AM to 9:00 AM	1	15	2	10	0	3	1	5	0	6	37	22	0	18	20	5	145	
<b>PEAK HOUR SUMMARY</b>																		
7:45 AM to 8:45 AM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME		1	14	2	10	0	4	2	4	0	3	49	19	0	15	24	5	152
PHF BY MOVEMENT		0.25	0.58	0.25	0.36	0.00	0.33	0.50	0.50	0.00	0.25	0.58	0.59	0.00	0.54	0.86	0.63	OVERALL
PHF BY APPROACH		0.56				0.83				0.74				0.92				0.93
BICYCLE		0				0				1				0				1
PEDESTRIAN		3				6				6				5				20
PEDESTRIAN BY LEG:		<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				
		2				9				5				4				20

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/22/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>PARK STREET</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>LINCOLN AVENUE - TILDEN WAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-10)AM</b>



TIME PERIOD	PARK STREET (NB)				PARK STREET (SB)				LINCOLN (EB)				LINCOLN	TILDEN WAY (WB)			TOTAL
	Lincoln (WB)	Park (NB)	Tilden (EB)	Lincoln (EB)	Tilden (EB)	Lincoln (EB)	Park (SB)	Lincoln (WB)	Park (NB)	Tilden (EB)	Lincoln (EB)	Park (SB)	Tilden (EB)	Park (SB)	Lincoln (WB)	Park (NB)	

SURVEY DATA																	
7:00 AM to 7:15 AM	3	103	8	0	0	0	51	5	14	27	4	3	4	8	29	4	263
7:15 AM to 7:30 AM	9	238	12	0	0	0	129	14	41	55	8	9	8	26	69	16	634
7:30 AM to 7:45 AM	16	389	22	0	2	2	194	22	88	93	16	13	16	47	138	19	1077
7:45 AM to 8:00 AM	26	557	38	1	5	4	289	25	133	148	35	17	22	72	234	24	1630
8:00 AM to 8:15 AM	34	663	66	1	7	6	393	34	174	218	46	21	30	93	309	30	2125
8:15 AM to 8:30 AM	42	793	91	2	7	6	499	40	204	289	59	27	40	113	374	37	2623
8:30 AM to 8:45 AM	51	893	125	2	9	6	592	51	233	352	66	28	44	130	429	46	3057
8:45 AM to 9:00 AM	56	990	148	2	10	7	708	60	269	379	72	33	47	161	503	56	3501

TOTAL BY PERIOD																	
7:00 AM to 7:15 AM	3	103	8	0	0	0	51	5	14	27	4	3	4	8	29	4	263
7:15 AM to 7:30 AM	6	135	4	0	0	0	78	9	27	28	4	6	4	18	40	12	371
7:30 AM to 7:45 AM	7	151	10	0	2	2	65	8	47	38	8	4	8	21	69	3	443
7:45 AM to 8:00 AM	10	168	16	1	3	2	95	3	45	55	19	4	6	25	96	5	553
8:00 AM to 8:15 AM	8	106	28	0	2	2	104	9	41	70	11	4	8	21	75	6	495
8:15 AM to 8:30 AM	8	130	25	1	0	0	106	6	30	71	13	6	10	20	65	7	498
8:30 AM to 8:45 AM	9	100	34	0	2	0	93	11	29	63	7	1	4	17	55	9	434
8:45 AM to 9:00 AM	5	97	23	0	1	1	116	9	36	27	6	5	3	31	74	10	444

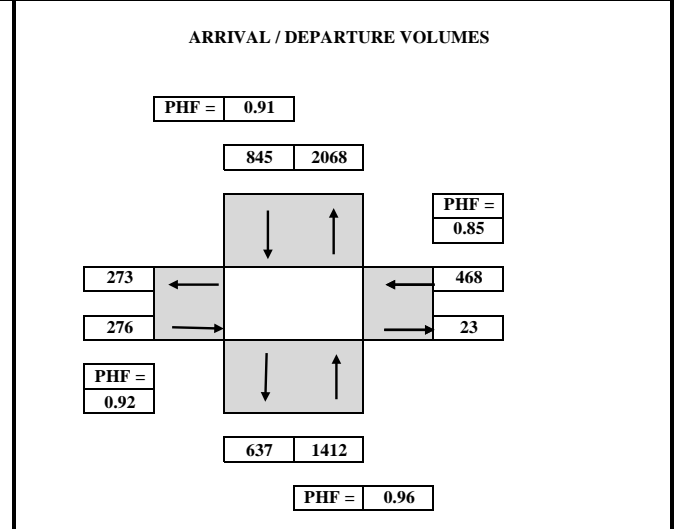
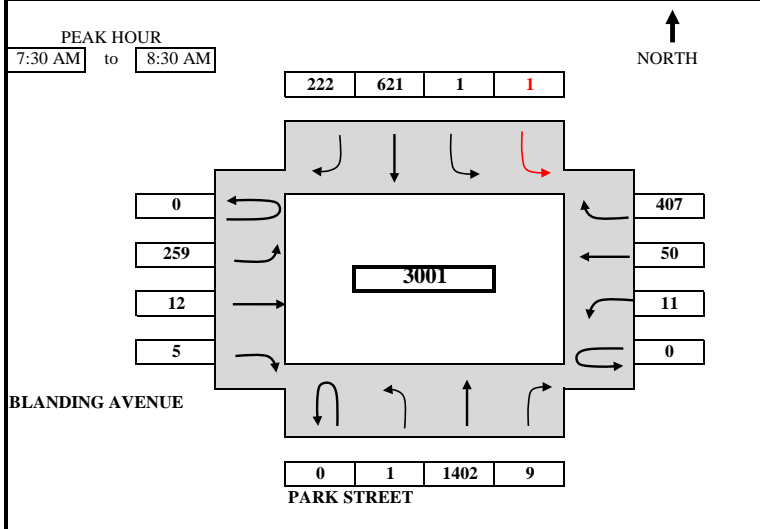
HOURLY TOTALS																	
7:00 AM to 8:00 AM	26	557	38	1	5	4	289	25	133	148	35	17	22	72	234	24	1630
7:15 AM to 8:15 AM	31	560	58	1	7	6	342	29	160	191	42	18	26	85	280	26	1862
7:30 AM to 8:30 AM	33	555	79	2	7	6	370	26	163	234	51	18	32	87	305	21	1989
7:45 AM to 8:45 AM	35	504	103	2	7	4	398	29	145	259	50	15	28	83	291	27	1980
8:00 AM to 9:00 AM	30	433	110	1	5	3	419	35	136	231	37	16	25	89	269	32	1871

PEAK HOUR SUMMARY																	
7:30 AM to 8:30 AM	PARK STREET (NB)				PARK STREET (SB)				LINCOLN (EB)				LINCOLN	TILDEN WAY (WB)			TOTAL
	Lincoln (WB)	Park (NB)	Tilden (EB)	Lincoln (EB)	Tilden (EB)	Lincoln (EB)	Park (SB)	Lincoln (WB)	Park (NB)	Tilden (WB)	Lincoln (EB)	Park (SB)	Tilden (WB)	Park (SB)	Lincoln (WB)	Park (NB)	
VOLUME	33	555	79	2	7	6	370	26	163	234	51	18	32	87	305	21	1989
PHF BY MOVEMENT	0.83	0.83	0.71	0.50	0.58	0.75	0.87	0.72	0.87	0.82	0.67	0.75	0.80	0.87	0.79	0.75	OVERALL
PHF BY APPROACH	0.86				0.87				0.92				0.80	0.82			0.90
BICYCLE	7				1				8				2			18	
PEDESTRIAN	15				13				10				8			46	
	N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:	13				5				21				7			46	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/22/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	PARK STREET	<b>SURVEY TIME:</b>	7:00 AM	<b>TO</b>	9:00 AM
<b>E-W APPROACH:</b>	BLANDING AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-11)AM

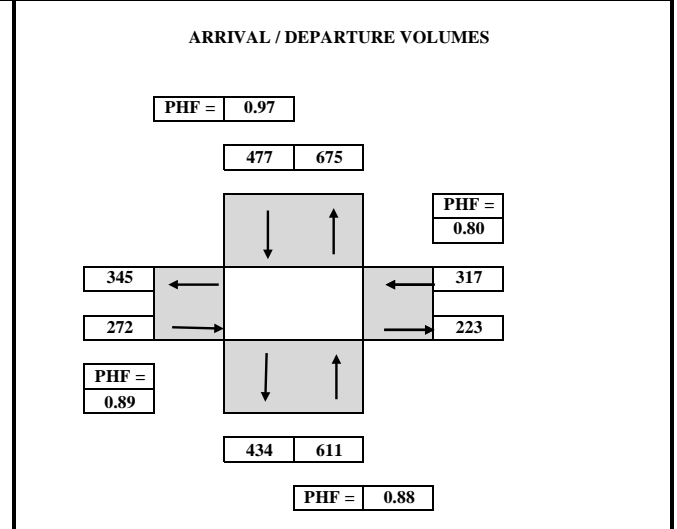
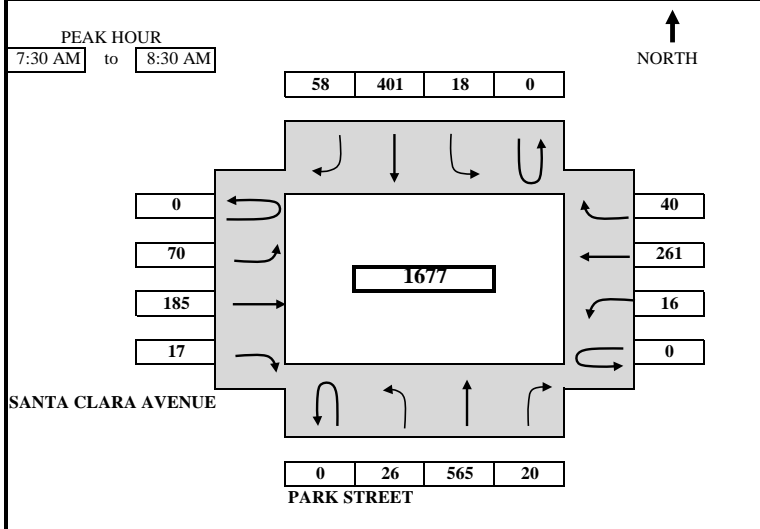


TIME PERIOD	NORTHBOUND				Frontage RIGHT	SOUTHBOUND			EASTBOUND				WESTBOUND				TOTAL		
	From	To	U-TURN	LEFT		THRU	RIGHT	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT		THRU	RIGHT
<b>SURVEY DATA</b>																			
7:00 AM to 7:15 AM			1	231	1	1	0	97	38	28	3	0	1	9	53		463		
7:15 AM to 7:30 AM			1	508	5	2	0	208	70	61	7	0	1	23	124		1010		
7:30 AM to 7:45 AM			1	863	6	2	0	342	122	120	11	3	4	38	208		1720		
7:45 AM to 8:00 AM			1	1227	9	3	1	513	180	179	15	3	7	48	290		2476		
8:00 AM to 8:15 AM			1	1559	10	3	1	678	235	249	16	4	10	62	407		3235		
8:15 AM to 8:30 AM			2	1910	14	3	1	829	292	320	19	5	12	73	531		4011		
8:30 AM to 8:45 AM			3	2226	14	4	1	964	327	389	19	7	14	85	642		4695		
8:45 AM to 9:00 AM			4	2553	19	4	1	1134	382	451	23	9	19	104	751		5454		
<b>TOTAL BY PERIOD</b>																			
7:00 AM to 7:15 AM			0	1	231	1	1	0	97	38	0	28	3	0	0	1	9	53	463
7:15 AM to 7:30 AM			0	0	277	4	1	0	111	32	0	33	4	0	0	0	14	71	547
7:30 AM to 7:45 AM			0	0	355	1	0	0	134	52	0	59	4	3	0	3	15	84	710
7:45 AM to 8:00 AM			0	0	364	3	1	1	171	58	0	59	4	0	0	3	10	82	756
8:00 AM to 8:15 AM			0	0	332	1	0	0	165	55	0	70	1	1	0	3	14	117	759
8:15 AM to 8:30 AM			0	1	351	4	0	0	151	57	0	71	3	1	0	2	11	124	776
8:30 AM to 8:45 AM			0	1	316	0	1	0	135	35	0	69	0	2	0	2	12	111	684
8:45 AM to 9:00 AM			0	1	327	5	0	0	170	55	0	62	4	2	0	5	19	109	759
<b>HOURLY TOTALS</b>																			
7:00 AM to 8:00 AM			0	1	1227	9	3	1	513	180	0	179	15	3	0	7	48	290	2476
7:15 AM to 8:15 AM			0	0	1328	9	2	1	581	197	0	221	13	4	0	9	53	354	2772
7:30 AM to 8:30 AM			0	1	1402	9	1	1	621	222	0	259	12	5	0	11	50	407	3001
7:45 AM to 8:45 AM			0	2	1363	8	2	1	622	205	0	269	8	4	0	10	47	434	2975
8:00 AM to 9:00 AM			0	3	1326	10	1	0	621	202	0	272	8	6	0	12	56	461	2978
<b>PEAK HOUR SUMMARY</b>																			
7:30 AM to 8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL		
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR			
VOLUME	0	1	1402	9	1	1	621	222	0	259	12	5	0	11	50	407	3001		
PHF BY MOVEMENT	0.00	0.25	0.96	0.56	0.25	0.25	0.91	0.96	0.00	0.91	0.75	0.42	0.00	0.92	0.83	0.82	OVERALL		
PHF BY APPROACH	0.96				0.91				0.92				0.85				0.97		
BICYCLE	2				2				3				19				26		
PEDESTRIAN	10				5				6				6				27		
	N-LEG				S-LEG				E-LEG				W-LEG						
PEDESTRIAN BY LEG:	2				10				9				6				27		

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/22/2015</b>	<b>DAY:</b>	<b>THURSDAY</b>
<b>N-S APPROACH:</b>	<b>PARK STREET</b>	<b>SURVEY TIME:</b>	<b>7:00 AM</b>	<b>TO</b>	<b>9:00 AM</b>
<b>E-W APPROACH:</b>	<b>SANTA CLARA AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-12)AM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
7:00 AM	to	7:15 AM	3	90	3	3	41	8	13	7	5	2	13	5	193		
7:15 AM	to	7:30 AM	4	193	6	5	125	16	24	23	8	3	48	14	469		
7:30 AM	to	7:45 AM	17	338	8	8	222	33	48	54	11	5	118	27	889		
7:45 AM	to	8:00 AM	18	508	10	11	326	49	66	109	14	11	202	36	1360		
8:00 AM	to	8:15 AM	27	639	18	15	429	63	82	161	20	14	247	47	1762		
8:15 AM	to	8:30 AM	30	758	26	23	526	74	94	208	25	19	309	54	2146		
8:30 AM	to	8:45 AM	40	893	30	30	634	90	109	254	33	21	358	67	2559		
8:45 AM	to	9:00 AM	45	1015	36	35	728	120	126	290	40	21	395	73	2924		

TOTAL BY PERIOD																			
7:00 AM	to	7:15 AM	0	3	90	3	0	3	41	8	0	13	7	5	0	2	13	5	193
7:15 AM	to	7:30 AM	0	1	103	3	0	2	84	8	0	11	16	3	0	1	35	9	276
7:30 AM	to	7:45 AM	0	13	145	2	0	3	97	17	0	24	31	3	0	2	70	13	420
7:45 AM	to	8:00 AM	0	1	170	2	0	3	104	16	0	18	55	3	0	6	84	9	471
8:00 AM	to	8:15 AM	0	9	131	8	0	4	103	14	0	16	52	6	0	3	45	11	402
8:15 AM	to	8:30 AM	0	3	119	8	0	8	97	11	0	12	47	5	0	5	62	7	384
8:30 AM	to	8:45 AM	0	10	135	4	0	7	108	16	0	15	46	8	0	2	49	13	413
8:45 AM	to	9:00 AM	0	5	122	6	0	5	94	30	0	17	36	7	0	0	37	6	365

HOURLY TOTALS																			
7:00 AM	to	8:00 AM	0	18	508	10	0	11	326	49	0	66	109	14	0	11	202	36	1360
7:15 AM	to	8:15 AM	0	24	549	15	0	12	388	55	0	69	154	15	0	12	234	42	1569
7:30 AM	to	8:30 AM	0	26	565	20	0	18	401	58	0	70	185	17	0	16	261	40	1677
7:45 AM	to	8:45 AM	0	23	555	22	0	22	412	57	0	61	200	22	0	16	240	40	1670
8:00 AM	to	9:00 AM	0	27	507	26	0	24	402	71	0	60	181	26	0	10	193	37	1564

PEAK HOUR SUMMARY																			
7:30 AM	to	8:30 AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	26	565	20	0	18	401	58	0	70	185	17	0	16	261	40	1677
PHF BY MOVEMENT			0.00	0.50	0.83	0.63	0.00	0.56	0.96	0.85	0.00	0.73	0.84	0.71	0.00	0.67	0.78	0.77	OVERALL
PHF BY APPROACH			0.88				0.97				0.89				0.80				0.89
BICYCLE			2				4				2				7				15
PEDESTRIAN			33				31				21				20				105
			N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:			21				20				24				40				105

TEL: (510) 232 - 1271

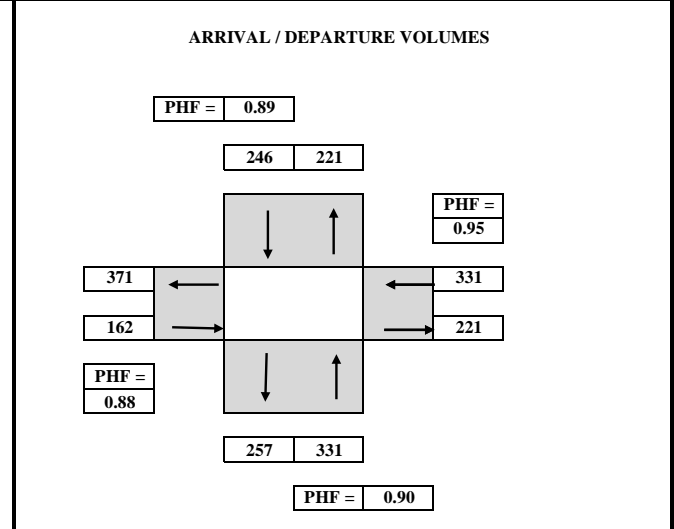
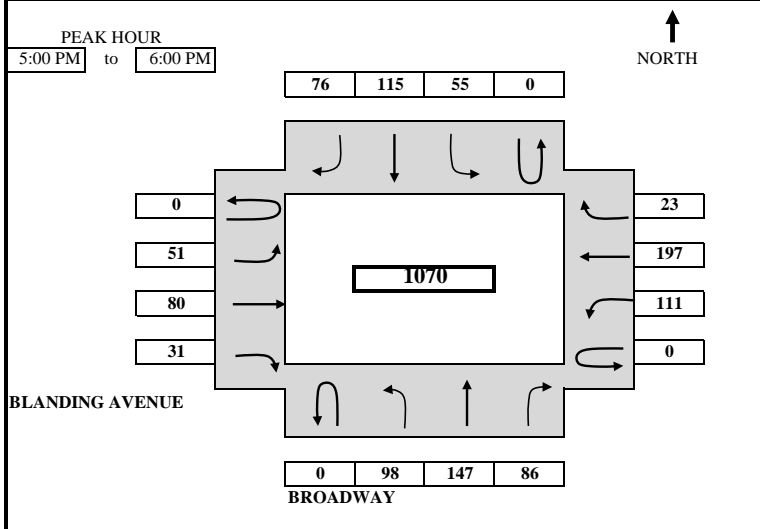
FAX: (510) 232 - 1272



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>BLANDING AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-1)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
4:00 PM to 4:15 PM	11	32	17		9	21	9		14	21	2		18	47	7		208
4:15 PM to 4:30 PM	42	65	45		17	40	25		23	47	8		41	98	17		468
4:30 PM to 4:45 PM	56	96	62		28	58	38		36	75	18		69	153	24		713
4:45 PM to 5:00 PM	68	124	80		42	85	50		45	84	32		91	206	34		941
5:00 PM to 5:15 PM	94	151	102		56	115	68		57	105	45		117	257	40		1207
5:15 PM to 5:30 PM	120	189	120		75	142	80		74	123	54		143	312	43		1475
5:30 PM to 5:45 PM	145	233	143		87	165	102		85	135	58		168	357	50		1728
5:45 PM to 6:00 PM	166	271	166		97	200	126		96	164	63		202	403	57		2011

<b>TOTAL BY PERIOD</b>																	
4:00 PM to 4:15 PM	0	11	32	17	0	9	21	9	0	14	21	2	0	18	47	7	208
4:15 PM to 4:30 PM	0	31	33	28	0	8	19	16	0	9	26	6	0	23	51	10	260
4:30 PM to 4:45 PM	0	14	31	17	0	11	18	13	0	13	28	10	0	28	55	7	245
4:45 PM to 5:00 PM	0	12	28	18	0	14	27	12	0	9	9	14	0	22	53	10	228
5:00 PM to 5:15 PM	0	26	27	22	0	14	30	18	0	12	21	13	0	26	51	6	266
5:15 PM to 5:30 PM	0	26	38	18	0	19	27	12	0	17	18	9	0	26	55	3	268
5:30 PM to 5:45 PM	0	25	44	23	0	12	23	22	0	11	12	4	0	25	45	7	253
5:45 PM to 6:00 PM	0	21	38	23	0	10	35	24	0	11	29	5	0	34	46	7	283

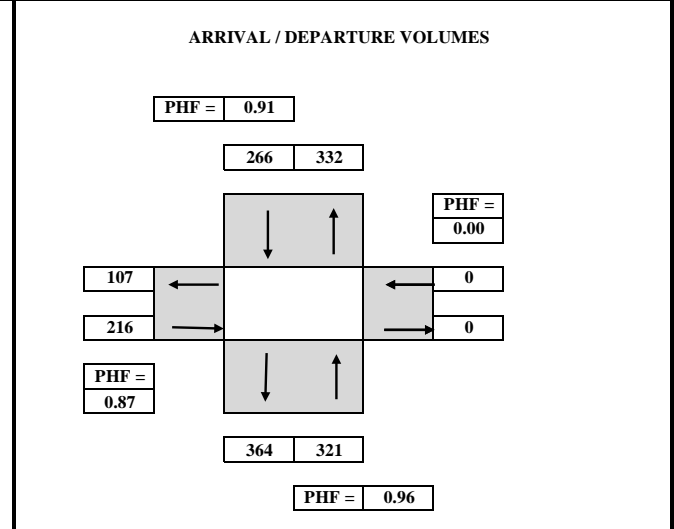
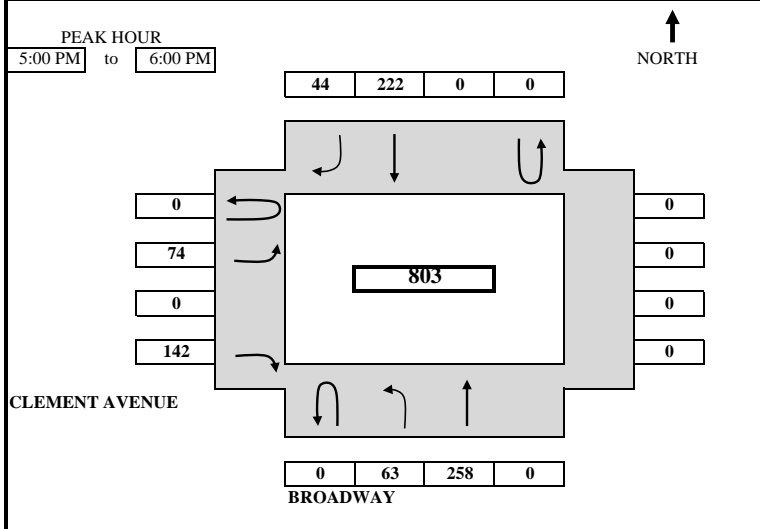
<b>HOURLY TOTALS</b>																	
4:00 PM to 5:00 PM	0	68	124	80	0	42	85	50	0	45	84	32	0	91	206	34	941
4:15 PM to 5:15 PM	0	83	119	85	0	47	94	59	0	43	84	43	0	99	210	33	999
4:30 PM to 5:30 PM	0	78	124	75	0	58	102	55	0	51	76	46	0	102	214	26	1007
4:45 PM to 5:45 PM	0	89	137	81	0	59	107	64	0	49	60	40	0	99	204	26	1015
5:00 PM to 6:00 PM	0	98	147	86	0	55	115	76	0	51	80	31	0	111	197	23	1070

<b>PEAK HOUR SUMMARY</b>																	
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	98	147	86	0	55	115	76	0	51	80	31	0	111	197	23	1070
PHF BY MOVEMENT	0.00	0.94	0.84	0.93	0.00	0.72	0.82	0.79	0.00	0.75	0.69	0.60	0.00	0.82	0.90	0.82	OVERALL
PHF BY APPROACH	0.90				0.89				0.88				0.95				0.95
BICYCLE	3				2				18				7				30
PEDESTRIAN	9				6				5				5				25
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	9				1				4				11				25

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>CLEMENT AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-2)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	9	51			35	10		12	32						149
4:15 PM	to	4:30 PM	25	120			72	24		29	70						340
4:30 PM	to	4:45 PM	37	171			119	35		42	107						511
4:45 PM	to	5:00 PM	62	219			172	43		57	150						703
5:00 PM	to	5:15 PM	77	278			231	52		75	183						896
5:15 PM	to	5:30 PM	89	347			288	58		94	210						1086
5:30 PM	to	5:45 PM	100	418			337	71		110	251						1287
5:45 PM	to	6:00 PM	125	477			394	87		131	292						1506

TOTAL BY PERIOD																		
4:00 PM	to	4:15 PM	0	9	51	0	0	0	35	10	0	12	0	32	0	0	0	149
4:15 PM	to	4:30 PM	0	16	69	0	0	0	37	14	0	17	0	38	0	0	0	191
4:30 PM	to	4:45 PM	0	12	51	0	0	0	47	11	0	13	0	37	0	0	0	171
4:45 PM	to	5:00 PM	0	25	48	0	0	0	53	8	0	15	0	43	0	0	0	192
5:00 PM	to	5:15 PM	0	15	59	0	0	0	59	9	0	18	0	33	0	0	0	193
5:15 PM	to	5:30 PM	0	12	69	0	0	0	57	6	0	19	0	27	0	0	0	190
5:30 PM	to	5:45 PM	0	11	71	0	0	0	49	13	0	16	0	41	0	0	0	201
5:45 PM	to	6:00 PM	0	25	59	0	0	0	57	16	0	21	0	41	0	0	0	219

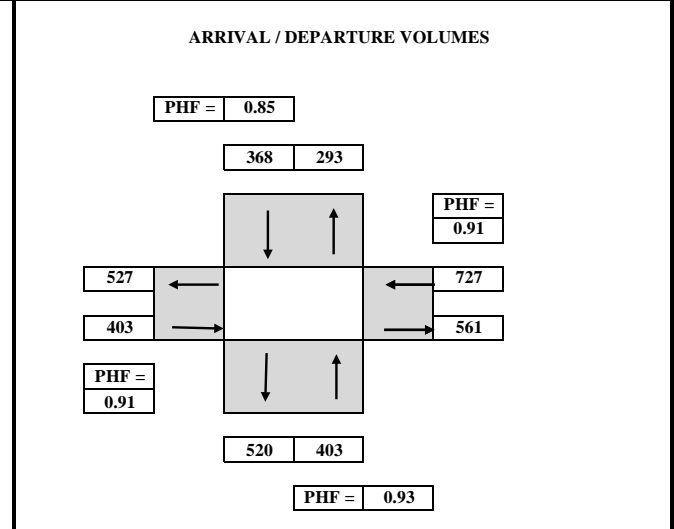
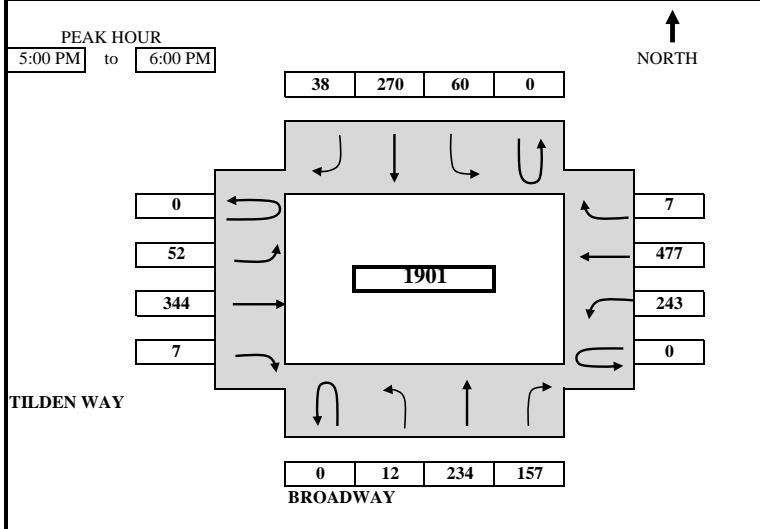
HOURLY TOTALS																		
4:00 PM	to	5:00 PM	0	62	219	0	0	0	172	43	0	57	0	150	0	0	0	703
4:15 PM	to	5:15 PM	0	68	227	0	0	0	196	42	0	63	0	151	0	0	0	747
4:30 PM	to	5:30 PM	0	64	227	0	0	0	216	34	0	65	0	140	0	0	0	746
4:45 PM	to	5:45 PM	0	63	247	0	0	0	218	36	0	68	0	144	0	0	0	776
5:00 PM	to	6:00 PM	0	63	258	0	0	0	222	44	0	74	0	142	0	0	0	803

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	63	258	0	0	0	222	44	0	74	0	142	0	0	0	0	803
PHF BY MOVEMENT			0.00	0.63	0.91	0.00	0.00	0.00	0.94	0.69	0.00	0.88	0.00	0.87	0.00	0.00	0.00	0.00	OVERALL
PHF BY APPROACH			0.96				0.91				0.87				0.00				0.92
BICYCLE			3				3				0				0				6
PEDESTRIAN			0				0				0				0				0
PEDESTRIAN BY LEG:			N-LEG				S-LEG				E-LEG				W-LEG				0
			0				0				0				0				0

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>TILDEN WAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-3)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	1	55	44	6	47	9	7	69	1	53	89	2	383		
4:15 PM	to	4:30 PM	5	130	81	16	109	18	16	140	5	114	193	3	830		
4:30 PM	to	4:45 PM	10	175	122	26	182	30	28	212	7	165	288	7	1252		
4:45 PM	to	5:00 PM	10	218	163	35	255	45	40	296	7	220	394	14	1697		
5:00 PM	to	5:15 PM	13	278	203	47	324	53	51	376	8	285	497	15	2150		
5:15 PM	to	5:30 PM	17	346	239	61	384	60	66	453	9	357	624	16	2632		
5:30 PM	to	5:45 PM	17	397	283	74	454	67	77	551	11	399	755	17	3102		
5:45 PM	to	6:00 PM	22	452	320	95	525	83	92	640	14	463	871	21	3598		

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	1	55	44	0	6	47	9	0	7	69	1	0	53	89	2	383
4:15 PM	to	4:30 PM	0	4	75	37	0	10	62	9	0	9	71	4	0	61	104	1	447
4:30 PM	to	4:45 PM	0	5	45	41	0	10	73	12	0	12	72	2	0	51	95	4	422
4:45 PM	to	5:00 PM	0	0	43	41	0	9	73	15	0	12	84	0	0	55	106	7	445
5:00 PM	to	5:15 PM	0	3	60	40	0	12	69	8	0	11	80	1	0	65	103	1	453
5:15 PM	to	5:30 PM	0	4	68	36	0	14	60	7	0	15	77	1	0	72	127	1	482
5:30 PM	to	5:45 PM	0	0	51	44	0	13	70	7	0	11	98	2	0	42	131	1	470
5:45 PM	to	6:00 PM	0	5	55	37	0	21	71	16	0	15	89	3	0	64	116	4	496

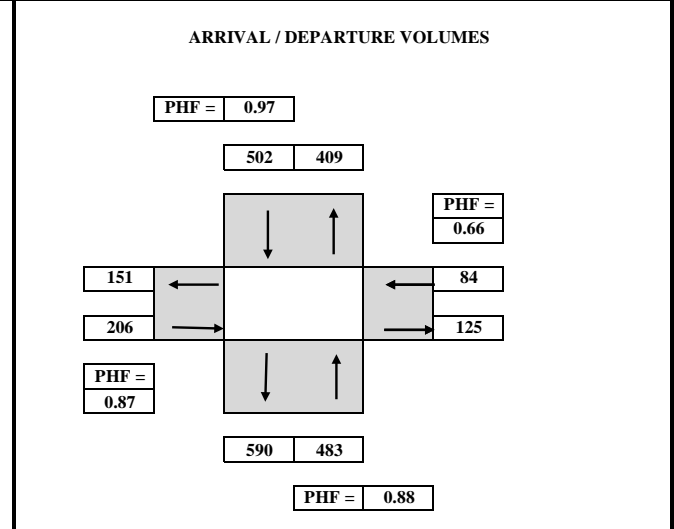
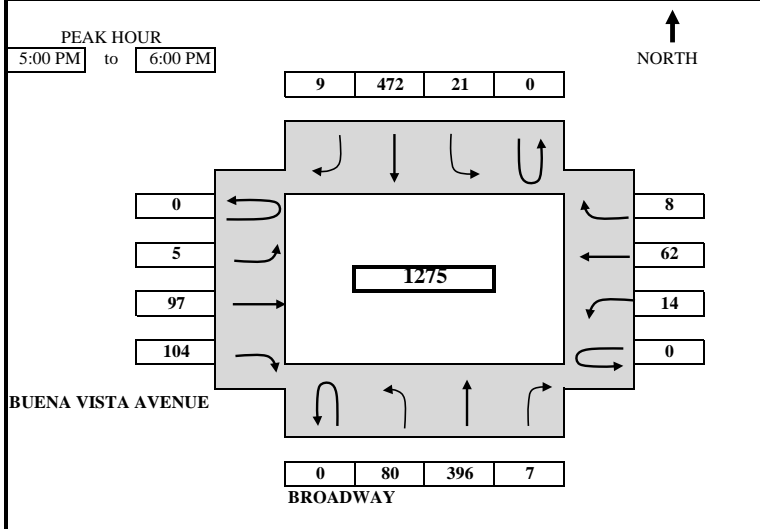
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	10	218	163	0	35	255	45	0	40	296	7	0	220	394	14	1697
4:15 PM	to	5:15 PM	0	12	223	159	0	41	277	44	0	44	307	7	0	232	408	13	1767
4:30 PM	to	5:30 PM	0	12	216	158	0	45	275	42	0	50	313	4	0	243	431	13	1802
4:45 PM	to	5:45 PM	0	7	222	161	0	48	272	37	0	49	339	4	0	234	467	10	1850
5:00 PM	to	6:00 PM	0	12	234	157	0	60	270	38	0	52	344	7	0	243	477	7	1901

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	12	234	157	0	60	270	38	0	52	344	7	0	243	477	7	1901
			PHF BY MOVEMENT				0.93				0.85				0.91				OVERALL
			0.00 0.60 0.86 0.89				0.00 0.71 0.95 0.59				0.00 0.87 0.88 0.58				0.00 0.84 0.91 0.44				
			PHF BY APPROACH				0.93				0.85				0.91				0.96
			5				11				4				3				23
			PEDESTRIAN				10				9				4				33
			N-LEG				S-LEG				E-LEG				W-LEG				
			7				7				5				14				33

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>BUENA VISTA AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-4)PM</b>



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	From	To	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	

SURVEY DATA																		
4:00 PM to 4:15 PM	19	100	2	4	106	1	1	17	17	0	13	0	280					
4:15 PM to 4:30 PM	31	210	3	8	211	2	2	42	39	1	26	1	576					
4:30 PM to 4:45 PM	44	302	6	16	331	3	4	60	58	3	33	3	863					
4:45 PM to 5:00 PM	62	388	9	21	459	3	5	79	79	4	45	6	1160					
5:00 PM to 5:15 PM	81	486	10	29	574	6	6	104	99	10	68	9	1482					
5:15 PM to 5:30 PM	94	590	13	30	702	7	7	126	121	12	79	11	1792					
5:30 PM to 5:45 PM	119	701	15	37	815	10	8	154	151	15	95	14	2134					
5:45 PM to 6:00 PM	142	784	16	42	931	12	10	176	183	18	107	14	2435					

TOTAL BY PERIOD																		
4:00 PM to 4:15 PM	0	19	100	2	0	4	106	1	0	1	17	17	0	0	13	0	280	
4:15 PM to 4:30 PM	0	12	110	1	0	4	105	1	0	1	25	22	0	1	13	1	296	
4:30 PM to 4:45 PM	0	13	92	3	0	8	120	1	0	2	18	19	0	2	7	2	287	
4:45 PM to 5:00 PM	0	18	86	3	0	5	128	0	0	1	19	21	0	1	12	3	297	
5:00 PM to 5:15 PM	0	19	98	1	0	8	115	3	0	1	25	20	0	6	23	3	322	
5:15 PM to 5:30 PM	0	13	104	3	0	1	128	1	0	1	22	22	0	2	11	2	310	
5:30 PM to 5:45 PM	0	25	111	2	0	7	113	3	0	1	28	30	0	3	16	3	342	
5:45 PM to 6:00 PM	0	23	83	1	0	5	116	2	0	2	22	32	0	3	12	0	301	

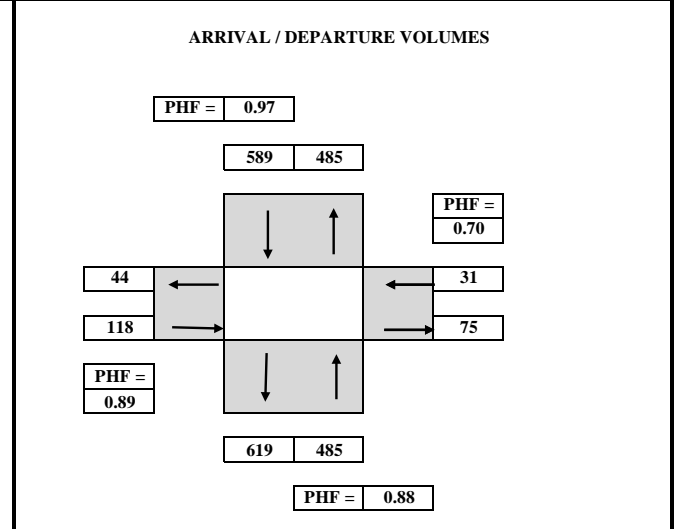
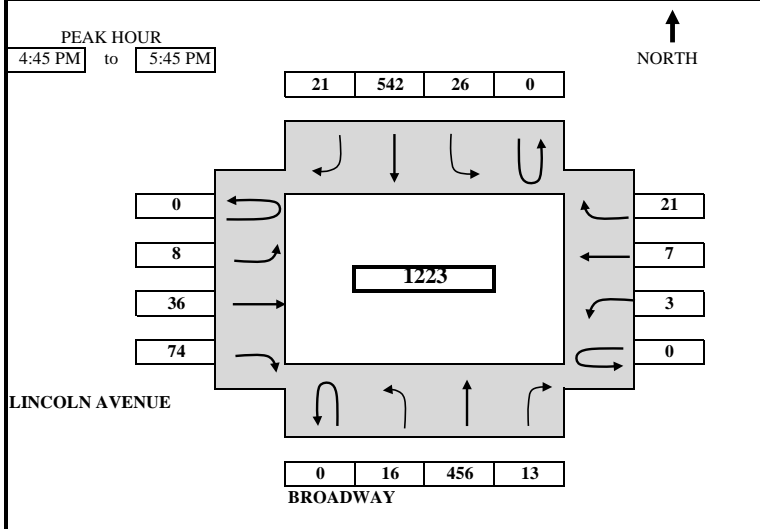
HOURLY TOTALS																		
4:00 PM to 5:00 PM	0	62	388	9	0	21	459	3	0	5	79	79	0	4	45	6	1160	
4:15 PM to 5:15 PM	0	62	386	8	0	25	468	5	0	5	87	82	0	10	55	9	1202	
4:30 PM to 5:30 PM	0	63	380	10	0	22	491	5	0	5	84	82	0	11	53	10	1216	
4:45 PM to 5:45 PM	0	75	399	9	0	21	484	7	0	4	94	93	0	12	62	11	1271	
5:00 PM to 6:00 PM	0	80	396	7	0	21	472	9	0	5	97	104	0	14	62	8	1275	

PEAK HOUR SUMMARY																		
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
VOLUME	0	80	396	7	0	21	472	9	0	5	97	104	0	14	62	8	1275	
PHF BY MOVEMENT	0.00	0.80	0.89	0.58	0.00	0.66	0.92	0.75	0.00	0.63	0.87	0.81	0.00	0.58	0.67	0.67	OVERALL	
PHF BY APPROACH	0.88				0.97				0.87				0.66				0.93	
BICYCLE	8				15				3				1				27	
PEDESTRIAN	11				6				16				11				44	
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG					
	8				19				5				12				44	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>BROADWAY</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>LINCOLN AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-5)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	1	110	1	1	100	7	4	7	10	1	2	0	244		
4:15 PM	to	4:30 PM	4	233	2	6	224	14	12	10	21	2	5	1	534		
4:30 PM	to	4:45 PM	6	331	5	9	354	16	13	19	36	2	6	6	803		
4:45 PM	to	5:00 PM	12	443	8	16	485	19	15	26	55	3	6	11	1099		
5:00 PM	to	5:15 PM	13	548	12	20	623	22	17	37	75	3	8	16	1394		
5:15 PM	to	5:30 PM	16	659	14	24	762	30	17	49	87	5	11	22	1696		
5:30 PM	to	5:45 PM	22	787	18	35	896	37	21	55	110	5	13	27	2026		
5:45 PM	to	6:00 PM	26	885	20	46	1030	45	25	60	127	6	13	29	2312		

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	1	110	1	0	1	100	7	0	4	7	10	0	1	2	0	244
4:15 PM	to	4:30 PM	0	3	123	1	0	5	124	7	0	8	3	11	0	1	3	1	290
4:30 PM	to	4:45 PM	0	2	98	3	0	3	130	2	0	1	9	15	0	0	1	5	269
4:45 PM	to	5:00 PM	0	6	112	3	0	7	131	3	0	2	7	19	0	1	0	5	296
5:00 PM	to	5:15 PM	0	1	105	4	0	4	138	3	0	2	11	20	0	0	2	5	295
5:15 PM	to	5:30 PM	0	3	111	2	0	4	139	8	0	0	12	12	0	2	3	6	302
5:30 PM	to	5:45 PM	0	6	128	4	0	11	134	7	0	4	6	23	0	0	2	5	330
5:45 PM	to	6:00 PM	0	4	98	2	0	11	134	8	0	4	5	17	0	1	0	2	286

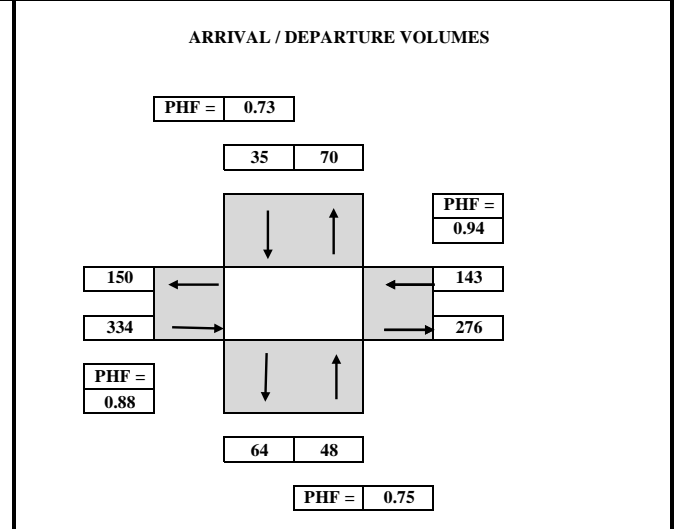
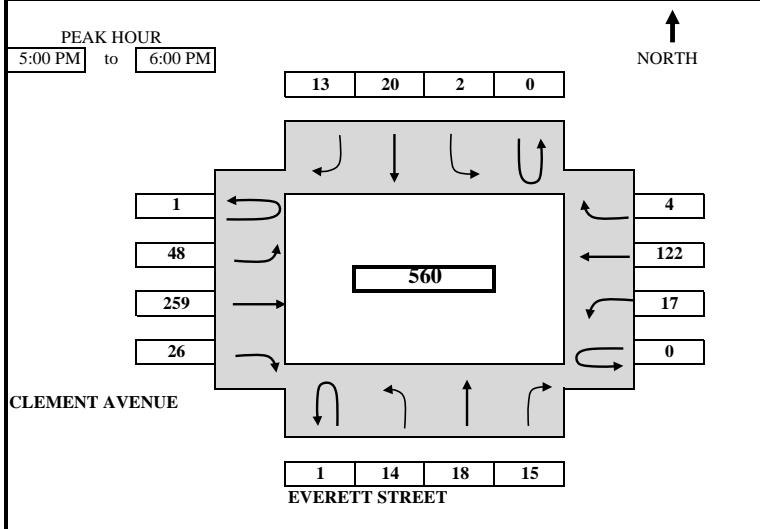
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	12	443	8	0	16	485	19	0	15	26	55	0	3	6	11	1099
4:15 PM	to	5:15 PM	0	12	438	11	0	19	523	15	0	13	30	65	0	2	6	16	1150
4:30 PM	to	5:30 PM	0	12	426	12	0	18	538	16	0	5	39	66	0	3	6	21	1162
4:45 PM	to	5:45 PM	0	16	456	13	0	26	542	21	0	8	36	74	0	3	7	21	1223
5:00 PM	to	6:00 PM	0	14	442	12	0	30	545	26	0	10	34	72	0	3	7	18	1213

PEAK HOUR SUMMARY																			
4:45 PM	to	5:45 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	16	456	13	0	26	542	21	0	8	36	74	0	3	7	21	1223
PHF BY MOVEMENT			0.00	0.67	0.89	0.81	0.00	0.59	0.97	0.66	0.00	0.50	0.75	0.80	0.00	0.38	0.58	0.88	OVERALL
PHF BY APPROACH			0.88				0.97				0.89				0.70				0.93
BICYCLE			13				15				0				3				31
PEDESTRIAN			12				4				2				5				23
			N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:			6				1				6				10				23

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>EVERETT STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>CLEMENT AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-6)PM</b>

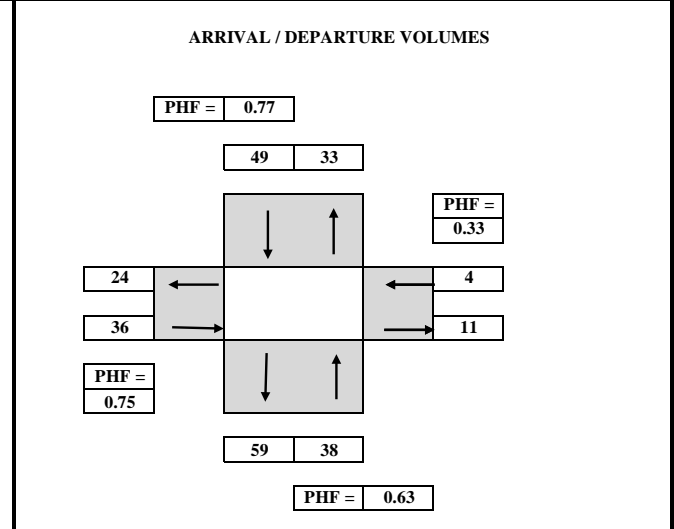
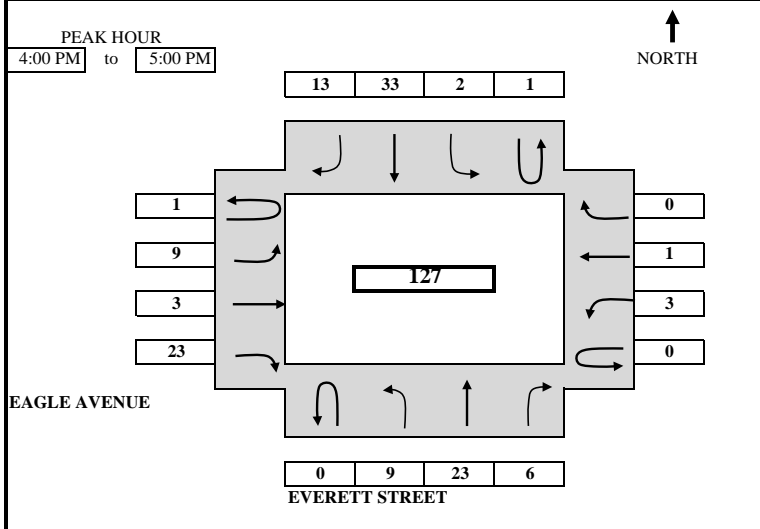


TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	
<b>SURVEY DATA</b>																	
4:00 PM to 4:15 PM	0	2	6	4	0	1	3	0	15	59	3	6	23	0	122		
4:15 PM to 4:30 PM	0	5	10	8	2	6	4	0	29	117	9	7	55	0	252		
4:30 PM to 4:45 PM	0	9	14	10	4	10	8	0	37	177	15	12	83	0	379		
4:45 PM to 5:00 PM	0	9	15	12	4	13	12	0	45	241	23	15	114	0	503		
5:00 PM to 5:15 PM	0	18	19	15	4	19	16	0	54	303	29	18	148	0	643		
5:15 PM to 5:30 PM	0	20	25	19	4	26	21	0	73	370	38	22	180	2	800		
5:30 PM to 5:45 PM	1	21	29	22	4	30	22	0	82	437	46	27	204	3	928		
5:45 PM to 6:00 PM	1	23	33	27	6	33	25	1	93	500	49	32	236	4	1063		
<b>TOTAL BY PERIOD</b>																	
4:00 PM to 4:15 PM	0	2	6	4	0	0	1	3	0	15	59	3	0	6	23	0	122
4:15 PM to 4:30 PM	0	3	4	4	0	2	5	1	0	14	58	6	0	1	32	0	130
4:30 PM to 4:45 PM	0	4	4	2	0	2	4	4	0	8	60	6	0	5	28	0	127
4:45 PM to 5:00 PM	0	0	1	2	0	0	3	4	0	8	64	8	0	3	31	0	124
5:00 PM to 5:15 PM	0	9	4	3	0	0	6	4	0	9	62	6	0	3	34	0	140
5:15 PM to 5:30 PM	0	2	6	4	0	0	7	5	0	19	67	9	0	4	32	2	157
5:30 PM to 5:45 PM	1	1	4	3	0	0	4	1	0	9	67	8	0	5	24	1	128
5:45 PM to 6:00 PM	0	2	4	5	0	2	3	3	1	11	63	3	0	5	32	1	135
<b>HOURLY TOTALS</b>																	
4:00 PM to 5:00 PM	0	9	15	12	0	4	13	12	0	45	241	23	0	15	114	0	503
4:15 PM to 5:15 PM	0	16	13	11	0	4	18	13	0	39	244	26	0	12	125	0	521
4:30 PM to 5:30 PM	0	15	15	11	0	2	20	17	0	44	253	29	0	15	125	2	548
4:45 PM to 5:45 PM	1	12	15	12	0	0	20	14	0	45	260	31	0	15	121	3	549
5:00 PM to 6:00 PM	1	14	18	15	0	2	20	13	1	48	259	26	0	17	122	4	560
<b>PEAK HOUR SUMMARY</b>																	
5:00 PM to 6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	1	14	18	15	0	2	20	13	1	48	259	26	0	17	122	4	560
PHF BY MOVEMENT	0.25	0.39	0.75	0.75	0.00	0.25	0.71	0.65	0.25	0.63	0.97	0.72	0.00	0.85	0.90	0.50	OVERALL
PHF BY APPROACH	0.75				0.73				0.88				0.94				0.89
BICYCLE	1				4				5				0				10
PEDESTRIAN	2				3				5				0				10
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	0				5				3				2				10

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/20/2015	<b>DAY:</b>	TUESDAY
<b>N-S APPROACH:</b>	EVERETT STREET	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	EAGLE AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-7)PM



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	2	8	3	0	0	9	2	0	1	1	7	2	1	0	36
4:15 PM	to	4:30 PM	7	17	4	1	0	14	6	1	3	2	15	2	1	0	73
4:30 PM	to	4:45 PM	8	21	4	1	1	22	13	1	8	2	20	2	1	0	104
4:45 PM	to	5:00 PM	9	23	6	1	2	33	13	1	9	3	23	3	1	0	127
5:00 PM	to	5:15 PM	10	30	6	1	2	40	16	2	13	3	29	4	1	0	157
5:15 PM	to	5:30 PM	12	35	9	1	3	50	22	2	15	3	30	4	2	0	188
5:30 PM	to	5:45 PM	13	41	10	1	3	59	24	3	19	4	37	6	2	0	222
5:45 PM	to	6:00 PM	14	47	10	3	5	64	27	3	21	4	43	8	3	0	252

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	2	8	3	0	0	9	2	0	1	1	7	0	2	1	0	36
4:15 PM	to	4:30 PM	0	5	9	1	1	0	5	4	1	2	1	8	0	0	0	0	37
4:30 PM	to	4:45 PM	0	1	4	0	0	1	8	7	0	5	0	5	0	0	0	0	31
4:45 PM	to	5:00 PM	0	1	2	2	0	1	11	0	0	1	1	3	0	1	0	0	23
5:00 PM	to	5:15 PM	0	1	7	0	0	0	7	3	1	4	0	6	0	1	0	0	30
5:15 PM	to	5:30 PM	0	2	5	3	0	1	10	6	0	2	0	1	0	0	1	0	31
5:30 PM	to	5:45 PM	0	1	6	1	0	0	9	2	1	4	1	7	0	2	0	0	34
5:45 PM	to	6:00 PM	0	1	6	0	2	2	5	3	0	2	0	6	0	2	1	0	30

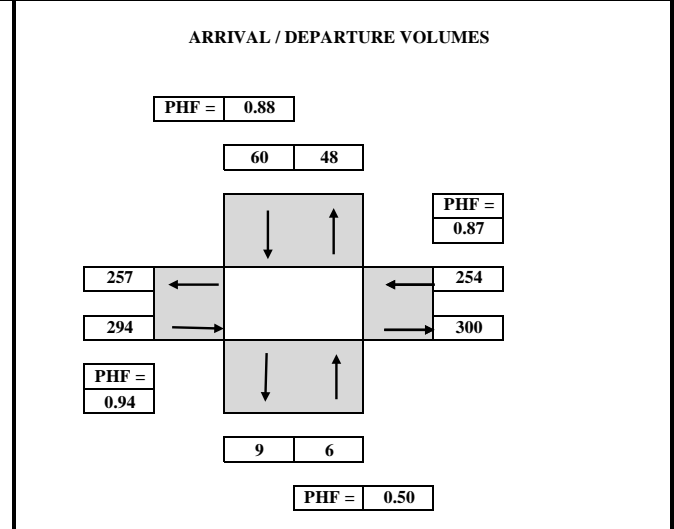
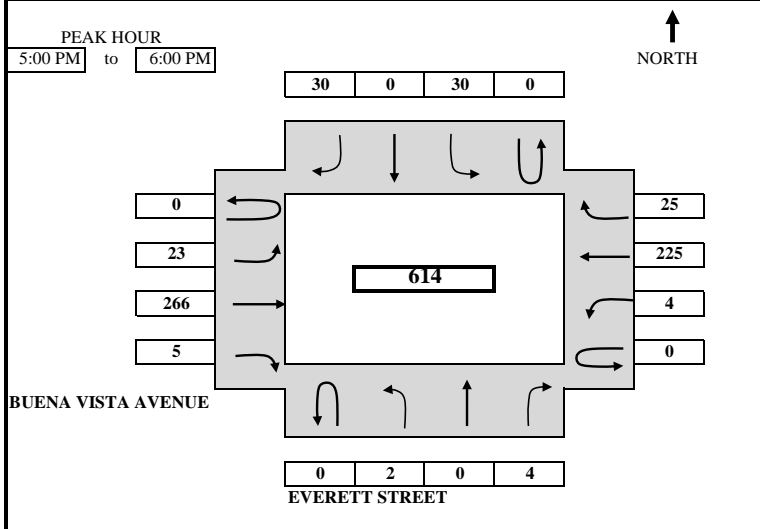
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	9	23	6	1	2	33	13	1	9	3	23	0	3	1	0	127
4:15 PM	to	5:15 PM	0	8	22	3	1	2	31	14	2	12	2	22	0	2	0	0	121
4:30 PM	to	5:30 PM	0	5	18	5	0	3	36	16	1	12	1	15	0	2	1	0	115
4:45 PM	to	5:45 PM	0	5	20	6	0	2	37	11	2	11	2	17	0	4	1	0	118
5:00 PM	to	6:00 PM	0	5	24	4	2	3	31	14	2	12	1	20	0	5	2	0	125

PEAK HOUR SUMMARY																			
4:00 PM	to	5:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
			0	9	23	6	1	2	33	13	1	9	3	23	0	3	1	0	127
			0.00	0.45	0.64	0.50	0.25	0.50	0.75	0.46	0.25	0.45	0.75	0.72	0.00	0.38	0.25	0.00	OVERALL
			0.63				0.77				0.75				0.33				0.86
			0				0				0				2				2
			1				5				1				0				7
			N-LEG				S-LEG				E-LEG				W-LEG				
			0				1				1				5				7

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>EVERETT STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>BUENA VISTA AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-8)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																	
4:00 PM	to	4:15 PM	0	0	0	6	0	11	1	5	58	0	0	53	4	138	
4:15 PM	to	4:30 PM	0	0	0	12	0	18	1	6	107	2	0	95	15	256	
4:30 PM	to	4:45 PM	1	1	1	20	0	28	1	8	162	3	0	133	20	378	
4:45 PM	to	5:00 PM	1	1	2	29	0	36	1	11	219	3	2	184	25	514	
5:00 PM	to	5:15 PM	2	1	2	37	0	42	1	16	291	4	2	239	30	667	
5:15 PM	to	5:30 PM	2	1	2	43	0	50	1	23	359	5	3	291	38	818	
5:30 PM	to	5:45 PM	2	1	4	51	0	59	1	28	422	7	5	355	45	980	
5:45 PM	to	6:00 PM	3	1	6	59	0	66	1	34	485	8	6	409	50	1128	

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	0	0	0	6	0	11	1	5	58	0	0	0	53	4	138
4:15 PM	to	4:30 PM	0	0	0	0	0	6	0	7	0	1	49	2	0	0	42	11	118
4:30 PM	to	4:45 PM	0	1	1	1	0	8	0	10	0	2	55	1	0	0	38	5	122
4:45 PM	to	5:00 PM	0	0	0	1	0	9	0	8	0	3	57	0	0	2	51	5	136
5:00 PM	to	5:15 PM	0	1	0	0	0	8	0	6	0	5	72	1	0	0	55	5	153
5:15 PM	to	5:30 PM	0	0	0	0	0	6	0	8	0	7	68	1	0	1	52	8	151
5:30 PM	to	5:45 PM	0	0	0	2	0	8	0	9	0	5	63	2	0	2	64	7	162
5:45 PM	to	6:00 PM	0	1	0	2	0	8	0	7	0	6	63	1	0	1	54	5	148

HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	1	1	2	0	29	0	36	1	11	219	3	0	2	184	25	514
4:15 PM	to	5:15 PM	0	2	1	2	0	31	0	31	0	11	233	4	0	2	186	26	529
4:30 PM	to	5:30 PM	0	2	1	2	0	31	0	32	0	17	252	3	0	3	196	23	562
4:45 PM	to	5:45 PM	0	1	0	3	0	31	0	31	0	20	260	4	0	5	222	25	602
5:00 PM	to	6:00 PM	0	2	0	4	0	30	0	30	0	23	266	5	0	4	225	25	614

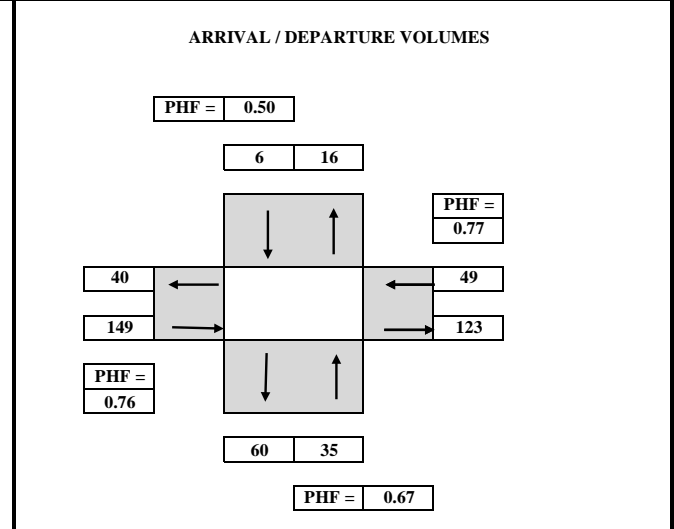
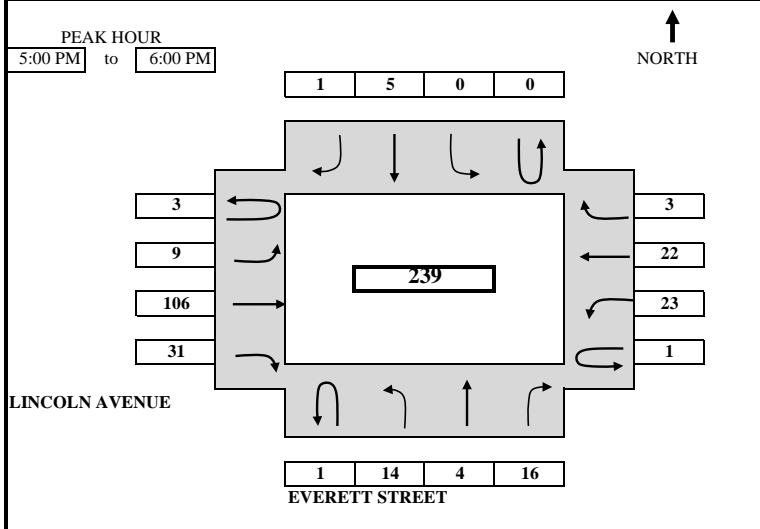
PEAK HOUR SUMMARY																				
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	0	2	0	4	0	30	0	30	0	23	266	5	0	4	225	25	614
			PHF BY MOVEMENT	0.00	0.50	0.00	0.50	0.00	0.94	0.00	0.83	0.00	0.82	0.92	0.63	0.00	0.50	0.88	0.78	OVERALL
			PHF BY APPROACH	0.50				0.88				0.94				0.87				0.95
			BICYCLE	0				5				8				3				16
			PEDESTRIAN	4				0				7				1				12
			PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
				5				3				2				2				12



# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>EVERETT STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>LINCOLN AVENUE</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-9)PM</b>



TIME	PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	

SURVEY DATA																		
4:00 PM	to	4:15 PM	0	0	1	4	0	2	0	0	2	80	7	0	6	4	0	106
4:15 PM	to	4:30 PM	0	1	1	12	0	5	1	0	4	30	17	0	10	7	2	90
4:30 PM	to	4:45 PM	1	4	1	16	1	6	3	0	4	57	22	0	11	10	3	139
4:45 PM	to	5:00 PM	1	6	2	22	1	10	5	0	4	75	29	0	13	11	6	185
5:00 PM	to	5:15 PM	1	11	2	30	1	10	5	1	6	112	38	0	17	14	6	254
5:15 PM	to	5:30 PM	2	14	3	33	1	12	6	1	9	129	44	1	24	20	8	307
5:30 PM	to	5:45 PM	2	18	4	34	1	13	6	3	9	158	51	1	31	27	9	367
5:45 PM	to	6:00 PM	2	20	6	38	1	15	6	3	13	181	60	1	36	33	9	424

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	0	1	4	0	0	2	0	0	2	80	7	0	6	4	0	106
4:15 PM	to	4:30 PM	0	1	0	8	0	0	3	1	0	2	-50	10	0	4	3	2	-16
4:30 PM	to	4:45 PM	1	3	0	4	0	1	1	2	0	0	27	5	0	1	3	1	49
4:45 PM	to	5:00 PM	0	2	1	6	0	0	4	2	0	0	18	7	0	2	1	3	46
5:00 PM	to	5:15 PM	0	5	0	8	0	0	0	0	1	2	37	9	0	4	3	0	69
5:15 PM	to	5:30 PM	1	3	1	3	0	0	2	1	0	3	17	6	1	7	6	2	53
5:30 PM	to	5:45 PM	0	4	1	1	0	0	1	0	2	0	29	7	0	7	7	1	60
5:45 PM	to	6:00 PM	0	2	2	4	0	0	2	0	0	4	23	9	0	5	6	0	57

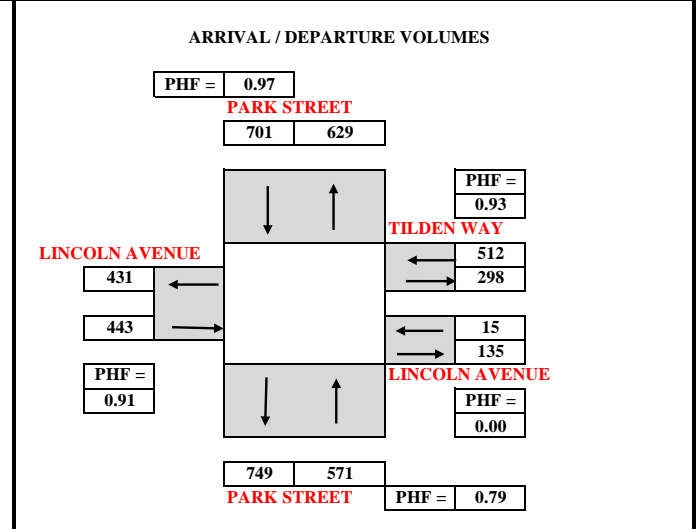
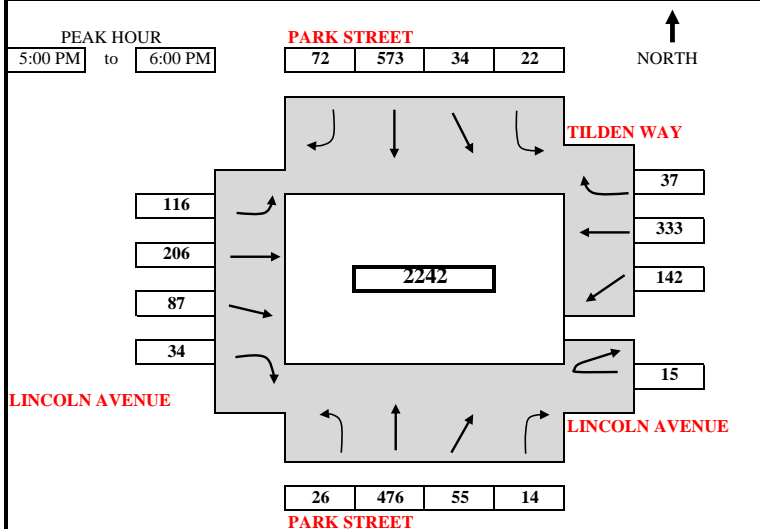
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	1	6	2	22	0	1	10	5	0	4	75	29	0	13	11	6	185
4:15 PM	to	5:15 PM	1	11	1	26	0	1	8	5	1	4	32	31	0	11	10	6	148
4:30 PM	to	5:30 PM	2	13	2	21	0	1	7	5	1	5	99	27	1	14	13	6	217
4:45 PM	to	5:45 PM	1	14	3	18	0	0	7	3	3	5	101	29	1	20	17	6	228
5:00 PM	to	6:00 PM	1	14	4	16	0	0	5	1	3	9	106	31	1	23	22	3	239

PEAK HOUR SUMMARY																				
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL	
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR		
			VOLUME	1	14	4	16	0	0	5	1	3	9	106	31	1	23	22	3	239
			PHF BY MOVEMENT	0.25	0.70	0.50	0.50	0.00	0.00	0.63	0.25	0.38	0.56	0.72	0.86	0.25	0.82	0.79	0.38	OVERALL
			PHF BY APPROACH	0.67				0.50				0.76				0.77				0.87
			BICYCLE	0				1				2				4				7
			PEDESTRIAN	17				14				12				22				65
				N-LEG				S-LEG				E-LEG				W-LEG				
			PEDESTRIAN BY LEG:	8				26				13				18				65

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	<b>EBMUD - CROSSING #3</b>	<b>SURVEY DATE:</b>	<b>10/20/2015</b>	<b>DAY:</b>	<b>TUESDAY</b>
<b>N-S APPROACH:</b>	<b>PARK STREET</b>	<b>SURVEY TIME:</b>	<b>4:00 PM</b>	<b>TO</b>	<b>6:00 PM</b>
<b>E-W APPROACH:</b>	<b>LINCOLN AVENUE - TILDEN WAY</b>	<b>JURISDICTION:</b>	<b>ALAMEDA</b>	<b>FILE:</b>	<b>3510117-(A-10)PM</b>



TIME PERIOD	PARK STREET (NB)				PARK STREET (SB)				LINCOLN (EB)				LINCOLN	TILDEN WAY (WB)			TOTAL
	Lincoln (WB)	Park (NB)	Tilden (EB)	Lincoln (EB)	Tilden (EB)	Lincoln (EB)	Park (SB)	Lincoln (WB)	Park (NB)	Tilden (EB)	Lincoln (EB)	Park (SB)	Tilden (WB)	Park (SB)	Lincoln (WB)	Park (NB)	

SURVEY DATA																	
4:00 PM to 4:15 PM	12	126	10	4	2	4	133	10	31	37	20	8	1	28	68	10	504
4:15 PM to 4:30 PM	18	247	22	8	5	9	260	25	65	83	31	33	2	62	132	20	1022
4:30 PM to 4:45 PM	26	379	33	10	12	16	404	52	92	122	46	39	4	105	197	30	1567
4:45 PM to 5:00 PM	31	491	40	11	15	25	547	64	126	183	67	56	7	146	251	35	2095
5:00 PM to 5:15 PM	38	646	54	16	20	33	696	82	157	241	89	67	10	190	324	41	2704
5:15 PM to 5:30 PM	43	754	67	19	25	41	844	97	194	276	102	75	15	221	407	50	3230
5:30 PM to 5:45 PM	48	851	83	20	31	55	983	116	217	336	130	83	18	256	500	59	3786
5:45 PM to 6:00 PM	57	967	95	25	37	59	1120	136	242	389	154	90	22	288	584	72	4337

TOTAL BY PERIOD																	
4:00 PM to 4:15 PM	12	126	10	4	2	4	133	10	31	37	20	8	1	28	68	10	504
4:15 PM to 4:30 PM	6	121	12	4	3	5	127	15	34	46	11	25	1	34	64	10	518
4:30 PM to 4:45 PM	8	132	11	2	7	7	144	27	27	39	15	6	2	43	65	10	545
4:45 PM to 5:00 PM	5	112	7	1	3	9	143	12	34	61	21	17	3	41	54	5	528
5:00 PM to 5:15 PM	7	155	14	5	5	8	149	18	31	58	22	11	3	44	73	6	609
5:15 PM to 5:30 PM	5	108	13	3	5	8	148	15	37	35	13	8	5	31	83	9	526
5:30 PM to 5:45 PM	5	97	16	1	6	14	139	19	23	60	28	8	3	35	93	9	556
5:45 PM to 6:00 PM	9	116	12	5	6	4	137	20	25	53	24	7	4	32	84	13	551

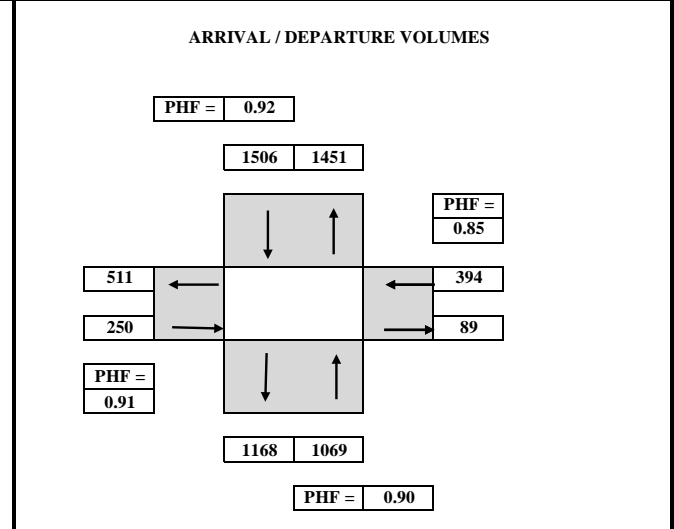
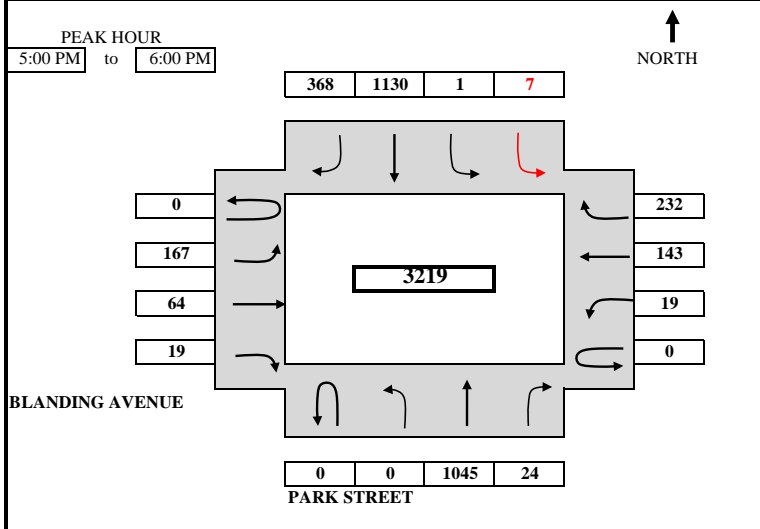
HOURLY TOTALS																	
4:00 PM to 5:00 PM	31	491	40	11	15	25	547	64	126	183	67	56	7	146	251	35	2095
4:15 PM to 5:15 PM	26	520	44	12	18	29	563	72	126	204	69	59	9	162	256	31	2200
4:30 PM to 5:30 PM	25	507	45	11	20	32	584	72	129	193	71	42	13	159	275	30	2208
4:45 PM to 5:45 PM	22	472	50	10	19	39	579	64	125	214	84	44	14	151	303	29	2219
5:00 PM to 6:00 PM	26	476	55	14	22	34	573	72	116	206	87	34	15	142	333	37	2242

PEAK HOUR SUMMARY																	
5:00 PM to 6:00 PM	PARK STREET (NB)				PARK STREET (SB)				LINCOLN (EB)				LINCOLN	TILDEN WAY (WB)			TOTAL
	Lincoln (WB)	Park (NB)	Tilden (EB)	Lincoln (EB)	Tilden (EB)	Lincoln (EB)	Park (SB)	Lincoln (WB)	Park (NB)	Tilden (WB)	Lincoln (EB)	Park (SB)	Tilden (WB)	Park (SB)	Lincoln (WB)	Park (NB)	
VOLUME	26	476	55	14	22	34	573	72	116	206	87	34	15	142	333	37	2242
PHF BY MOVEMENT	0.72	0.77	0.86	0.70	0.92	0.61	0.96	0.90	0.78	0.86	0.78	0.77	0.75	0.81	0.90	0.71	OVERALL
PHF BY APPROACH	0.79				0.97				0.91				0.75	0.93			0.92
BICYCLE	3				2				1				6			12	
PEDESTRIAN	35				43				17				19			114	
PEDESTRIAN BY LEG:	N-LEG				S-LEG				E-LEG				W-LEG				
	28				8				43				35			114	

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/22/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	PARK STREET	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	BLANDING AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-11)PM



TIME	PERIOD	NORTHBOUND				Frontage RIGHT	SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
		U-TURN	LEFT	THRU	RIGHT		LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT	U-TURN	LEFT	THRU	RIGHT		

SURVEY DATA																	
4:00 PM	to	4:15 PM	1	216	7	0	2	207	59	40	13	6	7	16	45	619	
4:15 PM	to	4:30 PM	1	474	16	1	2	489	136	82	26	7	19	39	108	1400	
4:30 PM	to	4:45 PM	1	759	28	2	2	734	216	117	42	14	20	67	150	2152	
4:45 PM	to	5:00 PM	2	999	37	4	3	1016	304	157	56	16	24	104	203	2925	
5:00 PM	to	5:15 PM	2	1257	44	6	3	1271	393	200	70	22	30	138	278	3714	
5:15 PM	to	5:30 PM	2	1547	52	8	3	1566	491	239	85	30	35	181	346	4585	
5:30 PM	to	5:45 PM	2	1809	57	11	3	1830	578	289	103	31	40	216	399	5368	
5:45 PM	to	6:00 PM	2	2044	61	11	4	2146	672	324	120	35	43	247	435	6144	

TOTAL BY PERIOD																			
4:00 PM	to	4:15 PM	0	1	216	7	0	2	207	59	0	40	13	6	0	7	16	45	619
4:15 PM	to	4:30 PM	0	0	258	9	1	0	282	77	0	42	13	1	0	12	23	63	781
4:30 PM	to	4:45 PM	0	0	285	12	1	0	245	80	0	35	16	7	0	1	28	42	752
4:45 PM	to	5:00 PM	0	1	240	9	2	1	282	88	0	40	14	2	0	4	37	53	773
5:00 PM	to	5:15 PM	0	0	258	7	2	0	255	89	0	43	14	6	0	6	34	75	789
5:15 PM	to	5:30 PM	0	0	290	8	2	0	295	98	0	39	15	8	0	5	43	68	871
5:30 PM	to	5:45 PM	0	0	262	5	3	0	264	87	0	50	18	1	0	5	35	53	783
5:45 PM	to	6:00 PM	0	0	235	4	0	1	316	94	0	35	17	4	0	3	31	36	776

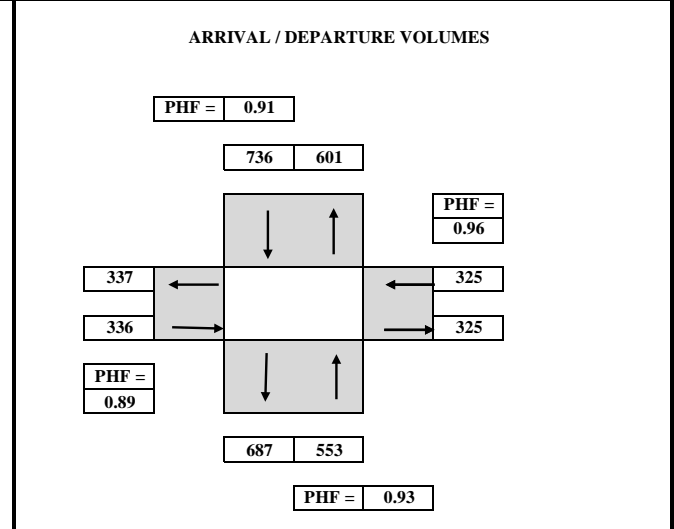
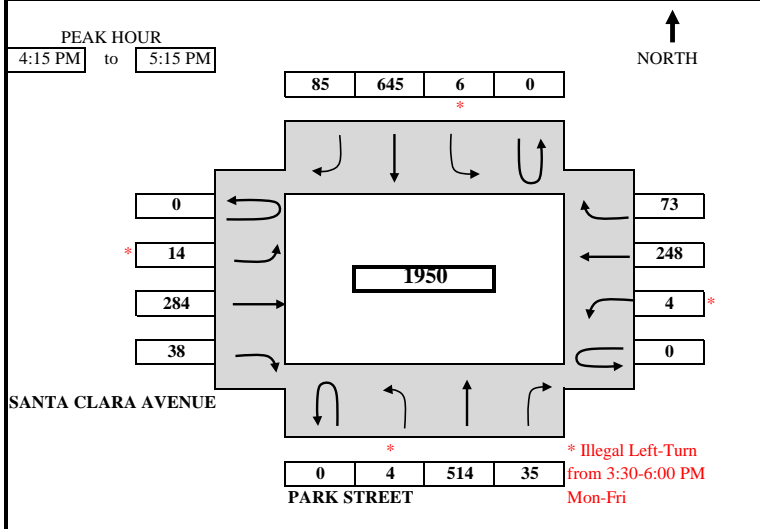
HOURLY TOTALS																			
4:00 PM	to	5:00 PM	0	2	999	37	4	3	1016	304	0	157	56	16	0	24	104	203	2925
4:15 PM	to	5:15 PM	0	1	1041	37	6	1	1064	334	0	160	57	16	0	23	122	233	3095
4:30 PM	to	5:30 PM	0	1	1073	36	7	1	1077	355	0	157	59	23	0	16	142	238	3185
4:45 PM	to	5:45 PM	0	1	1050	29	9	1	1096	362	0	172	61	17	0	20	149	249	3216
5:00 PM	to	6:00 PM	0	0	1045	24	7	1	1130	368	0	167	64	19	0	19	143	232	3219

PEAK HOUR SUMMARY																			
5:00 PM	to	6:00 PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
			NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME			0	0	1045	24	7	1	1130	368	0	167	64	19	0	19	143	232	3219
PHF BY MOVEMENT			0.00	0.00	0.90	0.75	0.58	0.25	0.89	0.94	0.00	0.84	0.89	0.59	0.00	0.79	0.83	0.77	OVERALL
PHF BY APPROACH			0.90				0.92				0.91				0.85				0.92
BICYCLE			2				4				10				5				21
PEDESTRIAN			24				30				15				12				81
			N-LEG				S-LEG				E-LEG				W-LEG				
PEDESTRIAN BY LEG:			3				24				24				30				81

# B.A.Y.M.E.T.R.I.C.S.

## INTERSECTION TURNING MOVEMENT SUMMARY

<b>PROJECT:</b>	EBMUD - CROSSING #3	<b>SURVEY DATE:</b>	10/22/2015	<b>DAY:</b>	THURSDAY
<b>N-S APPROACH:</b>	PARK STREET	<b>SURVEY TIME:</b>	4:00 PM	<b>TO</b>	6:00 PM
<b>E-W APPROACH:</b>	SANTA CLARA AVENUE	<b>JURISDICTION:</b>	ALAMEDA	<b>FILE:</b>	3510117-(A-12)PM



TIME PERIOD	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				TOTAL
	U-TURN	LEFT*	THRU	RIGHT	U-TURN	LEFT*	THRU	RIGHT	U-TURN	LEFT*	THRU	RIGHT	U-TURN	LEFT*	THRU	RIGHT	
<b>SURVEY DATA</b>																	
4:00 PM to 4:15 PM	1	120	7		0	121	19		8	62	11		1	56	16		422
4:15 PM to 4:30 PM	2	238	12		1	309	33		11	124	21		2	116	30		899
4:30 PM to 4:45 PM	2	377	21		2	453	51		13	198	31		3	186	44		1381
4:45 PM to 5:00 PM	5	502	34		4	609	80		15	269	39		4	246	67		1874
5:00 PM to 5:15 PM	5	634	42		6	766	104		22	346	49		5	304	89		2372
5:15 PM to 5:30 PM	5	750	55		9	908	124		24	412	59		7	362	100		2815
5:30 PM to 5:45 PM	6	851	65		9	1057	148		35	469	77		7	423	114		3261
5:45 PM to 6:00 PM	7	966	71		13	1219	176		42	526	95		10	480	133		3738
<b>TOTAL BY PERIOD</b>																	
4:00 PM to 4:15 PM	0	1	120	7	0	0	121	19	0	8	62	11	0	1	56	16	422
4:15 PM to 4:30 PM	0	1	118	5	0	1	188	14	0	3	62	10	0	1	60	14	477
4:30 PM to 4:45 PM	0	0	139	9	0	1	144	18	0	2	74	10	0	1	70	14	482
4:45 PM to 5:00 PM	0	3	125	13	0	2	156	29	0	2	71	8	0	1	60	23	493
5:00 PM to 5:15 PM	0	0	132	8	0	2	157	24	0	7	77	10	0	1	58	22	498
5:15 PM to 5:30 PM	0	0	116	13	0	3	142	20	0	2	66	10	0	2	58	11	443
5:30 PM to 5:45 PM	0	1	101	10	0	0	149	24	0	11	57	18	0	0	61	14	446
5:45 PM to 6:00 PM	0	1	115	6	0	4	162	28	0	7	57	18	0	3	57	19	477
<b>HOURLY TOTALS</b>																	
4:00 PM to 5:00 PM	0	5	502	34	0	4	609	80	0	15	269	39	0	4	246	67	1874
4:15 PM to 5:15 PM	0	4	514	35	0	6	645	85	0	14	284	38	0	4	248	73	1950
4:30 PM to 5:30 PM	0	3	512	43	0	8	599	91	0	13	288	38	0	5	246	70	1916
4:45 PM to 5:45 PM	0	4	474	44	0	7	604	97	0	22	271	46	0	4	237	70	1880
5:00 PM to 6:00 PM	0	2	464	37	0	9	610	96	0	27	257	56	0	6	234	66	1864
<b>PEAK HOUR SUMMARY</b>																	
4:15 PM to 5:15 PM	<b>NORTHBOUND</b>				<b>SOUTHBOUND</b>				<b>EASTBOUND</b>				<b>WESTBOUND</b>				TOTAL
	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	
VOLUME	0	4	514	35	0	6	645	85	0	14	284	38	0	4	248	73	1950
PHF BY MOVEMENT	0.00	0.33	0.92	0.67	0.00	0.75	0.86	0.73	0.00	0.50	0.92	0.95	0.00	1.00	0.89	0.79	OVERALL
PHF BY APPROACH	0.93				0.91				0.89				0.96				0.98
BICYCLE	10				10				7				7				34
PEDESTRIAN	143				108				103				116				470
	<b>N-LEG</b>				<b>S-LEG</b>				<b>E-LEG</b>				<b>W-LEG</b>				
PEDESTRIAN BY LEG:	104				115				108				143				470

# B.A.Y.M.E.T.R.I.C.S.

## OAKLAND - ALAMEDA: NORTH BAY FARM ISLAND PIPELINE CROSSING PROJECT

Date	7-Oct-15 Wednesday				8-Oct-15 Thursday				7-Oct-15 Wednesday				8-Oct-15 Thursday				7-Oct-15 Wednesday				8-Oct-15 Thursday			
Location	1. MARINA VILLAGE PKWY BETWEEN MARINER'S SQUARE DR & TYNAN AV				2. MARINER'S SQUARE DRIVE, SOUTH OF MARINA VILLAGE PKWY				3. MITCHELL AVENUE, EAST OF 5TH ST															
Direction	EB		WB		EB		WB		NB		SB		NB		SB		EB		WB		EB		WB	
Time	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN

1200	0	0	3	0	3	0	0	0	3	0	6	0	1	0	1	0	3	0	1	0	2	0	0	0
1215	1	0	2	0	3	0	1	0	1	0	2	0	0	0	2	0	0	0	0	0	0	0	1	0
1230	2	0	1	0	2	0	1	0	0	0	3	0	1	0	0	0	0	0	0	0	2	0	0	0
1245	1	4	2	8	0	8	2	4	2	6	3	14	1	3	1	4	1	4	0	1	0	4	0	1
100	1	5	2	7	2	7	1	5	2	5	2	10	0	2	0	3	0	1	3	3	2	4	0	1
115	0	4	0	5	1	5	0	4	0	4	0	8	1	3	2	3	1	2	0	3	0	4	0	0
130	0	2	1	5	1	4	0	3	2	6	2	7	0	2	0	3	0	2	0	3	1	3	0	0
145	0	1	1	4	0	4	1	2	3	7	0	4	0	1	0	2	0	1	1	4	0	3	0	0
200	3	3	2	4	1	3	0	1	0	5	2	4	1	2	0	2	1	2	1	2	0	1	0	0
215	1	4	0	4	1	3	2	3	0	5	0	4	0	1	2	2	0	1	0	2	0	1	1	1
230	3	7	1	4	0	2	0	3	2	5	3	5	0	1	1	3	0	1	0	2	1	1	1	2
245	0	7	0	3	0	2	0	2	1	3	3	8	1	2	0	3	0	1	0	1	0	1	0	2
300	1	5	0	1	1	2	0	2	0	3	0	6	1	2	0	3	1	1	1	1	0	1	0	2
315	0	4	0	1	0	1	0	0	1	4	1	7	2	4	4	5	0	1	0	1	0	1	0	1
330	0	1	0	0	1	2	0	0	0	2	1	5	1	5	0	4	0	1	0	1	0	0	0	0
345	1	2	0	0	1	3	0	0	0	1	2	4	0	4	2	6	1	2	1	2	0	0	0	0
400	0	1	0	0	1	3	1	1	0	1	1	5	1	4	4	10	1	2	0	1	0	0	0	0
415	0	1	1	1	1	4	0	1	0	2	6	1	3	0	6	0	2	0	1	0	0	1	1	1
430	1	2	2	3	0	3	2	3	2	2	7	2	4	2	8	0	2	0	1	0	0	0	1	1
445	1	2	1	4	2	4	0	3	0	2	2	7	2	6	4	10	2	3	0	0	1	1	0	1
500	2	4	4	8	0	3	1	3	2	4	6	12	1	6	8	14	0	2	1	1	0	1	1	2
515	1	5	4	11	1	3	4	7	4	8	7	17	9	14	6	20	2	4	1	2	0	1	0	1
530	3	7	5	14	2	5	7	12	0	6	4	19	8	20	8	26	1	5	5	7	3	4	2	3
545	7	13	4	17	6	9	4	16	9	15	9	26	6	24	7	29	3	6	0	7	6	9	2	5
600	7	18	7	20	3	12	5	20	3	16	4	24	3	26	14	35	3	9	6	12	1	10	3	7
615	5	22	4	20	8	19	6	22	7	19	12	29	14	31	6	35	3	10	2	13	4	14	3	10
630	8	27	5	20	10	27	11	26	7	26	11	36	9	32	14	41	8	17	7	15	4	15	9	17
645	6	26	4	20	4	25	9	31	10	27	17	44	10	36	15	49	2	16	6	21	3	12	8	23
700	7	26	3	16	7	29	3	29	7	31	10	50	16	49	20	55	5	18	13	28	4	15	11	31
715	6	27	10	22	7	28	11	34	13	37	14	52	10	45	26	75	7	22	5	31	13	24	8	36
730	11	30	10	27	4	22	11	34	11	41	23	64	15	51	27	88	10	24	14	38	7	27	6	33
745	13	37	19	42	10	28	24	49	10	41	19	66	13	54	27	100	8	30	11	43	13	37	17	42
800	16	46	25	64	11	32	21	67	12	46	24	80	23	61	40	120	6	31	22	52	13	46	19	50
815	11	51	30	84	19	44	27	83	17	50	39	105	15	66	28	122	13	37	9	56	14	47	14	56
830	16	56	26	100	21	61	20	92	23	62	33	115	14	65	19	114	11	38	16	58	10	50	15	65
845	22	65	25	106	21	72	33	101	17	69	25	121	22	74	27	114	20	50	17	64	16	53	10	58
900	18	67	23	104	18	79	32	112	11	68	27	124	16	67	28	102	13	57	6	48	9	49	14	53
915	19	75	29	103	27	87	14	99	20	71	32	117	21	73	14	88	5	49	18	57	17	53	17	56
930	28	87	23	100	19	85	14	93	19	67	23	107	24	83	30	99	15	53	15	56	17	60	12	53
945	18	83	17	92	14	78	15	75	13	63	25	107	15	76	25	97	19	52	11	50	16	60	14	57
1000	20	85	23	92	27	87	18	61	18	70	23	103	21	81	16	85	9	48	5	49	7	58	20	63
1015	26	92	21	84	22	82	17	64	16	66	31	102	25	85	42	113	15	58	13	44	19	59	18	64
1030	24	88	17	78	32	95	20	70	14	61	23	102	17	78	25	108	13	56	11	40	21	63	17	69
1045	24	94	17	78	12	93	14	69	14	62	22	99	26	89	30	113	23	60	22	51	13	60	18	73
1100	21	95	14	69	20	86	24	75	20	64	30	106	23	91	31	128	17	68	8	54	19	72	19	72
1115	27	96	23	71	27	91	26	84	28	76	26	101	25	91	39	125	16	69	9	50	15	68	14	68
1130	28	100	31	85	24	83	19	83	17	79	19	97	29	103	24	124	18	74	18	57	14	61	12	63
1145	33	109	20	88	25	96	28	97	21	86	30	105	24	101	23	117	16	67	17	52	25	73	20	65
1200	29	117	26	100	66	142	34	107	24	90	36	111	35	113	30	116	16	66	13	57	29	83	22	68
1215	40	130	28	105	43	158	31	112	27	89	31	116	33	121	30	107	15	65	20	68	21	89	24	78
1230	46	148	31	105	29	163	23	116	33	105	23	120	24	116	40	123	28	75	13	63	20	95	19	85
1245	33	148	13	98	30	168	35	123	26	110	29	119	20	112	31	131	19	78	14	60	13	83	18	83
1300	26	145	30	102	44	146	31	120	17	103	23	106	28	105	32	133	15	77	14	61	22	76	17	78
1315	37	142	20	94	47	150	31	120	18	94	42	117	21	93	41	144	22	84	15	56	28	83	19	73
1330	29	125	20	83	44	165	26	123	20	81	40	134	20	89	39	143	19	75	9	52	19	82	14	68
1345	36	128	27	97	27	162	26	114	26	81	30	135	24	93	30	142	19	75	12	50	19	88	13	63
1400	30	132	24	91	28	146	24	107	22	86	36	148	24	89	35	145	21	81	17	53	23	89	18	64
1415	26	121	18	89	28	127	21	97	17	85	47	153	19	87	46	150	27	86	25	63	25	86	23	68
1430	42	134	17	86	39	122	19	90	26	91	32	145	25	92	33	144	21	88	16	70	23	90	21	75
1445	27	125	23	82	29	124	21	85	20	85	43	158	19	87	34	148	27	96	14	72	17	88	17	79
1500	36	131	18	76	33	129	18	79	19	82	39	161	21	84	41	154	12	87	20	75	19	84	15	76
1515	26	131	23	81	26	127	24	82	19	84	51	165	26	91	47	155	26	86	13	63	14	73	13	66
1530	19	108	19	83	21	109	20	83	24	82	39	172	31	97	43	165	18	83	15	62	23	73	20	65
1545	28	109	27	87	20	100	13	75	17	79	42	171	26	104	46	177	20	76	15	63	23	79	14	62
1600	44	117	22	91	30	97	30	87	15	75	36	168	18	101	43	179	33	97	8	51	23	83	17	64
1615	31	122	33	101	38	109	26	89	24	80	38	155	27	102	54	186	21	92	18	56	24	93	16	67
1630	25	128	28	110	34	122	30	99	27	83	51	167	20	91	42	185	14	88	8	49	19	89	13	60
1645	36	136	29	112	33	135	30	116	20	86														

# B. A. Y. M. E. T. R. I. C. S.

## OAKLAND - ALAMEDA: NORTH BAY FARM ISLAND PIPELINE CROSSING PROJECT

Date	20-Oct-15 Tuesday				21-Oct-15 Wednesday				20-Oct-15 Tuesday				21-Oct-15 Wednesday			
Location	1. Peach Street between Adam Street & San Jose Avenue								2. San Jose Avenue between Peach Street & Post Street							
Direction	NB		SB		NB		SB		EB		WB		EB		WB	
Time	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN

1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1215	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
1230	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
1245	0	1	0	0	0	0	0	0	0	3	1	2	0	1	0	0
100	0	1	0	0	0	0	0	0	0	3	1	3	2	3	0	0
115	0	0	0	0	0	0	0	0	0	2	0	3	0	2	1	1
130	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	1
145	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	1
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
215	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
230	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
245	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
300	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
315	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1
330	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1
345	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
400	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
415	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
430	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
445	0	0	1	1	0	2	0	0	1	1	0	0	1	1	0	0
500	1	1	0	1	0	1	0	0	0	1	0	0	0	1	0	0
515	0	1	0	1	1	1	1	1	0	1	1	1	2	3	0	0
530	0	1	0	1	0	1	0	1	3	4	1	2	0	3	0	0
545	1	2	0	0	0	1	1	2	2	5	1	3	0	2	1	1
600	0	1	1	1	4	5	0	2	0	5	2	5	4	6	2	3
615	0	1	1	2	3	7	0	1	0	5	1	5	2	6	0	3
630	2	3	1	3	4	11	3	4	1	3	1	5	1	7	3	6
645	2	4	0	3	7	18	4	7	2	3	1	5	0	7	1	6
700	6	10	4	6	7	21	3	10	2	5	1	4	2	5	0	4
715	6	16	2	7	1	19	2	12	3	8	0	3	1	4	4	8
730	5	19	3	9	2	17	1	10	3	10	5	7	4	7	4	9
745	1	18	0	9	3	13	0	6	2	10	6	12	2	9	3	11
800	0	12	3	8	2	8	1	4	12	20	13	24	14	21	13	24
815	3	9	1	7	1	8	1	3	29	46	18	42	29	49	13	33
830	2	6	0	4	3	9	0	2	3	46	1	38	2	47	6	35
845	2	7	3	7	1	7	2	4	5	49	3	35	2	47	9	41
900	3	10	0	4	1	6	0	3	1	38	6	28	2	35	9	37
915	1	8	0	3	0	5	0	2	7	16	5	15	4	10	5	29
930	0	6	1	4	1	3	0	2	4	17	4	18	3	11	2	25
945	3	7	1	2	2	4	0	0	5	17	2	17	4	13	2	18
1000	1	5	0	2	1	4	1	1	0	16	4	15	4	15	3	12
1015	1	5	0	2	1	5	2	3	4	13	2	12	2	13	3	10
1030	0	5	0	1	0	4	1	4	3	12	3	11	4	14	2	10
1045	1	3	1	1	1	3	0	4	5	12	3	12	1	11	0	8
1100	3	5	9	10	1	3	2	5	2	14	1	9	2	9	2	7
1115	1	5	0	10	2	4	1	4	1	11	3	10	1	8	2	6
1130	0	5	0	10	0	4	4	7	3	11	4	11	4	8	2	6
1145	1	5	1	10	1	4	0	7	1	7	2	10	2	9	3	9
1200	2	4	2	3	0	3	1	6	8	13	3	12	3	10	1	8
1215	1	4	1	4	4	5	3	8	5	17	3	12	2	11	5	11
1230	5	9	1	5	3	8	1	5	4	18	3	11	5	12	3	12
1245	7	15	4	8	2	9	1	6	2	19	1	10	3	13	5	14
1300	2	15	1	7	1	10	1	6	3	14	5	12	5	15	5	18
1315	0	14	3	9	5	11	0	3	4	13	3	12	3	16	5	18
1330	2	11	2	10	6	14	5	7	4	13	2	11	3	14	2	17
1345	1	5	2	8	9	21	5	11	9	20	9	19	6	17	1	13
1400	1	4	0	7	3	23	1	11	7	24	12	26	2	14	3	11
1415	3	7	5	9	2	20	2	13	4	24	5	28	2	13	4	10
1430	1	6	3	10	4	18	2	10	3	23	1	27	6	16	1	9
1445	2	7	0	8	4	13	1	6	4	18	8	26	8	18	4	12
1500	3	9	1	9	4	14	2	7	2	13	3	17	10	26	6	15
1515	0	6	1	5	1	13	4	9	5	14	4	16	1	25	17	28
1530	1	6	1	3	2	11	3	10	6	17	2	17	4	23	9	36
1545	4	8	4	7	0	7	2	11	9	22	2	11	1	16	4	36
1600	5	10	2	8	2	5	0	9	2	22	2	10	6	12	1	31
1615	4	14	4	11	1	5	1	6	0	17	1	7	10	21	1	15
1630	2	15	1	11	2	5	3	6	4	15	4	9	5	22	3	9
1645	0	11	1	8	3	8	3	7	8	14	4	11	4	25	3	8
1700	0	6	1	7	3	9	0	7	7	19	4	13	6	25	3	10
1715	1	3	0	3	1	9	1	7	8	27	7	19	6	21	6	15
1730	2	3	0	2	1	8	1	5	8	31	4	19	7	23	1	13
1745	2	5	0	1	0	5	2	4	8	31	2	17	9	28	5	15
1800	3	8	2	2	1	3	0	4	12	36	6	19	7	29	4	16
1815	1	8	2	4	1	3	0	3	8	36	5	17	5	28	2	12
1830	0	6	0	4	0	2	0	2	6	34	5	18	5	26	4	15
1845	2	6	1	5	1	3	0	0	8	34	6	22	0	17	5	15
1900	3	6	2	5	0	2	1	1	4	26	7	23	4	14	5	16
1915	0	5	1	4	0	1	1	2	11	29	5	23	3	12	1	15
1930	0	5	0	4	0	1	1	3	2	25	1	19	2	9	2	13
1945	1	4	0	3	1	1	3	6	0	17	7	20	3	12	3	11
2000	1	2	1	2	0	1	0	5	2	15	5	18	2	10	1	7
2015	0	2	0	1	1	2	0	4	7	11	4	17	3	10	1	7
2030	0	2	3	4	0	2	0	3	1	10	1	17	6	14	1	6
2045	0	1	0	4	3	4	0	0	1	11	1	11	5	16	2	5
2100	1	1	1	4	0	4	1	1	2	11	2	8	1	15	0	4
2115	1	2	0	4	1	4	0	1	2	6	4	8	5	17	1	4
2130	0	2	0	1	0	4	0	1	1	6	1	8	5	16	0	3
2145	0	2	0	1	0	1	0	1	1	6	2	9	3	14	4	5
2200	0	1	0	0	0	1	0	0	1	5	2	9	2	15	2	7
2215	0	0	0	0	0	0	2	2	5	8	0	5	3	13	0	6
2230	0	0	0	0	0	0	0	2	2	9	1	5	3	11	3	9
2245	0	0	0	0	0	0	0	2	1	9	1	4	0	8	1	6
2300	0	0	0	0	0	0	0	2	0	8	0	2	0	6	2	6
2315	1	1	0	0	0	0	0	0	0	3	1	3	3	6	1	7
2330	0	1	1	1	0	0	0	0	0	1	1	3	0	3	1	5
2345	0	1	0	1	0	0	0	0	0	0	1	3	1	4	0	4
TOTAL	112	N/A	87	N/A	125	N/A	84	N/A	308	N/A	261	N/A	291	N/A	240	N/A
AM	19		9		21		12		49		42		49		41	
NOON	15		10		23		13		24		28		18		18	
PM	15		11		14		11		36		23		29		36	
EVEN	2		4		4		5		15		18		17		9	

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# B. A. Y. M. E. T. R. I. C. S.

## OAKLAND - ALAMEDA: NORTH BAY FARM ISLAND PIPELINE CROSSING PROJECT

Date	20-Oct-15 Tuesday				21-Oct-15 Wednesday				20-Oct-15 Tuesday				21-Oct-15 Wednesday			
Location	3. Mound Street between Encinal Avenue & Madison Street								4. Madison Street between Post Street & High Street							
Direction	NB		SB		NB		SB		EB		WB		EB		WB	
Time	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN

1200	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
1215	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
1230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1245	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
100	1	1	0	0	0	1	2	2	0	0	0	0	0	0	0	0
115	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0
130	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0
145	0	1	0	0	1	1	0	2	0	0	0	0	0	0	0	0
200	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0
215	0	0	0	0	1	2	0	0	0	0	2	3	2	2	0	0
230	1	1	0	0	0	2	0	0	0	0	0	3	0	2	0	0
245	1	2	1	1	0	1	1	1	0	0	0	3	0	2	0	0
300	0	2	0	1	0	1	0	1	0	0	0	2	1	3	0	0
315	0	2	0	1	1	1	0	1	0	0	0	0	0	1	1	1
330	0	1	0	1	1	2	0	1	0	0	0	0	0	1	0	1
345	2	2	0	0	1	3	0	0	0	0	0	0	0	1	0	1
400	1	3	0	0	1	4	0	0	0	0	0	0	0	0	0	1
415	3	6	0	0	0	3	1	1	0	0	0	0	0	0	0	0
430	1	7	1	1	0	2	0	1	0	0	2	2	0	0	0	0
445	0	5	0	1	2	3	0	1	0	0	1	3	0	0	0	0
500	0	4	0	1	0	2	0	1	2	2	1	4	3	3	0	0
515	2	3	1	2	1	3	0	0	0	2	0	4	0	3	0	0
530	2	4	0	1	4	7	0	0	0	2	0	2	0	3	0	0
545	1	5	0	1	3	8	0	0	1	3	2	3	1	4	0	0
600	1	6	1	2	2	10	2	2	0	1	2	4	0	1	5	5
615	2	6	0	1	7	16	2	4	2	3	2	6	0	1	1	6
630	5	9	0	1	9	21	10	14	1	4	2	8	0	1	1	7
645	6	14	4	5	12	30	10	24	0	3	2	8	0	0	1	8
700	13	26	5	9	4	32	20	42	2	5	1	7	0	0	0	3
715	10	34	17	26	10	35	5	45	0	3	2	7	2	2	2	4
730	9	38	18	44	12	38	7	42	0	2	0	5	0	2	1	4
745	17	49	2	42	3	29	6	38	3	5	4	7	1	3	5	8
800	8	44	3	40	7	32	2	20	2	5	5	11	4	7	6	14
815	11	45	4	27	3	25	1	16	5	10	6	15	2	7	4	16
830	3	39	2	11	8	21	2	11	4	14	6	21	4	11	2	17
845	7	29	1	10	5	23	5	10	4	15	5	22	2	12	2	14
900	8	29	4	11	4	20	6	14	1	14	1	18	5	13	0	8
915	7	25	3	10	2	19	3	16	0	9	1	13	3	14	0	4
930	6	28	1	9	5	16	4	18	0	5	5	12	0	10	4	6
945	3	24	5	13	3	14	4	17	1	2	2	9	1	9	1	5
1000	7	23	5	14	10	20	4	15	1	2	1	9	1	5	0	5
1015	7	23	2	13	6	24	4	16	1	3	4	12	2	4	3	8
1030	2	19	2	14	5	24	4	16	0	3	2	9	4	8	2	6
1045	3	19	3	12	4	25	3	15	1	3	3	10	0	7	2	7
1100	3	15	3	10	6	21	3	14	4	6	1	10	0	6	1	8
1115	5	13	2	10	10	25	4	14	2	7	4	10	2	6	1	6
1130	3	14	2	10	4	24	4	14	1	8	1	9	2	4	4	8
1145	2	13	7	14	11	31	5	16	2	9	5	11	1	5	1	7
1200	3	13	2	13	4	29	0	13	5	10	3	13	2	7	1	7
1215	6	14	2	13	3	22	2	11	1	9	2	11	3	8	3	9
1230	2	13	2	13	4	22	4	11	5	13	1	11	7	13	0	5
1245	4	15	10	16	1	12	2	8	2	13	2	8	3	15	4	8
1300	6	18	12	26	4	12	7	15	1	9	3	8	2	15	2	9
1315	11	23	3	27	3	12	7	20	5	13	4	10	0	12	2	8
1330	5	26	8	33	8	16	11	27	2	10	2	11	1	6	1	9
1345	6	28	6	29	18	33	11	36	2	10	6	15	3	6	1	6
1400	7	29	5	22	7	36	6	35	1	10	1	13	1	5	2	6
1415	8	26	6	25	8	41	6	34	4	9	2	11	1	6	0	4
1430	5	26	4	21	7	40	5	28	2	9	1	10	1	6	1	4
1445	11	31	5	20	6	28	3	20	4	11	1	5	5	8	2	5
1500	10	34	3	18	3	24	10	24	3	13	0	4	5	12	2	5
1515	9	35	8	20	9	25	3	21	3	12	3	5	2	13	7	12
1530	6	36	4	20	4	22	4	20	1	11	0	4	6	18	1	12
1545	6	31	6	21	7	23	10	27	3	10	4	7	2	15	2	12
1600	7	28	6	24	7	27	7	24	1	8	2	9	1	11	1	11
1615	7	26	13	29	8	26	16	37	5	10	1	7	4	13	3	7
1630	6	26	10	35	5	27	9	42	4	13	1	8	6	13	6	12
1645	4	24	9	38	4	24	5	37	4	14	2	6	3	14	1	11
1700	5	22	7	39	4	21	8	38	4	17	3	7	5	18	0	10
1715	5	20	4	30	5	18	9	31	0	12	2	8	5	19	1	8
1730	2	16	4	24	3	16	4	26	5	13	0	7	1	14	3	5
1745	3	15	5	20	2	14	3	24	7	16	2	7	8	19	5	9
1800	6	16	5	18	0	10	3	19	3	15	0	4	3	17	3	12
1815	6	17	5	19	2	7	4	14	4	19	4	6	3	15	2	13
1830	3	18	1	16	6	10	4	14	2	16	1	7	3	17	2	12
1845	2	17	4	15	2	10	1	12	2	11	2	7	2	11	1	8
1900	3	14	4	14	2	12	2	11	4	12	1	8	4	12	1	6
1915	3	11	10	19	0	10	3	10	2	10	0	4	3	12	1	5
1930	4	12	3	21	2	6	1	7	7	15	0	3	3	12	1	4
1945	3	13	2	19	1	5	3	9	2	15	4	5	2	12	1	4
2000	0	10	1	16	1	4	0	7	3	14	1	5	2	10	3	6
2015	0	7	1	7	5	9	2	6	1	13	2	7	0	7	1	6
2030	0	3	4	8	1	8	1	6	3	9	2	9	5	9	0	5
2045	0	0	2	8	1	8	1	4	1	8	1	6	4	11	0	4
2100	0	0	0	7	1	8	3	7	2	7	0	5	1	10	0	1
2115	0	0	5	11	0	3	1	6	1	7	1	4	1	11	2	2
2130	1	1	1	8	1	3	1	6	1	5	0	2	0	6	0	2
2145	0	1	0	6	0	2	1	6	1	5	2	3	1	3	1	3
2200	1	2	0	6	0	1	0	3	1	4	0	3	0	2	1	4
2215	0	2	2	3	0	1	2	4	1	4	0	2	0	1	0	2
2230	1	2	0	2	0	0	2	5	0	3	0	2	0	1	0	2
2245	0	2	2	4	1	1	0	4	0	2	1	1	1	1	0	1
2300	1	2	0	4	0	1	1	5	3	4	0	1	1	2	0	0
2315	2	4	0	2	0	1	0	3	1	4	2	3	2	4	0	0
2330	0	3	1	3	0	1	0	1	0	4	0	3	0	4	0	0
2345	0	3	1	2	0	0	2	3	0	4	0	2	1	4	0	0
TOTAL	343	N/A	298	N/A	330	N/A	314	N/A	159	N/A	148	N/A	162	N/A	121	N/A
AM	49		44		38		45		15		22		14		17	
NOON	31		33		41		36		13		15		15		9	
PM	36		39		27		42		19		9		19		13	
EVEN	10		16		9		7		14		9		11		6	

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## **OAKLAND - ALAMEDA: NORTH BAY FARM ISLAND PIPELINE CROSSING PROJECT**

Date	20-Oct-15 Tuesday				21-Oct-15 Wednesday				20-Oct-15 Tuesday				21-Oct-15 Wednesday			
Location	1. Ford Street between Peterson Street & Derby Avenue								2. Chapman Street between Peterson Street & Derby Avenue							
Direction	EB		WB		EB		WB		EB		WB		EB		WB	
Time	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN
1200	0	0	2	0	2	0	1	0	4	0	0	0	2	0	0	0
1215	2	0	4	0	2	0	1	0	2	0	0	1	0	0	0	0
1230	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
1245	0	3	2	10	2	7	1	3	0	6	0	0	2	5	0	0
100	0	3	1	9	2	7	2	4	0	2	1	1	3	6	1	1
115	1	2	1	6	1	6	3	6	0	0	0	1	0	5	0	1
130	0	1	0	4	0	5	0	6	0	0	0	1	0	5	0	1
145	1	2	1	3	0	3	3	8	0	0	1	2	2	5	1	2
200	0	2	0	2	2	3	3	9	0	0	0	1	1	3	0	1
215	1	2	0	1	0	2	1	7	1	1	2	3	3	6	2	3
230	2	4	1	2	0	2	1	8	1	2	0	3	0	6	0	3
245	1	4	0	1	0	2	1	6	0	2	0	2	1	5	0	2
300	0	4	2	3	2	2	0	3	1	3	0	2	0	4	0	2
315	1	4	1	4	0	2	1	3	0	2	0	0	0	1	0	0
330	0	2	1	4	0	2	1	3	0	1	0	0	2	3	0	0
345	0	1	1	5	1	3	1	3	0	1	0	0	0	2	0	0
400	0	1	1	4	0	1	1	4	0	0	0	0	2	4	0	0
415	3	3	0	3	0	1	3	6	0	0	0	0	0	4	0	0
430	1	4	3	5	2	3	0	5	0	0	0	0	0	2	0	0
445	0	4	0	4	0	2	2	6	0	0	0	0	0	2	0	0
500	0	4	2	5	0	2	5	10	1	1	1	1	0	0	1	1
515	0	1	1	6	0	2	1	8	1	2	0	1	0	0	0	1
530	0	0	2	5	1	1	1	9	0	2	3	4	1	1	3	4
545	1	1	3	8	2	3	9	16	0	2	0	4	1	2	0	4
600	1	2	8	14	2	5	1	12	6	7	0	3	1	3	0	3
615	4	6	6	19	1	6	11	22	0	6	0	3	1	4	0	3
630	0	6	3	20	1	6	3	24	1	7	0	0	4	7	0	0
645	2	7	9	26	3	7	7	22	0	7	1	1	6	12	1	1
700	3	9	5	23	6	11	7	28	4	5	2	3	7	18	2	3
715	2	7	8	25	1	11	3	20	1	6	1	4	2	19	4	7
730	4	11	15	37	7	17	8	25	3	8	4	8	2	17	3	10
745	4	13	15	43	7	21	13	31	3	11	1	8	1	12	1	10
800	5	15	19	57	3	18	9	33	1	8	1	7	4	9	2	10
815	4	17	16	65	7	24	19	49	1	8	4	10	7	14	6	12
830	1	14	19	69	4	21	17	58	2	7	1	7	3	15	1	10
845	4	14	17	71	2	16	13	58	5	9	0	6	6	20	0	9
900	5	14	14	66	10	23	22	71	2	10	6	11	5	21	6	13
915	3	13	13	63	4	20	11	63	1	10	2	9	7	21	6	13
930	5	17	16	60	5	21	18	64	5	13	3	11	6	24	3	15
945	9	22	9	52	5	24	13	64	3	11	3	14	4	22	2	17
1000	4	21	11	49	4	18	17	59	2	11	3	11	9	26	4	15
1015	5	23	10	46	3	17	9	57	6	16	4	13	11	30	1	10
1030	1	19	8	38	6	18	15	54	3	14	3	13	5	29	5	12
1045	3	13	13	42	0	13	9	50	7	18	2	12	2	27	3	13
1100	8	17	11	42	9	18	6	39	6	22	2	11	8	26	1	10
1115	5	17	7	39	9	24	13	43	7	23	0	7	7	22	0	9
1130	9	25	12	43	10	28	13	41	4	24	1	5	8	25	3	7
1145	9	31	14	44	17	45	7	39	6	23	2	5	11	34	0	4
1200	4	27	11	44	14	50	7	40	6	23	0	3	8	34	0	3
1215	8	30	14	51	20	61	12	39	2	18	3	6	2	29	3	6
1230	6	27	8	47	14	65	7	33	5	19	0	5	0	21	0	3
1245	7	25	9	42	15	63	6	32	0	13	3	6	4	14	3	6
1300	10	31	13	44	4	53	13	38	5	12	2	8	7	13	2	8
1315	2	25	13	43	12	45	7	33	6	16	4	9	2	13	0	5
1330	5	24	18	53	6	37	20	46	6	17	1	10	7	20	1	6
1345	3	20	6	50	9	31	10	50	3	20	0	7	6	22	0	3
1400	5	15	8	45	9	36	8	45	5	20	0	5	3	18	0	1
1415	7	20	8	40	5	29	6	44	4	18	0	1	6	22	0	1
1430	4	19	5	27	2	25	4	28	3	15	2	2	9	24	0	0
1445	4	20	14	35	8	24	10	28	2	14	1	3	5	23	5	5
1500	5	20	6	33	6	21	6	26	3	12	2	5	7	27	6	11
1515	6	19	4	29	4	20	9	29	9	17	4	9	13	34	4	15
1530	9	24	10	34	12	30	9	34	6	20	3	10	9	34	3	18
1545	4	24	7	27	4	26	9	33	0	18	3	12	11	40	3	16
1600	5	24	5	26	6	26	4	31	4	19	2	12	9	42	2	12
1615	11	29	5	27	2	24	7	29	6	16	5	13	5	34	6	14
1630	6	26	6	23	12	24	10	30	1	11	3	13	2	27	3	14
1645	15	37	13	29	9	29	9	30	2	13	7	17	3	19	5	16
1700	10	42	8	32	11	34	11	37	4	13	4	19	2	12	4	18
1715	7	38	16	43	7	39	8	38	3	10	7	21	4	11	3	15
1730	11	43	8	45	6	33	10	38	5	14	2	20	3	12	4	16
1745	8	36	10	42	13	37	9	38	2	14	5	18	2	11	3	14
1800	9	35	8	42	10	36	8	35	5	15	2	16	4	13	2	12
1815	3	31	9	35	9	38	8	35	2	14	1	10	11	20	1	10
1830	7	27	9	36	3	35	9	34	5	14	2	10	8	25	1	7
1845	2	21	9	35	7	29	9	34	4	16	2	7	4	27	2	6
1900	5	17	10	37	6	25	11	37	6	17	1	6	3	26	1	5
1915	3	17	6	34	1	17	5	34	3	18	0	5	8	23	0	4
1930	3	13	6	31	3	17	11	36	1	14	1	4	6	21	4	7
1945	3	14	8	30	1	11	7	34	1	11	0	2	6	23	2	7
2000	3	12	5	25	2	7	7	30	1	6	1	2	4	24	1	7
2015	3	12	8	27	1	7	7	32	9	12	0	2	8	24	0	7
2030	4	13	6	27	10	14	8	29	6	17	1	2	8	26	1	4
2045	6	16	0	19	2	15	4	26	5	21	1	3	3	23	1	3
2100	0	13	1	15	1	14	5	24	1	21	5	7	5	24	5	7
2115	1	11	5	12	6	19	5	22	2	14	3	10	3	19	3	10
2130	1	8	6	12	2	11	2	16	0	8	1	10	1	12	3	12
2145	3	5	8	20	8	17	7	19	7	10	0	9	0	9	0	11
2200	4	9	3	22	3	19	1	15	0	9	0	4	2	6	0	6
2215	2	10	0	17	3	16	3	13	4	11	3	4	3	6	3	6
2230	3	12	0	11	3	17	1	12	3	14	1	4	3	8	1	4
2245	2	11	3	6	1	10	6	11	5	12	2	6	4	12	2	6
2300	1	8	0	3	2	9	1	11	0	12	0	6	1	11	0	6
2315	0	6	2	5	4	10	1	9	3	11	1	4	5	13	1	4
2330	0	3	1	6	4	11	2	10	0	8	0	3	4	14	0	3
2345	2	3	1	4	2	12	2	6	4	7	0	1	0	10	0	1
TOTAL	347	N/A	648	N/A	450	N/A	647	N/A	259	N/A	145	N/A	381	N/A	156	N/A
AM		22		71		24		71		13		14		24		17
NOON		31		53		65		59		24		13		34		15
PM		43		45		39		38		20		21		42		18
EVEN		16		27		19		32		21		10		26		12

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# B. A. Y. M. E. T. R. I. C. S.

## OAKLAND - ALAMEDA: NORTH BAY FARM ISLAND PIPELINE CROSSING PROJECT

Date	20-Oct-15 Tuesday				21-Oct-15 Wednesday				20-Oct-15 Tuesday				21-Oct-15 Wednesday			
	3. Clement Avenue between Broadway & Everett Street								4. Everett Street between Blanding Avenue & Clement Avenue							
Location	EB				WB				NB				SB			
Direction	EB		WB		EB		WB		NB		SB		NB		SB	
Time	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN	15 MIN	60 MIN
1200	3	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0
1215	3	0	2	0	2	0	2	0	0	0	0	0	0	0	0	0
1230	1	0	0	0	7	0	3	0	1	0	0	0	0	0	0	0
1245	2	9	1	3	0	10	0	5	0	1	0	2	0	0	0	0
100	2	8	0	3	1	10	1	6	0	1	0	0	0	0	0	0
115	0	5	0	1	1	9	2	6	1	2	1	1	0	0	0	0
130	3	7	1	2	3	5	4	7	0	1	0	1	1	1	0	0
145	1	6	0	1	1	6	1	8	0	1	0	1	0	1	0	0
200	1	5	1	2	3	8	2	9	0	1	2	3	0	1	2	2
215	0	5	0	2	1	8	1	8	0	0	0	2	0	1	0	2
230	1	3	2	3	1	6	4	8	0	0	0	2	0	0	0	2
245	1	3	0	3	1	6	1	8	1	1	0	2	1	1	0	2
300	3	5	2	4	0	3	1	7	0	1	0	0	0	1	0	0
315	1	6	3	7	1	3	3	9	1	2	0	0	0	1	0	0
330	1	6	1	6	3	5	3	8	0	2	0	0	0	1	1	1
345	0	5	5	11	3	7	8	15	0	1	0	0	0	0	0	1
400	3	5	1	10	1	8	8	22	1	2	0	0	1	1	0	1
415	1	5	12	19	4	11	6	25	0	1	0	0	0	1	0	1
430	8	12	11	29	4	12	16	38	0	1	0	0	0	1	0	0
445	5	17	14	38	10	19	35	65	2	3	0	0	0	1	1	1
500	4	18	16	53	11	29	20	77	3	5	0	0	3	3	0	1
515	9	26	29	70	5	30	22	93	1	6	2	2	1	4	0	1
530	15	33	24	83	18	44	36	113	5	11	1	3	0	4	0	1
545	8	36	28	97	18	52	34	112	2	11	1	4	0	4	1	1
600	13	45	29	110	25	66	39	131	2	10	0	4	3	4	0	1
615	16	52	35	116	14	75	74	183	3	12	1	3	8	11	1	2
630	31	68	45	137	19	76	87	234	1	8	3	5	4	15	2	4
645	24	84	67	176	21	79	80	280	12	18	1	5	10	25	5	8
700	27	98	74	221	20	74	104	345	9	25	2	7	8	30	2	10
715	16	98	90	276	20	80	83	354	6	28	4	10	14	36	11	20
730	12	79	82	313	16	77	91	358	7	34	5	12	12	44	2	20
745	18	73	100	346	16	72	80	358	14	36	4	15	14	48	2	17
800	25	71	79	351	27	79	86	340	24	51	4	17	29	69	6	21
815	19	74	88	349	22	81	74	331	15	60	2	15	18	73	5	15
830	24	86	74	341	19	84	67	307	20	73	8	18	12	73	7	20
845	22	90	64	305	18	86	59	286	20	79	5	19	20	79	6	24
900	18	83	34	260	19	78	52	252	15	70	7	22	15	65	7	25
915	23	87	38	210	28	84	37	215	6	61	3	23	6	53	7	27
930	28	91	23	159	35	100	22	170	6	47	2	17	11	52	3	23
945	33	102	41	136	30	112	31	142	11	38	1	13	12	44	1	18
1000	27	111	24	126	29	122	29	119	11	34	9	15	7	36	4	15
1015	42	130	30	118	41	135	25	107	12	40	6	18	12	42	1	9
1030	43	145	24	119	33	133	36	121	16	50	4	20	11	42	2	8
1045	57	169	32	110	56	159	29	119	11	50	6	25	16	46	5	12
1100	53	195	35	121	57	187	22	112	23	62	8	24	10	49	4	12
1115	52	205	27	118	53	199	36	123	12	62	6	24	6	43	13	24
1130	63	225	32	126	51	217	55	142	20	66	5	25	11	43	8	30
1145	57	225	33	127	44	205	48	161	10	65	6	25	15	42	1	26
1200	46	218	39	131	62	210	34	173	21	63	3	20	14	46	0	22
1215	39	205	32	136	47	204	30	167	12	63	4	18	9	49	6	15
1230	47	189	56	160	58	211	31	143	17	60	6	19	8	46	7	14
1245	58	190	25	152	42	209	34	129	3	53	9	22	17	48	17	30
1300	49	193	33	146	50	197	32	127	8	40	2	21	12	46	4	34
1315	49	203	29	143	53	203	29	126	12	40	4	21	9	46	5	33
1330	40	196	40	127	59	204	33	128	20	43	6	21	21	59	2	28
1345	43	181	38	140	57	219	25	119	14	54	7	19	19	61	10	21
1400	46	178	29	136	65	234	32	119	7	53	4	21	15	64	6	23
1415	56	185	38	145	56	237	36	126	14	55	4	21	14	69	6	24
1430	66	211	21	126	71	249	37	130	14	49	9	24	11	59	3	25
1445	64	232	34	122	64	256	35	140	15	50	2	19	21	61	4	19
1500	56	242	21	114	69	260	26	134	14	57	8	23	25	71	5	18
1515	68	254	38	114	84	288	36	134	16	59	6	25	14	71	2	14
1530	71	259	41	134	68	285	38	135	17	62	5	21	17	77	8	19
1545	67	262	42	142	76	297	31	131	21	68	5	24	28	84	14	29
1600	82	288	37	158	92	320	32	137	9	63	6	22	26	85	6	30
1615	64	284	29	149	97	333	36	137	22	69	6	22	26	97	5	33
1630	69	282	35	143	76	341	35	134	16	68	6	23	19	99	6	31
1645	71	286	42	143	80	345	32	135	12	59	7	25	13	84	9	26
1700	82	286	46	152	94	347	31	134	12	62	8	27	21	79	5	25
1715	70	292	35	158	63	313	29	127	21	61	10	31	8	61	8	28
1730	70	293	29	152	64	301	33	125	21	66	9	34	12	54	14	36
1745	66	288	32	142	50	271	30	123	13	67	10	37	14	55	5	32
1800	61	267	28	124	41	218	32	124	15	70	8	37	13	47	7	34
1815	32	229	15	104	23	178	16	111	16	65	1	28	18	57	5	31
1830	33	192	24	99	22	136	14	92	13	57	5	24	11	56	3	20
1845	39	165	18	85	27	113	14	76	14	58	8	22	7	49	3	18
1900	22	126	15	72	28	100	7	51	13	56	4	18	14	50	0	11
1915	25	119	17	74	27	104	8	43	9	49	1	18	7	39	2	8
1930	22	108	9	59	9	91	15	44	6	42	2	15	8	36	3	8
1945	19	88	8	49	15	79	3	33	5	33	1	8	4	33	0	5
2000	19	85	15	49	18	69	11	37	8	28	0	4	9	28	2	7
2015	21	81	7	39	13	55	4	33	2	21	5	8	2	23	2	7
2030	15	74	10	40	10	56	5	23	6	21	1	7	7	22	2	6
2045	12	67	2	34	8	49	4	24	3	19	1	7	3	21	1	7
2100	19	67	6	25	11	42	2	15	4	15	0	7	0	12	0	5
2115	7	53	8	26	14	43	3	14	4	17	2	4	1	11	3	6
2130	7	45	4	20	5	38	5	14	5	16	4	7	7	11	0	4
2145	7	40	4	22	3	33	5	15	2	15	3	9	1	9	1	4
2200	7	28	4	20	3	25	6	19	2	13	0	9	4	13	2	6
2215	5	26	4	16	5	16	1	17	1	10	0	7	0	12	1	4
2230	5	24	1	13	1	12	1	13	0	5	3	6	2	7	3	7
2245	2	19	0	9	3	12	3	11	2	5	0	3	5	11	0	6
2300	4	16	0	5	4	13	2	7	1	4	1	4	0	7	1	5
2315	4	15	3	4	0	8	2	8	0	3	2	6	0	7	0	4
2330	2	12	2	5	1	8	0	7	0	3	0	3	1	6	0	1
2345	0	10	1	6	2	7	2	6	3	4	2	5	1	2	0	1
TOTAL	2,647	N/A	2,399	N/A	2,703	N/A	2,501	N/A	789	N/A	311	N/A	809	N/A	308	N/A
AM	102		351		112</											

**Synchro-Simtraffic (Software 8) AM and PM Peak Hour Intersection Level-of-Service Calculations:**

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Crossing #1

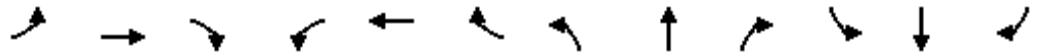
AM Baseline (No Project) Oakland & Alameda  
PM Baseline (No Project) Oakland & Alameda  
AM Baseline plus Project Oakland & Alameda  
PM Baseline plus Project Oakland & Alameda  
AM Baseline plus Project (Mitigated) Oakland  
PM Baseline plus Project (Mitigated) Oakland

# HCM Signalized Intersection Capacity Analysis

AM2019Baseline(NP)

## 1: Madison St. & 8th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					←↑↑↑						↑↑↑	
Volume (vph)	0	0	0	246	665	0	0	0	0	0	571	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.86						0.91	
Frt					1.00						0.98	
Flt Protected					0.99						1.00	
Satd. Flow (prot)					5690						4476	
Flt Permitted					0.99						1.00	
Satd. Flow (perm)					5690						4476	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	267	723	0	0	0	0	0	621	107
RTOR Reduction (vph)	0	0	0	0	94	0	0	0	0	0	40	0
Lane Group Flow (vph)	0	0	0	0	896	0	0	0	0	0	688	0
Turn Type				Perm	NA						NA	
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					26.0						26.0	
Effective Green, g (s)					26.0						26.0	
Actuated g/C Ratio					0.43						0.43	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					2465						1939	
v/s Ratio Prot											c0.15	
v/s Ratio Perm					0.16							
v/c Ratio					0.36						0.35	
Uniform Delay, d1					11.4						11.4	
Progression Factor					1.00						1.00	
Incremental Delay, d2					0.4						0.5	
Delay (s)					11.9						11.9	
Level of Service					B						B	
Approach Delay (s)		0.0			11.9			0.0			11.9	
Approach LOS		A			B			A			B	

### Intersection Summary

HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 2: Madison. St./Madison St. & 7th St.

AM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑									↑↑↑	
Volume (vph)	0	350	204	0	0	0	0	0	0	128	610	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		0.86									0.91	
Frt		0.94									1.00	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		6053									5042	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		6053									5042	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	380	222	0	0	0	0	0	0	139	663	0
RTOR Reduction (vph)	0	111	0	0	0	0	0	0	0	0	54	0
Lane Group Flow (vph)	0	491	0	0	0	0	0	0	0	0	748	0
Turn Type		NA								Perm	NA	
Protected Phases		4									6	
Permitted Phases										6		
Actuated Green, G (s)		23.0									29.0	
Effective Green, g (s)		23.0									29.0	
Actuated g/C Ratio		0.38									0.48	
Clearance Time (s)		4.0									4.0	
Lane Grp Cap (vph)		2320									2436	
v/s Ratio Prot		c0.08										
v/s Ratio Perm											0.15	
v/c Ratio		0.21									0.31	
Uniform Delay, d1		12.4									9.4	
Progression Factor		0.35									0.66	
Incremental Delay, d2		0.2									0.3	
Delay (s)		4.5									6.5	
Level of Service		A									A	
Approach Delay (s)		4.5			0.0			0.0			6.5	
Approach LOS		A			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	29.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

AM2019Baseline(NP)

## 3: Madison St. /Madison. St. & 6th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					←←←						←←←	
Volume (vph)	0	0	0	21	155	0	0	0	0	0	741	196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.91						0.91	
Frt					1.00						0.97	
Flt Protected					0.99						1.00	
Satd. Flow (prot)					5055						4926	
Flt Permitted					0.99						1.00	
Satd. Flow (perm)					5055						4926	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	23	168	0	0	0	0	0	805	213
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	0	0	79	0
Lane Group Flow (vph)	0	0	0	0	176	0	0	0	0	0	939	0
Turn Type				Perm	NA						NA	
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					20.0						32.0	
Effective Green, g (s)					20.0						32.0	
Actuated g/C Ratio					0.33						0.53	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					1685						2627	
v/s Ratio Prot											c0.19	
v/s Ratio Perm					0.03							
v/c Ratio					0.10						0.36	
Uniform Delay, d1					13.8						8.1	
Progression Factor					1.00						0.59	
Incremental Delay, d2					0.1						0.4	
Delay (s)					13.9						5.2	
Level of Service					B						A	
Approach Delay (s)		0.0			13.9			0.0			5.2	
Approach LOS		A			B			A			A	

### Intersection Summary

HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 4: Madison St./Madison St. & 5th St.

AM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑								↑↑	↑	
Volume (vph)	0	527	21	0	0	0	0	0	0	567	99	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0								4.0	4.0	
Lane Util. Factor		0.91								0.97	1.00	
Frt		0.99								1.00	1.00	
Flt Protected		1.00								0.95	1.00	
Satd. Flow (prot)		4550								3090	1676	
Flt Permitted		1.00								0.95	1.00	
Satd. Flow (perm)		4550								3090	1676	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	573	23	0	0	0	0	0	0	616	108	0
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	0	172	0	0
Lane Group Flow (vph)	0	589	0	0	0	0	0	0	0	444	108	0
Turn Type		NA								Prot	NA	
Protected Phases		4								1	6	
Permitted Phases												
Actuated Green, G (s)		24.0								28.0	28.0	
Effective Green, g (s)		24.0								28.0	28.0	
Actuated g/C Ratio		0.40								0.47	0.47	
Clearance Time (s)		4.0								4.0	4.0	
Lane Grp Cap (vph)		1820								1442	782	
v/s Ratio Prot		c0.13								c0.14	0.06	
v/s Ratio Perm												
v/c Ratio		0.32								0.31	0.14	
Uniform Delay, d1		12.4								10.0	9.1	
Progression Factor		0.78								0.17	0.52	
Incremental Delay, d2		0.4								0.5	0.3	
Delay (s)		10.0								2.2	5.1	
Level of Service		B								A	A	
Approach Delay (s)		10.0			0.0			0.0			2.7	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

**Intersection**

Intersection Delay, s/veh 5.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	52	11	4	55	0	12	0	16	19	54	48
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	57	12	4	60	0	13	0	17	21	59	52
Number of Lanes	0	1	0	0	1	0	0	1	0	1	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	60	0	0	68	0	0	187	131	63	139	136	60
Stage 1	-	-	-	-	-	-	63	63	-	68	68	-
Stage 2	-	-	-	-	-	-	124	68	-	71	68	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1544	-	-	1533	-	-	774	760	1002	831	755	1005
Stage 1	-	-	-	-	-	-	948	842	-	942	838	-
Stage 2	-	-	-	-	-	-	880	838	-	939	838	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1544	-	-	1533	-	-	689	758	1002	815	753	1005
Mov Capacity-2 Maneuver	-	-	-	-	-	-	689	758	-	815	753	-
Stage 1	-	-	-	-	-	-	948	842	-	942	835	-
Stage 2	-	-	-	-	-	-	773	835	-	923	838	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.5	9.5	9.9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Cap, veh/h	839	1544	-	-	1533	-	-	815	851
HCM Control Delay, s	9.5	0	-	-	7.355	0	-	9.5	9.9
HCM Lane V/C Ratio	0.04	-	-	-	0.00	-	-	0.02	0.14
HCM Lane LOS	A	A	-	-	A	A	-	A	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.1	0.5

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	76	4	9	91	7	9	2	8	8	2	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	83	4	10	99	8	10	2	9	9	2	29
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	107	0	0	87	0	0	236	224	85	225	222	103
Stage 1	-	-	-	-	-	-	98	98	-	122	122	-
Stage 2	-	-	-	-	-	-	138	126	-	103	100	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1484	-	-	1509	-	-	718	675	974	730	677	952
Stage 1	-	-	-	-	-	-	908	814	-	882	795	-
Stage 2	-	-	-	-	-	-	865	792	-	903	812	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1484	-	-	1509	-	-	688	667	974	715	669	952
Mov Capacity-2 Maneuver	-	-	-	-	-	-	688	667	-	715	669	-
Stage 1	-	-	-	-	-	-	903	810	-	878	789	-
Stage 2	-	-	-	-	-	-	830	786	-	888	808	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	0.6	9.7	9.3
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	782	1484	-	-	1509	-	-	870
HCM Control Delay, s	9.7	7.437	0	-	7.401	0	-	9.3
HCM Lane V/C Ratio	0.03	0.00	-	-	0.01	-	-	0.05
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.1

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	60	27	73	235	117	42
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	75			0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	65	29	79	255	127	46
Number of Lanes	1	0	1	1	1	0

**Major/Minor**

		Major 1		Major 2	
Conflicting Flow All	564	150	173	0	0
Stage 1	150	-	-	-	-
Stage 2	414	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	487	896	1404	-	-
Stage 1	878	-	-	-	-
Stage 2	667	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	460	896	1404	-	-
Mov Capacity-2 Maneuver	460	-	-	-	-
Stage 1	878	-	-	-	-
Stage 2	629	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	13	1.8	0
HCM LOS	B	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1404	-	542	-	-
HCM Control Delay, s	7.718	-	13	-	-
HCM Lane V/C Ratio	0.06	-	0.17	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th-tile Q, veh	0.2	-	0.6	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	70	0	58	0	0	0	192	235	0	0	94	52
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	160		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	76	0	63	0	0	0	209	255	0	0	102	57
Number of Lanes	0	1	0	0	0	0	1	1	0	0	2	0

Major/Minor	Minor 2			Major 1			Major 2		
Conflicting Flow All	803	803	79	159	0	0	255	0	0
Stage 1	130	130	-	-	-	-	-	-	-
Stage 2	673	673	-	-	-	-	-	-	-
Follow-up Headway	3.519	4.019	3.319	2.22	-	-	2.218	-	-
Pot Capacity-1 Maneuver	336	316	966	1418	-	-	1310	-	-
Stage 1	883	788	-	-	-	-	-	-	-
Stage 2	506	453	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	286	0	966	1418	-	-	1310	-	-
Mov Capacity-2 Maneuver	286	0	-	-	-	-	-	-	-
Stage 1	883	0	-	-	-	-	-	-	-
Stage 2	431	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	17.8	3.6	0
HCM LOS	C	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Cap, veh/h	1418	-	-	420	1310	-	-
HCM Control Delay, s	7.976	-	-	17.8	0	-	-
HCM Lane V/C Ratio	0.15	-	-	0.33	-	-	-
HCM Lane LOS	A	-	-	C	A	-	-
HCM 95th-tile Q, veh	0.5	-	-	1.4	0.0	-	-

**Notes**

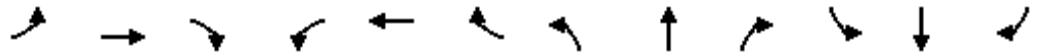
- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis

AM2019Baseline(NP)

9: Jackson St. & 8th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					4111			4			1	
Volume (vph)	0	0	0	76	485	72	106	223	0	0	223	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0			4.0			4.0	
Lane Util. Factor					0.86			1.00			1.00	
Frt					0.98			1.00			0.97	
Flt Protected					0.99			0.98			1.00	
Satd. Flow (prot)					5635			1650			1627	
Flt Permitted					0.99			0.79			1.00	
Satd. Flow (perm)					5635			1320			1627	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	83	527	78	115	242	0	0	242	68
RTOR Reduction (vph)	0	0	0	0	39	0	0	0	0	0	17	0
Lane Group Flow (vph)	0	0	0	0	650	0	0	357	0	0	293	0
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					8			2			6	
Permitted Phases				8			2					
Actuated Green, G (s)					27.0			25.0			25.0	
Effective Green, g (s)					27.0			25.0			25.0	
Actuated g/C Ratio					0.45			0.42			0.42	
Clearance Time (s)					4.0			4.0			4.0	
Lane Grp Cap (vph)					2535			550			677	
v/s Ratio Prot											0.18	
v/s Ratio Perm					0.12			c0.27				
v/c Ratio					0.26			0.65			0.43	
Uniform Delay, d1					10.3			14.0			12.5	
Progression Factor					0.57			0.39			1.00	
Incremental Delay, d2					0.2			5.2			2.0	
Delay (s)					6.1			10.6			14.5	
Level of Service					A			B			B	
Approach Delay (s)		0.0			6.1			10.6			14.5	
Approach LOS		A			A			B			B	

Intersection Summary

HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 10: Jackson St. & 7th St.

AM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↗↗					↖			↕	
Volume (vph)	43	557	1285	0	0	0	0	262	59	25	318	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0			4.0	
Lane Util. Factor		0.95	0.88					1.00			1.00	
Frt		1.00	0.85					0.98			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		3527	2787					1817			1856	
Flt Permitted		1.00	1.00					1.00			0.96	
Satd. Flow (perm)		3527	2787					1817			1788	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	605	1397	0	0	0	0	285	64	27	346	0
RTOR Reduction (vph)	0	0	232	0	0	0	0	13	0	0	0	0
Lane Group Flow (vph)	0	652	1165	0	0	0	0	336	0	0	373	0
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4		4							6		
Actuated Green, G (s)		32.0	32.0					20.0			20.0	
Effective Green, g (s)		32.0	32.0					20.0			20.0	
Actuated g/C Ratio		0.53	0.53					0.33			0.33	
Clearance Time (s)		4.0	4.0					4.0			4.0	
Lane Grp Cap (vph)		1881	1486					605			596	
v/s Ratio Prot								0.18				
v/s Ratio Perm		0.18	c0.42								c0.21	
v/c Ratio		0.35	0.78					0.55			0.63	
Uniform Delay, d1		8.0	11.2					16.4			16.8	
Progression Factor		1.00	1.00					1.00			0.64	
Incremental Delay, d2		0.5	4.2					3.6			4.7	
Delay (s)		8.5	15.4					20.0			15.5	
Level of Service		A	B					C			B	
Approach Delay (s)		13.2			0.0			20.0			15.5	
Approach LOS		B			A			C			B	

Intersection Summary

HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

AM2019Baseline(NP)

## 11: Jackson St. & 6th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↗	↖	↖	↗			↗	↖
Volume (vph)	0	0	0	7	336	49	228	254	0	0	650	1034
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1863	1583	1770	1863			1863	1583
Flt Permitted				0.95	1.00	1.00	0.32	1.00			1.00	1.00
Satd. Flow (perm)				1770	1863	1583	590	1863			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	8	365	53	248	276	0	0	707	1124
RTOR Reduction (vph)	0	0	0	0	0	42	0	0	0	0	0	28
Lane Group Flow (vph)	0	0	0	8	365	11	248	276	0	0	707	1096
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				18.0	18.0	18.0	64.0	64.0			64.0	64.0
Effective Green, g (s)				18.0	18.0	18.0	64.0	64.0			64.0	64.0
Actuated g/C Ratio				0.20	0.20	0.20	0.71	0.71			0.71	0.71
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				354	372	316	419	1324			1324	1125
v/s Ratio Prot					c0.20			0.15			0.38	
v/s Ratio Perm				0.00		0.01	0.42					c0.69
v/c Ratio				0.02	0.98	0.03	0.59	0.21			0.53	0.97
Uniform Delay, d1				28.9	35.8	29.0	6.5	4.4			6.1	12.2
Progression Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2				0.1	42.2	0.2	6.0	0.4			1.5	21.3
Delay (s)				29.0	78.0	29.2	12.5	4.8			7.6	33.5
Level of Service				C	E	C	B	A			A	C
Approach Delay (s)		0.0			71.0			8.4			23.5	
Approach LOS		A			E			A			C	

### Intersection Summary

HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	104.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 12: Jackson St. & I-880 EB Off 5th St./5th St.

AM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕			↕	
Volume (vph)	333	450	549	0	0	0	0	207	29	68	74	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.95						1.00			1.00	
Frt		0.94						0.98			1.00	
Flt Protected		0.99						1.00			0.98	
Satd. Flow (prot)		3279						1831			1819	
Flt Permitted		0.99						1.00			0.75	
Satd. Flow (perm)		3279						1831			1406	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	362	489	597	0	0	0	0	225	32	74	80	0
RTOR Reduction (vph)	0	211	0	0	0	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	1237	0	0	0	0	0	249	0	0	154	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		34.0						18.0			18.0	
Effective Green, g (s)		34.0						18.0			18.0	
Actuated g/C Ratio		0.57						0.30			0.30	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		1858						549			421	
v/s Ratio Prot								c0.14				
v/s Ratio Perm		0.38									0.11	
v/c Ratio		0.67						0.45			0.37	
Uniform Delay, d1		9.0						17.0			16.5	
Progression Factor		1.00						1.00			1.00	
Incremental Delay, d2		1.9						2.7			2.4	
Delay (s)		11.0						19.7			19.0	
Level of Service		B						B			B	
Approach Delay (s)		11.0			0.0			19.7			19.0	
Approach LOS		B			A			B			B	

Intersection Summary

HCM 2000 Control Delay	12.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 13: Oak St. & 5th St.

AM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔↔						↔			↔	
Volume (vph)	231	586	133	0	0	0	0	246	100	2	106	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.91						1.00			1.00	
Frt		0.98						0.96			1.00	
Flt Protected		0.99						1.00			1.00	
Satd. Flow (prot)		4918						1790			1861	
Flt Permitted		0.99						1.00			1.00	
Satd. Flow (perm)		4918						1790			1854	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	251	637	145	0	0	0	0	267	109	2	115	0
RTOR Reduction (vph)	0	37	0	0	0	0	0	25	0	0	0	0
Lane Group Flow (vph)	0	996	0	0	0	0	0	352	0	0	117	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		27.0						25.0			25.0	
Effective Green, g (s)		27.0						25.0			25.0	
Actuated g/C Ratio		0.45						0.42			0.42	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		2213						745			772	
v/s Ratio Prot								c0.20				
v/s Ratio Perm		0.20									0.06	
v/c Ratio		0.45						0.47			0.15	
Uniform Delay, d1		11.4						12.7			10.9	
Progression Factor		0.50						1.00			1.00	
Incremental Delay, d2		0.6						2.1			0.4	
Delay (s)		6.4						14.8			11.3	
Level of Service		A						B			B	
Approach Delay (s)		6.4			0.0			14.8			11.3	
Approach LOS		A			A			B			B	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 14: 5th St. & Mitchell Ave.

AM2019Baseline(NP)  
 2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Volume (vph)	17	6	27	35	25	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	1.00			1.00	1.00	
Frt	0.96			1.00	0.93	
Flt Protected	1.00			0.98	0.98	
Satd. Flow (prot)	1792			1823	1695	
Flt Permitted	1.00			0.85	0.98	
Satd. Flow (perm)	1792			1581	1695	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	7	29	38	27	27
RTOR Reduction (vph)	6	0	0	0	7	0
Lane Group Flow (vph)	19	0	0	67	47	0
Turn Type	NA		Perm	NA	NA	
Protected Phases	4			8		
Permitted Phases			8		2	
Actuated Green, G (s)	4.8			4.8	36.2	
Effective Green, g (s)	4.8			4.8	36.2	
Actuated g/C Ratio	0.10			0.10	0.74	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	175			154	1252	
v/s Ratio Prot	0.01					
v/s Ratio Perm				c0.04	c0.03	
v/c Ratio	0.11			0.44	0.04	
Uniform Delay, d1	20.1			20.8	1.7	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.3			2.0	0.1	
Delay (s)	20.4			22.8	1.8	
Level of Service	C			C	A	
Approach Delay (s)	20.4			22.8	1.8	
Approach LOS	C			C	A	

Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.08		
Actuated Cycle Length (s)	49.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	20.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



HCM Signalized Intersection Capacity Analysis  
 15: Mariner's Sq. Loop & Mitchell Ave./Marina Village Pkwy.

AM2019Baseline(NP)

2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Volume (vph)	38	9	61	35	23	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	1813		1770	1863	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	1813		1770	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	10	66	38	25	227
RTOR Reduction (vph)	9	0	0	0	0	74
Lane Group Flow (vph)	42	0	66	38	25	153
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	4.7		6.7	15.4	48.7	48.7
Effective Green, g (s)	4.7		6.7	15.4	48.7	48.7
Actuated g/C Ratio	0.07		0.09	0.21	0.68	0.68
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	118		164	397	1195	1069
v/s Ratio Prot	c0.02		c0.04	0.02	0.01	
v/s Ratio Perm						c0.10
v/c Ratio	0.35		0.40	0.10	0.02	0.14
Uniform Delay, d1	32.2		30.8	22.8	3.9	4.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8		1.6	0.1	0.0	0.3
Delay (s)	34.1		32.4	22.9	3.9	4.5
Level of Service	C		C	C	A	A
Approach Delay (s)	34.1			28.9	4.4	
Approach LOS	C			C	A	

Intersection Summary

HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.19		
Actuated Cycle Length (s)	72.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection												
Intersection Delay, s/veh	8.3											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	21	55	62	56	51	15	43	23	5	12	15	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	60	67	61	55	16	47	25	5	13	16	16
Number of Lanes	1	1	0	1	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	8.2	8.4	8.6	8.1
HCM LOS	A	A	A	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	100%	0%	100%	0%
Vol Thru, %	0%	82%	0%	47%	0%	77%	0%	50%
Vol Right, %	0%	18%	0%	53%	0%	23%	0%	50%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	28	21	117	56	66	12	30
LT Vol	0	23	0	55	0	51	0	15
Through Vol	0	5	0	62	0	15	0	15
RT Vol	43	0	21	0	56	0	12	0
Lane Flow Rate	47	30	23	127	61	72	13	33
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.075	0.043	0.035	0.163	0.093	0.096	0.021	0.045
Departure Headway (Hd)	5.771	5.142	5.489	4.615	5.493	4.832	5.811	4.956
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	622	697	654	778	654	743	617	723
Service Time	3.496	2.868	3.209	2.335	3.214	2.552	3.539	2.684
HCM Lane V/C Ratio	0.076	0.043	0.035	0.163	0.093	0.097	0.021	0.046
HCM Control Delay	9	8.1	8.4	8.2	8.8	8.1	8.7	7.9
HCM Lane LOS	A	A	A	A	A	A	A	A
HCM 95th-tile Q	0.2	0.1	0.1	0.6	0.3	0.3	0.1	0.1

Notes  
 - : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	64	1	2	109	6	0	0	0	5	1	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	75		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	70	1	2	118	7	0	0	0	5	1	12
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	125	0	0	71	0	0	212	208	70	205	205	122
Stage 1	-	-	-	-	-	-	79	79	-	126	126	-
Stage 2	-	-	-	-	-	-	133	129	-	79	79	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1462	-	-	1529	-	-	745	689	993	753	691	929
Stage 1	-	-	-	-	-	-	930	829	-	878	792	-
Stage 2	-	-	-	-	-	-	870	789	-	930	829	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1462	-	-	1529	-	-	732	686	993	751	688	929
Mov Capacity-2 Maneuver	-	-	-	-	-	-	732	686	-	751	688	-
Stage 1	-	-	-	-	-	-	927	827	-	876	791	-
Stage 2	-	-	-	-	-	-	857	788	-	927	827	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.1	0	9.3
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	0	1462	-	-	1529	-	-	852
HCM Control Delay, s	0	7.47	-	-	7.358	-	-	9.3
HCM Lane V/C Ratio	-	0.00	-	-	0.00	-	-	0.02
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	0.1

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	59	9	11	109	4	2	1	0	3	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	125		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	64	10	12	118	4	2	1	0	3	0	2
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	123	0	0	74	0	0	219	220	69	219	223	121
Stage 1	-	-	-	-	-	-	73	73	-	145	145	-
Stage 2	-	-	-	-	-	-	146	147	-	74	78	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1464	-	-	1526	-	-	737	678	994	737	676	930
Stage 1	-	-	-	-	-	-	937	834	-	858	777	-
Stage 2	-	-	-	-	-	-	857	775	-	935	830	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1464	-	-	1526	-	-	730	672	994	731	670	930
Mov Capacity-2 Maneuver	-	-	-	-	-	-	730	672	-	731	670	-
Stage 1	-	-	-	-	-	-	936	833	-	857	771	-
Stage 2	-	-	-	-	-	-	848	769	-	933	829	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.7	10.1	9.5
HCM LOS	-	-	B	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	710	1464	-	-	1526	-	-	799
HCM Control Delay, s	10.1	7.463	-	-	7.378	-	-	9.5
HCM Lane V/C Ratio	0.01	0.00	-	-	0.01	-	-	0.01
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	60	1	42	122	5	1	1	14	4	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	95		0	80		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	65	1	46	133	5	1	1	15	4	1	0
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	138	0	0	66	0	0	295	297	66	303	295	135
Stage 1	-	-	-	-	-	-	68	68	-	227	227	-
Stage 2	-	-	-	-	-	-	227	229	-	76	68	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1446	-	-	1536	-	-	657	615	998	649	616	914
Stage 1	-	-	-	-	-	-	942	838	-	776	716	-
Stage 2	-	-	-	-	-	-	776	715	-	933	838	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1446	-	-	1536	-	-	641	596	998	623	597	914
Mov Capacity-2 Maneuver	-	-	-	-	-	-	641	596	-	623	597	-
Stage 1	-	-	-	-	-	-	941	837	-	775	695	-
Stage 2	-	-	-	-	-	-	752	694	-	917	837	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1.8	9	10.9
HCM LOS	-	-	A	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	927	1446	-	-	1536	-	-	618
HCM Control Delay, s	9	7.491	-	-	7.416	-	-	10.9
HCM Lane V/C Ratio	0.02	0.00	-	-	0.03	-	-	0.01
HCM Lane LOS	A	A	-	-	A	-	-	B
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.1	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	67	5	24	157	27	1	0	0	2	1	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	95		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	73	5	26	171	29	1	0	0	2	1	7
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	200	0	0	78	0	0	330	341	76	327	329	185
Stage 1	-	-	-	-	-	-	89	89	-	238	238	-
Stage 2	-	-	-	-	-	-	241	252	-	89	91	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1372	-	-	1520	-	-	623	581	985	626	590	857
Stage 1	-	-	-	-	-	-	918	821	-	765	708	-
Stage 2	-	-	-	-	-	-	762	698	-	918	820	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1372	-	-	1520	-	-	607	568	985	615	577	857
Mov Capacity-2 Maneuver	-	-	-	-	-	-	607	568	-	615	577	-
Stage 1	-	-	-	-	-	-	913	817	-	761	696	-
Stage 2	-	-	-	-	-	-	742	686	-	913	816	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.9	10.9	9.9
HCM LOS	-	-	B	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	607	1372	-	-	1520	-	-	751
HCM Control Delay, s	10.9	7.636	-	-	7.41	-	-	9.9
HCM Lane V/C Ratio	0.00	0.01	-	-	0.02	-	-	0.01
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.1	-	-	0.0

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 3.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	204	38	21	65	23	120
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	50		0	0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	222	41	23	71	25	130
Number of Lanes	2	0	1	2	1	0

Major/Minor	Major 1	Major 2	Major 1	Major 2	Major 1	Major 2
Conflicting Flow All	0	0	263	0	323	132
Stage 1	-	-	-	-	242	-
Stage 2	-	-	-	-	81	-
Follow-up Headway	-	-	2.22	-	3.52	3.32
Pot Capacity-1 Maneuver	-	-	1298	-	646	893
Stage 1	-	-	-	-	776	-
Stage 2	-	-	-	-	933	-
Time blocked-Platoon, %	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1298	-	635	893
Mov Capacity-2 Maneuver	-	-	-	-	635	-
Stage 1	-	-	-	-	776	-
Stage 2	-	-	-	-	916	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	10.3
HCM LOS	-	-	B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Cap, veh/h	838	-	-	1298	-
HCM Control Delay, s	10.3	-	-	7.823	-
HCM Lane V/C Ratio	0.18	-	-	0.02	-
HCM Lane LOS	B	-	-	A	-
HCM 95th-tile Q, veh	0.7	-	-	0.1	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 22: Challenger Dr./Marina Village & Marina Village Pkwy.

AM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Volume (vph)	12	158	84	22	57	5	370	62	64	4	19	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.99		1.00	0.92		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3356		1770	3500		1770	1720		1770	1786	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3356		1770	3500		1770	1720		1770	1786	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	13	172	91	24	62	5	402	67	70	4	21	8
RTOR Reduction (vph)	0	78	0	0	4	0	0	30	0	0	5	0
Lane Group Flow (vph)	13	185	0	24	63	0	402	107	0	4	24	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	0.7	9.1		1.4	9.8		16.7	35.7		0.7	19.7	
Effective Green, g (s)	0.7	9.1		1.4	9.8		16.7	35.7		0.7	19.7	
Actuated g/C Ratio	0.01	0.14		0.02	0.16		0.27	0.57		0.01	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	19	485		39	545		469	976		19	559	
v/s Ratio Prot	0.01	c0.06		c0.01	0.02		c0.23	c0.06		0.00	0.01	
v/s Ratio Perm												
v/c Ratio	0.68	0.38		0.62	0.12		0.86	0.11		0.21	0.04	
Uniform Delay, d1	31.0	24.4		30.5	22.8		22.0	6.3		30.8	15.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	69.9	0.5		25.5	0.1		14.3	0.2		5.5	0.1	
Delay (s)	100.9	24.9		56.0	22.9		36.3	6.5		36.3	15.2	
Level of Service	F	C		E	C		D	A		D	B	
Approach Delay (s)		28.4			31.6			28.7			17.7	
Approach LOS		C			C			C			B	

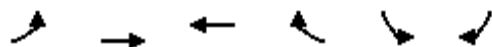
Intersection Summary

HCM 2000 Control Delay	28.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



HCM Signalized Intersection Capacity Analysis  
 23: Atlantic Ave. & Challenger Dr.

AM2019Baseline(NP)  
 2/16/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	59	230	301	490	86	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	64	250	327	533	93	24
RTOR Reduction (vph)	0	0	0	365	0	14
Lane Group Flow (vph)	64	250	327	168	93	10
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	3.1	23.7	16.6	16.6	21.1	21.1
Effective Green, g (s)	3.1	23.7	16.6	16.6	21.1	21.1
Actuated g/C Ratio	0.06	0.45	0.31	0.31	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	103	836	585	497	707	632
v/s Ratio Prot	c0.04	0.13	c0.18		c0.05	
v/s Ratio Perm				0.11		0.01
v/c Ratio	0.62	0.30	0.56	0.34	0.13	0.02
Uniform Delay, d1	24.3	9.3	15.1	13.9	10.0	9.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.1	0.2	1.2	0.4	0.4	0.0
Delay (s)	35.4	9.5	16.2	14.3	10.4	9.6
Level of Service	D	A	B	B	B	A
Approach Delay (s)		14.7	15.0		10.3	
Approach LOS		B	B		B	

**Intersection Summary**

HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	52.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	15	238	792	141	42	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length	100			0	0	0
Median Width		12	12		12	
Grade, %		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	259	861	153	46	10
Number of Lanes	1	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow All	1014	0	-	0	1229	938
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	291	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	684	-	-	-	196	321
Stage 1	-	-	-	-	381	-
Stage 2	-	-	-	-	759	-
Time blocked-Platoon, %	0	-	-	-	0	0
Mov Capacity-1 Maneuver	684	-	-	-	191	321
Mov Capacity-2 Maneuver	-	-	-	-	191	-
Stage 1	-	-	-	-	381	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	28.8
HCM LOS	-	-	D

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Cap, veh/h	684	-	-	-	206
HCM Control Delay, s	10.392	-	-	-	28.8
HCM Lane V/C Ratio	0.02	-	-	-	0.27
HCM Lane LOS	B	-	-	-	D
HCM 95th-tile Q, veh	0.1	-	-	-	1.0




















**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
25: Sherman St. & Buena Vista

AM2019Baseline(NP)

2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	195	16	5	186	623	17	328	11	168	96	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1839			1860	1583	1770	1854		1770	1850	
Flt Permitted		0.97			0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1789			1848	1583	1770	1854		1770	1850	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	212	17	5	202	677	18	357	12	183	104	5
RTOR Reduction (vph)	0	5	0	0	0	148	0	2	0	0	2	0
Lane Group Flow (vph)	0	241	0	0	207	529	18	367	0	183	107	0
Turn Type	Perm	NA		Perm	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)		11.6			11.6	20.5	0.7	20.5		8.9	28.7	
Effective Green, g (s)		11.6			11.6	20.5	0.7	20.5		8.9	28.7	
Actuated g/C Ratio		0.22			0.22	0.39	0.01	0.39		0.17	0.54	
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		391			404	731	23	717		297	1001	
v/s Ratio Prot						c0.12	0.01	c0.20		0.10	0.06	
v/s Ratio Perm		0.13			0.11	0.21						
v/c Ratio		0.62			0.51	0.72	0.78	0.51		0.62	0.11	
Uniform Delay, d1		18.7			18.2	13.8	26.1	12.4		20.5	5.9	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.9			1.1	3.6	93.8	2.6		3.8	0.2	
Delay (s)		21.6			19.3	17.4	119.9	15.0		24.2	6.1	
Level of Service		C			B	B	F	B		C	A	
Approach Delay (s)		21.6			17.9			19.9			17.5	
Approach LOS		C			B			B			B	

Intersection Summary

HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	5	8	1	12	39	6	293	3	10	113	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	5	9	1	13	42	7	318	3	11	123	5
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	508	482	126	487	483	320	128	0	0	322	0	0
Stage 1	147	147	-	333	333	-	-	-	-	-	-	-
Stage 2	361	335	-	154	150	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	475	484	924	491	483	721	1458	-	-	1238	-	-
Stage 1	856	775	-	681	644	-	-	-	-	-	-	-
Stage 2	657	643	-	848	773	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	432	476	924	476	475	721	1458	-	-	1238	-	-
Mov Capacity-2 Maneuver	432	476	-	476	475	-	-	-	-	-	-	-
Stage 1	851	767	-	677	640	-	-	-	-	-	-	-
Stage 2	602	639	-	826	765	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11	11.2	0.1	0.6
HCM LOS	B	B	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1458	-	-	613	638	1238	-	-
HCM Control Delay, s	7.48	0	-	11	11.2	7.934	0	-
HCM Lane V/C Ratio	0.00	-	-	0.03	0.09	0.01	-	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th-tile Q, veh	0.0	-	-	0.1	0.3	0.0	-	-

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
27: Sherman St. & Lincoln Ave.

AM2019Baseline(NP)  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	289	22	2	344	74	23	165	14	44	67	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95			0.95			1.00			1.00	
Frt	1.00	0.99			0.97			0.99			0.99	
Flt Protected	0.95	1.00			1.00			0.99			0.98	
Satd. Flow (prot)	1770	3502			3445			1835			1815	
Flt Permitted	0.47	1.00			0.95			0.97			0.85	
Satd. Flow (perm)	868	3502			3288			1784			1578	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	314	24	2	374	80	25	179	15	48	73	7
RTOR Reduction (vph)	0	10	0	0	30	0	0	5	0	0	3	0
Lane Group Flow (vph)	24	328	0	0	426	0	0	214	0	0	125	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.0	26.0			26.0			26.0			26.0	
Effective Green, g (s)	26.0	26.0			26.0			26.0			26.0	
Actuated g/C Ratio	0.43	0.43			0.43			0.43			0.43	
Clearance Time (s)	4.0	4.0			4.0			4.0			4.0	
Lane Grp Cap (vph)	376	1517			1424			773			683	
v/s Ratio Prot		0.09										
v/s Ratio Perm	0.03				c0.13			c0.12			0.08	
v/c Ratio	0.06	0.22			0.30			0.28			0.18	
Uniform Delay, d1	9.9	10.6			11.1			10.9			10.5	
Progression Factor	1.00	1.00			1.00			1.00			1.00	
Incremental Delay, d2	0.3	0.3			0.5			0.9			0.6	
Delay (s)	10.2	11.0			11.6			11.8			11.0	
Level of Service	B	B			B			B			B	
Approach Delay (s)		10.9			11.6			11.8			11.0	
Approach LOS		B			B			B			B	

**Intersection Summary**


















HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
28: 8th St. & Lincoln Ave.

AM2019Baseline(NP)

2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	142	21	9	238	251	22	590	15	157	253	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor		0.95			0.95			0.95		0.97	1.00	
Frt		0.98			0.92			1.00		1.00	1.00	
Flt Protected		0.99			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		3460			3269			3521		3433	1859	
Flt Permitted		0.78			0.95			1.00		0.95	1.00	
Satd. Flow (perm)		2709			3103			3521		3433	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	154	23	10	259	273	24	641	16	171	275	4
RTOR Reduction (vph)	0	10	0	0	185	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	187	0	0	357	0	0	680	0	171	278	0
Turn Type	Perm	NA		Perm	NA		Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)		15.7			15.7			39.7		18.5	18.5	
Effective Green, g (s)		15.7			15.7			39.7		18.5	18.5	
Actuated g/C Ratio		0.18			0.18			0.46		0.22	0.22	
Clearance Time (s)		4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)		495			567			1627		739	400	
v/s Ratio Prot								c0.19		0.05	c0.15	
v/s Ratio Perm		0.07			c0.12							
v/c Ratio		0.38			0.63			0.42		0.23	0.70	
Uniform Delay, d1		30.8			32.4			15.4		27.8	31.1	
Progression Factor		1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2		0.5			2.3			0.8		0.2	5.2	
Delay (s)		31.3			34.7			16.2		28.0	36.3	
Level of Service		C			C			B		C	D	
Approach Delay (s)		31.3			34.7			16.2			33.1	
Approach LOS		C			C			B			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			27.2								HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			85.9								Sum of lost time (s)	12.0
Intersection Capacity Utilization			62.5%								ICU Level of Service	B
Analysis Period (min)			15									
c	Critical Lane Group											

# HCM Signalized Intersection Capacity Analysis

PM2019Baseline(NP)

## 1: Madison St. & 8th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					←↑↑↑						↑↑↑	
Volume (vph)	0	0	0	220	487	0	0	0	0	0	811	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.86						0.91	
Frt					1.00						0.99	
Flt Protected					0.98						1.00	
Satd. Flow (prot)					5679						4514	
Flt Permitted					0.98						1.00	
Satd. Flow (perm)					5679						4514	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	239	529	0	0	0	0	0	882	89
RTOR Reduction (vph)	0	0	0	0	67	0	0	0	0	0	20	0
Lane Group Flow (vph)	0	0	0	0	702	0	0	0	0	0	951	0
Turn Type				Perm	NA						NA	
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					22.0						30.0	
Effective Green, g (s)					22.0						30.0	
Actuated g/C Ratio					0.37						0.50	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					2082						2257	
v/s Ratio Prot											c0.21	
v/s Ratio Perm					0.12							
v/c Ratio					0.34						0.42	
Uniform Delay, d1					13.7						9.5	
Progression Factor					1.00						1.00	
Incremental Delay, d2					0.4						0.6	
Delay (s)					14.2						10.1	
Level of Service					B						B	
Approach Delay (s)		0.0			14.2			0.0			10.1	
Approach LOS		A			B			A			B	

### Intersection Summary

HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 2: Madison. St./Madison St. & 7th St.

PM2019Baseline(NP)  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑									↑↑↑	
Volume (vph)	0	699	307	0	0	0	0	0	0	255	705	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		0.86									0.91	
Frt		0.95									1.00	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		6114									5019	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		6114									5019	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	760	334	0	0	0	0	0	0	277	766	0
RTOR Reduction (vph)	0	75	0	0	0	0	0	0	0	0	46	0
Lane Group Flow (vph)	0	1019	0	0	0	0	0	0	0	0	997	0
Turn Type		NA								Perm		NA
Protected Phases		4									6	
Permitted Phases										6		
Actuated Green, G (s)		24.0									28.0	
Effective Green, g (s)		24.0									28.0	
Actuated g/C Ratio		0.40									0.47	
Clearance Time (s)		4.0									4.0	
Lane Grp Cap (vph)		2445									2342	
v/s Ratio Prot		c0.17										
v/s Ratio Perm											0.20	
v/c Ratio		0.42									0.43	
Uniform Delay, d1		13.0									10.6	
Progression Factor		0.47									0.59	
Incremental Delay, d2		0.4									0.5	
Delay (s)		6.5									6.9	
Level of Service		A									A	
Approach Delay (s)		6.5				0.0		0.0			6.9	
Approach LOS		A				A		A			A	

Intersection Summary

HCM 2000 Control Delay	6.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

PM2019Baseline(NP)

## 3: Madison St. /Madison. St. & 6th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					←←←						←←←	
Volume (vph)	0	0	0	11	222	0	0	0	0	0	724	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.91						0.91	
Frt					1.00						0.97	
Flt Protected					1.00						1.00	
Satd. Flow (prot)					5073						4932	
Flt Permitted					1.00						1.00	
Satd. Flow (perm)					5073						4932	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	12	241	0	0	0	0	0	787	198
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	73	0
Lane Group Flow (vph)	0	0	0	0	241	0	0	0	0	0	912	0
Turn Type				Perm	NA						NA	
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					20.0						32.0	
Effective Green, g (s)					20.0						32.0	
Actuated g/C Ratio					0.33						0.53	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					1691						2630	
v/s Ratio Prot											c0.18	
v/s Ratio Perm					0.05							
v/c Ratio					0.14						0.35	
Uniform Delay, d1					14.0						8.0	
Progression Factor					1.00						0.65	
Incremental Delay, d2					0.2						0.3	
Delay (s)					14.2						5.5	
Level of Service					B						A	
Approach Delay (s)		0.0			14.2			0.0			5.5	
Approach LOS		A			B			A			A	

### Intersection Summary

HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

PM2019Baseline(NP)

## 4: Madison St./Madison St. & 5th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑								↑↑	↑	
Volume (vph)	0	781	26	0	0	0	0	0	0	700	74	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0								4.0	4.0	
Lane Util. Factor		0.91								0.97	1.00	
Frt		1.00								1.00	1.00	
Flt Protected		1.00								0.95	1.00	
Satd. Flow (prot)		4555								3090	1676	
Flt Permitted		1.00								0.95	1.00	
Satd. Flow (perm)		4555								3090	1676	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	849	28	0	0	0	0	0	0	761	80	0
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	0	56	0	0
Lane Group Flow (vph)	0	871	0	0	0	0	0	0	0	705	80	0
Turn Type		NA								Prot	NA	
Protected Phases		4								1	6	
Permitted Phases												
Actuated Green, G (s)		23.0								29.0	29.0	
Effective Green, g (s)		23.0								29.0	29.0	
Actuated g/C Ratio		0.38								0.48	0.48	
Clearance Time (s)		4.0								4.0	4.0	
Lane Grp Cap (vph)		1746								1493	810	
v/s Ratio Prot		c0.19								c0.23	0.05	
v/s Ratio Perm												
v/c Ratio		0.50								0.47	0.10	
Uniform Delay, d1		14.1								10.4	8.4	
Progression Factor		0.69								0.39	0.55	
Incremental Delay, d2		0.6								1.0	0.2	
Delay (s)		10.4								5.1	4.9	
Level of Service		B								A	A	
Approach Delay (s)		10.4			0.0			0.0			5.1	
Approach LOS		B			A			A			A	

### Intersection Summary

HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

**Intersection**

Intersection Delay, s/veh 3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	184	18	8	77	0	10	0	23	35	44	30
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	200	20	9	84	0	11	0	25	38	48	33
Number of Lanes	0	1	0	0	1	0	0	1	0	1	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	84	0	0	220	0	0	351	311	210	323	321	84
Stage 1	-	-	-	-	-	-	210	210	-	101	101	-
Stage 2	-	-	-	-	-	-	141	101	-	222	220	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1513	-	-	1349	-	-	604	604	830	630	596	975
Stage 1	-	-	-	-	-	-	792	728	-	905	811	-
Stage 2	-	-	-	-	-	-	862	811	-	780	721	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1513	-	-	1349	-	-	545	600	830	608	592	975
Mov Capacity-2 Maneuver	-	-	-	-	-	-	545	600	-	608	592	-
Stage 1	-	-	-	-	-	-	792	728	-	905	805	-
Stage 2	-	-	-	-	-	-	778	805	-	757	721	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.7	10.3	11
HCM LOS	-	-	B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Cap, veh/h	716	1513	-	-	1349	-	-	608	689
HCM Control Delay, s	10.3	0	-	-	7.686	0	-	11.2	11
HCM Lane V/C Ratio	0.05	-	-	-	0.01	-	-	0.04	0.14
HCM Lane LOS	B	A	-	-	A	A	-	B	B
HCM 95th-tile Q, veh	0.2	0.0	-	-	0.0	-	-	0.1	0.5

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	159	8	3	88	12	5	1	5	19	6	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	173	9	3	96	13	5	1	5	21	7	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	109	0	0	182	0	0	310	305	177	302	304	102
Stage 1	-	-	-	-	-	-	190	190	-	109	109	-
Stage 2	-	-	-	-	-	-	120	115	-	193	195	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1481	-	-	1393	-	-	642	608	866	650	609	953
Stage 1	-	-	-	-	-	-	812	743	-	896	805	-
Stage 2	-	-	-	-	-	-	884	800	-	809	739	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1481	-	-	1393	-	-	622	604	866	642	605	953
Mov Capacity-2 Maneuver	-	-	-	-	-	-	622	604	-	642	605	-
Stage 1	-	-	-	-	-	-	808	739	-	892	803	-
Stage 2	-	-	-	-	-	-	860	798	-	799	735	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.2	10.2	10.3
HCM LOS	-	-	B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	711	1481	-	-	1393	-	-	724
HCM Control Delay, s	10.2	7.442	0	-	7.59	0	-	10.3
HCM Lane V/C Ratio	0.02	0.00	-	-	0.00	-	-	0.06
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 5.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	89	117	76	290	383	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	75			0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	97	127	83	315	416	28
Number of Lanes	1	0	1	1	1	0

**Major/Minor**

		Major 1		Major 2	
Conflicting Flow All	910	430	445	0	0
Stage 1	430	-	-	-	-
Stage 2	480	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	305	625	1115	-	-
Stage 1	656	-	-	-	-
Stage 2	622	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	282	625	1115	-	-
Mov Capacity-2 Maneuver	282	-	-	-	-
Stage 1	656	-	-	-	-
Stage 2	576	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	23.8	1.8	0
HCM LOS	C	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1115	-	410	-	-
HCM Control Delay, s	8.487	-	23.8	-	-
HCM Lane V/C Ratio	0.07	-	0.55	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th-tile Q, veh	0.2	-	3.2	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 11.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	96	0	227	0	0	0	100	262	0	0	451	57
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	160		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	104	0	247	0	0	0	109	285	0	0	490	62
Number of Lanes	0	1	0	0	0	0	1	1	0	0	2	0

Major/Minor	Minor 2			Major 1			Major 2			
Conflicting Flow All	1023	1023	276		552	0	0	285	0	0
Stage 1	521	521	-		-	-	-	-	-	-
Stage 2	502	502	-		-	-	-	-	-	-
Follow-up Headway	3.519	4.019	3.319		2.22	-	-	2.218	-	-
Pot Capacity-1 Maneuver	246	235	722		1014	-	-	1277	-	-
Stage 1	562	531	-		-	-	-	-	-	-
Stage 2	607	541	-		-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0		0	-	-	0	-	-
Mov Capacity-1 Maneuver	220	0	722		1014	-	-	1277	-	-
Mov Capacity-2 Maneuver	220	0	-		-	-	-	-	-	-
Stage 1	562	0	-		-	-	-	-	-	-
Stage 2	542	0	-		-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	41.2	2.5	0
HCM LOS	E	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Cap, veh/h	1014	-	-	430	1277	-	-
HCM Control Delay, s	8.976	-	-	41.2	0	-	-
HCM Lane V/C Ratio	0.11	-	-	0.82	-	-	-
HCM Lane LOS	A	-	-	E	A	-	-
HCM 95th-tile Q, veh	0.4	-	-	7.6	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

# HCM Signalized Intersection Capacity Analysis

PM2019Baseline(NP)

## 9: Jackson St. & 8th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					4111			4			1	
Volume (vph)	0	0	0	51	451	31	113	168	0	0	309	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0			4.0			4.0	
Lane Util. Factor					0.86			1.00			1.00	
Frt					0.99			1.00			0.97	
Flt Protected					1.00			0.98			1.00	
Satd. Flow (prot)					5689			1643			1633	
Flt Permitted					1.00			0.61			1.00	
Satd. Flow (perm)					5689			1022			1633	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	55	490	34	123	183	0	0	336	80
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	0	0	14	0
Lane Group Flow (vph)	0	0	0	0	564	0	0	306	0	0	402	0
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					8			2			6	
Permitted Phases				8			2					
Actuated Green, G (s)					27.0			25.0			25.0	
Effective Green, g (s)					27.0			25.0			25.0	
Actuated g/C Ratio					0.45			0.42			0.42	
Clearance Time (s)					4.0			4.0			4.0	
Lane Grp Cap (vph)					2560			425			680	
v/s Ratio Prot											0.25	
v/s Ratio Perm					0.10			0.30				
v/c Ratio					0.22			0.72			0.59	
Uniform Delay, d1					10.1			14.6			13.5	
Progression Factor					0.58			0.35			1.00	
Incremental Delay, d2					0.2			7.5			3.8	
Delay (s)					6.0			12.6			17.3	
Level of Service					A			B			B	
Approach Delay (s)		0.0			6.0			12.6			17.3	
Approach LOS		A			A			B			B	

### Intersection Summary

HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 10: Jackson St. & 7th St.

PM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↗↗					↖			↕	
Volume (vph)	34	886	1021	0	0	0	0	264	134	32	299	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0			4.0	
Lane Util. Factor		0.95	0.88					1.00			1.00	
Frt		1.00	0.85					0.95			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		3533	2787					1778			1854	
Flt Permitted		1.00	1.00					1.00			0.85	
Satd. Flow (perm)		3533	2787					1778			1586	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	963	1110	0	0	0	0	287	146	35	325	0
RTOR Reduction (vph)	0	0	252	0	0	0	0	31	0	0	0	0
Lane Group Flow (vph)	0	1000	858	0	0	0	0	402	0	0	360	0
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4		4							6		
Actuated Green, G (s)		32.0	32.0					20.0			20.0	
Effective Green, g (s)		32.0	32.0					20.0			20.0	
Actuated g/C Ratio		0.53	0.53					0.33			0.33	
Clearance Time (s)		4.0	4.0					4.0			4.0	
Lane Grp Cap (vph)		1884	1486					592			528	
v/s Ratio Prot								0.23				
v/s Ratio Perm		0.28	c0.31								c0.23	
v/c Ratio		0.53	0.58					0.68			0.68	
Uniform Delay, d1		9.1	9.4					17.2			17.3	
Progression Factor		1.00	1.00					1.00			0.63	
Incremental Delay, d2		1.1	1.6					6.2			5.9	
Delay (s)		10.2	11.1					23.4			16.8	
Level of Service		B	B					C			B	
Approach Delay (s)		10.7			0.0			23.4			16.8	
Approach LOS		B			A			C			B	

Intersection Summary

HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

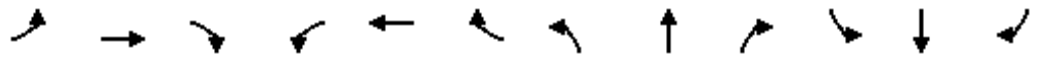


HCM Signalized Intersection Capacity Analysis

PM2019Baseline(NP)

11: Jackson St. & 6th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↗	↖	↖	↗			↗	↖
Volume (vph)	0	0	0	7	336	49	388	372	0	0	319	1010
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1863	1583	1770	1863			1863	1583
Flt Permitted				0.95	1.00	1.00	0.53	1.00			1.00	1.00
Satd. Flow (perm)				1770	1863	1583	994	1863			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	8	365	53	422	404	0	0	347	1098
RTOR Reduction (vph)	0	0	0	0	0	42	0	0	0	0	0	28
Lane Group Flow (vph)	0	0	0	8	365	11	422	404	0	0	347	1070
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				18.0	18.0	18.0	64.0	64.0			64.0	64.0
Effective Green, g (s)				18.0	18.0	18.0	64.0	64.0			64.0	64.0
Actuated g/C Ratio				0.20	0.20	0.20	0.71	0.71			0.71	0.71
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				354	372	316	706	1324			1324	1125
v/s Ratio Prot					c0.20			0.22			0.19	
v/s Ratio Perm				0.00		0.01	0.42					c0.68
v/c Ratio				0.02	0.98	0.03	0.60	0.31			0.26	0.95
Uniform Delay, d1				28.9	35.8	29.0	6.5	4.8			4.6	11.6
Progression Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2				0.1	42.2	0.2	3.7	0.6			0.5	17.4
Delay (s)				29.0	78.0	29.2	10.2	5.4			5.1	29.0
Level of Service				C	E	C	B	A			A	C
Approach Delay (s)		0.0			71.0			7.9			23.3	
Approach LOS		A			E			A			C	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	111.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 12: Jackson St. & I-880 EB Off 5th St./5th St.

PM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕			↕	
Volume (vph)	339	649	312	0	0	0	0	388	46	80	73	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.95						1.00			1.00	
Frt		0.96						0.99			1.00	
Flt Protected		0.99						1.00			0.97	
Satd. Flow (prot)		3368						1836			1815	
Flt Permitted		0.99						1.00			0.53	
Satd. Flow (perm)		3368						1836			985	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	368	705	339	0	0	0	0	422	50	87	79	0
RTOR Reduction (vph)	0	50	0	0	0	0	0	7	0	0	0	0
Lane Group Flow (vph)	0	1362	0	0	0	0	0	465	0	0	166	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		29.0						23.0			23.0	
Effective Green, g (s)		29.0						23.0			23.0	
Actuated g/C Ratio		0.48						0.38			0.38	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		1627						703			377	
v/s Ratio Prot								c0.25				
v/s Ratio Perm		0.40									0.17	
v/c Ratio		0.84						0.66			0.44	
Uniform Delay, d1		13.4						15.3			13.7	
Progression Factor		1.00						1.00			1.00	
Incremental Delay, d2		5.3						4.8			3.7	
Delay (s)		18.7						20.1			17.4	
Level of Service		B						C			B	
Approach Delay (s)		18.7			0.0			20.1			17.4	
Approach LOS		B			A			C			B	

Intersection Summary

HCM 2000 Control Delay	19.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 13: Oak St. & 5th St.

PM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↕↔						↔			↕	
Volume (vph)	218	901	125	0	0	0	0	418	82	4	102	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.91						1.00			1.00	
Frt		0.98						0.98			1.00	
Flt Protected		0.99						1.00			1.00	
Satd. Flow (prot)		4965						1822			1860	
Flt Permitted		0.99						1.00			0.99	
Satd. Flow (perm)		4965						1822			1836	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	979	136	0	0	0	0	454	89	4	111	0
RTOR Reduction (vph)	0	23	0	0	0	0	0	12	0	0	0	0
Lane Group Flow (vph)	0	1329	0	0	0	0	0	531	0	0	115	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		27.0						25.0			25.0	
Effective Green, g (s)		27.0						25.0			25.0	
Actuated g/C Ratio		0.45						0.42			0.42	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		2234						759			765	
v/s Ratio Prot								c0.29				
v/s Ratio Perm		0.27									0.06	
v/c Ratio		0.60						0.70			0.15	
Uniform Delay, d1		12.4						14.4			10.9	
Progression Factor		0.75						1.00			1.00	
Incremental Delay, d2		1.0						5.3			0.4	
Delay (s)		10.3						19.7			11.3	
Level of Service		B						B			B	
Approach Delay (s)		10.3			0.0			19.7			11.3	
Approach LOS		B			A			B			B	

Intersection Summary

HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 14: 5th St. & Mitchell Ave.

PM2019Baseline(NP)  
 2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Volume (vph)	39	11	52	10	7	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	1.00			1.00	1.00	
Frt	0.97			1.00	0.88	
Flt Protected	1.00			0.96	0.99	
Satd. Flow (prot)	1807			1788	1631	
Flt Permitted	1.00			0.74	0.99	
Satd. Flow (perm)	1807			1370	1631	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	12	57	11	8	61
RTOR Reduction (vph)	11	0	0	0	17	0
Lane Group Flow (vph)	43	0	0	68	52	0
Turn Type	NA		Perm	NA	NA	
Protected Phases	4			8		
Permitted Phases			8		2	
Actuated Green, G (s)	5.0			5.0	34.2	
Effective Green, g (s)	5.0			5.0	34.2	
Actuated g/C Ratio	0.11			0.11	0.72	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	191			145	1181	
v/s Ratio Prot	0.02					
v/s Ratio Perm				c0.05	c0.03	
v/c Ratio	0.23			0.47	0.04	
Uniform Delay, d1	19.3			19.9	1.8	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.6			2.4	0.1	
Delay (s)	19.9			22.2	1.9	
Level of Service	B			C	A	
Approach Delay (s)	19.9			22.2	1.9	
Approach LOS	B			C	A	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.10		
Actuated Cycle Length (s)	47.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 15: Mariner's Sq. Loop & Mitchell Ave./Marina Village Pkwy.

PM2019Baseline(NP)

2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗		↖	↗	↖	↗
Volume (vph)	80	9	94	53	9	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	1837		1770	1863	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	1837		1770	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	10	102	58	10	141
RTOR Reduction (vph)	7	0	0	0	0	66
Lane Group Flow (vph)	90	0	102	58	10	75
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	6.7		7.1	17.8	29.0	29.0
Effective Green, g (s)	6.7		7.1	17.8	29.0	29.0
Actuated g/C Ratio	0.12		0.13	0.32	0.53	0.53
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	224		229	605	936	837
v/s Ratio Prot	c0.05		c0.06	0.03	0.01	
v/s Ratio Perm						c0.05
v/c Ratio	0.40		0.45	0.10	0.01	0.09
Uniform Delay, d1	22.2		22.0	12.9	6.1	6.4
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2		1.4	0.1	0.0	0.2
Delay (s)	23.4		23.4	13.0	6.1	6.6
Level of Service	C		C	B	A	A
Approach Delay (s)	23.4			19.6	6.6	
Approach LOS	C			B	A	

**Intersection Summary**

HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	54.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection												
Intersection Delay, s/veh	9.2											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	19	114	88	34	71	16	61	23	23	20	48	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	124	96	37	77	17	66	25	25	22	52	8
Number of Lanes	1	1	0	1	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	9.6	8.8	9.1	8.9
HCM LOS	A	A	A	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	100%	0%	100%	0%
Vol Thru, %	0%	50%	0%	56%	0%	82%	0%	87%
Vol Right, %	0%	50%	0%	44%	0%	18%	0%	13%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	61	46	19	202	34	87	20	55
LT Vol	0	23	0	114	0	71	0	48
Through Vol	0	23	0	88	0	16	0	7
RT Vol	61	0	19	0	34	0	20	0
Lane Flow Rate	66	50	21	220	37	95	22	60
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.111	0.072	0.033	0.299	0.06	0.136	0.037	0.091
Departure Headway (Hd)	6.052	5.196	5.713	4.904	5.809	5.177	6.099	5.505
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	590	686	626	731	615	690	585	647
Service Time	3.812	2.955	3.457	2.648	3.561	2.928	3.862	3.267
HCM Lane V/C Ratio	0.112	0.073	0.034	0.301	0.06	0.138	0.038	0.093
HCM Control Delay	9.6	8.4	8.7	9.7	8.9	8.7	9.1	8.8
HCM Lane LOS	A	A	A	A	A	A	A	A
HCM 95th-tile Q	0.4	0.2	0.1	1.3	0.2	0.5	0.1	0.3

Notes  
 - : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	14	146	1	2	115	11	1	0	1	12	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	75		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	159	1	2	125	12	1	0	1	13	0	7
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	137	0	0	160	0	0	329	331	159	325	325	131
Stage 1	-	-	-	-	-	-	190	190	-	135	135	-
Stage 2	-	-	-	-	-	-	139	141	-	190	190	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1447	-	-	1419	-	-	624	588	886	628	593	919
Stage 1	-	-	-	-	-	-	812	743	-	868	785	-
Stage 2	-	-	-	-	-	-	864	780	-	812	743	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1447	-	-	1419	-	-	614	581	886	622	586	919
Mov Capacity-2 Maneuver	-	-	-	-	-	-	614	581	-	622	586	-
Stage 1	-	-	-	-	-	-	804	735	-	859	784	-
Stage 2	-	-	-	-	-	-	857	779	-	803	735	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0.1	10	10.3
HCM LOS	-	-	B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	725	1447	-	-	1419	-	-	697
HCM Control Delay, s	10	7.514	-	-	7.541	-	-	10.3
HCM Lane V/C Ratio	0.00	0.01	-	-	0.00	-	-	0.03
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.1

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	151	3	1	118	7	4	0	7	6	2	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	125		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	164	3	1	128	8	4	0	8	7	2	4
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	136	0	0	167	0	0	308	308	166	308	306	132
Stage 1	-	-	-	-	-	-	170	170	-	134	134	-
Stage 2	-	-	-	-	-	-	138	138	-	174	172	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1448	-	-	1411	-	-	644	606	878	644	608	917
Stage 1	-	-	-	-	-	-	832	758	-	869	785	-
Stage 2	-	-	-	-	-	-	865	782	-	828	756	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1448	-	-	1411	-	-	638	605	878	637	607	917
Mov Capacity-2 Maneuver	-	-	-	-	-	-	638	605	-	637	607	-
Stage 1	-	-	-	-	-	-	831	757	-	868	784	-
Stage 2	-	-	-	-	-	-	858	781	-	820	755	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	9.7	10.2
HCM LOS	-	-	A	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	772	1448	-	-	1411	-	-	703
HCM Control Delay, s	9.7	7.49	-	-	7.553	-	-	10.2
HCM Lane V/C Ratio	0.01	0.00	-	-	0.00	-	-	0.02
HCM Lane LOS	A	A	-	-	A	-	-	B
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.1

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	162	0	19	122	1	4	2	33	2	6	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	95		0	80		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	176	0	21	133	1	4	2	36	2	7	1
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	134	0	0	176	0	0	356	353	176	371	352	133
Stage 1	-	-	-	-	-	-	178	178	-	174	174	-
Stage 2	-	-	-	-	-	-	178	175	-	197	178	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1451	-	-	1400	-	-	599	572	867	586	573	916
Stage 1	-	-	-	-	-	-	824	752	-	828	755	-
Stage 2	-	-	-	-	-	-	824	754	-	805	752	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1451	-	-	1400	-	-	586	563	867	553	564	916
Mov Capacity-2 Maneuver	-	-	-	-	-	-	586	563	-	553	564	-
Stage 1	-	-	-	-	-	-	823	751	-	827	744	-
Stage 2	-	-	-	-	-	-	804	743	-	769	751	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1	9.7	11.2
HCM LOS	-	-	A	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	805	1451	-	-	1400	-	-	586
HCM Control Delay, s	9.7	7.483	-	-	7.61	-	-	11.2
HCM Lane V/C Ratio	0.05	0.00	-	-	0.01	-	-	0.02
HCM Lane LOS	A	A	-	-	A	-	-	B
HCM 95th-tile Q, veh	0.2	0.0	-	-	0.0	-	-	0.1

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	193	2	5	114	2	1	1	9	19	3	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	95		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	210	2	5	124	2	1	1	10	21	3	28
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	126	0	0	212	0	0	376	361	211	365	361	125
Stage 1	-	-	-	-	-	-	224	224	-	136	136	-
Stage 2	-	-	-	-	-	-	152	137	-	229	225	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1460	-	-	1358	-	-	581	566	829	591	566	926
Stage 1	-	-	-	-	-	-	779	718	-	867	784	-
Stage 2	-	-	-	-	-	-	850	783	-	774	718	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1460	-	-	1358	-	-	557	561	829	579	561	926
Mov Capacity-2 Maneuver	-	-	-	-	-	-	557	561	-	579	561	-
Stage 1	-	-	-	-	-	-	775	715	-	863	781	-
Stage 2	-	-	-	-	-	-	818	780	-	760	715	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.3	9.8	10.4
HCM LOS	-	-	A	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	762	1460	-	-	1358	-	-	725
HCM Control Delay, s	9.8	7.477	-	-	7.662	-	-	10.4
HCM Lane V/C Ratio	0.02	0.00	-	-	0.00	-	-	0.07
HCM Lane LOS	A	A	-	-	A	-	-	B
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.2

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 3.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	75	39	113	190	40	68
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	50		0	0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	82	42	123	207	43	74
Number of Lanes	2	0	1	2	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow All	0	0	124	0	452	62
Stage 1	-	-	-	-	103	-
Stage 2	-	-	-	-	349	-
Follow-up Headway	-	-	2.22	-	3.52	3.32
Pot Capacity-1 Maneuver	-	-	1461	-	536	990
Stage 1	-	-	-	-	910	-
Stage 2	-	-	-	-	685	-
Time blocked-Platoon, %	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1461	-	491	990
Mov Capacity-2 Maneuver	-	-	-	-	491	-
Stage 1	-	-	-	-	910	-
Stage 2	-	-	-	-	627	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.9	11
HCM LOS	-	-	B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Cap, veh/h	719	-	-	1461	-
HCM Control Delay, s	11	-	-	7.69	-
HCM Lane V/C Ratio	0.16	-	-	0.08	-
HCM Lane LOS	B	-	-	A	-
HCM 95th-tile Q, veh	0.6	-	-	0.3	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 22: Challenger Dr./Marina Village & Marina Village Pkwy.

PM2019Baseline(NP)  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Volume (vph)	35	71	211	91	125	12	171	108	43	5	107	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.89		1.00	0.99		1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3142		1770	3493		1770	1783		1770	1773	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3142		1770	3493		1770	1783		1770	1773	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	77	229	99	136	13	186	117	47	5	116	55
RTOR Reduction (vph)	0	193	0	0	11	0	0	19	0	0	25	0
Lane Group Flow (vph)	38	113	0	99	138	0	186	145	0	5	146	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	1.5	8.8		3.1	10.4		7.1	26.8		0.7	20.4	
Effective Green, g (s)	1.5	8.8		3.1	10.4		7.1	26.8		0.7	20.4	
Actuated g/C Ratio	0.03	0.16		0.06	0.19		0.13	0.48		0.01	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	47	499		99	655		226	862		22	652	
v/s Ratio Prot	0.02	0.04		c0.06	c0.04		c0.11	0.08		0.00	c0.08	
v/s Ratio Perm												
v/c Ratio	0.81	0.23		1.00	0.21		0.82	0.17		0.23	0.22	
Uniform Delay, d1	26.8	20.3		26.1	19.0		23.5	8.0		27.1	12.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	63.4	0.2		90.5	0.2		20.9	0.4		5.2	0.8	
Delay (s)	90.2	20.6		116.6	19.2		44.4	8.5		32.3	12.8	
Level of Service	F	C		F	B		D	A		C	B	
Approach Delay (s)		28.3			58.1			27.6			13.4	
Approach LOS		C			E			C			B	

Intersection Summary

HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	55.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 23: Atlantic Ave. & Challenger Dr.

PM2019Baseline(NP)  
 2/16/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	42	343	289	246	374	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	373	314	267	407	55
RTOR Reduction (vph)	0	0	0	183	0	34
Lane Group Flow (vph)	46	373	314	84	407	21
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	1.3	19.0	13.7	13.7	16.6	16.6
Effective Green, g (s)	1.3	19.0	13.7	13.7	16.6	16.6
Actuated g/C Ratio	0.03	0.44	0.31	0.31	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	52	811	585	497	673	602
v/s Ratio Prot	0.03	c0.20	0.17		c0.23	
v/s Ratio Perm				0.05		0.01
v/c Ratio	0.88	0.46	0.54	0.17	0.60	0.03
Uniform Delay, d1	21.1	8.7	12.3	10.8	10.9	8.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	82.7	0.4	1.0	0.2	4.0	0.1
Delay (s)	103.8	9.1	13.3	11.0	14.9	8.6
Level of Service	F	A	B	B	B	A
Approach Delay (s)		19.5	12.2		14.1	
Approach LOS		B	B		B	

**Intersection Summary**

HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	43.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 12.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	15	727	448	78	139	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length	100			0	0	0
Median Width		12	12		12	
Grade, %		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	790	487	85	151	18
Number of Lanes	1	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow All	572	0	-	0	1352	529
Stage 1	-	-	-	-	529	-
Stage 2	-	-	-	-	823	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	1001	-	-	-	165	550
Stage 1	-	-	-	-	591	-
Stage 2	-	-	-	-	431	-
Time blocked-Platoon, %	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1001	-	-	-	162	550
Mov Capacity-2 Maneuver	-	-	-	-	162	-
Stage 1	-	-	-	-	591	-
Stage 2	-	-	-	-	424	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	113.6
HCM LOS	-	-	F

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Cap, veh/h	1001	-	-	-	175
HCM Control Delay, s	8.656	-	-	-	113.6
HCM Lane V/C Ratio	0.02	-	-	-	0.97
HCM Lane LOS	A	-	-	-	F
HCM 95th-tile Q, veh	0.1	-	-	-	7.6

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
25: Sherman St. & Buena Vista

PM2019Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Volume (vph)	15	271	34	17	225	352	12	118	16	455	426	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1832			1856	1583	1770	1830		1770	1855	
Flt Permitted		0.98			0.94	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1796			1756	1583	1770	1830		1770	1855	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	295	37	18	245	383	13	128	17	495	463	13
RTOR Reduction (vph)	0	7	0	0	0	182	0	7	0	0	1	0
Lane Group Flow (vph)	0	341	0	0	263	201	13	138	0	495	475	0
Turn Type	Perm	NA		Perm	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)		14.8			14.8	34.6	0.8	19.4		19.8	38.4	
Effective Green, g (s)		14.8			14.8	34.6	0.8	19.4		19.8	38.4	
Actuated g/C Ratio		0.22			0.22	0.52	0.01	0.29		0.30	0.58	
Clearance Time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		402			393	925	21	537		531	1079	
v/s Ratio Prot						0.07	0.01	0.08		c0.28	c0.26	
v/s Ratio Perm		c0.19			0.15	0.06						
v/c Ratio		0.85			0.67	0.22	0.62	0.26		0.93	0.44	
Uniform Delay, d1		24.5			23.4	8.4	32.4	17.8		22.4	7.8	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		15.2			4.3	0.1	43.9	1.2		23.4	1.3	
Delay (s)		39.8			27.7	8.5	76.4	18.9		45.9	9.1	
Level of Service		D			C	A	E	B		D	A	
Approach Delay (s)		39.8			16.3			23.7			27.8	
Approach LOS		D			B			C			C	

Intersection Summary

HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	66.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	18	22	4	6	16	7	121	5	74	377	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	20	24	4	7	17	8	132	5	80	410	12
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	738	729	416	747	732	134	422	0	0	137	0	0
Stage 1	577	577	-	149	149	-	-	-	-	-	-	-
Stage 2	161	152	-	598	583	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	334	350	637	329	348	915	1137	-	-	1447	-	-
Stage 1	502	502	-	854	774	-	-	-	-	-	-	-
Stage 2	841	772	-	489	499	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	303	322	637	284	320	915	1137	-	-	1447	-	-
Mov Capacity-2 Maneuver	303	322	-	284	320	-	-	-	-	-	-	-
Stage 1	498	466	-	847	768	-	-	-	-	-	-	-
Stage 2	811	766	-	418	463	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.5	12.4	0.4	1.2
HCM LOS	B	B	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1137	-	-	425	517	1447	-	-
HCM Control Delay, s	8.188	0	-	14.5	12.4	7.634	0	-
HCM Lane V/C Ratio	0.01	-	-	0.11	0.06	0.06	-	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th-tile Q, veh	0.0	-	-	0.4	0.2	0.2	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



HCM Signalized Intersection Capacity Analysis  
27: Sherman St. & Lincoln Ave.

PM2019Baseline(NP)  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	659	76	9	333	34	20	80	6	153	222	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95			0.95			1.00			1.00	
Frt	1.00	0.98			0.99			0.99			0.99	
Flt Protected	0.95	1.00			1.00			0.99			0.98	
Satd. Flow (prot)	1770	3484			3487			1830			1808	
Flt Permitted	0.50	1.00			0.94			0.91			0.83	
Satd. Flow (perm)	931	3484			3268			1672			1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	716	83	10	362	37	22	87	7	166	241	36
RTOR Reduction (vph)	0	15	0	0	12	0	0	4	0	0	5	0
Lane Group Flow (vph)	26	784	0	0	397	0	0	112	0	0	438	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.0	26.0			26.0			26.0			26.0	
Effective Green, g (s)	26.0	26.0			26.0			26.0			26.0	
Actuated g/C Ratio	0.43	0.43			0.43			0.43			0.43	
Clearance Time (s)	4.0	4.0			4.0			4.0			4.0	
Lane Grp Cap (vph)	403	1509			1416			724			666	
v/s Ratio Prot		c0.23										
v/s Ratio Perm	0.03				0.12			0.07			c0.28	
v/c Ratio	0.06	0.52			0.28			0.15			0.66	
Uniform Delay, d1	9.9	12.4			11.0			10.3			13.5	
Progression Factor	1.00	1.00			1.00			1.00			1.00	
Incremental Delay, d2	0.3	1.3			0.5			0.5			5.0	
Delay (s)	10.2	13.7			11.5			10.8			18.5	
Level of Service	B	B			B			B			B	
Approach Delay (s)		13.6			11.5			10.8			18.5	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
28: 8th St. & Lincoln Ave.

PM2019Baseline(NP)  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔		↔	↔	
Volume (vph)	8	175	16	17	184	152	34	383	25	580	520	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor		0.95			0.95			0.95		0.97	1.00	
Frt		0.99			0.94			0.99		1.00	1.00	
Flt Protected		1.00			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		3490			3303			3496		3433	1859	
Flt Permitted		0.93			0.93			1.00		0.95	1.00	
Satd. Flow (perm)		3257			3088			3496		3433	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	190	17	18	200	165	37	416	27	630	565	8
RTOR Reduction (vph)	0	9	0	0	138	0	0	5	0	0	1	0
Lane Group Flow (vph)	0	207	0	0	245	0	0	475	0	630	572	0
Turn Type	Perm	NA		Perm	NA		Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)		10.5			10.5			16.3		26.5	26.5	
Effective Green, g (s)		10.5			10.5			16.3		26.5	26.5	
Actuated g/C Ratio		0.16			0.16			0.25		0.41	0.41	
Clearance Time (s)		4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)		523			496			872		1393	754	
v/s Ratio Prot								c0.14		0.18	c0.31	
v/s Ratio Perm		0.06			c0.08							
v/c Ratio		0.40			0.49			0.54		0.45	0.76	
Uniform Delay, d1		24.6			25.0			21.3		14.1	16.7	
Progression Factor		1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2		0.5			0.8			2.4		0.2	4.4	
Delay (s)		25.0			25.7			23.7		14.4	21.1	
Level of Service		C			C			C		B	C	
Approach Delay (s)		25.0			25.7			23.7			17.6	
Approach LOS		C			C			C			B	

Intersection Summary

HCM 2000 Control Delay	20.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	65.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 1: Madison St. & 8th St.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑↑							↑↑
Volume (vph)	0	0	0	0	911	0	0	0	0	0	0	669
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0							4.0
Lane Util. Factor					0.86							0.88
Frt					1.00							0.85
Flt Protected					1.00							1.00
Satd. Flow (prot)					5767							2508
Flt Permitted					1.00							1.00
Satd. Flow (perm)					5767							2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	990	0	0	0	0	0	0	727
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	104
Lane Group Flow (vph)	0	0	0	0	990	0	0	0	0	0	0	623
Turn Type					NA							custom
Protected Phases					8							
Permitted Phases												6
Actuated Green, G (s)					26.0							16.0
Effective Green, g (s)					26.0							16.0
Actuated g/C Ratio					0.52							0.32
Clearance Time (s)					4.0							4.0
Lane Grp Cap (vph)					2998							802
v/s Ratio Prot					c0.17							
v/s Ratio Perm												c0.25
v/c Ratio					0.33							0.78
Uniform Delay, d1					7.0							15.4
Progression Factor					1.00							1.00
Incremental Delay, d2					0.3							7.3
Delay (s)					7.2							22.7
Level of Service					A							C
Approach Delay (s)		0.0			7.2			0.0			22.7	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 2: Madison. St./Madison St. & 7th St.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑									↑↑↑	
Volume (vph)	0	478	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0										
Lane Util. Factor		0.86										
Frt		1.00										
Flt Protected		1.00										
Satd. Flow (prot)		6408										
Flt Permitted		1.00										
Satd. Flow (perm)		6408										
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	520	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	520	0	0	0	0	0	0	0	0	0	0
Turn Type		NA								Perm		
Protected Phases		4									6	
Permitted Phases										6		
Actuated Green, G (s)		23.0										
Effective Green, g (s)		23.0										
Actuated g/C Ratio		0.38										
Clearance Time (s)		4.0										
Lane Grp Cap (vph)		2456										
v/s Ratio Prot		c0.08										
v/s Ratio Perm												
v/c Ratio		0.21										
Uniform Delay, d1		12.4										
Progression Factor		1.00										
Incremental Delay, d2		0.2										
Delay (s)		12.6										
Level of Service		B										
Approach Delay (s)		12.6			0.0			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.09		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 3: Madison St. /Madison. St. & 6th St.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	
Volume (vph)	0	0	0	0	176	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0							
Lane Util. Factor					0.91							
Frt					1.00							
Flt Protected					1.00							
Satd. Flow (prot)					5085							
Flt Permitted					1.00							
Satd. Flow (perm)					5085							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	191	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	191	0	0	0	0	0	0	0
Turn Type					NA							
Protected Phases					8						6	
Permitted Phases												
Actuated Green, G (s)					20.0							
Effective Green, g (s)					20.0							
Actuated g/C Ratio					0.33							
Clearance Time (s)					4.0							
Lane Grp Cap (vph)					1695							
v/s Ratio Prot					c0.04							
v/s Ratio Perm												
v/c Ratio					0.11							
Uniform Delay, d1					13.9							
Progression Factor					1.00							
Incremental Delay, d2					0.1							
Delay (s)					14.0							
Level of Service					B							
Approach Delay (s)		0.0			14.0			0.0			0.0	
Approach LOS		A			B			A			A	

**Intersection Summary**

HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.04		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 4: Madison St./Madison St. & 5th St.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑								↑↑	↑	
Volume (vph)	0	1083	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0										
Lane Util. Factor		0.91										
Frt		1.00										
Flt Protected		1.00										
Satd. Flow (prot)		4577										
Flt Permitted		1.00										
Satd. Flow (perm)		4577										
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1177	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1177	0	0	0	0	0	0	0	0	0	0
Turn Type		NA								Prot		
Protected Phases		4								1	6	
Permitted Phases												
Actuated Green, G (s)		24.0										
Effective Green, g (s)		24.0										
Actuated g/C Ratio		0.40										
Clearance Time (s)		4.0										
Lane Grp Cap (vph)		1830										
v/s Ratio Prot		c0.26										
v/s Ratio Perm												
v/c Ratio		0.64										
Uniform Delay, d1		14.5										
Progression Factor		1.00										
Incremental Delay, d2		1.8										
Delay (s)		16.3										
Level of Service		B										
Approach Delay (s)		16.3			0.0			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	139	0	0	170	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	151	0	0	185	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	1	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	185	0	0	151	0	0	336	336	151	336	336	185
Stage 1	-	-	-	-	-	-	151	151	-	185	185	-
Stage 2	-	-	-	-	-	-	185	185	-	151	151	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1390	-	-	1430	-	-	618	585	895	618	585	857
Stage 1	-	-	-	-	-	-	851	772	-	817	747	-
Stage 2	-	-	-	-	-	-	817	747	-	851	772	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1390	-	-	1430	-	-	618	585	895	618	585	857
Mov Capacity-2 Maneuver	-	-	-	-	-	-	618	585	-	618	585	-
Stage 1	-	-	-	-	-	-	851	772	-	817	747	-
Stage 2	-	-	-	-	-	-	817	747	-	851	772	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	0
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Cap, veh/h	0	1390	-	-	1430	-	-	0	0
HCM Control Delay, s	0	0	-	-	0	-	-	0	0
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	-	A	-	-	A	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	4	0	0	0	9	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	4	0	0	0	10	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	4	0	0	2	2	2	2	4	0
Stage 1	-	-	-	-	-	-	2	2	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	2	4	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	1618	-	-	1020	894	1082	1020	891	-
Stage 1	-	-	-	-	-	-	1021	894	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	1021	892	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	1618	-	-	-	894	1082	1020	891	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	894	-	1020	891	-
Stage 1	-	-	-	-	-	-	1021	894	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	1021	892	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	0
HCM LOS	-	-	-	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	1618	-	-	-
HCM Control Delay, s	-	0	-	-	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	-	-	-	-	0.0	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	0	308	144	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	75			0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	335	157	0
Number of Lanes	1	0	1	1	1	0

**Major/Minor**

	Major 1			Major 2	
Conflicting Flow All	492	157	157	0	0
Stage 1	157	-	-	-	-
Stage 2	335	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	536	889	1423	-	-
Stage 1	871	-	-	-	-
Stage 2	725	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	536	889	1423	-	-
Mov Capacity-2 Maneuver	536	-	-	-	-
Stage 1	871	-	-	-	-
Stage 2	725	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1423	-	0	-	-
HCM Control Delay, s	0	-	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th-tile Q, veh	0.0	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	70	0	58	0	0	0	192	235	0	0	94	52
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	160		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	76	0	63	0	0	0	209	255	0	0	102	57
Number of Lanes	0	1	0	0	0	0	0	1	0	0	1	0

Major/Minor	Minor 2			Major 1			Major 2		
Conflicting Flow All	803	803	130	159	0	0	255	0	0
Stage 1	130	130	-	-	-	-	-	-	-
Stage 2	673	673	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	353	317	920	1420	-	-	1310	-	-
Stage 1	896	789	-	-	-	-	-	-	-
Stage 2	507	454	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	292	0	920	1420	-	-	1310	-	-
Mov Capacity-2 Maneuver	292	0	-	-	-	-	-	-	-
Stage 1	896	0	-	-	-	-	-	-	-
Stage 2	420	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	17.6	3.6	0
HCM LOS	C	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Cap, veh/h	1420	-	-	423	1310	-	-
HCM Control Delay, s	7.972	0	-	17.6	0	-	-
HCM Lane V/C Ratio	0.15	-	-	0.33	-	-	-
HCM Lane LOS	A	A	-	C	A	-	-
HCM 95th-tile Q, veh	0.5	-	-	1.4	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 9: Jackson St. & 8th St.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↑↑↑			↑			↑	
Volume (vph)	0	0	0	893	485	72	106	223	0	0	223	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0			4.0			4.0	
Lane Util. Factor				1.00	0.91			1.00			1.00	
Frt				1.00	0.98			1.00			0.97	
Flt Protected				0.95	1.00			0.98			1.00	
Satd. Flow (prot)				1593	4488			1650			1627	
Flt Permitted				0.95	1.00			0.61			1.00	
Satd. Flow (perm)				1593	4488			1024			1627	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	971	527	78	115	242	0	0	242	68
RTOR Reduction (vph)	0	0	0	0	22	0	0	0	0	0	11	0
Lane Group Flow (vph)	0	0	0	971	583	0	0	357	0	0	299	0
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					8			2			6	
Permitted Phases				8			2					
Actuated Green, G (s)				52.0	52.0			30.0			30.0	
Effective Green, g (s)				52.0	52.0			30.0			30.0	
Actuated g/C Ratio				0.58	0.58			0.33			0.33	
Clearance Time (s)				4.0	4.0			4.0			4.0	
Lane Grp Cap (vph)				920	2593			341			542	
v/s Ratio Prot					0.13						0.18	
v/s Ratio Perm				c0.61				c0.35				
v/c Ratio				1.06	0.23			1.05			0.55	
Uniform Delay, d1				19.0	9.2			30.0			24.5	
Progression Factor				1.00	1.00			1.00			1.00	
Incremental Delay, d2				45.4	0.2			61.5			4.0	
Delay (s)				64.4	9.4			91.5			28.5	
Level of Service				E	A			F			C	
Approach Delay (s)		0.0			43.3			91.5			28.5	
Approach LOS		A			D			F			C	

Intersection Summary

HCM 2000 Control Delay	48.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
10: Jackson St. & 7th St.

AM2019Baseline\_w/Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↗↗					↖			↕	
Volume (vph)	43	373	1469	0	0	0	0	262	59	153	1007	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0			4.0	
Lane Util. Factor		0.95	0.88					1.00			1.00	
Frt		1.00	0.85					0.98			1.00	
Flt Protected		0.99	1.00					1.00			0.99	
Satd. Flow (prot)		3521	2787					1817			1851	
Flt Permitted		0.99	1.00					1.00			0.81	
Satd. Flow (perm)		3521	2787					1817			1512	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	405	1597	0	0	0	0	285	64	166	1095	0
RTOR Reduction (vph)	0	0	97	0	0	0	0	7	0	0	0	0
Lane Group Flow (vph)	0	452	1500	0	0	0	0	342	0	0	1261	0
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4		4							6		
Actuated Green, G (s)		39.0	39.0					63.0			63.0	
Effective Green, g (s)		39.0	39.0					63.0			63.0	
Actuated g/C Ratio		0.35	0.35					0.57			0.57	
Clearance Time (s)		4.0	4.0					4.0			4.0	
Lane Grp Cap (vph)		1248	988					1040			865	
v/s Ratio Prot								0.19				
v/s Ratio Perm		0.13	c0.54								c0.83	
v/c Ratio		0.36	1.52					0.33			1.46	
Uniform Delay, d1		26.3	35.5					12.4			23.5	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		0.8	238.2					0.8			212.4	
Delay (s)		27.1	273.7					13.2			235.9	
Level of Service		C	F					B			F	
Approach Delay (s)		219.3			0.0			13.2			235.9	
Approach LOS		F			A			B			F	

Intersection Summary

HCM 2000 Control Delay	205.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	119.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 11: Jackson St. & 6th St.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↗	↖	↖	↗			↗	↖
Volume (vph)	0	0	0	28	129	19	228	254	0	0	813	1744
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1863	1583	1770	1863			1863	1583
Flt Permitted				0.95	1.00	1.00	0.28	1.00			1.00	1.00
Satd. Flow (perm)				1770	1863	1583	531	1863			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	30	140	21	248	276	0	0	884	1896
RTOR Reduction (vph)	0	0	0	0	0	19	0	0	0	0	0	31
Lane Group Flow (vph)	0	0	0	30	140	2	248	276	0	0	884	1865
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				16.0	16.0	16.0	126.0	126.0			126.0	126.0
Effective Green, g (s)				16.0	16.0	16.0	126.0	126.0			126.0	126.0
Actuated g/C Ratio				0.11	0.11	0.11	0.84	0.84			0.84	0.84
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				188	198	168	446	1564			1564	1329
v/s Ratio Prot					c0.08			0.15			0.47	
v/s Ratio Perm				0.02		0.00	0.47					c1.18
v/c Ratio				0.16	0.71	0.01	0.56	0.18			0.57	1.40
Uniform Delay, d1				60.9	64.7	59.9	3.6	2.3			3.7	12.0
Progression Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2				1.8	19.2	0.1	4.9	0.2			1.5	186.1
Delay (s)				62.7	83.9	60.1	8.5	2.5			5.1	198.1
Level of Service				E	F	E	A	A			A	F
Approach Delay (s)		0.0			77.9			5.4			136.7	
Approach LOS		A			E			A			F	

Intersection Summary			
HCM 2000 Control Delay	113.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	137.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 12: Jackson St. & I-880 EB Off 5th St./5th St.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↑			↔	
Volume (vph)	333	450	549	0	0	0	0	207	29	624	195	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.95						1.00			1.00	
Frt		0.94						0.98			1.00	
Flt Protected		0.99						1.00			0.96	
Satd. Flow (prot)		3279						1831			1794	
Flt Permitted		0.99						1.00			0.62	
Satd. Flow (perm)		3279						1831			1157	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	362	489	597	0	0	0	0	225	32	678	212	0
RTOR Reduction (vph)	0	253	0	0	0	0	0	10	0	0	0	0
Lane Group Flow (vph)	0	1195	0	0	0	0	0	247	0	0	890	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		16.0						26.0			26.0	
Effective Green, g (s)		16.0						26.0			26.0	
Actuated g/C Ratio		0.32						0.52			0.52	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		1049						952			601	
v/s Ratio Prot								0.13				
v/s Ratio Perm		0.36									c0.77	
v/c Ratio		1.14						0.26			1.48	
Uniform Delay, d1		17.0						6.7			12.0	
Progression Factor		1.00						1.00			1.00	
Incremental Delay, d2		74.5						0.7			225.2	
Delay (s)		91.5						7.3			237.2	
Level of Service		F						A			F	
Approach Delay (s)		91.5			0.0			7.3			237.2	
Approach LOS		F			A			A			F	

Intersection Summary

HCM 2000 Control Delay	133.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	107.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
13: Oak St. & 5th St.

AM2019Baseline\_w/Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔↔						↔			↔	
Volume (vph)	359	591	133	0	0	0	0	246	100	2	106	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.91						1.00			1.00	
Frt		0.98						0.96			1.00	
Flt Protected		0.98						1.00			1.00	
Satd. Flow (prot)		4910						1790			1861	
Flt Permitted		0.98						1.00			1.00	
Satd. Flow (perm)		4910						1790			1854	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	390	642	145	0	0	0	0	267	109	2	115	0
RTOR Reduction (vph)	0	30	0	0	0	0	0	25	0	0	0	0
Lane Group Flow (vph)	0	1147	0	0	0	0	0	352	0	0	117	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		27.0						25.0			25.0	
Effective Green, g (s)		27.0						25.0			25.0	
Actuated g/C Ratio		0.45						0.42			0.42	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		2209						745			772	
v/s Ratio Prot								c0.20				
v/s Ratio Perm		0.23									0.06	
v/c Ratio		0.52						0.47			0.15	
Uniform Delay, d1		11.8						12.7			10.9	
Progression Factor		0.46						1.00			1.00	
Incremental Delay, d2		0.7						2.1			0.4	
Delay (s)		6.2						14.8			11.3	
Level of Service		A						B			B	
Approach Delay (s)		6.2			0.0			14.8			11.3	
Approach LOS		A			A			B			B	

Intersection Summary

HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 14: 5th St. & Mitchell Ave.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Volume (vph)	17	6	27	35	25	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	1.00			1.00	1.00	
Frt	0.96			1.00	0.93	
Flt Protected	1.00			0.98	0.98	
Satd. Flow (prot)	1792			1823	1695	
Flt Permitted	1.00			0.85	0.98	
Satd. Flow (perm)	1792			1581	1695	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	7	29	38	27	27
RTOR Reduction (vph)	6	0	0	0	7	0
Lane Group Flow (vph)	19	0	0	67	47	0
Turn Type	NA		Perm	NA	NA	
Protected Phases	4			8		
Permitted Phases			8		2	
Actuated Green, G (s)	4.8			4.8	36.2	
Effective Green, g (s)	4.8			4.8	36.2	
Actuated g/C Ratio	0.10			0.10	0.74	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	175			154	1252	
v/s Ratio Prot	0.01					
v/s Ratio Perm				c0.04	c0.03	
v/c Ratio	0.11			0.44	0.04	
Uniform Delay, d1	20.1			20.8	1.7	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.3			2.0	0.1	
Delay (s)	20.4			22.8	1.8	
Level of Service	C			C	A	
Approach Delay (s)	20.4			22.8	1.8	
Approach LOS	C			C	A	

Intersection Summary

HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.08		
Actuated Cycle Length (s)	49.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	20.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



HCM Signalized Intersection Capacity Analysis  
 15: Mariner's Sq. Loop & Mitchell Ave./Marina Village Pkwy.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Volume (vph)	38	9	241	35	76	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	1813		1770	1863	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	1813		1770	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	10	262	38	83	227
RTOR Reduction (vph)	9	0	0	0	0	110
Lane Group Flow (vph)	42	0	262	38	83	117
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	4.4		14.3	22.7	32.6	32.6
Effective Green, g (s)	4.4		14.3	22.7	32.6	32.6
Actuated g/C Ratio	0.07		0.23	0.36	0.52	0.52
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	126		399	668	911	815
v/s Ratio Prot	c0.02		c0.15	0.02	0.05	
v/s Ratio Perm						c0.07
v/c Ratio	0.33		0.66	0.06	0.09	0.14
Uniform Delay, d1	28.0		22.3	13.3	7.8	8.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5		3.9	0.0	0.2	0.4
Delay (s)	29.6		26.1	13.3	8.0	8.4
Level of Service	C		C	B	A	A
Approach Delay (s)	29.6			24.5	8.3	
Approach LOS	C			C	A	

Intersection Summary

HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	63.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh	9.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	110	133	0	106	15	0	0	114	0	0	42
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	120	145	0	115	16	0	0	124	0	0	46
Number of Lanes	1	1	0	1	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	9.9	9	8.6	8
HCM LOS	A	A	A	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	0%	0%	0%	0%	0%	0%	0%	0%
Vol Thru, %	100%	0%	100%	45%	100%	88%	100%	0%
Vol Right, %	0%	100%	0%	55%	0%	12%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	114	0	243	0	121	0	42
LT Vol	0	0	0	110	0	106	0	0
Through Vol	0	114	0	133	0	15	0	42
RT Vol	0	0	0	0	0	0	0	0
Lane Flow Rate	0	124	0	264	0	132	0	46
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0	0.167	0	0.344	0	0.186	0	0.063
Departure Headway (Hd)	5.554	4.847	5.074	4.689	5.181	5.094	5.644	4.937
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	0	739	0	766	0	702	0	723
Service Time	3.293	2.587	2.812	2.427	2.924	2.837	3.391	2.684
HCM Lane V/C Ratio	0	0.168	0	0.345	0	0.188	0	0.064
HCM Control Delay	8.3	8.6	7.8	9.9	7.9	9	8.4	8
HCM Lane LOS	N	A	N	A	N	A	N	A
HCM 95th-tile Q	0	0.6	0	1.5	0	0.7	0	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	117	4	0	109	6	0	0	0	0	0	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	75		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	127	4	0	118	7	0	0	0	0	0	17
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	125	0	0	132	0	0	259	254	129	251	254	122
Stage 1	-	-	-	-	-	-	129	129	-	122	122	-
Stage 2	-	-	-	-	-	-	130	125	-	129	132	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1462	-	-	1453	-	-	694	650	921	702	650	929
Stage 1	-	-	-	-	-	-	875	789	-	882	795	-
Stage 2	-	-	-	-	-	-	874	792	-	875	787	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1462	-	-	1453	-	-	681	650	921	702	650	929
Mov Capacity-2 Maneuver	-	-	-	-	-	-	681	650	-	702	650	-
Stage 1	-	-	-	-	-	-	875	789	-	882	795	-
Stage 2	-	-	-	-	-	-	858	792	-	875	787	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	8.9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	0	1462	-	-	1453	-	-	929
HCM Control Delay, s	0	0	-	-	0	-	-	8.9
HCM Lane V/C Ratio	-	-	-	-	-	-	-	0.02
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	0.1

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	97	20	0	109	4	0	0	3	0	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	125		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	105	22	0	118	4	0	0	3	0	0	5
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	123	0	0	127	0	0	239	239	116	239	248	121
Stage 1	-	-	-	-	-	-	116	116	-	121	121	-
Stage 2	-	-	-	-	-	-	123	123	-	118	127	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1464	-	-	1459	-	-	715	662	936	715	655	930
Stage 1	-	-	-	-	-	-	889	800	-	883	796	-
Stage 2	-	-	-	-	-	-	881	794	-	887	791	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1464	-	-	1459	-	-	711	662	936	713	655	930
Mov Capacity-2 Maneuver	-	-	-	-	-	-	711	662	-	713	655	-
Stage 1	-	-	-	-	-	-	889	800	-	883	796	-
Stage 2	-	-	-	-	-	-	876	794	-	884	791	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	8.9	8.9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	936	1464	-	-	1459	-	-	930
HCM Control Delay, s	8.9	0	-	-	0	-	-	8.9
HCM Lane V/C Ratio	0.00	-	-	-	-	-	-	0.01
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	54	43	0	122	5	0	0	16	0	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	95		0	80		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	59	47	0	133	5	0	0	17	0	0	5
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	138	0	0	105	0	0	220	220	82	226	240	135
Stage 1	-	-	-	-	-	-	82	82	-	135	135	-
Stage 2	-	-	-	-	-	-	138	138	-	91	105	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1446	-	-	1486	-	-	736	678	978	729	661	914
Stage 1	-	-	-	-	-	-	926	827	-	868	785	-
Stage 2	-	-	-	-	-	-	865	782	-	916	808	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1446	-	-	1486	-	-	732	678	978	716	661	914
Mov Capacity-2 Maneuver	-	-	-	-	-	-	732	678	-	716	661	-
Stage 1	-	-	-	-	-	-	926	827	-	868	785	-
Stage 2	-	-	-	-	-	-	860	782	-	900	808	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	8.7	9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	978	1446	-	-	1486	-	-	914
HCM Control Delay, s	8.7	0	-	-	0	-	-	9
HCM Lane V/C Ratio	0.02	-	-	-	-	-	-	0.01
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	78	24	157	27	2	0	0	0	2	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	95		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	85	26	171	29	2	0	0	0	2	7
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	200	0	0	85	0	0	284	294	42	280	323	185
Stage 1	-	-	-	-	-	-	42	42	-	238	238	-
Stage 2	-	-	-	-	-	-	242	252	-	42	85	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1372	-	-	1512	-	-	668	617	1029	672	595	857
Stage 1	-	-	-	-	-	-	972	860	-	765	708	-
Stage 2	-	-	-	-	-	-	762	698	-	972	824	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1372	-	-	1512	-	-	652	606	1029	663	585	857
Mov Capacity-2 Maneuver	-	-	-	-	-	-	652	606	-	663	585	-
Stage 1	-	-	-	-	-	-	972	860	-	765	696	-
Stage 2	-	-	-	-	-	-	741	686	-	972	824	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.9	10.5	9.7
HCM LOS	-	-	B	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	652	1372	-	-	1512	-	-	768
HCM Control Delay, s	10.5	0	-	-	7.423	-	-	9.7
HCM Lane V/C Ratio	0.00	-	-	-	0.02	-	-	0.01
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.1	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 3.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	204	122	0	0	0	143
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	50		0	0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	222	133	0	0	0	155
Number of Lanes	2	0	1	2	1	0

Major/Minor	Major 1	Major 2	Major 2	Major 2	Major 2	Major 2
Conflicting Flow All	0	0	354	0	288	177
Stage 1	-	-	-	-	288	-
Stage 2	-	-	-	-	0	-
Follow-up Headway	-	-	2.22	-	3.52	3.32
Pot Capacity-1 Maneuver	-	-	1201	-	679	835
Stage 1	-	-	-	-	735	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1201	-	679	835
Mov Capacity-2 Maneuver	-	-	-	-	679	-
Stage 1	-	-	-	-	735	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	10.3
HCM LOS	-	-	B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Cap, veh/h	835	-	-	1201	-
HCM Control Delay, s	10.3	-	-	0	-
HCM Lane V/C Ratio	0.19	-	-	-	-
HCM Lane LOS	B	-	-	A	-
HCM 95th-tile Q, veh	0.7	-	-	0.0	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 22: Challenger Dr./Marina Village & Marina Village Pkwy.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Volume (vph)	12	242	0	0	0	0	70	62	64	0	0	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0					4.0	4.0				4.0
Lane Util. Factor	1.00	0.95					1.00	1.00				1.00
Frt	1.00	1.00					1.00	0.92				0.85
Flt Protected	0.95	1.00					0.95	1.00				1.00
Satd. Flow (prot)	1770	3539					1770	1720				1583
Flt Permitted	0.95	1.00					0.95	1.00				1.00
Satd. Flow (perm)	1770	3539					1770	1720				1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	13	263	0	0	0	0	76	67	70	0	0	33
RTOR Reduction (vph)	0	0	0	0	0	0	0	27	0	0	18	0
Lane Group Flow (vph)	13	263	0	0	0	0	76	110	0	0	15	0
Turn Type	Prot	NA		Prot			Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.2	12.9					5.2	33.6				24.4
Effective Green, g (s)	2.2	12.9					5.2	33.6				24.4
Actuated g/C Ratio	0.04	0.24					0.10	0.62				0.45
Clearance Time (s)	4.0	4.0					4.0	4.0				4.0
Vehicle Extension (s)	3.0	3.0					3.0	3.0				3.0
Lane Grp Cap (vph)	71	837					168	1060				708
v/s Ratio Prot	0.01	c0.07					c0.04	c0.06				0.01
v/s Ratio Perm												
v/c Ratio	0.18	0.31					0.45	0.10				0.02
Uniform Delay, d1	25.3	17.2					23.3	4.3				8.4
Progression Factor	1.00	1.00					1.00	1.00				1.00
Incremental Delay, d2	1.2	0.2					1.9	0.2				0.1
Delay (s)	26.5	17.4					25.2	4.5				8.4
Level of Service	C	B					C	A				A
Approach Delay (s)		17.8			0.0			11.9				8.4
Approach LOS		B			A			B				A

Intersection Summary

HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	54.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



HCM Signalized Intersection Capacity Analysis  
 23: Atlantic Ave. & Challenger Dr.

AM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑	↗	↖	↖	↖
Volume (vph)	59	0	100	196	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		
Lane Util. Factor	1.00		1.00	1.00		
Frt	1.00		1.00	0.85		
Flt Protected	0.95		1.00	1.00		
Satd. Flow (prot)	1770		1863	1583		
Flt Permitted	0.95		1.00	1.00		
Satd. Flow (perm)	1770		1863	1583		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	64	0	109	213	0	0
RTOR Reduction (vph)	0	0	0	176	0	0
Lane Group Flow (vph)	64	0	109	37	0	0
Turn Type	Prot		NA	Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	3.4		8.2	8.2		
Effective Green, g (s)	3.4		8.2	8.2		
Actuated g/C Ratio	0.07		0.18	0.18		
Clearance Time (s)	4.0		4.0	4.0		
Vehicle Extension (s)	3.0		3.0	3.0		
Lane Grp Cap (vph)	128		327	277		
v/s Ratio Prot	c0.04		c0.06			
v/s Ratio Perm				0.02		
v/c Ratio	0.50		0.33	0.14		
Uniform Delay, d1	20.8		16.9	16.3		
Progression Factor	1.00		1.00	1.00		
Incremental Delay, d2	3.1		0.6	0.2		
Delay (s)	23.9		17.5	16.5		
Level of Service	C		B	B		
Approach Delay (s)		23.9	16.8		0.0	
Approach LOS		C	B		A	

**Intersection Summary**

HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	46.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	22.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	0	0	196	141	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length	100			0	0	0
Median Width		12	12		12	
Grade, %		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	213	153	0	10
Number of Lanes	1	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow All	366	0	-	0	290	290
Stage 1	-	-	-	-	290	-
Stage 2	-	-	-	-	0	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	1193	-	-	-	701	749
Stage 1	-	-	-	-	759	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1193	-	-	-	701	749
Mov Capacity-2 Maneuver	-	-	-	-	701	-
Stage 1	-	-	-	-	759	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	9.9
HCM LOS	-	-	A




















Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Cap, veh/h	1193	-	-	-	749
HCM Control Delay, s	0	-	-	-	9.9
HCM Lane V/C Ratio	-	-	-	-	0.01
HCM Lane LOS	A	-	-	-	A
HCM 95th-tile Q, veh	0.0	-	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 25: Sherman St. & Buena Vista

AM2019Baseline\_w/Prj.  
 2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	295	0	0	809	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0							
Lane Util. Factor		1.00			1.00							
Frt		1.00			1.00							
Flt Protected		1.00			1.00							
Satd. Flow (prot)		1863			1863							
Flt Permitted		1.00			1.00							
Satd. Flow (perm)		1863			1863							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	321	0	0	879	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	321	0	0	879	0	0	0	0	0	0	0
Turn Type	Perm	NA		Perm	NA	pm+ov	Prot				Prot	
Protected Phases		4			8	1	5	2			1	6
Permitted Phases	4			8		8						
Actuated Green, G (s)		30.9			30.9							
Effective Green, g (s)		30.9			30.9							
Actuated g/C Ratio		0.56			0.56							
Clearance Time (s)		4.0			4.0							
Vehicle Extension (s)		3.0			3.0							
Lane Grp Cap (vph)		1046			1046							
v/s Ratio Prot		0.17			0.47							
v/s Ratio Perm												
v/c Ratio		0.31			0.84							
Uniform Delay, d1		6.4			10.0							
Progression Factor		1.00			1.00							
Incremental Delay, d2		0.2			6.2							
Delay (s)		6.5			16.2							
Level of Service		A			B							
Approach Delay (s)		6.5			16.2			0.0			0.0	
Approach LOS		A			B			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.6			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			55.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			45.9%			ICU Level of Service				A		
Analysis Period (min)			15									
c	Critical Lane Group											

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	13	0	0	51	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	0	0	55	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	28	0	0	7	0	0	0	0	0	0	0	0
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	28	0	-	7	0	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	981	-	-	1013	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	989	-	-	1015	-	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	989	-	-	1015	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	-	-	0	0
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	0	-	-	-	-	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	-	-	A	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
27: Sherman St. & Lincoln Ave.

AM2019Baseline\_w/Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	399	92	2	688	0	188	0	14	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		0.95			0.95			1.00				
Frt		0.97			1.00			0.99				
Flt Protected		1.00			1.00			0.96				
Satd. Flow (prot)		3440			3539			1763				
Flt Permitted		1.00			0.95			0.74				
Satd. Flow (perm)		3440			3377			1367				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	434	100	2	748	0	204	0	15	0	0	0
RTOR Reduction (vph)	0	33	0	0	0	0	0	10	0	0	0	0
Lane Group Flow (vph)	0	501	0	0	750	0	0	209	0	0	0	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm		
Protected Phases		4			8			2				6
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		26.0			26.0			26.0				
Effective Green, g (s)		26.0			26.0			26.0				
Actuated g/C Ratio		0.43			0.43			0.43				
Clearance Time (s)		4.0			4.0			4.0				
Lane Grp Cap (vph)		1490			1463			592				
v/s Ratio Prot		0.15										
v/s Ratio Perm					c0.22			c0.15				
v/c Ratio		0.34			0.51			0.35				
Uniform Delay, d1		11.3			12.4			11.4				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		0.6			1.3			1.6				
Delay (s)		11.9			13.7			13.0				
Level of Service		B			B			B				
Approach Delay (s)		11.9			13.7			13.0			0.0	
Approach LOS		B			B			B			A	

Intersection Summary

HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
28: 8th St. & Lincoln Ave.

AM2019Baseline\_w/Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔			↔↔		↔↔	↔	
Volume (vph)	18	142	21	9	238	760	22	590	15	337	253	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor		0.95			0.95			0.95		0.97	1.00	
Frt		0.98			0.89			1.00		1.00	1.00	
Flt Protected		0.99			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		3460			3137			3521		3433	1859	
Flt Permitted		0.66			0.95			1.00		0.95	1.00	
Satd. Flow (perm)		2300			2988			3521		3433	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	154	23	10	259	826	24	641	16	366	275	4
RTOR Reduction (vph)	0	9	0	0	393	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	188	0	0	702	0	0	680	0	366	278	0
Turn Type	Perm	NA		Perm	NA		Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)		26.8			26.8			39.3		21.3	21.3	
Effective Green, g (s)		26.8			26.8			39.3		21.3	21.3	
Actuated g/C Ratio		0.27			0.27			0.40		0.21	0.21	
Clearance Time (s)		4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)		620			805			1392		735	398	
v/s Ratio Prot								c0.19		0.11	c0.15	
v/s Ratio Perm		0.08			c0.23							
v/c Ratio		0.30			1.00dr			0.49		0.50	0.70	
Uniform Delay, d1		28.9			34.7			22.5		34.3	36.1	
Progression Factor		1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2		0.3			10.3			1.2		0.5	5.3	
Delay (s)		29.2			44.9			23.7		34.9	41.4	
Level of Service		C			D			C		C	D	
Approach Delay (s)		29.2			44.9			23.7			37.7	
Approach LOS		C			D			C			D	

Intersection Summary

HCM 2000 Control Delay	36.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	99.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
dr Defacto Right Lane. Recode with 1 though lane as a right lane.			
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 1: Madison St. & 8th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑↑							↑↑↑
Volume (vph)	0	0	0	0	707	0	0	0	0	0	0	893
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0							4.0
Lane Util. Factor					0.86							0.88
Frt					1.00							0.85
Flt Protected					1.00							1.00
Satd. Flow (prot)					5767							2508
Flt Permitted					1.00							1.00
Satd. Flow (perm)					5767							2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	768	0	0	0	0	0	0	971
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	59
Lane Group Flow (vph)	0	0	0	0	768	0	0	0	0	0	0	913
Turn Type					NA							custom
Protected Phases					8							
Permitted Phases												6
Actuated Green, G (s)					22.0							30.0
Effective Green, g (s)					22.0							30.0
Actuated g/C Ratio					0.37							0.50
Clearance Time (s)					4.0							4.0
Lane Grp Cap (vph)					2114							1254
v/s Ratio Prot					c0.13							
v/s Ratio Perm												c0.36
v/c Ratio					0.36							0.73
Uniform Delay, d1					13.9							11.8
Progression Factor					1.00							1.00
Incremental Delay, d2					0.5							3.7
Delay (s)					14.4							15.5
Level of Service					B							B
Approach Delay (s)		0.0			14.4			0.0			15.5	
Approach LOS		A			B			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			15.0		HCM 2000 Level of Service				B			
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			60.0		Sum of lost time (s)			8.0				
Intersection Capacity Utilization			52.8%		ICU Level of Service			A				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 2: Madison. St./Madison St. & 7th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑									↑↑↑	
Volume (vph)	0	924	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0										
Lane Util. Factor		0.86										
Frt		1.00										
Flt Protected		1.00										
Satd. Flow (prot)		6408										
Flt Permitted		1.00										
Satd. Flow (perm)		6408										
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1004	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1004	0	0	0	0	0	0	0	0	0	0
Turn Type		NA								Perm		
Protected Phases		4									6	
Permitted Phases										6		
Actuated Green, G (s)		24.0										
Effective Green, g (s)		24.0										
Actuated g/C Ratio		0.40										
Clearance Time (s)		4.0										
Lane Grp Cap (vph)		2563										
v/s Ratio Prot		c0.16										
v/s Ratio Perm												
v/c Ratio		0.39										
Uniform Delay, d1		12.8										
Progression Factor		1.00										
Incremental Delay, d2		0.5										
Delay (s)		13.3										
Level of Service		B										
Approach Delay (s)		13.3			0.0			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.18		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



HCM Signalized Intersection Capacity Analysis  
 3: Madison St. /Madison. St. & 6th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑↑↑	
Volume (vph)	0	0	0	0	222	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0							
Lane Util. Factor					0.91							
Frt					1.00							
Flt Protected					1.00							
Satd. Flow (prot)					5085							
Flt Permitted					1.00							
Satd. Flow (perm)					5085							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	241	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	241	0	0	0	0	0	0	0
Turn Type					NA							
Protected Phases					8						6	
Permitted Phases												
Actuated Green, G (s)					20.0							
Effective Green, g (s)					20.0							
Actuated g/C Ratio					0.33							
Clearance Time (s)					4.0							
Lane Grp Cap (vph)					1695							
v/s Ratio Prot					c0.05							
v/s Ratio Perm												
v/c Ratio					0.14							
Uniform Delay, d1					14.0							
Progression Factor					1.00							
Incremental Delay, d2					0.2							
Delay (s)					14.2							
Level of Service					B							
Approach Delay (s)		0.0			14.2			0.0			0.0	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.05		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 4: Madison St./Madison St. & 5th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑								↑↑	↑	
Volume (vph)	0	1603	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0										
Lane Util. Factor		0.91										
Frt		1.00										
Flt Protected		1.00										
Satd. Flow (prot)		4577										
Flt Permitted		1.00										
Satd. Flow (perm)		4577										
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1742	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1742	0	0	0	0	0	0	0	0	0	0
Turn Type		NA								Prot		
Protected Phases		4								1	6	
Permitted Phases												
Actuated Green, G (s)		23.0										
Effective Green, g (s)		23.0										
Actuated g/C Ratio		0.38										
Clearance Time (s)		4.0										
Lane Grp Cap (vph)		1754										
v/s Ratio Prot		c0.38										
v/s Ratio Perm												
v/c Ratio		0.99										
Uniform Delay, d1		18.4										
Progression Factor		1.00										
Incremental Delay, d2		19.9										
Delay (s)		38.4										
Level of Service		D										
Approach Delay (s)		38.4			0.0			0.0			0.0	
Approach LOS		D			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	390	0	0	179	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	424	0	0	195	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	1	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	195	0	0	424	0	0	619	619	424	619	619	195
Stage 1	-	-	-	-	-	-	424	424	-	195	195	-
Stage 2	-	-	-	-	-	-	195	195	-	424	424	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1378	-	-	1135	-	-	401	404	630	401	404	846
Stage 1	-	-	-	-	-	-	608	587	-	807	739	-
Stage 2	-	-	-	-	-	-	807	739	-	608	587	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1378	-	-	1135	-	-	401	404	630	401	404	846
Mov Capacity-2 Maneuver	-	-	-	-	-	-	401	404	-	401	404	-
Stage 1	-	-	-	-	-	-	608	587	-	807	739	-
Stage 2	-	-	-	-	-	-	807	739	-	608	587	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	0
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Cap, veh/h	0	1378	-	-	1135	-	-	0	0
HCM Control Delay, s	0	0	-	-	0	-	-	0	0
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	-	A	-	-	A	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	-	-

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	8	0	0	0	11	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	9	0	0	0	12	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	9	0	0	4	4	4	4	9	0
Stage 1	-	-	-	-	-	-	4	4	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	4	9	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	1611	-	-	1017	891	1080	1017	886	-
Stage 1	-	-	-	-	-	-	1018	892	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	1018	888	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	1611	-	-	-	891	1080	1017	886	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	891	-	1017	886	-
Stage 1	-	-	-	-	-	-	1018	892	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	1018	888	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	0
HCM LOS	-	-	-	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	1611	-	-	-
HCM Control Delay, s	-	0	-	-	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	-	-	-	-	0.0	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	0	366	500	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	75			0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	398	543	0
Number of Lanes	1	0	1	1	1	0

**Major/Minor**

		Major 1			Major 2	
Conflicting Flow All	941	543	543	0	-	0
Stage 1	543	-	-	-	-	-
Stage 2	398	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	292	540	1026	-	-	-
Stage 1	582	-	-	-	-	-
Stage 2	678	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-	-
Mov Capacity-1 Maneuver	292	540	1026	-	-	-
Mov Capacity-2 Maneuver	292	-	-	-	-	-
Stage 1	582	-	-	-	-	-
Stage 2	678	-	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1026	-	0	-	-
HCM Control Delay, s	0	-	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th-tile Q, veh	0.0	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 16.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	96	0	227	0	0	0	100	262	0	0	451	57
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	160		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	104	0	247	0	0	0	109	285	0	0	490	62
Number of Lanes	0	1	0	0	0	0	0	1	0	0	1	0

Major/Minor	Minor 2			Major 1			Major 2			
Conflicting Flow All	1023	1023	521		552	0	0	285	0	0
Stage 1	521	521	-		-	-	-	-	-	-
Stage 2	502	502	-		-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318		2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	261	236	555		1018	-	-	1277	-	-
Stage 1	596	532	-		-	-	-	-	-	-
Stage 2	608	542	-		-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0		0	-	-	0	-	-
Mov Capacity-1 Maneuver	228	0	555		1018	-	-	1277	-	-
Mov Capacity-2 Maneuver	228	0	-		-	-	-	-	-	-
Stage 1	596	0	-		-	-	-	-	-	-
Stage 2	531	0	-		-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	57.4	2.5	0
HCM LOS	F	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Cap, veh/h	1018	-	-	389	1277	-	-
HCM Control Delay, s	8.959	0	-	57.4	0	-	-
HCM Lane V/C Ratio	0.11	-	-	0.90	-	-	-
HCM Lane LOS	A	A	-	F	A	-	-
HCM 95th-tile Q, veh	0.4	-	-	9.3	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 9: Jackson St. & 8th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖↖↖			↖			↗	
Volume (vph)	0	0	0	1082	451	31	113	168	0	0	309	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0			4.0			4.0	
Lane Util. Factor				1.00	0.91			1.00			1.00	
Fr <sub>t</sub>				1.00	0.99			1.00			0.97	
Fl <sub>t</sub> Protected				0.95	1.00			0.98			1.00	
Satd. Flow (prot)				1593	4532			1643			1633	
Fl <sub>t</sub> Permitted				0.95	1.00			0.42			1.00	
Satd. Flow (perm)				1593	4532			712			1633	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1176	490	34	123	183	0	0	336	80
RTOR Reduction (vph)	0	0	0	0	8	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	0	0	1176	516	0	0	306	0	0	408	0
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					8			2			6	
Permitted Phases				8			2					
Actuated Green, G (s)				57.0	57.0			35.0			35.0	
Effective Green, g (s)				57.0	57.0			35.0			35.0	
Actuated g/C Ratio				0.57	0.57			0.35			0.35	
Clearance Time (s)				4.0	4.0			4.0			4.0	
Lane Grp Cap (vph)				908	2583			249			571	
v/s Ratio Prot					0.11						0.25	
v/s Ratio Perm				c0.74				c0.43				
v/c Ratio				1.30	0.20			1.23			0.71	
Uniform Delay, d <sub>1</sub>				21.5	10.4			32.5			28.2	
Progression Factor				1.00	1.00			1.00			1.00	
Incremental Delay, d <sub>2</sub>				141.0	0.2			133.1			7.4	
Delay (s)				162.5	10.6			165.6			35.6	
Level of Service				F	B			F			D	
Approach Delay (s)		0.0			115.7			165.6			35.6	
Approach LOS		A			F			F			D	

Intersection Summary

HCM 2000 Control Delay	108.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	116.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 10: Jackson St. & 7th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↗↗					↕			↕	
Volume (vph)	34	579	1328	0	0	0	0	264	134	257	1105	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0			4.0	
Lane Util. Factor		0.95	0.88					1.00			1.00	
Frt		1.00	0.85					0.95			1.00	
Flt Protected		1.00	1.00					1.00			0.99	
Satd. Flow (prot)		3529	2787					1778			1845	
Flt Permitted		1.00	1.00					1.00			0.72	
Satd. Flow (perm)		3529	2787					1778			1349	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	629	1443	0	0	0	0	287	146	279	1201	0
RTOR Reduction (vph)	0	0	127	0	0	0	0	12	0	0	0	0
Lane Group Flow (vph)	0	666	1316	0	0	0	0	421	0	0	1480	0
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4		4							6		
Actuated Green, G (s)		42.0	42.0					100.0			100.0	
Effective Green, g (s)		42.0	42.0					100.0			100.0	
Actuated g/C Ratio		0.28	0.28					0.67			0.67	
Clearance Time (s)		4.0	4.0					4.0			4.0	
Lane Grp Cap (vph)		988	780					1185			899	
v/s Ratio Prot								0.24				
v/s Ratio Perm		0.19	c0.47								c1.10	
v/c Ratio		0.67	1.69					0.35			1.65	
Uniform Delay, d1		47.9	54.0					10.9			25.0	
Progression Factor		1.00	1.00					0.71			1.00	
Incremental Delay, d2		3.7	315.0					0.8			295.8	
Delay (s)		51.6	369.0					8.6			320.8	
Level of Service		D	F					A			F	
Approach Delay (s)		268.7			0.0			8.6			320.8	
Approach LOS		F			A			A			F	

Intersection Summary

HCM 2000 Control Delay	259.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.66		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	125.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



HCM Signalized Intersection Capacity Analysis  
 11: Jackson St. & 6th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↗	↖	↖	↗			↗	↖
Volume (vph)	0	0	0	11	192	30	388	372	0	0	1082	1360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1863	1583	1770	1863			1863	1583
Flt Permitted				0.95	1.00	1.00	0.17	1.00			1.00	1.00
Satd. Flow (perm)				1770	1863	1583	320	1863			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	12	209	33	422	404	0	0	1176	1478
RTOR Reduction (vph)	0	0	0	0	0	29	0	0	0	0	0	13
Lane Group Flow (vph)	0	0	0	12	209	4	422	404	0	0	1176	1465
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8	2					6
Actuated Green, G (s)				16.0	16.0	16.0	126.0	126.0			126.0	126.0
Effective Green, g (s)				16.0	16.0	16.0	126.0	126.0			126.0	126.0
Actuated g/C Ratio				0.11	0.11	0.11	0.84	0.84			0.84	0.84
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				188	198	168	268	1564			1564	1329
v/s Ratio Prot					c0.11			0.22			0.63	
v/s Ratio Perm				0.01		0.00	c1.32					0.93
v/c Ratio				0.06	1.06	0.02	1.57	0.26			0.75	1.10
Uniform Delay, d1				60.3	67.0	60.0	12.0	2.5			5.2	12.0
Progression Factor				1.00	1.00	1.00	2.51	1.94			2.06	2.04
Incremental Delay, d2				0.7	79.4	0.2	267.1	0.2			0.3	47.4
Delay (s)				60.9	146.4	60.2	297.2	4.9			11.1	71.9
Level of Service				E	F	E	F	A			B	E
Approach Delay (s)		0.0			131.2			154.3			44.9	
Approach LOS		A			F			F			D	

Intersection Summary			
HCM 2000 Control Delay	75.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.51		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	125.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 12: Jackson St. & I-880 EB Off 5th St./5th St.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕			↕	
Volume (vph)	339	649	312	0	0	0	0	388	46	902	182	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.95						1.00			1.00	
Frt		0.96						0.99			1.00	
Flt Protected		0.99						1.00			0.96	
Satd. Flow (prot)		3368						1836			1788	
Flt Permitted		0.99						1.00			0.43	
Satd. Flow (perm)		3368						1836			796	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	368	705	339	0	0	0	0	422	50	980	198	0
RTOR Reduction (vph)	0	20	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	0	1392	0	0	0	0	0	469	0	0	1178	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		41.0						101.0			101.0	
Effective Green, g (s)		41.0						101.0			101.0	
Actuated g/C Ratio		0.27						0.67			0.67	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		920						1236			535	
v/s Ratio Prot								0.26				
v/s Ratio Perm		0.41									c1.48	
v/c Ratio		1.51						0.38			2.20	
Uniform Delay, d1		54.5						10.8			24.5	
Progression Factor		1.00						1.00			0.88	
Incremental Delay, d2		236.3						0.9			544.8	
Delay (s)		290.8						11.6			566.4	
Level of Service		F						B			F	
Approach Delay (s)		290.8			0.0			11.6			566.4	
Approach LOS		F			A			B			F	

Intersection Summary

HCM 2000 Control Delay	353.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	2.00		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	130.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
13: Oak St. & 5th St.

PM2019Baseline\_w/Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↕↔						↔			↕	
Volume (vph)	462	981	160	0	0	0	0	418	82	4	102	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.91						1.00			1.00	
Frt		0.99						0.98			1.00	
Flt Protected		0.99						1.00			1.00	
Satd. Flow (prot)		4938						1822			1860	
Flt Permitted		0.99						1.00			0.99	
Satd. Flow (perm)		4938						1822			1836	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	502	1066	174	0	0	0	0	454	89	4	111	0
RTOR Reduction (vph)	0	23	0	0	0	0	0	12	0	0	0	0
Lane Group Flow (vph)	0	1719	0	0	0	0	0	531	0	0	115	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		27.0						25.0			25.0	
Effective Green, g (s)		27.0						25.0			25.0	
Actuated g/C Ratio		0.45						0.42			0.42	
Clearance Time (s)		4.0						4.0			4.0	
Lane Grp Cap (vph)		2222						759			765	
v/s Ratio Prot								c0.29				
v/s Ratio Perm		0.35									0.06	
v/c Ratio		0.77						0.70			0.15	
Uniform Delay, d1		13.9						14.4			10.9	
Progression Factor		0.94						1.00			1.00	
Incremental Delay, d2		0.7						5.3			0.4	
Delay (s)		13.7						19.7			11.3	
Level of Service		B						B			B	
Approach Delay (s)		13.7			0.0			19.7			11.3	
Approach LOS		B			A			B			B	

Intersection Summary

HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 14: 5th St. & Mitchell Ave.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Volume (vph)	39	11	52	10	7	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	1.00			1.00	1.00	
Frt	0.97			1.00	0.88	
Flt Protected	1.00			0.96	0.99	
Satd. Flow (prot)	1807			1788	1631	
Flt Permitted	1.00			0.74	0.99	
Satd. Flow (perm)	1807			1370	1631	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	12	57	11	8	61
RTOR Reduction (vph)	11	0	0	0	17	0
Lane Group Flow (vph)	43	0	0	68	52	0
Turn Type	NA		Perm	NA	NA	
Protected Phases	4			8		
Permitted Phases			8		2	
Actuated Green, G (s)	5.0			5.0	34.2	
Effective Green, g (s)	5.0			5.0	34.2	
Actuated g/C Ratio	0.11			0.11	0.72	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	191			145	1181	
v/s Ratio Prot	0.02					
v/s Ratio Perm				c0.05	c0.03	
v/c Ratio	0.23			0.47	0.04	
Uniform Delay, d1	19.3			19.9	1.8	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.6			2.4	0.1	
Delay (s)	19.9			22.2	1.9	
Level of Service	B			C	A	
Approach Delay (s)	19.9			22.2	1.9	
Approach LOS	B			C	A	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.10		
Actuated Cycle Length (s)	47.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 15: Mariner's Sq. Loop & Mitchell Ave./Marina Village Pkwy.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻		↻	↻	↻	↻
Volume (vph)	80	9	355	53	72	153
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	1837		1770	1863	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	1837		1770	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	10	386	58	78	166
RTOR Reduction (vph)	7	0	0	0	0	97
Lane Group Flow (vph)	90	0	386	58	78	69
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	7.0		16.9	27.9	25.6	25.6
Effective Green, g (s)	7.0		16.9	27.9	25.6	25.6
Actuated g/C Ratio	0.11		0.27	0.45	0.42	0.42
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	209		486	845	736	658
v/s Ratio Prot	c0.05		c0.22	0.03	c0.04	
v/s Ratio Perm						0.04
v/c Ratio	0.43		0.79	0.07	0.11	0.11
Uniform Delay, d1	25.4		20.7	9.5	11.0	11.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4		8.7	0.0	0.3	0.3
Delay (s)	26.8		29.4	9.5	11.3	11.3
Level of Service	C		C	A	B	B
Approach Delay (s)	26.8			26.8	11.3	
Approach LOS	C			C	B	

Intersection Summary

HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection												
Intersection Delay, s/veh	12											
Intersection LOS	B											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	134	170	0	228	16	0	0	178	0	0	75
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	146	185	0	248	17	0	0	193	0	0	82
Number of Lanes	1	1	0	1	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	13	12.5	10.7	9.4
HCM LOS	B	B	B	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	0%	0%	0%	0%	0%	0%	0%	0%
Vol Thru, %	100%	0%	100%	44%	100%	93%	100%	0%
Vol Right, %	0%	100%	0%	56%	0%	7%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	178	0	304	0	244	0	75
LT Vol	0	0	0	134	0	228	0	0
Through Vol	0	178	0	170	0	16	0	75
RT Vol	0	0	0	0	0	0	0	0
Lane Flow Rate	0	193	0	330	0	265	0	82
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0	0.3	0	0.486	0	0.42	0	0.131
Departure Headway (Hd)	6.299	5.587	5.686	5.29	5.742	5.696	6.502	5.789
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	0	642	0	681	0	631	0	618
Service Time	4.041	3.329	3.419	3.023	3.476	3.429	4.25	3.537
HCM Lane V/C Ratio	0	0.301	0	0.485	0	0.42	0	0.133
HCM Control Delay	9	10.7	8.4	13	8.5	12.5	9.3	9.4
HCM Lane LOS	N	B	N	B	N	B	N	A
HCM 95th-tile Q	0	1.3	0	2.7	0	2.1	0	0.4

Notes  
 - : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	271	1	0	118	11	0	0	2	0	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	75		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	295	1	0	128	12	0	0	2	0	0	20
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	140	0	0	296	0	0	439	435	295	430	430	134
Stage 1	-	-	-	-	-	-	295	295	-	134	134	-
Stage 2	-	-	-	-	-	-	144	140	-	296	296	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1443	-	-	1265	-	-	528	514	744	535	518	915
Stage 1	-	-	-	-	-	-	713	669	-	869	785	-
Stage 2	-	-	-	-	-	-	859	781	-	712	668	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1443	-	-	1265	-	-	517	514	744	533	518	915
Mov Capacity-2 Maneuver	-	-	-	-	-	-	517	514	-	533	518	-
Stage 1	-	-	-	-	-	-	713	669	-	869	785	-
Stage 2	-	-	-	-	-	-	841	781	-	710	668	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	9.9	9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	744	1443	-	-	1265	-	-	915
HCM Control Delay, s	9.9	0	-	-	0	-	-	9
HCM Lane V/C Ratio	0.00	-	-	-	-	-	-	0.02
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.1

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	269	4	0	117	7	0	0	11	0	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	125		0	0		0	0		0
Median Width		12			12			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	292	4	0	127	8	0	0	12	0	0	13
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	135	0	0	297	0	0	433	430	295	432	428	131
Stage 1	-	-	-	-	-	-	295	295	-	131	131	-
Stage 2	-	-	-	-	-	-	138	135	-	301	297	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1449	-	-	1264	-	-	533	518	744	534	519	919
Stage 1	-	-	-	-	-	-	713	669	-	873	788	-
Stage 2	-	-	-	-	-	-	865	785	-	708	668	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1449	-	-	1264	-	-	525	518	744	525	519	919
Mov Capacity-2 Maneuver	-	-	-	-	-	-	525	518	-	525	519	-
Stage 1	-	-	-	-	-	-	713	669	-	873	788	-
Stage 2	-	-	-	-	-	-	853	785	-	697	668	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	9.9	9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	744	1449	-	-	1264	-	-	919
HCM Control Delay, s	9.9	0	-	-	0	-	-	9
HCM Lane V/C Ratio	0.02	-	-	-	-	-	-	0.01
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.0

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	280	0	0	124	1	0	0	39	0	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	95		0	80		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	304	0	0	135	1	0	0	42	0	0	10
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	136	0	0	304	0	0	444	440	304	461	439	135
Stage 1	-	-	-	-	-	-	304	304	-	135	135	-
Stage 2	-	-	-	-	-	-	140	136	-	326	304	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1448	-	-	1257	-	-	524	511	736	511	512	914
Stage 1	-	-	-	-	-	-	705	663	-	868	785	-
Stage 2	-	-	-	-	-	-	863	784	-	687	663	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1448	-	-	1257	-	-	518	511	736	482	512	914
Mov Capacity-2 Maneuver	-	-	-	-	-	-	518	511	-	482	512	-
Stage 1	-	-	-	-	-	-	705	663	-	868	785	-
Stage 2	-	-	-	-	-	-	854	784	-	647	663	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	10.2	9
HCM LOS	-	-	B	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	736	1448	-	-	1257	-	-	914
HCM Control Delay, s	10.2	0	-	-	0	-	-	9
HCM Lane V/C Ratio	0.06	-	-	-	-	-	-	0.01
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.2	0.0	-	-	0.0	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	319	5	114	2	11	0	0	0	0	49
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	75		0	95		0	0		0	0		0
Median Width		12			12			0				0
Grade, %		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	347	5	124	2	12	0	0	0	0	53
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	126	0	0	347	0	0	336	310	173	309	483	125
Stage 1	-	-	-	-	-	-	173	173	-	136	136	-
Stage 2	-	-	-	-	-	-	163	137	-	173	347	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1460	-	-	1212	-	-	618	605	871	643	483	926
Stage 1	-	-	-	-	-	-	829	756	-	867	784	-
Stage 2	-	-	-	-	-	-	839	783	-	829	635	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1460	-	-	1212	-	-	581	603	871	641	481	926
Mov Capacity-2 Maneuver	-	-	-	-	-	-	581	603	-	641	481	-
Stage 1	-	-	-	-	-	-	829	756	-	867	781	-
Stage 2	-	-	-	-	-	-	787	780	-	829	635	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	11.3	9.1
HCM LOS	-	-	B	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	581	1460	-	-	1212	-	-	926
HCM Control Delay, s	11.3	0	-	-	7.984	-	-	9.1
HCM Lane V/C Ratio	0.02	-	-	-	0.00	-	-	0.06
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.2

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	75	63	0	0	0	68
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	50		0	0
Median Width	12			12	12	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	82	68	0	0	0	74
Number of Lanes	2	0	1	2	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow All	0	0	150	0	116	75
Stage 1	-	-	-	-	116	-
Stage 2	-	-	-	-	0	-
Follow-up Headway	-	-	2.22	-	3.52	3.32
Pot Capacity-1 Maneuver	-	-	1429	-	868	971
Stage 1	-	-	-	-	896	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	-	-	0	-	0	0
Mov Capacity-1 Maneuver	-	-	1429	-	868	971
Mov Capacity-2 Maneuver	-	-	-	-	868	-
Stage 1	-	-	-	-	896	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	9
HCM LOS	-	-	A

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Cap, veh/h	971	-	-	1429	-
HCM Control Delay, s	9	-	-	0	-
HCM Lane V/C Ratio	0.08	-	-	-	-
HCM Lane LOS	A	-	-	A	-
HCM 95th-tile Q, veh	0.2	-	-	0.0	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 22: Challenger Dr./Marina Village & Marina Village Pkwy.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Volume (vph)	35	92	0	0	0	0	35	0	43	0	0	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0					4.0	4.0				4.0
Lane Util. Factor	1.00	0.95					1.00	1.00				1.00
Frt	1.00	1.00					1.00	0.85				0.85
Flt Protected	0.95	1.00					0.95	1.00				1.00
Satd. Flow (prot)	1770	3539					1770	1583				1583
Flt Permitted	0.95	1.00					0.95	1.00				1.00
Satd. Flow (perm)	1770	3539					1770	1583				1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	100	0	0	0	0	38	0	47	0	0	63
RTOR Reduction (vph)	0	0	0	0	0	0	0	17	0	0	29	0
Lane Group Flow (vph)	38	100	0	0	0	0	38	30	0	0	34	0
Turn Type	Prot	NA		Prot			Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	1.4	9.5					1.3	31.3				26.0
Effective Green, g (s)	1.4	9.5					1.3	31.3				26.0
Actuated g/C Ratio	0.03	0.19					0.03	0.64				0.53
Clearance Time (s)	4.0	4.0					4.0	4.0				4.0
Vehicle Extension (s)	3.0	3.0					3.0	3.0				3.0
Lane Grp Cap (vph)	50	688					47	1015				843
v/s Ratio Prot	c0.02	c0.03					c0.02	0.02				c0.02
v/s Ratio Perm												
v/c Ratio	0.76	0.15					0.81	0.03				0.04
Uniform Delay, d1	23.5	16.3					23.6	3.2				5.4
Progression Factor	1.00	1.00					1.00	1.00				1.00
Incremental Delay, d2	48.9	0.1					63.4	0.1				0.1
Delay (s)	72.5	16.4					87.0	3.3				5.5
Level of Service	E	B					F	A				A
Approach Delay (s)		31.8			0.0			40.7				5.5
Approach LOS		C			A			D				A

**Intersection Summary**

HCM 2000 Control Delay	28.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.12		
Actuated Cycle Length (s)	48.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	18.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 23: Atlantic Ave. & Challenger Dr.

PM2019Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑	↑	↗	↖	↗
Volume (vph)	42	0	101	78	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		
Lane Util. Factor	1.00		1.00	1.00		
Frt	1.00		1.00	0.85		
Flt Protected	0.95		1.00	1.00		
Satd. Flow (prot)	1770		1863	1583		
Flt Permitted	0.95		1.00	1.00		
Satd. Flow (perm)	1770		1863	1583		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	0	110	85	0	0
RTOR Reduction (vph)	0	0	0	71	0	0
Lane Group Flow (vph)	46	0	110	14	0	0
Turn Type	Prot		NA	Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	1.5		6.5	6.5		
Effective Green, g (s)	1.5		6.5	6.5		
Actuated g/C Ratio	0.04		0.16	0.16		
Clearance Time (s)	4.0		4.0	4.0		
Vehicle Extension (s)	3.0		3.0	3.0		
Lane Grp Cap (vph)	65		296	252		
v/s Ratio Prot	c0.03		c0.06			
v/s Ratio Perm				0.01		
v/c Ratio	0.71		0.37	0.05		
Uniform Delay, d1	19.4		15.3	14.5		
Progression Factor	1.00		1.00	1.00		
Incremental Delay, d2	29.6		0.8	0.1		
Delay (s)	49.0		16.1	14.6		
Level of Service	D		B	B		
Approach Delay (s)		49.0	15.5		0.0	
Approach LOS		D	B		A	

Intersection Summary			
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.12		
Actuated Cycle Length (s)	40.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	14.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 12.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	15	727	448	78	139	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length	100			0	0	0
Median Width		12	12		12	
Grade, %		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	790	487	85	151	18
Number of Lanes	1	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow All	572	0	-	0	1352	529
Stage 1	-	-	-	-	529	-
Stage 2	-	-	-	-	823	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	1001	-	-	-	165	550
Stage 1	-	-	-	-	591	-
Stage 2	-	-	-	-	431	-
Time blocked-Platoon, %	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1001	-	-	-	162	550
Mov Capacity-2 Maneuver	-	-	-	-	162	-
Stage 1	-	-	-	-	591	-
Stage 2	-	-	-	-	424	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	113.6
HCM LOS	-	-	F




















Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Cap, veh/h	1001	-	-	-	175
HCM Control Delay, s	8.656	-	-	-	113.6
HCM Lane V/C Ratio	0.02	-	-	-	0.97
HCM Lane LOS	A	-	-	-	F
HCM 95th-tile Q, veh	0.1	-	-	-	7.6

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
25: Sherman St. & Buena Vista

PM2019Baseline\_w/Prj.  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	576	0	0	594	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0							
Lane Util. Factor		1.00			1.00							
Frt		1.00			1.00							
Flt Protected		1.00			1.00							
Satd. Flow (prot)		1863			1863							
Flt Permitted		1.00			1.00							
Satd. Flow (perm)		1863			1863							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	626	0	0	646	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	626	0	0	646	0	0	0	0	0	0	0
Turn Type	Perm	NA		Perm	NA	pm+ov	Prot				Prot	
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)		20.9			20.9							
Effective Green, g (s)		20.9			20.9							
Actuated g/C Ratio		0.46			0.46							
Clearance Time (s)		4.0			4.0							
Vehicle Extension (s)		3.0			3.0							
Lane Grp Cap (vph)		863			863							
v/s Ratio Prot		0.34			c0.35							
v/s Ratio Perm												
v/c Ratio		0.73			0.75							
Uniform Delay, d1		9.8			9.9							
Progression Factor		1.00			1.00							
Incremental Delay, d2		3.1			3.6							
Delay (s)		12.8			13.5							
Level of Service		B			B							
Approach Delay (s)		12.8			13.5		0.0				0.0	
Approach LOS		B			B		A				A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.2			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			45.1			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			34.6%			ICU Level of Service				A		
Analysis Period (min)			15									
c	Critical Lane Group											

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	44	0	0	26	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			12			12	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	48	0	0	28	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	14	0	0	24	0	0	0	0	0	0	0	0
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	14	0	-	24	0	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	1002	-	-	987	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	1006	-	-	994	-	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	1006	-	-	994	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	-	-	0	0
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	0	-	-	-	-	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	-	-	A	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



HCM Signalized Intersection Capacity Analysis  
27: Sherman St. & Lincoln Ave.

PM2019Baseline\_w/Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	996	349	9	500	0	100	0	6	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		0.95			0.95			1.00				
Frt		0.96			1.00			0.99				
Flt Protected		1.00			1.00			0.96				
Satd. Flow (prot)		3402			3536			1765				
Flt Permitted		1.00			0.84			0.77				
Satd. Flow (perm)		3402			2984			1429				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1083	379	10	543	0	109	0	7	0	0	0
RTOR Reduction (vph)	0	58	0	0	0	0	0	10	0	0	0	0
Lane Group Flow (vph)	0	1404	0	0	553	0	0	106	0	0	0	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		26.0			26.0			26.0				
Effective Green, g (s)		26.0			26.0			26.0				
Actuated g/C Ratio		0.43			0.43			0.43				
Clearance Time (s)		4.0			4.0			4.0				
Lane Grp Cap (vph)		1474			1293			619				
v/s Ratio Prot		c0.41										
v/s Ratio Perm					0.19			c0.07				
v/c Ratio		0.95			0.43			0.17				
Uniform Delay, d1		16.4			11.8			10.4				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		14.5			1.0			0.6				
Delay (s)		30.9			12.9			11.0				
Level of Service		C			B			B				
Approach Delay (s)		30.9			12.9			11.0			0.0	
Approach LOS		C			B			B			A	

Intersection Summary

HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
28: 8th St. & Lincoln Ave.

PM2019Baseline\_w/Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔			↔↔		↔↔	↔	
Volume (vph)	8	175	16	17	184	365	34	383	25	1018	520	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor		0.95			0.95			0.95		0.97	1.00	
Frt		0.99			0.90			0.99		1.00	1.00	
Flt Protected		1.00			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		3490			3192			3496		3433	1859	
Flt Permitted		0.79			0.94			1.00		0.95	1.00	
Satd. Flow (perm)		2766			3009			3496		3433	1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	190	17	18	200	397	37	416	27	1107	565	8
RTOR Reduction (vph)	0	9	0	0	330	0	0	5	0	0	1	0
Lane Group Flow (vph)	0	207	0	0	285	0	0	475	0	1107	572	0
Turn Type	Perm	NA		Perm	NA		Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)		11.8			11.8			16.1		29.6	29.6	
Effective Green, g (s)		11.8			11.8			16.1		29.6	29.6	
Actuated g/C Ratio		0.17			0.17			0.23		0.43	0.43	
Clearance Time (s)		4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)		469			510			809		1462	791	
v/s Ratio Prot								c0.14		c0.32	0.31	
v/s Ratio Perm		0.07			c0.09							
v/c Ratio		0.44			0.56			0.59		0.76	0.72	
Uniform Delay, d1		25.9			26.5			23.7		16.9	16.6	
Progression Factor		1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2		0.7			1.3			3.1		2.3	3.3	
Delay (s)		26.6			27.8			26.8		19.2	19.9	
Level of Service		C			C			C		B	B	
Approach Delay (s)		26.6			27.8			26.8			19.4	
Approach LOS		C			C			C			B	

Intersection Summary

HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	69.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

# HCM Signalized Intersection Capacity Analysis

AM Base+Prj. MITIGATED

1: Madison St. & 8th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					←←←←						→	
Volume (vph)	0	0	0	246	665	0	0	0	0	0	571	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.86						1.00	
Frt					1.00						0.98	
Flt Protected					0.99						1.00	
Satd. Flow (prot)					5690						1643	
Flt Permitted					0.99						1.00	
Satd. Flow (perm)					5690						1643	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	267	723	0	0	0	0	0	621	107
RTOR Reduction (vph)	0	0	0	0	94	0	0	0	0	0	10	0
Lane Group Flow (vph)	0	0	0	0	896	0	0	0	0	0	718	0
Turn Type				Perm	NA						NA	
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					26.0						26.0	
Effective Green, g (s)					26.0						26.0	
Actuated g/C Ratio					0.43						0.43	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					2465						711	
v/s Ratio Prot											c0.44	
v/s Ratio Perm					0.16							
v/c Ratio					0.36						1.01	
Uniform Delay, d1					11.4						17.0	
Progression Factor					1.00						1.00	
Incremental Delay, d2					0.4						36.1	
Delay (s)					11.9						53.1	
Level of Service					B						D	
Approach Delay (s)		0.0			11.9			0.0			53.1	
Approach LOS		A			B			A			D	

## Intersection Summary

HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 2: Madison. St./Madison St. & 7th St.

AM Base+Prj. MITIGATED

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑↑										↖
Volume (vph)	0	350	204	0	0	0	0	0	0	128	610	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		0.86									1.00	
Frt		0.94									1.00	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		6053									1847	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		6053									1847	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	380	222	0	0	0	0	0	0	139	663	0
RTOR Reduction (vph)	0	111	0	0	0	0	0	0	0	0	12	0
Lane Group Flow (vph)	0	491	0	0	0	0	0	0	0	0	790	0
Turn Type		NA								Perm	NA	
Protected Phases		4									6	
Permitted Phases										6		
Actuated Green, G (s)		23.0									29.0	
Effective Green, g (s)		23.0									29.0	
Actuated g/C Ratio		0.38									0.48	
Clearance Time (s)		4.0									4.0	
Lane Grp Cap (vph)		2320									892	
v/s Ratio Prot		c0.08										
v/s Ratio Perm											0.43	
v/c Ratio		0.21									0.89	
Uniform Delay, d1		12.4									14.0	
Progression Factor		0.35									0.65	
Incremental Delay, d2		0.2									7.4	
Delay (s)		4.5									16.5	
Level of Service		A									B	
Approach Delay (s)		4.5			0.0			0.0			16.5	
Approach LOS		A			A			A			B	

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 3: Madison St. /Madison. St. & 6th St.

AM Base+Prj. MITIGATED  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	
Volume (vph)	0	0	0	21	155	0	0	0	0	0	741	196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.91						1.00	
Frt					1.00						0.97	
Flt Protected					0.99						1.00	
Satd. Flow (prot)					5055						1810	
Flt Permitted					0.99						1.00	
Satd. Flow (perm)					5055						1810	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	23	168	0	0	0	0	0	805	213
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	0	0	16	0
Lane Group Flow (vph)	0	0	0	0	176	0	0	0	0	0	1002	0
Turn Type				Perm	NA						NA	
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					20.0						32.0	
Effective Green, g (s)					20.0						32.0	
Actuated g/C Ratio					0.33						0.53	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					1685						965	
v/s Ratio Prot											c0.55	
v/s Ratio Perm					0.03							
v/c Ratio					0.10						1.04	
Uniform Delay, d1					13.8						14.0	
Progression Factor					1.00						0.58	
Incremental Delay, d2					0.1						36.0	
Delay (s)					13.9						44.1	
Level of Service					B						D	
Approach Delay (s)		0.0			13.9			0.0			44.1	
Approach LOS		A			B			A			D	

Intersection Summary

HCM 2000 Control Delay	39.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 4: Madison St./Madison St. & 5th St.

AM Base+Prj. MITIGATED

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑									↑	
Volume (vph)	0	527	21	0	0	0	0	0	0	567	99	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		0.91									1.00	
Frt		0.99									1.00	
Flt Protected		1.00									0.96	
Satd. Flow (prot)		4550									1608	
Flt Permitted		1.00									0.96	
Satd. Flow (perm)		4550									1608	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	573	23	0	0	0	0	0	0	616	108	0
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	0	0	89	0
Lane Group Flow (vph)	0	589	0	0	0	0	0	0	0	0	635	0
Turn Type		NA								Prot	NA	
Protected Phases		4								1	6	
Permitted Phases												
Actuated Green, G (s)		24.0									28.0	
Effective Green, g (s)		24.0									28.0	
Actuated g/C Ratio		0.40									0.47	
Clearance Time (s)		4.0									4.0	
Lane Grp Cap (vph)		1820									750	
v/s Ratio Prot		c0.13									c0.40	
v/s Ratio Perm												
v/c Ratio		0.32									0.85	
Uniform Delay, d1		12.4									14.1	
Progression Factor		0.78									0.77	
Incremental Delay, d2		0.4									1.2	
Delay (s)		10.0									12.0	
Level of Service		B									B	
Approach Delay (s)		10.0			0.0			0.0			12.0	
Approach LOS		B			A			A			B	

Intersection Summary

HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

PM Base+Prj. MITIGATED

1: Madison St. & 8th St.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					←←←←						→	
Volume (vph)	0	0	0	220	487	0	0	0	0	0	811	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.86						1.00	
Frt					1.00						0.99	
Flt Protected					0.98						1.00	
Satd. Flow (prot)					5679						1656	
Flt Permitted					0.98						1.00	
Satd. Flow (perm)					5679						1656	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	239	529	0	0	0	0	0	882	89
RTOR Reduction (vph)	0	0	0	0	126	0	0	0	0	0	6	0
Lane Group Flow (vph)	0	0	0	0	642	0	0	0	0	0	965	0
Turn Type				Perm	NA						NA	
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					16.0						41.0	
Effective Green, g (s)					16.0						41.0	
Actuated g/C Ratio					0.25						0.63	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					1397						1044	
v/s Ratio Prot											c0.58	
v/s Ratio Perm					0.11							
v/c Ratio					0.46						0.92	
Uniform Delay, d1					20.8						10.6	
Progression Factor					1.00						1.00	
Incremental Delay, d2					1.1						14.8	
Delay (s)					21.9						25.4	
Level of Service					C						C	
Approach Delay (s)		0.0			21.9			0.0			25.4	
Approach LOS		A			C			A			C	

## Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 2: Madison. St./Madison St. & 7th St.

PM Base+Prj. MITIGATED

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑↑									↑	
Volume (vph)	0	699	307	0	0	0	0	0	0	255	705	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		0.86									1.00	
Frt		0.95									1.00	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		6114									1838	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		6114									1838	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	760	334	0	0	0	0	0	0	277	766	0
RTOR Reduction (vph)	0	132	0	0	0	0	0	0	0	0	9	0
Lane Group Flow (vph)	0	962	0	0	0	0	0	0	0	0	1034	0
Turn Type		NA								Perm	NA	
Protected Phases		4									6	
Permitted Phases										6		
Actuated Green, G (s)		16.0									36.0	
Effective Green, g (s)		16.0									36.0	
Actuated g/C Ratio		0.27									0.60	
Clearance Time (s)		4.0									4.0	
Lane Grp Cap (vph)		1630									1102	
v/s Ratio Prot		c0.16										
v/s Ratio Perm											0.56	
v/c Ratio		0.59									0.94	
Uniform Delay, d1		19.1									11.0	
Progression Factor		0.59									1.00	
Incremental Delay, d2		1.3									15.8	
Delay (s)		12.7									26.8	
Level of Service		B									C	
Approach Delay (s)		12.7			0.0			0.0			26.8	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



HCM Signalized Intersection Capacity Analysis  
 3: Madison St. /Madison. St. & 6th St.

PM Base+Prj. MITIGATED

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	
Volume (vph)	0	0	0	11	222	0	0	0	0	0	724	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0						4.0	
Lane Util. Factor					0.91						1.00	
Frt					1.00						0.97	
Flt Protected					1.00						1.00	
Satd. Flow (prot)					5073						1812	
Flt Permitted					1.00						1.00	
Satd. Flow (perm)					5073						1812	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	12	241	0	0	0	0	0	787	198
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	15	0
Lane Group Flow (vph)	0	0	0	0	241	0	0	0	0	0	970	0
Turn Type				Perm	NA							NA
Protected Phases					8						6	
Permitted Phases				8								
Actuated Green, G (s)					20.0						32.0	
Effective Green, g (s)					20.0						32.0	
Actuated g/C Ratio					0.33						0.53	
Clearance Time (s)					4.0						4.0	
Lane Grp Cap (vph)					1691						966	
v/s Ratio Prot											c0.54	
v/s Ratio Perm					0.05							
v/c Ratio					0.14						1.00	
Uniform Delay, d1					14.0						14.0	
Progression Factor					1.00						0.84	
Incremental Delay, d2					0.2						21.7	
Delay (s)					14.2						33.5	
Level of Service					B						C	
Approach Delay (s)		0.0			14.2			0.0			33.5	
Approach LOS		A			B			A			C	

Intersection Summary

HCM 2000 Control Delay	29.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 4: Madison St./Madison St. & 5th St.

PM Base+Prj. MITIGATED

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑										↔
Volume (vph)	0	781	26	0	0	0	0	0	0	700	74	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		0.91									1.00	
Frt		1.00									1.00	
Flt Protected		1.00									0.96	
Satd. Flow (prot)		4555									1604	
Flt Permitted		1.00									0.96	
Satd. Flow (perm)		4555									1604	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	849	28	0	0	0	0	0	0	761	80	0
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	0	0	29	0
Lane Group Flow (vph)	0	871	0	0	0	0	0	0	0	0	812	0
Turn Type		NA								Prot	NA	
Protected Phases		4								1	6	
Permitted Phases												
Actuated Green, G (s)		23.0									29.0	
Effective Green, g (s)		23.0									29.0	
Actuated g/C Ratio		0.38									0.48	
Clearance Time (s)		4.0									4.0	
Lane Grp Cap (vph)		1746									775	
v/s Ratio Prot		c0.19									c0.51	
v/s Ratio Perm												
v/c Ratio		0.50									1.05	
Uniform Delay, d1		14.1									15.5	
Progression Factor		0.69									0.66	
Incremental Delay, d2		0.6									32.8	
Delay (s)		10.4									43.1	
Level of Service		B									D	
Approach Delay (s)		10.4			0.0			0.0			43.1	
Approach LOS		B			A			A			D	

Intersection Summary

HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 1: Madison St. & 8th St.

Movement	WB	WB	WB	WB	SB
Directions Served	LT	T	T	T	TR
Maximum Queue (ft)	212	202	84	74	268
Average Queue (ft)	179	80	18	26	230
95th Queue (ft)	235	176	55	61	260
Link Distance (ft)	189	189	189	189	213
Upstream Blk Time (%)	11	1			74
Queuing Penalty (veh)	0	0			0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Madison. St./Madison St. & 7th St.

Movement	EB	EB	EB	EB	SB
Directions Served	T	T	T	TR	LT
Maximum Queue (ft)	54	38	223	275	274
Average Queue (ft)	27	12	33	170	240
95th Queue (ft)	53	37	165	359	305
Link Distance (ft)	322	322	322	322	258
Upstream Blk Time (%)			0	11	7
Queuing Penalty (veh)			0	18	55
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Madison St. /Madison. St. & 6th St.

Movement	WB	WB	WB	SB
Directions Served	LT	T	T	TR
Maximum Queue (ft)	45	135	53	174
Average Queue (ft)	11	54	11	146
95th Queue (ft)	37	102	37	173
Link Distance (ft)	195	195	195	135
Upstream Blk Time (%)				29
Queuing Penalty (veh)				235
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 4: Madison St./Madison St. & 5th St.

Movement	EB	EB	EB	SB
Directions Served	T	T	TR	LT
Maximum Queue (ft)	81	76	86	272
Average Queue (ft)	37	27	34	142
95th Queue (ft)	69	60	68	209
Link Distance (ft)	307	307	307	329
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Madison St. & 4th St.

Movement	WB	NB	SB	SB
Directions Served	LT	LTR	L	TR
Maximum Queue (ft)	7	39	30	60
Average Queue (ft)	0	19	15	31
95th Queue (ft)	4	44	39	49
Link Distance (ft)		478	208	208
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Madison St. & 2nd St.

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	20	37	46
Average Queue (ft)	1	16	21
95th Queue (ft)	11	41	45
Link Distance (ft)	164	60	478
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1: Madison St. & 8th St.

Movement	WB	WB	WB	WB	SB
Directions Served	LT	T	T	T	TR
Maximum Queue (ft)	226	196	90	52	259
Average Queue (ft)	180	90	12	11	233
95th Queue (ft)	239	186	50	39	250
Link Distance (ft)	189	189	189	189	213
Upstream Blk Time (%)	14	1			77
Queuing Penalty (veh)	0	0			0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Madison. St./Madison St. & 7th St.

Movement	EB	EB	EB	EB	SB
Directions Served	T	T	T	TR	LT
Maximum Queue (ft)	73	79	255	321	276
Average Queue (ft)	42	29	56	152	260
95th Queue (ft)	71	63	162	300	297
Link Distance (ft)	322	322	322	322	258
Upstream Blk Time (%)			0	3	13
Queuing Penalty (veh)			0	9	138
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Madison St. /Madison. St. & 6th St.

Movement	WB	WB	WB	SB
Directions Served	LT	T	T	TR
Maximum Queue (ft)	44	164	64	170
Average Queue (ft)	9	72	16	142
95th Queue (ft)	33	127	49	158
Link Distance (ft)	195	195	195	135
Upstream Blk Time (%)		0		20
Queuing Penalty (veh)		0		204
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 4: Madison St./Madison St. & 5th St.

Movement	EB	EB	EB	SB
Directions Served	T	T	TR	LT
Maximum Queue (ft)	126	132	94	199
Average Queue (ft)	61	48	44	139
95th Queue (ft)	105	92	85	186
Link Distance (ft)	307	307	307	329
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Madison St. & 4th St.

Movement	EB	WB	NB	SB	SB
Directions Served	TR	LT	LTR	L	TR
Maximum Queue (ft)	7	28	37	43	65
Average Queue (ft)	0	1	19	16	32
95th Queue (ft)	4	12	44	42	56
Link Distance (ft)			478	208	208
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Madison St. & 2nd St.

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	28	30	31
Average Queue (ft)	1	6	22
95th Queue (ft)	11	27	44
Link Distance (ft)	164	60	478
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Synchro-Simtraffic (Software 8) AM and PM Peak Hour Intersection Level-of-Service Calculations:**

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Crossing #2 (Alameda Only)

AM Baseline (No Project)

PM Baseline (No Project)

AM Baseline plus Project

PM Baseline plus Project

HCM Signalized Intersection Capacity Analysis  
 1: Island Dr. & Robert Davey Jr.

C2AM2020Baseline(NP)  
 2/16/2016



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	762	146	167	783	542	425
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	828	159	182	851	589	462
RTOR Reduction (vph)	0	100	0	0	0	103
Lane Group Flow (vph)	828	59	182	851	589	359
Turn Type	NA	Perm	Prot	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	29.4	29.4	14.6	54.3	35.7	65.1
Effective Green, g (s)	29.4	29.4	14.6	54.3	35.7	65.1
Actuated g/C Ratio	0.32	0.32	0.16	0.59	0.39	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1100	507	281	2095	1377	1192
v/s Ratio Prot	c0.24		c0.10	c0.24	0.17	0.10
v/s Ratio Perm		0.04				0.13
v/c Ratio	0.75	0.12	0.65	0.41	0.43	0.30
Uniform Delay, d1	27.9	22.0	36.1	10.0	20.5	4.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.1	5.1	0.6	1.0	0.1
Delay (s)	30.9	22.1	41.2	10.6	21.5	5.1
Level of Service	C	C	D	B	C	A
Approach Delay (s)	29.4			16.0	14.3	
Approach LOS	C			B	B	

**Intersection Summary**

HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	91.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	3	0	0	1041	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	3	0	0	1132	4
Number of Lanes	0	1	0	0	2	0

**Major/Minor Major 2**

Conflicting Flow All	1134	567	-	0
Stage 1	1134	-	-	-
Stage 2	0	-	-	-
Follow-up Headway	3.52	3.32	-	-
Pot Capacity-1 Maneuver	157	467	-	-
Stage 1	216	-	-	-
Stage 2	-	-	-	-
Time blocked-Platoon, %	0	0	-	-
Mov Capacity-1 Maneuver	157	467	-	-
Mov Capacity-2 Maneuver	157	-	-	-
Stage 1	216	-	-	-
Stage 2	-	-	-	-

**Approach EB SB**

HCM Control Delay, s 12.8 0  
HCM LOS B -

**Minor Lane / Major Mvmt EBLn1 SBT SBR**

Cap, veh/h 467 - -  
HCM Control Delay, s 12.8 - -  
HCM Lane V/C Ratio 0.01 - -  
HCM Lane LOS B - -  
HCM 95th-tile Q, veh 0.0 - -

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1306	42	0	0	0	34
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1420	46	0	0	0	37
Number of Lanes	2	0	0	0	0	1

**Major/Minor Major 1**

Conflicting Flow All	0	0		1442	732
Stage 1	-	-		1442	-
Stage 2	-	-		0	-
Follow-up Headway	-	-		3.52	3.32
Pot Capacity-1 Maneuver	-	-		93	364
Stage 1	-	-		139	-
Stage 2	-	-		-	-
Time blocked-Platoon, %	-	-		0	0
Mov Capacity-1 Maneuver	-	-		93	364
Mov Capacity-2 Maneuver	-	-		93	-
Stage 1	-	-		139	-
Stage 2	-	-		-	-

**Approach EB NB**

HCM Control Delay, s	0	16
HCM LOS	-	C

**Minor Lane / Major Mvmt NBLn1 EBT EBR**

Cap, veh/h	364	-	-
HCM Control Delay, s	16	-	-
HCM Lane V/C Ratio	0.10	-	-
HCM Lane LOS	C	-	-
HCM 95th-tile Q, veh	0.3	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	12	34	12	892	529	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	37	13	970	575	15
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

	Major 1				Major 2	
Conflicting Flow All	1579	583	590	0	-	0
Stage 1	583	-	-	-	-	-
Stage 2	996	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	120	512	985	-	-	-
Stage 1	558	-	-	-	-	-
Stage 2	357	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-	-
Mov Capacity-1 Maneuver	117	512	985	-	-	-
Mov Capacity-2 Maneuver	117	-	-	-	-	-
Stage 1	558	-	-	-	-	-
Stage 2	347	-	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	21.2	0.1	0
HCM LOS	C	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	985	-	272	-	-
HCM Control Delay, s	8.704	0	21.2	-	-
HCM Lane V/C Ratio	0.01	-	0.18	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th-tile Q, veh	0.0	-	0.7	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	47	1	1	32	3	6	2	5	1	1	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	51	1	1	35	3	7	2	5	1	1	2
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	38	0	0	52	0	0	96	96	52	99	96	36
Stage 1	-	-	-	-	-	-	56	56	-	39	39	-
Stage 2	-	-	-	-	-	-	40	40	-	60	57	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1572	-	-	1554	-	-	887	794	1016	883	794	1037
Stage 1	-	-	-	-	-	-	956	848	-	976	862	-
Stage 2	-	-	-	-	-	-	975	862	-	951	847	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1572	-	-	1554	-	-	883	792	1016	875	792	1037
Mov Capacity-2 Maneuver	-	-	-	-	-	-	883	792	-	875	792	-
Stage 1	-	-	-	-	-	-	955	847	-	975	861	-
Stage 2	-	-	-	-	-	-	971	861	-	943	846	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.2	9	8.9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	913	1572	-	-	1554	-	-	923
HCM Control Delay, s	9	7.293	0	-	7.318	0	-	8.9
HCM Lane V/C Ratio	0.01	0.00	-	-	0.00	-	-	0.01
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	49	4	2	33	5	0	17	2	4	8	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	53	4	2	36	5	0	18	2	4	9	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	41	0	0	58	0	0	110	108	55	115	107	39
Stage 1	-	-	-	-	-	-	62	62	-	43	43	-
Stage 2	-	-	-	-	-	-	48	46	-	72	64	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1568	-	-	1546	-	-	868	782	1012	862	783	1033
Stage 1	-	-	-	-	-	-	949	843	-	971	859	-
Stage 2	-	-	-	-	-	-	965	857	-	938	842	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1568	-	-	1546	-	-	858	780	1012	843	781	1033
Mov Capacity-2 Maneuver	-	-	-	-	-	-	858	780	-	843	781	-
Stage 1	-	-	-	-	-	-	947	841	-	969	858	-
Stage 2	-	-	-	-	-	-	953	856	-	914	840	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.4	9.6	9.5
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	799	1568	-	-	1546	-	-	815
HCM Control Delay, s	9.6	7.301	0	-	7.332	0	-	9.5
HCM Lane V/C Ratio	0.03	0.00	-	-	0.00	-	-	0.02
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.1

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	12	36	12	2	6	25	12	301	5	15	301	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	39	13	2	7	27	13	327	5	16	327	10
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	738	724	332	747	726	330	337	0	0	333	0	0
Stage 1	365	365	-	356	356	-	-	-	-	-	-	-
Stage 2	373	359	-	391	370	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	334	352	710	329	351	712	1222	-	-	1226	-	-
Stage 1	654	623	-	661	629	-	-	-	-	-	-	-
Stage 2	648	627	-	633	620	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	310	342	710	288	341	712	1222	-	-	1226	-	-
Mov Capacity-2 Maneuver	310	342	-	288	341	-	-	-	-	-	-	-
Stage 1	645	613	-	652	621	-	-	-	-	-	-	-
Stage 2	609	619	-	572	610	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	16.7	12	0.3	0.4
HCM LOS	C	B	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1222	-	-	373	553	1226	-	-
HCM Control Delay, s	7.978	0	-	16.7	12	7.976	0	-
HCM Lane V/C Ratio	0.01	-	-	0.18	0.07	0.01	-	-
HCM Lane LOS	A	A	-	C	B	A	A	-
HCM 95th-tile Q, veh	0.0	-	-	0.6	0.2	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	55	22	2	41	2	24	34	1	1	36	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	60	24	2	45	2	26	37	1	1	39	3
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.5	7.5	7.7	7.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	41%	5%	4%	3%
Vol Thru, %	58%	68%	91%	90%
Vol Right, %	2%	27%	4%	7%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	59	81	45	40
LT Vol	34	55	41	36
Through Vol	1	22	2	3
RT Vol	24	4	2	1
Lane Flow Rate	64	88	49	43
Geometry Grp	1	1	1	1
Degree of Util (X)	0.076	0.098	0.057	0.05
Departure Headway (Hd)	4.275	4.005	4.171	4.179
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	829	885	848	845
Service Time	2.351	2.076	2.248	2.263
HCM Lane V/C Ratio	0.077	0.099	0.058	0.051
HCM Control Delay	7.7	7.5	7.5	7.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.3	0.2	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	17	70	3	4	36	41	2	59	3	14	17	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	76	3	4	39	45	2	64	3	15	18	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.8	7.4	7.7	7.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	3%	19%	5%	44%
Vol Thru, %	92%	78%	44%	53%
Vol Right, %	5%	3%	51%	3%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	64	90	81	32
LT Vol	59	70	36	17
Through Vol	3	3	41	1
RT Vol	2	17	4	14
Lane Flow Rate	70	98	88	35
Geometry Grp	1	1	1	1
Degree of Util (X)	0.082	0.114	0.095	0.043
Departure Headway (Hd)	4.259	4.201	3.897	4.482
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	828	843	905	804
Service Time	2.354	2.279	1.983	2.482
HCM Lane V/C Ratio	0.085	0.116	0.097	0.044
HCM Control Delay	7.7	7.8	7.4	7.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.3	0.4	0.3	0.1

**Notes**

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**Intersection**

Intersection Delay, s/veh 2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	77	2	2	36	2	5	12	5	9	6	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	84	2	2	39	2	5	13	5	10	7	7
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	41	0	0	86	0	0	144	139	85	148	140	40
Stage 1	-	-	-	-	-	-	93	93	-	45	45	-
Stage 2	-	-	-	-	-	-	51	46	-	103	95	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1568	-	-	1510	-	-	825	752	974	820	751	1031
Stage 1	-	-	-	-	-	-	914	818	-	969	857	-
Stage 2	-	-	-	-	-	-	962	857	-	903	816	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1568	-	-	1510	-	-	812	749	974	802	748	1031
Mov Capacity-2 Maneuver	-	-	-	-	-	-	812	749	-	802	748	-
Stage 1	-	-	-	-	-	-	911	816	-	966	856	-
Stage 2	-	-	-	-	-	-	948	856	-	881	814	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.4	9.6	9.4
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	805	1568	-	-	1510	-	-	838
HCM Control Delay, s	9.6	7.302	0	-	7.388	0	-	9.4
HCM Lane V/C Ratio	0.03	0.00	-	-	0.00	-	-	0.03
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.1

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
1: Island Dr. & Robert Davey Jr.

C2PM2020Baseline(NP)  
2/16/2016



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	419	100	92	698	819	661
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	455	109	100	759	890	718
RTOR Reduction (vph)	0	86	0	0	0	81
Lane Group Flow (vph)	455	23	100	759	890	637
Turn Type	NA	Perm	Prot	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	19.8	19.8	8.7	65.0	52.3	72.1
Effective Green, g (s)	19.8	19.8	8.7	65.0	52.3	72.1
Actuated g/C Ratio	0.21	0.21	0.09	0.70	0.56	0.78
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	732	337	165	2478	1994	1298
v/s Ratio Prot	c0.13		c0.06	0.21	0.25	c0.10
v/s Ratio Perm		0.01				0.30
v/c Ratio	0.62	0.07	0.61	0.31	0.45	0.49
Uniform Delay, d1	33.1	29.1	40.4	5.3	11.8	3.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1	6.2	0.3	0.7	0.3
Delay (s)	34.8	29.2	46.6	5.6	12.5	4.0
Level of Service	C	C	D	A	B	A
Approach Delay (s)	33.7			10.4	8.7	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	92.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	3	0	0	1465	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	3	0	0	1592	2
Number of Lanes	0	1	0	0	2	0

**Major/Minor Major 2**

Conflicting Flow All	1593	796	-	0
Stage 1	1593	-	-	-
Stage 2	0	-	-	-
Follow-up Headway	3.52	3.32	-	-
Pot Capacity-1 Maneuver	72	330	-	-
Stage 1	112	-	-	-
Stage 2	-	-	-	-
Time blocked-Platoon, %	0	0	-	-
Mov Capacity-1 Maneuver	72	330	-	-
Mov Capacity-2 Maneuver	72	-	-	-
Stage 1	112	-	-	-
Stage 2	-	-	-	-

**Approach EB SB**

HCM Control Delay, s 16 0  
HCM LOS C -

**Minor Lane / Major Mvmt EBLn1 SBT SBR**

Cap, veh/h 330 - -  
HCM Control Delay, s 16 - -  
HCM Lane V/C Ratio 0.01 - -  
HCM Lane LOS C - -  
HCM 95th-tile Q, veh 0.0 - -

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1509	38	0	0	0	48
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1640	41	0	0	0	52
Number of Lanes	2	0	0	0	0	1

**Major/Minor Major 1**

Conflicting Flow All	0	0		1661	840
Stage 1	-	-		1661	-
Stage 2	-	-		0	-
Follow-up Headway	-	-		3.52	3.32
Pot Capacity-1 Maneuver	-	-		64	309
Stage 1	-	-		101	-
Stage 2	-	-		-	-
Time blocked-Platoon, %	-	-		0	0
Mov Capacity-1 Maneuver	-	-		64	309
Mov Capacity-2 Maneuver	-	-		64	-
Stage 1	-	-		101	-
Stage 2	-	-		-	-

**Approach EB NB**

HCM Control Delay, s	0	19
HCM LOS	-	C

**Minor Lane / Major Mvmt NBLn1 EBT EBR**

Cap, veh/h	309	-	-
HCM Control Delay, s	19	-	-
HCM Lane V/C Ratio	0.17	-	-
HCM Lane LOS	C	-	-
HCM 95th-tile Q, veh	0.6	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	3	27	15	759	874	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	29	16	825	950	9
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

	Major 1			Major 2	
Conflicting Flow All	1812	954	959	0	0
Stage 1	954	-	-	-	-
Stage 2	858	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	86	314	717	-	-
Stage 1	374	-	-	-	-
Stage 2	415	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	82	314	717	-	-
Mov Capacity-2 Maneuver	82	-	-	-	-
Stage 1	374	-	-	-	-
Stage 2	398	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	21.9	0.2	0
HCM LOS	C	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	717	-	245	-	-
HCM Control Delay, s	10.138	0	21.9	-	-
HCM Lane V/C Ratio	0.02	-	0.13	-	-
HCM Lane LOS	B	A	C	-	-
HCM 95th-tile Q, veh	0.1	-	0.5	-	-

**Notes**

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**Intersection**

Intersection Delay, s/veh 1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	33	1	0	22	1	5	1	0	1	1	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	36	1	0	24	1	5	1	0	1	1	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	25	0	0	37	0	0	70	68	36	67	67	24
Stage 1	-	-	-	-	-	-	43	43	-	24	24	-
Stage 2	-	-	-	-	-	-	27	25	-	43	43	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1589	-	-	1574	-	-	922	823	1037	926	824	1052
Stage 1	-	-	-	-	-	-	971	859	-	994	875	-
Stage 2	-	-	-	-	-	-	990	874	-	971	859	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1589	-	-	1574	-	-	916	821	1037	924	822	1052
Mov Capacity-2 Maneuver	-	-	-	-	-	-	916	821	-	924	822	-
Stage 1	-	-	-	-	-	-	969	857	-	992	875	-
Stage 2	-	-	-	-	-	-	985	874	-	968	857	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0	9	8.7
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	899	1589	-	-	1574	-	-	983
HCM Control Delay, s	9	7.27	0	-	0	-	-	8.7
HCM Lane V/C Ratio	0.01	0.00	-	-	-	-	-	0.01
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.0

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	38	4	2	24	4	1	3	0	0	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	41	4	2	26	4	1	3	0	0	3	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	30	0	0	46	0	0	82	83	43	82	83	28
Stage 1	-	-	-	-	-	-	48	48	-	33	33	-
Stage 2	-	-	-	-	-	-	34	35	-	49	50	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1583	-	-	1562	-	-	905	807	1027	905	807	1047
Stage 1	-	-	-	-	-	-	965	855	-	983	868	-
Stage 2	-	-	-	-	-	-	982	866	-	964	853	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1583	-	-	1562	-	-	901	805	1027	901	805	1047
Mov Capacity-2 Maneuver	-	-	-	-	-	-	901	805	-	901	805	-
Stage 1	-	-	-	-	-	-	964	854	-	982	867	-
Stage 2	-	-	-	-	-	-	977	865	-	959	852	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.5	9.4	9.5
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	827	1583	-	-	1562	-	-	805
HCM Control Delay, s	9.4	7.277	0	-	7.308	0	-	9.5
HCM Lane V/C Ratio	0.01	0.00	-	-	0.00	-	-	0.00
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.0

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	23	14	2	16	7	8	210	5	16	336	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	25	15	2	17	8	9	228	5	17	365	9
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	665	655	370	672	657	231	374	0	0	234	0	0
Stage 1	404	404	-	248	248	-	-	-	-	-	-	-
Stage 2	261	251	-	424	409	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	374	386	676	370	385	808	1184	-	-	1333	-	-
Stage 1	623	599	-	756	701	-	-	-	-	-	-	-
Stage 2	744	699	-	608	596	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	351	376	676	337	375	808	1184	-	-	1333	-	-
Mov Capacity-2 Maneuver	351	376	-	337	375	-	-	-	-	-	-	-
Stage 1	617	589	-	749	695	-	-	-	-	-	-	-
Stage 2	712	693	-	560	586	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.2	13.8	0.3	0.3
HCM LOS	B	B	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1184	-	-	437	437	1333	-	-
HCM Control Delay, s	8.063	0	-	14.2	13.8	7.736	0	-
HCM Lane V/C Ratio	0.01	-	-	0.10	0.06	0.01	-	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th-tile Q, veh	0.0	-	-	0.3	0.2	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh	7.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	46	11	1	21	2	11	22	1	3	24	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	50	12	1	23	2	12	24	1	3	26	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.3	7.2	7.4	7.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	32%	7%	4%	10%
Vol Thru, %	65%	75%	88%	77%
Vol Right, %	3%	18%	8%	13%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	34	61	24	31
LT Vol	22	46	21	24
Through Vol	1	11	2	4
RT Vol	11	4	1	3
Lane Flow Rate	37	66	26	34
Geometry Grp	1	1	1	1
Degree of Util (X)	0.043	0.073	0.029	0.038
Departure Headway (Hd)	4.167	3.981	4.066	4.064
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	855	896	876	876
Service Time	2.213	2.022	2.113	2.112
HCM Lane V/C Ratio	0.043	0.074	0.03	0.039
HCM Control Delay	7.4	7.3	7.2	7.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.2	0.1	0.1

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh	7.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	53	4	3	26	8	3	32	5	17	27	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	58	4	3	28	9	3	35	5	18	29	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.5	7.3	7.4	7.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	7%	10%	8%	33%
Vol Thru, %	80%	84%	70%	53%
Vol Right, %	12%	6%	22%	14%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	40	63	37	51
LT Vol	32	53	26	27
Through Vol	5	4	8	7
RT Vol	3	6	3	17
Lane Flow Rate	43	68	40	55
Geometry Grp	1	1	1	1
Degree of Util (X)	0.05	0.078	0.045	0.064
Departure Headway (Hd)	4.106	4.118	4.045	4.141
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	864	863	876	858
Service Time	2.169	2.176	2.111	2.201
HCM Lane V/C Ratio	0.05	0.079	0.046	0.064
HCM Control Delay	7.4	7.5	7.3	7.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.3	0.1	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	55	5	3	34	1	19	15	1	6	19	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	60	5	3	37	1	21	16	1	7	21	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	38	0	0	65	0	0	128	118	63	126	120	38
Stage 1	-	-	-	-	-	-	73	73	-	44	44	-
Stage 2	-	-	-	-	-	-	55	45	-	82	76	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1572	-	-	1537	-	-	845	772	1002	848	770	1034
Stage 1	-	-	-	-	-	-	937	834	-	970	858	-
Stage 2	-	-	-	-	-	-	957	857	-	926	832	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1572	-	-	1537	-	-	824	768	1002	830	766	1034
Mov Capacity-2 Maneuver	-	-	-	-	-	-	824	768	-	830	766	-
Stage 1	-	-	-	-	-	-	934	831	-	967	856	-
Stage 2	-	-	-	-	-	-	931	855	-	904	830	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.6	9.7	9.7
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	803	1572	-	-	1537	-	-	788
HCM Control Delay, s	9.7	7.298	0	-	7.347	0	-	9.7
HCM Lane V/C Ratio	0.05	0.00	-	-	0.00	-	-	0.04
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.1

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 1: Island Dr. & Robert Davey Jr.

C2AM2020Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	762	146	167	798	557	425
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	828	159	182	867	605	462
RTOR Reduction (vph)	0	100	0	0	0	103
Lane Group Flow (vph)	828	59	182	867	605	359
Turn Type	NA	Perm	Prot	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	29.4	29.4	14.6	54.3	35.7	65.1
Effective Green, g (s)	29.4	29.4	14.6	54.3	35.7	65.1
Actuated g/C Ratio	0.32	0.32	0.16	0.59	0.39	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1100	507	281	2095	1377	1192
v/s Ratio Prot	c0.24		c0.10	c0.24	0.17	0.10
v/s Ratio Perm		0.04				0.13
v/c Ratio	0.75	0.12	0.65	0.41	0.44	0.30
Uniform Delay, d1	27.9	22.0	36.1	10.1	20.6	4.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.1	5.1	0.6	1.0	0.1
Delay (s)	30.9	22.1	41.2	10.7	21.6	5.1
Level of Service	C	C	D	B	C	A
Approach Delay (s)	29.4			16.0	14.5	
Approach LOS	C			B	B	

**Intersection Summary**

HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	91.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	3	0	0	1041	34
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	3	0	0	1132	37
Number of Lanes	0	1	0	0	2	0

**Major/Minor Major 2**

Conflicting Flow All	1150	583	-	0
Stage 1	1150	-	-	-
Stage 2	0	-	-	-
Follow-up Headway	3.52	3.32	-	-
Pot Capacity-1 Maneuver	153	456	-	-
Stage 1	211	-	-	-
Stage 2	-	-	-	-
Time blocked-Platoon, %	0	0	-	-
Mov Capacity-1 Maneuver	153	456	-	-
Mov Capacity-2 Maneuver	153	-	-	-
Stage 1	211	-	-	-
Stage 2	-	-	-	-

**Approach EB SB**

HCM Control Delay, s	13	0
HCM LOS	B	-

**Minor Lane / Major Mvmt EBLn1 SBT SBR**

Cap, veh/h	456	-	-
HCM Control Delay, s	13	-	-
HCM Lane V/C Ratio	0.01	-	-
HCM Lane LOS	B	-	-
HCM 95th-tile Q, veh	0.0	-	-

**Notes**

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**Intersection**

Intersection Delay, s/veh 0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1306	72	0	0	0	34
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1420	78	0	0	0	37
Number of Lanes	2	0	0	0	0	1

**Major/Minor Major 1**

Conflicting Flow All	0	0		1459	748
Stage 1	-	-		1459	-
Stage 2	-	-		0	-
Follow-up Headway	-	-		3.52	3.32
Pot Capacity-1 Maneuver	-	-		90	355
Stage 1	-	-		136	-
Stage 2	-	-		-	-
Time blocked-Platoon, %	-	-		0	0
Mov Capacity-1 Maneuver	-	-		90	355
Mov Capacity-2 Maneuver	-	-		90	-
Stage 1	-	-		136	-
Stage 2	-	-		-	-

**Approach EB NB**

HCM Control Delay, s	0	16.3
HCM LOS	-	C

**Minor Lane / Major Mvmt NBLn1 EBT EBR**

Cap, veh/h	355	-	-
HCM Control Delay, s	16.3	-	-
HCM Lane V/C Ratio	0.10	-	-
HCM Lane LOS	C	-	-
HCM 95th-tile Q, veh	0.3	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	12	35	33	899	532	31
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	38	36	977	578	34
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

	Major 1			Major 2	
Conflicting Flow All	1644	595	612	0	0
Stage 1	595	-	-	-	-
Stage 2	1049	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	110	504	967	-	-
Stage 1	551	-	-	-	-
Stage 2	337	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	101	504	967	-	-
Mov Capacity-2 Maneuver	101	-	-	-	-
Stage 1	551	-	-	-	-
Stage 2	310	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	23.1	0.3	0
HCM LOS	C	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	967	-	250	-	-
HCM Control Delay, s	8.866	0	23.1	-	-
HCM Lane V/C Ratio	0.04	-	0.20	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th-tile Q, veh	0.1	-	0.7	-	-

**Notes**

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**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	46	0	35	0	17	5	1	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	50	0	38	0	18	5	1	3	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	38	0	0	0	0	0	121	138	0	131	119	19
Stage 1	-	-	-	-	-	-	0	0	-	119	119	-
Stage 2	-	-	-	-	-	-	121	138	-	12	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1572	-	-	-	-	-	854	753	-	841	771	1059
Stage 1	-	-	-	-	-	-	-	-	-	885	797	-
Stage 2	-	-	-	-	-	-	883	782	-	1009	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1572	-	-	-	-	-	851	753	-	-	771	1059
Mov Capacity-2 Maneuver	-	-	-	-	-	-	851	753	-	-	771	-
Stage 1	-	-	-	-	-	-	-	-	-	885	797	-
Stage 2	-	-	-	-	-	-	879	782	-	1009	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	1572	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	-	-	-	-
HCM 95th-tile Q, veh	-	0.0	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	35	0	0	28	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	38	0	0	30	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	0	0	0	15	0	0	19	0	0
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	15	0	-	19	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	-	-	-	1001	-	-	995	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	1005	-	-	1000	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	1005	-	-	1000	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	333	0	0	340	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	362	0	0	370	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	732	732	370	732	732	362	370	0	0	362	0	0
Stage 1	370	370	-	362	362	-	-	-	-	-	-	-
Stage 2	362	362	-	370	370	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	337	348	676	337	348	683	1189	-	-	1197	-	-
Stage 1	650	620	-	657	625	-	-	-	-	-	-	-
Stage 2	657	625	-	650	620	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	337	348	676	337	348	683	1189	-	-	1197	-	-
Mov Capacity-2 Maneuver	337	348	-	337	348	-	-	-	-	-	-	-
Stage 1	650	620	-	657	625	-	-	-	-	-	-	-
Stage 2	657	625	-	650	620	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	0
HCM LOS	A	A	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1189	-	-	0	0	1197	-	-
HCM Control Delay, s	0	-	-	0	0	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th-tile Q, veh	0.0	-	-	-	-	0.0	-	-

**Notes**

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**Intersection**

Intersection Delay, s/veh	7.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	74	0	0	65	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	80	0	0	71	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	0	0	7.4	7.3
HCM LOS	-	-	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	0%	0%
Vol Thru, %	100%	100%	100%	100%
Vol Right, %	0%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	74	0	0	65
LT Vol	74	0	0	65
Through Vol	0	0	0	0
RT Vol	0	0	0	0
Lane Flow Rate	80	0	0	71
Geometry Grp	1	1	1	1
Degree of Util (X)	0.089	0	0	0.078
Departure Headway (Hd)	3.986	4.193	4.193	3.993
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	902	0	0	899
Service Time	1.999	2.256	2.256	2.008
HCM Lane V/C Ratio	0.089	0	0	0.079
HCM Control Delay	7.4	7.3	7.3	7.3
HCM Lane LOS	A	N	N	A
HCM 95th-tile Q	0.3	0	0	0.3

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh	7.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	79	0	0	44	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	86	0	0	48	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	0	0	7.4	7.2
HCM LOS	-	-	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	0%	0%
Vol Thru, %	100%	100%	100%	100%
Vol Right, %	0%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	79	0	0	44
LT Vol	79	0	0	44
Through Vol	0	0	0	0
RT Vol	0	0	0	0
Lane Flow Rate	86	0	0	48
Geometry Grp	1	1	1	1
Degree of Util (X)	0.095	0	0	0.053
Departure Headway (Hd)	3.97	4.164	4.164	3.997
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	906	0	0	898
Service Time	1.978	2.22	2.22	2.013
HCM Lane V/C Ratio	0.095	0	0	0.053
HCM Control Delay	7.4	7.2	7.2	7.2
HCM Lane LOS	A	N	N	A
HCM 95th-tile Q	0.3	0	0	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	0	83	0	0	0	5	37	0	0	36	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	90	0	0	0	5	40	0	0	39	7
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	90	0	0	77	54	45	74	99	0
Stage 1	-	-	-	-	-	-	54	54	-	0	0	-
Stage 2	-	-	-	-	-	-	23	0	-	74	99	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	1505	-	-	912	837	1025	916	791	-
Stage 1	-	-	-	-	-	-	958	850	-	-	-	-
Stage 2	-	-	-	-	-	-	995	-	-	935	813	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	1505	-	-	-	837	1025	882	791	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	837	-	882	791	-
Stage 1	-	-	-	-	-	-	958	850	-	-	-	-
Stage 2	-	-	-	-	-	-	995	-	-	891	813	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	1505	-	-	-
HCM Control Delay, s	-	-	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	-	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	0.0	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 1: Island Dr. & Robert Davey Jr.

C2PM2020Baseline\_w/Prj.  
 2/16/2016



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	419	100	92	713	834	661
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	455	109	100	775	907	718
RTOR Reduction (vph)	0	86	0	0	0	81
Lane Group Flow (vph)	455	23	100	775	907	637
Turn Type	NA	Perm	Prot	NA	NA	pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	19.8	19.8	8.7	65.0	52.3	72.1
Effective Green, g (s)	19.8	19.8	8.7	65.0	52.3	72.1
Actuated g/C Ratio	0.21	0.21	0.09	0.70	0.56	0.78
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	732	337	165	2478	1994	1298
v/s Ratio Prot	c0.13		c0.06	0.22	0.26	c0.10
v/s Ratio Perm		0.01				0.30
v/c Ratio	0.62	0.07	0.61	0.31	0.45	0.49
Uniform Delay, d1	33.1	29.1	40.4	5.3	11.9	3.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1	6.2	0.3	0.8	0.3
Delay (s)	34.8	29.2	46.6	5.7	12.6	4.0
Level of Service	C	C	D	A	B	A
Approach Delay (s)	33.7			10.3	8.8	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	92.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	33	0	0	1465	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	36	0	0	1592	2
Number of Lanes	0	1	0	0	2	0

**Major/Minor Major 2**

Conflicting Flow All	1593	796	-	0
Stage 1	1593	-	-	-
Stage 2	0	-	-	-
Follow-up Headway	3.52	3.32	-	-
Pot Capacity-1 Maneuver	72	330	-	-
Stage 1	112	-	-	-
Stage 2	-	-	-	-
Time blocked-Platoon, %	0	0	-	-
Mov Capacity-1 Maneuver	72	330	-	-
Mov Capacity-2 Maneuver	72	-	-	-
Stage 1	112	-	-	-
Stage 2	-	-	-	-

**Approach EB SB**

HCM Control Delay, s	17.2	0
HCM LOS	C	-

**Minor Lane / Major Mvmt EBLn1 SBT SBR**

Cap, veh/h	330	-	-
HCM Control Delay, s	17.2	-	-
HCM Lane V/C Ratio	0.11	-	-
HCM Lane LOS	C	-	-
HCM 95th-tile Q, veh	0.4	-	-

**Notes**

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**Intersection**

Intersection Delay, s/veh 1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1509	38	0	0	0	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	None	None	None	None	None	None
Storage Length		0	0		0	0
Median Width	0			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1640	41	0	0	0	85
Number of Lanes	2	0	0	0	0	1

**Major/Minor Major 1**

Conflicting Flow All	0	0			1661	840
Stage 1	-	-			1661	-
Stage 2	-	-			0	-
Follow-up Headway	-	-			3.52	3.32
Pot Capacity-1 Maneuver	-	-			64	309
Stage 1	-	-			101	-
Stage 2	-	-			-	-
Time blocked-Platoon, %	-	-			0	0
Mov Capacity-1 Maneuver	-	-			64	309
Mov Capacity-2 Maneuver	-	-			64	-
Stage 1	-	-			101	-
Stage 2	-	-			-	-

**Approach EB NB**

HCM Control Delay, s	0	21
HCM LOS	-	C

**Minor Lane / Major Mvmt NBLn1 EBT EBR**

Cap, veh/h	309	-	-
HCM Control Delay, s	21	-	-
HCM Lane V/C Ratio	0.27	-	-
HCM Lane LOS	C	-	-
HCM 95th-tile Q, veh	1.1	-	-

**Notes**

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**Intersection**

Intersection Delay, s/veh 0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	10	35	22	759	874	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	38	24	825	950	16
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

	Major 1			Major 2	
Conflicting Flow All	1831	958	966	0	0
Stage 1	958	-	-	-	-
Stage 2	873	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	84	312	713	-	-
Stage 1	373	-	-	-	-
Stage 2	409	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	79	312	713	-	-
Mov Capacity-2 Maneuver	79	-	-	-	-
Stage 1	373	-	-	-	-
Stage 2	384	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	30.8	0.3	0
HCM LOS	D	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	713	-	188	-	-
HCM Control Delay, s	10.224	0	30.8	-	-
HCM Lane V/C Ratio	0.03	-	0.26	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th-tile Q, veh	0.1	-	1.0	-	-

**Notes**

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**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	23	0	6	15	15	5	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	25	0	7	16	16	5	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	25	0	0	0	0	0	15	25	0	24	13	13
Stage 1	-	-	-	-	-	-	0	0	-	13	13	-
Stage 2	-	-	-	-	-	-	15	25	-	11	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1589	-	-	-	-	-	1001	868	-	987	881	1067
Stage 1	-	-	-	-	-	-	-	-	-	1007	885	-
Stage 2	-	-	-	-	-	-	1005	874	-	1010	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1589	-	-	-	-	-	996	868	-	-	881	1067
Mov Capacity-2 Maneuver	-	-	-	-	-	-	996	868	-	-	881	-
Stage 1	-	-	-	-	-	-	-	-	-	1007	885	-
Stage 2	-	-	-	-	-	-	999	874	-	1010	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	1589	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	0.0	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	19	0	0	18	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	21	0	0	20	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	0	0	0	10	0	0	10	0	0
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	10	0	-	10	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	-	-	-	1008	-	-	1008	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	1011	-	-	1011	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	1011	-	-	1011	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	238	0	0	375	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	259	0	0	408	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	667	667	408	667	667	259	408	0	0	259	0	0
Stage 1	408	408	-	259	259	-	-	-	-	-	-	-
Stage 2	259	259	-	408	408	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	372	380	643	372	380	780	1151	-	-	1306	-	-
Stage 1	620	597	-	746	694	-	-	-	-	-	-	-
Stage 2	746	694	-	620	597	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	372	380	643	372	380	780	1151	-	-	1306	-	-
Mov Capacity-2 Maneuver	372	380	-	372	380	-	-	-	-	-	-	-
Stage 1	620	597	-	746	694	-	-	-	-	-	-	-
Stage 2	746	694	-	620	597	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	0
HCM LOS	A	A	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1151	-	-	0	0	1306	-	-
HCM Control Delay, s	0	-	-	0	0	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th-tile Q, veh	0.0	-	-	-	-	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh	7.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	49	0	0	46	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	53	0	0	50	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	0	0	7.2	7.2
HCM LOS	-	-	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	0%	0%
Vol Thru, %	100%	100%	100%	100%
Vol Right, %	0%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	49	0	0	46
LT Vol	49	0	0	46
Through Vol	0	0	0	0
RT Vol	0	0	0	0
Lane Flow Rate	53	0	0	50
Geometry Grp	1	1	1	1
Degree of Util (X)	0.059	0	0	0.055
Departure Headway (Hd)	3.971	4.11	4.11	3.973
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	905	0	0	905
Service Time	1.98	2.155	2.155	1.983
HCM Lane V/C Ratio	0.059	0	0	0.055
HCM Control Delay	7.2	7.2	7.2	7.2
HCM Lane LOS	A	N	N	A
HCM 95th-tile Q	0.2	0	0	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh	7.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	55	0	0	66	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	60	0	0	72	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	0	0	7.3	7.3
HCM LOS	-	-	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	0%	0%
Vol Thru, %	100%	100%	100%	100%
Vol Right, %	0%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	55	0	0	66
LT Vol	55	0	0	66
Through Vol	0	0	0	0
RT Vol	0	0	0	0
Lane Flow Rate	60	0	0	72
Geometry Grp	1	1	1	1
Degree of Util (X)	0.066	0	0	0.079
Departure Headway (Hd)	3.987	4.16	4.16	3.978
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	901	0	0	904
Service Time	2	2.214	2.214	1.989
HCM Lane V/C Ratio	0.067	0	0	0.08
HCM Control Delay	7.3	7.2	7.2	7.3
HCM Lane LOS	A	N	N	A
HCM 95th-tile Q	0.2	0	0	0.3

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	0	5	0	0	0	19	50	0	0	41	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	0	5	0	0	0	21	54	0	0	45	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	5	0	0	37	14	3	41	16	0
Stage 1	-	-	-	-	-	-	14	14	-	0	0	-
Stage 2	-	-	-	-	-	-	23	0	-	41	16	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	1616	-	-	968	880	1081	963	878	-
Stage 1	-	-	-	-	-	-	1006	884	-	-	-	-
Stage 2	-	-	-	-	-	-	995	-	-	974	882	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	1616	-	-	-	880	1081	918	878	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	880	-	918	878	-
Stage 1	-	-	-	-	-	-	1006	884	-	-	-	-
Stage 2	-	-	-	-	-	-	995	-	-	914	882	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	1616	-	-	-
HCM Control Delay, s	-	-	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	-	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	0.0	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Synchro-Simtraffic (Software 8) AM and PM Peak Hour Intersection Level-of-Service Calculations:**

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Crossing #3

AM Baseline (No Project) Oakland & Alameda

PM Baseline (No Project) Oakland & Alameda

AM Baseline plus Project Oakland & Alameda

PM Baseline plus Project Oakland & Alameda



**Intersection**

Intersection Delay, s/veh -

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0		0	0	
Median Width	0		12			12
Grade, %	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0
Number of Lanes	0	1	1	0	1	0

**Major/Minor**

			Major 1	Major 2		
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	-	-	0	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

**Approach**

	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBT	NBR	WBLn1	SBL	SBT
Cap, veh/h	-	-	-	-	-
HCM Control Delay, s	-	-	0	0	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Lane LOS	-	-	A	A	-
HCM 95th-tile Q, veh	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 8.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	10	1	1	1	4	1	1	15	0	4	39	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	1	1	1	4	1	1	16	0	4	42	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	5	0	0	2	0	0	55	31	2	39	31	5
Stage 1	-	-	-	-	-	-	23	23	-	7	7	-
Stage 2	-	-	-	-	-	-	32	8	-	32	24	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1616	-	-	1620	-	-	943	862	1082	966	862	1078
Stage 1	-	-	-	-	-	-	995	876	-	1015	890	-
Stage 2	-	-	-	-	-	-	984	889	-	984	875	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1616	-	-	1620	-	-	895	855	1082	946	855	1078
Mov Capacity-2 Maneuver	-	-	-	-	-	-	895	855	-	946	855	-
Stage 1	-	-	-	-	-	-	988	870	-	1008	889	-
Stage 2	-	-	-	-	-	-	930	888	-	959	869	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	6	1.2	9.3	9.3
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	857	1616	-	-	1620	-	-	888
HCM Control Delay, s	9.3	7.243	0	-	7.224	0	-	9.3
HCM Lane V/C Ratio	0.02	0.01	-	-	0.00	-	-	0.06
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh -

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0
Number of Lanes	0	0	0	0	1	0	0	1	0	0	0	0

**Major/Minor**

	Minor 1			Major 1		
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	0	-	-	-	-
Stage 2	0	0	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	-	-	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	-	-
Mov Capacity-1 Maneuver	-	0	-	-	-	-
Mov Capacity-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

**Approach**

	WB	NB
HCM Control Delay, s	0	0
HCM LOS	A	-

**Minor Lane / Major Mvmt**

	NBL	NBT	NBR	WBLn1
Cap, veh/h	-	-	-	-
HCM Control Delay, s	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-
HCM Lane LOS	A	-	-	A
HCM 95th-tile Q, veh	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 4.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	13	1	4	67	3	27	3	4	6	7	32
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	14	1	4	73	3	29	3	4	7	8	35
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	76	0	0	15	0	0	123	104	15	106	103	74
Stage 1	-	-	-	-	-	-	19	19	-	83	83	-
Stage 2	-	-	-	-	-	-	104	85	-	23	20	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1523	-	-	1603	-	-	852	786	1065	873	787	988
Stage 1	-	-	-	-	-	-	1000	880	-	925	826	-
Stage 2	-	-	-	-	-	-	902	824	-	995	879	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1523	-	-	1603	-	-	813	783	1065	864	784	988
Mov Capacity-2 Maneuver	-	-	-	-	-	-	813	783	-	864	784	-
Stage 1	-	-	-	-	-	-	999	879	-	924	824	-
Stage 2	-	-	-	-	-	-	860	822	-	986	878	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	0.4	9.5	9.1
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	833	1523	-	-	1603	-	-	932
HCM Control Delay, s	9.5	7.367	0	-	7.252	0	-	9.1
HCM Lane V/C Ratio	0.04	0.00	-	-	0.00	-	-	0.05
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	3	0	1	30	1	17	8	0	2	7	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	3	0	1	33	1	18	9	0	2	8	27
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	34	0	0	3	0	0	69	52	3	56	51	33
Stage 1	-	-	-	-	-	-	16	16	-	35	35	-
Stage 2	-	-	-	-	-	-	53	36	-	21	16	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1578	-	-	1619	-	-	923	839	1081	941	840	1041
Stage 1	-	-	-	-	-	-	1004	882	-	981	866	-
Stage 2	-	-	-	-	-	-	960	865	-	998	882	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1578	-	-	1619	-	-	889	835	1081	930	836	1041
Mov Capacity-2 Maneuver	-	-	-	-	-	-	889	835	-	930	836	-
Stage 1	-	-	-	-	-	-	1000	878	-	977	865	-
Stage 2	-	-	-	-	-	-	926	864	-	984	878	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.9	0.2	9.3	8.8
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	871	1578	-	-	1619	-	-	984
HCM Control Delay, s	9.3	7.291	0	-	7.225	0	-	8.8
HCM Lane V/C Ratio	0.03	0.00	-	-	0.00	-	-	0.04
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.1

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	11	14	0	17	8	0	0	0	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	12	15	0	18	9	0	0	0	0	0	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	27	0	0	27	0	0	52	51	20	47	55	23
Stage 1	-	-	-	-	-	-	24	24	-	23	23	-
Stage 2	-	-	-	-	-	-	28	27	-	24	32	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1587	-	-	1587	-	-	947	840	1058	954	836	1054
Stage 1	-	-	-	-	-	-	994	875	-	995	876	-
Stage 2	-	-	-	-	-	-	989	873	-	994	868	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1587	-	-	1587	-	-	937	839	1058	953	835	1054
Mov Capacity-2 Maneuver	-	-	-	-	-	-	937	839	-	953	835	-
Stage 1	-	-	-	-	-	-	993	874	-	994	876	-
Stage 2	-	-	-	-	-	-	979	873	-	993	867	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	0	0	8.5
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	0	1587	-	-	1587	-	-	1054
HCM Control Delay, s	0	7.272	0	-	0	-	-	8.5
HCM Lane V/C Ratio	-	0.00	-	-	-	-	-	0.01
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	0.0

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
7: Park St. /Park St. & Blanding Ave.

AM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	277	13	5	12	54	435	0	1501	9	0	666	237
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		1.00			0.88			1.00			0.96	
Flt Protected		0.96			1.00			1.00			1.00	
Satd. Flow (prot)		1775			1643			3536			3400	
Flt Permitted		0.34			0.99			1.00			1.00	
Satd. Flow (perm)		627			1629			3536			3400	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	14	5	13	59	473	0	1632	10	0	724	258
RTOR Reduction (vph)	0	1	0	0	3	0	0	1	0	0	48	0
Lane Group Flow (vph)	0	319	0	0	542	0	0	1641	0	0	934	0
Turn Type	Perm	NA		Perm	NA			NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)		34.0			34.0			33.0			33.0	
Effective Green, g (s)		34.0			34.0			33.0			33.0	
Actuated g/C Ratio		0.45			0.45			0.44			0.44	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		284			738			1555			1496	
v/s Ratio Prot								c0.46			0.27	
v/s Ratio Perm		c0.51			0.33							
v/c Ratio		1.12			0.73			1.06			0.62	
Uniform Delay, d1		20.5			16.8			21.0			16.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		91.3			3.8			39.1			2.0	
Delay (s)		111.8			20.6			60.1			18.2	
Level of Service		F			C			E			B	
Approach Delay (s)		111.8			20.6			60.1			18.2	
Approach LOS		F			C			E			B	

Intersection Summary

HCM 2000 Control Delay	46.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh	18.6
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	7	33	11	109	357	15	145	79	49	28	43	48
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	36	12	118	388	16	158	86	53	30	47	52
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.7	24	14.1	10.6
HCM LOS	A	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	53%	14%	23%	24%
Vol Thru, %	29%	65%	74%	36%
Vol Right, %	18%	22%	3%	40%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	273	51	481	119
LT Vol	79	33	357	43
Through Vol	49	11	15	48
RT Vol	145	7	109	28
Lane Flow Rate	297	55	523	129
Geometry Grp	1	1	1	1
Degree of Util (X)	0.477	0.092	0.771	0.213
Departure Headway (Hd)	5.789	5.986	5.312	5.917
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	620	595	680	603
Service Time	3.848	4.062	3.357	3.988
HCM Lane V/C Ratio	0.479	0.092	0.769	0.214
HCM Control Delay	14.1	9.7	24	10.6
HCM Lane LOS	B	A	C	B
HCM 95th-tile Q	2.6	0.3	7.3	0.8

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 4.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	25	78	9	15	373	6	74	50	15	0	5	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	27	85	10	16	405	7	80	54	16	0	5	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	412	0	0	95	0	0	598	589	90	620	590	409
Stage 1	-	-	-	-	-	-	144	144	-	441	441	-
Stage 2	-	-	-	-	-	-	454	445	-	179	149	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1147	-	-	1499	-	-	414	421	968	400	420	642
Stage 1	-	-	-	-	-	-	859	778	-	595	577	-
Stage 2	-	-	-	-	-	-	586	575	-	823	774	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1147	-	-	1499	-	-	386	405	968	343	404	642
Mov Capacity-2 Maneuver	-	-	-	-	-	-	386	405	-	343	404	-
Stage 1	-	-	-	-	-	-	838	759	-	580	569	-
Stage 2	-	-	-	-	-	-	555	567	-	732	755	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.8	0.3	18.3	11.6
HCM LOS	-	-	C	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	420	1147	-	-	1499	-	-	569
HCM Control Delay, s	18.3	8.215	0	-	7.428	0	-	11.6
HCM Lane V/C Ratio	0.36	0.02	-	-	0.01	-	-	0.04
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th-tile Q, veh	1.6	0.1	-	-	0.0	-	-	0.1

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 4.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	28	41	278	233	83	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	30	45	302	253	90	85
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

		Major 1			Major 2	
Conflicting Flow All	991	133	175	0	-	0
Stage 1	133	-	-	-	-	-
Stage 2	858	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	273	916	1401	-	-	-
Stage 1	893	-	-	-	-	-
Stage 2	415	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-	-
Mov Capacity-1 Maneuver	204	916	1401	-	-	-
Mov Capacity-2 Maneuver	204	-	-	-	-	-
Stage 1	893	-	-	-	-	-
Stage 2	311	-	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	16.8	4.5	0
HCM LOS	C	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1401	-	379	-	-
HCM Control Delay, s	8.275	0	16.8	-	-
HCM Lane V/C Ratio	0.22	-	0.20	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th-tile Q, veh	0.8	-	0.7	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	17	1	12	6	1	3	14	112	0	1	9	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	1	13	7	1	3	15	122	0	1	10	9
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2		Minor 1			Major 1			Major 2			
Conflicting Flow All	170	168	14	175	173	122	18	0	0	122	0	0
Stage 1	16	16	-	152	152	-	-	-	-	-	-	-
Stage 2	154	152	-	23	21	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	794	725	1066	788	720	929	1599	-	-	1465	-	-
Stage 1	1004	882	-	850	772	-	-	-	-	-	-	-
Stage 2	848	772	-	995	878	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	784	717	1066	771	712	929	1599	-	-	1465	-	-
Mov Capacity-2 Maneuver	784	717	-	771	712	-	-	-	-	-	-	-
Stage 1	994	881	-	842	764	-	-	-	-	-	-	-
Stage 2	835	764	-	981	877	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	9.5	0.8	0.4
HCM LOS	A	A	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1599	-	-	874	805	1465	-	-
HCM Control Delay, s	7.273	0	-	9.3	9.5	7.459	0	-
HCM Lane V/C Ratio	0.01	-	-	0.04	0.01	0.00	-	-
HCM Lane LOS	A	A	-	A	A	A	A	-
HCM 95th-tile Q, veh	0.0	-	-	0.1	0.0	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 12: Broadway & Tilden Way

AM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕		↕	↕↕			↕	↕		↕	↕
Volume (vph)	31	379	5	195	488	7	7	504	182	10	96	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor		0.95		1.00	0.95			1.00	1.00		1.00	1.00
Frt		1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected		1.00		0.95	1.00			1.00	1.00		1.00	1.00
Satd. Flow (prot)		3520		1770	3531			1861	1583		1854	1583
Flt Permitted		0.88		0.95	1.00			1.00	1.00		0.95	1.00
Satd. Flow (perm)		3113		1770	3531			1857	1583		1772	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	412	5	212	530	8	8	548	198	11	104	27
RTOR Reduction (vph)	0	1	0	0	2	0	0	0	108	0	0	15
Lane Group Flow (vph)	0	450	0	212	536	0	0	556	90	0	115	12
Turn Type	Perm	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		3	8			2			6	
Permitted Phases	4						2		2	6		6
Actuated Green, G (s)		14.3		12.6	30.9			32.1	32.1		32.1	32.1
Effective Green, g (s)		14.3		12.6	30.9			32.1	32.1		32.1	32.1
Actuated g/C Ratio		0.20		0.18	0.44			0.45	0.45		0.45	0.45
Clearance Time (s)		4.0		4.0	4.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		626		314	1536			839	715		801	715
v/s Ratio Prot				c0.12	0.15							
v/s Ratio Perm		c0.14						c0.30	0.06		0.06	0.01
v/c Ratio		0.72		0.68	0.35			0.66	0.13		0.14	0.02
Uniform Delay, d1		26.5		27.3	13.4			15.2	11.3		11.4	10.7
Progression Factor		1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		4.0		5.6	0.1			4.1	0.4		0.4	0.0
Delay (s)		30.4		32.9	13.5			19.3	11.7		11.8	10.8
Level of Service		C		C	B			B	B		B	B
Approach Delay (s)		30.4			19.0			17.3			11.6	
Approach LOS		C			B			B			B	

Intersection Summary

HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	71.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	299	64	0	322	73	1	2	3	17	1	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	325	70	0	350	79	1	2	3	18	1	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	429	0	0	395	0	0	760	791	360	755	787	390
Stage 1	-	-	-	-	-	-	362	362	-	390	390	-
Stage 2	-	-	-	-	-	-	398	429	-	365	397	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1130	-	-	1164	-	-	323	322	684	325	324	658
Stage 1	-	-	-	-	-	-	657	625	-	634	608	-
Stage 2	-	-	-	-	-	-	628	584	-	654	603	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1130	-	-	1164	-	-	314	322	684	322	324	658
Mov Capacity-2 Maneuver	-	-	-	-	-	-	314	322	-	322	324	-
Stage 1	-	-	-	-	-	-	656	624	-	633	608	-
Stage 2	-	-	-	-	-	-	612	584	-	648	602	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	13.4	14.5
HCM LOS	-	-	B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	435	1130	-	-	1164	-	-	415
HCM Control Delay, s	13.4	8.189	0	-	0	-	-	14.5
HCM Lane V/C Ratio	0.01	0.00	-	-	-	-	-	0.08
HCM Lane LOS	B	A	A	-	A	-	-	B
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.3

















**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 14: Broadway & Buena Vista

AM2020Baseline(NP)

2/16/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	0	65	52	19	103	42	93	635	6	8	281	9	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0			4.0			4.0			4.0		
Lane Util. Factor		1.00			1.00			1.00			1.00		
Frt		0.94			0.97			1.00			1.00		
Flt Protected		1.00			0.99			0.99			1.00		
Satd. Flow (prot)		1751			1788			1849			1852		
Flt Permitted		1.00			0.95			0.92			0.98		
Satd. Flow (perm)		1751			1702			1709			1817		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	71	57	21	112	46	101	690	7	9	305	10	
RTOR Reduction (vph)	0	46	0	0	37	0	0	0	0	0	2	0	
Lane Group Flow (vph)	0	83	0	0	142	0	0	798	0	0	322	0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		4			8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)		6.9			6.9			19.3			19.3		
Effective Green, g (s)		6.9			6.9			19.3			19.3		
Actuated g/C Ratio		0.20			0.20			0.56			0.56		
Clearance Time (s)		4.0			4.0			4.0			4.0		
Vehicle Extension (s)		3.0			3.0			3.0			3.0		
Lane Grp Cap (vph)		353			343			964			1025		
v/s Ratio Prot		0.05											
v/s Ratio Perm					c0.08			c0.47			0.18		
v/c Ratio		0.23			0.41			0.83			0.31		
Uniform Delay, d1		11.4			11.9			6.1			3.9		
Progression Factor		1.00			1.00			1.00			1.00		
Incremental Delay, d2		0.3			0.8			8.1			0.8		
Delay (s)		11.8			12.7			14.2			4.7		
Level of Service		B			B			B			A		
Approach Delay (s)		11.8			12.7			14.2			4.7		
Approach LOS		B			B			B			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			11.6									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.72										
Actuated Cycle Length (s)			34.2									Sum of lost time (s)	8.0
Intersection Capacity Utilization			80.4%									ICU Level of Service	D
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 15: Park St. & Tilden Wy.

AM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↗	↖
Volume (vph)	174	305	19	93	326	22	35	593	87	14	396	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.99		1.00	0.99			0.98			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1770	3508		1770	3506			3466			3500	
Flt Permitted	0.50	1.00		0.53	1.00			0.92			0.93	
Satd. Flow (perm)	936	3508		981	3506			3193			3260	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	189	332	21	101	354	24	38	645	95	15	430	30
RTOR Reduction (vph)	0	8	0	0	9	0	0	14	0	0	6	0
Lane Group Flow (vph)	189	345	0	101	369	0	0	764	0	0	469	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.4	16.4		16.4	16.4			30.4			30.4	
Effective Green, g (s)	16.4	16.4		16.4	16.4			30.4			30.4	
Actuated g/C Ratio	0.30	0.30		0.30	0.30			0.55			0.55	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	280	1049		293	1049			1771			1808	
v/s Ratio Prot		0.10			0.11							
v/s Ratio Perm	c0.20			0.10				c0.24			0.14	
v/c Ratio	0.68	0.33		0.34	0.35			0.43			0.26	
Uniform Delay, d1	16.9	14.9		15.0	15.0			7.1			6.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	6.3	0.2		0.7	0.2			0.8			0.3	
Delay (s)	23.2	15.1		15.7	15.2			7.9			6.7	
Level of Service	C	B		B	B			A			A	
Approach Delay (s)		17.9			15.3			7.9			6.7	
Approach LOS		B			B			A			A	

Intersection Summary

HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	54.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 3.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	52	20	16	26	5	16	2	11	4	2	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	57	22	17	28	5	17	2	12	4	2	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	34	0	0	78	0	0	143	142	67	147	151	31
Stage 1	-	-	-	-	-	-	74	74	-	66	66	-
Stage 2	-	-	-	-	-	-	69	68	-	81	85	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1578	-	-	1520	-	-	826	749	997	821	741	1043
Stage 1	-	-	-	-	-	-	935	833	-	945	840	-
Stage 2	-	-	-	-	-	-	941	838	-	927	824	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1578	-	-	1520	-	-	813	739	997	801	731	1043
Mov Capacity-2 Maneuver	-	-	-	-	-	-	813	739	-	801	731	-
Stage 1	-	-	-	-	-	-	933	831	-	943	831	-
Stage 2	-	-	-	-	-	-	924	829	-	912	822	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	2.5	9.3	9.2
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	868	1578	-	-	1520	-	-	865
HCM Control Delay, s	9.3	7.286	0	-	7.396	0	-	9.2
HCM Lane V/C Ratio	0.04	0.00	-	-	0.01	-	-	0.01
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.0

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	16	52	6	12	29	21	721	15	9	348	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	17	57	7	13	32	23	784	16	10	378	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	1264	1250	385	1279	1249	792	391	0	0	800	0	0
Stage 1	404	404	-	838	838	-	-	-	-	-	-	-
Stage 2	860	846	-	441	411	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	146	173	663	143	173	389	1168	-	-	823	-	-
Stage 1	623	599	-	361	382	-	-	-	-	-	-	-
Stage 2	351	378	-	595	595	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	121	164	663	116	164	389	1168	-	-	823	-	-
Mov Capacity-2 Maneuver	121	164	-	116	164	-	-	-	-	-	-	-
Stage 1	601	589	-	348	368	-	-	-	-	-	-	-
Stage 2	300	364	-	520	585	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.5	24.4	0.2	0.2
HCM LOS	C	C	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1168	-	-	344	236	823	-	-
HCM Control Delay, s	8.144	0	-	18.5	24.4	9.427	0	-
HCM Lane V/C Ratio	0.02	-	-	0.23	0.22	0.01	-	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th-tile Q, veh	0.1	-	-	0.9	0.8	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 18: Park St. & Santa Clara Ave.

AM2020Baseline(NP)

2/16/2016



















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	75	198	18	17	279	42	26	604	21	19	429	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.99			0.98			1.00			0.98	
Flt Protected		0.99			1.00			1.00			1.00	
Satd. Flow (prot)		1823			1827			3515			3468	
Flt Permitted		0.77			0.98			0.93			0.92	
Satd. Flow (perm)		1413			1789			3260			3211	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	215	20	18	303	46	28	657	23	21	466	67
RTOR Reduction (vph)	0	5	0	0	10	0	0	3	0	0	13	0
Lane Group Flow (vph)	0	312	0	0	357	0	0	705	0	0	541	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		15.7			15.7			29.2			29.2	
Effective Green, g (s)		15.7			15.7			29.2			29.2	
Actuated g/C Ratio		0.30			0.30			0.55			0.55	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		419			530			1799			1772	
v/s Ratio Prot												
v/s Ratio Perm		c0.22			0.20			c0.22			0.17	
v/c Ratio		0.74			0.67			0.39			0.31	
Uniform Delay, d1		16.8			16.3			6.8			6.4	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		7.0			3.4			0.6			0.4	
Delay (s)		23.8			19.7			7.4			6.8	
Level of Service		C			B			A			A	
Approach Delay (s)		23.8			19.7			7.4			6.8	
Approach LOS		C			B			A			A	

Intersection Summary

HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	52.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

















HCM Signalized Intersection Capacity Analysis  
20: Peterson St. & Chapman St.

AM2020Baseline(NP)  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
25: Glascock St. & Peterson St.
















AM2020Baseline(NP)  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service		A						
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0		Sum of lost time (s)		8.0							
Intersection Capacity Utilization	0.0%		ICU Level of Service		A							
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 28: Park St. & Clement Ave.

AM2020Baseline(NP)

2/16/2016

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)														
Lane Util. Factor														
Frt														
Flt Protected														
Satd. Flow (prot)														
Flt Permitted														
Satd. Flow (perm)														
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Turn Type	Perm													
Protected Phases					8					2				
Permitted Phases					8									
Actuated Green, G (s)														
Effective Green, g (s)														
Actuated g/C Ratio														
Clearance Time (s)														
Lane Grp Cap (vph)														
v/s Ratio Prot														
v/s Ratio Perm														
v/c Ratio														
Uniform Delay, d1														
Progression Factor														
Incremental Delay, d2														
Delay (s)														
Level of Service														
Approach Delay (s)	0.0			0.0			0.0			0.0				
Approach LOS	A			A			A			A				
<b>Intersection Summary</b>														
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A							
HCM 2000 Volume to Capacity ratio	0.00													
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0							
Intersection Capacity Utilization	0.0%			ICU Level of Service			A							
Analysis Period (min)	15													
c Critical Lane Group														

HCM Signalized Intersection Capacity Analysis  
32: Park St. & Eagle Ave.

AM2020Baseline(NP)  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR				
Lane Configurations					↔			↑↑			↑↑					
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Total Lost time (s)																
Lane Util. Factor																
Frt																
Flt Protected																
Satd. Flow (prot)																
Flt Permitted																
Satd. Flow (perm)																
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92				
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Turn Type	Perm															
Protected Phases					8						2		6			
Permitted Phases					8											
Actuated Green, G (s)																
Effective Green, g (s)																
Actuated g/C Ratio																
Clearance Time (s)																
Lane Grp Cap (vph)																
v/s Ratio Prot																
v/s Ratio Perm																
v/c Ratio																
Uniform Delay, d1																
Progression Factor																
Incremental Delay, d2																
Delay (s)																
Level of Service																
Approach Delay (s)	0.0			0.0			0.0			0.0						
Approach LOS	A			A			A			A						

















Intersection Summary

HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
43: Everett St. & Blanding Ave.

AM2020Baseline(NP)  
2/16/2016

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

AM2020Baseline(NP)

## 48: Broadway

2/16/2016

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												



HCM Signalized Intersection Capacity Analysis  
 49: Everett St. & Santa Clara Ave.

AM2020Baseline(NP)

2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Fr <sub>t</sub>												
Fl <sub>t</sub> Protected												
Satd. Flow (prot)												
Fl <sub>t</sub> Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm								
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d <sub>1</sub>												
Progression Factor												
Incremental Delay, d <sub>2</sub>												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

**Intersection**

Intersection Delay, s/veh -

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0		0	0	
Median Width	0		12			12
Grade, %	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0
Number of Lanes	0	1	1	0	1	0

**Major/Minor**

			Major 1	Major 2		
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	-	-	0	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

**Approach**

	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBT	NBR	WBLn1	SBL	SBT
Cap, veh/h	-	-	-	-	-
HCM Control Delay, s	-	-	0	0	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Lane LOS	-	-	A	A	-
HCM 95th-tile Q, veh	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 8.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	8	3	2	4	0	3	6	29	4	8	36	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	3	2	4	0	3	7	32	4	9	39	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	3	0	0	5	0	0	60	34	4	50	33	2
Stage 1	-	-	-	-	-	-	22	22	-	10	10	-
Stage 2	-	-	-	-	-	-	38	12	-	40	23	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1619	-	-	1616	-	-	936	859	1080	950	860	1082
Stage 1	-	-	-	-	-	-	996	877	-	1011	887	-
Stage 2	-	-	-	-	-	-	977	886	-	975	876	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1619	-	-	1616	-	-	885	852	1080	914	853	1082
Mov Capacity-2 Maneuver	-	-	-	-	-	-	885	852	-	914	853	-
Stage 1	-	-	-	-	-	-	990	872	-	1005	885	-
Stage 2	-	-	-	-	-	-	919	884	-	930	871	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.5	4.1	9.3	9.3
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	876	1619	-	-	1616	-	-	908
HCM Control Delay, s	9.3	7.236	0	-	7.234	0	-	9.3
HCM Lane V/C Ratio	0.05	0.01	-	-	0.00	-	-	0.07
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.2	0.0	-	-	0.0	-	-	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh -

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0
Number of Lanes	0	0	0	0	1	0	0	1	0	0	0	0

**Major/Minor**

	Minor 1			Major 1		
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	0	-	-	-	-
Stage 2	0	0	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	-	-	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	-	-
Mov Capacity-1 Maneuver	-	0	-	-	-	-
Mov Capacity-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

**Approach**

	WB	NB
HCM Control Delay, s	0	0
HCM LOS	A	-

**Minor Lane / Major Mvmt**

	NBL	NBT	NBR	WBLn1
Cap, veh/h	-	-	-	-
HCM Control Delay, s	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-
HCM Lane LOS	A	-	-	A
HCM 95th-tile Q, veh	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	8	25	0	5	44	4	8	2	1	16	14	31
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	27	0	5	48	4	9	2	1	17	15	34
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	52	0	0	27	0	0	130	108	27	107	106	50
Stage 1	-	-	-	-	-	-	45	45	-	61	61	-
Stage 2	-	-	-	-	-	-	85	63	-	46	45	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1554	-	-	1587	-	-	843	782	1048	872	784	1018
Stage 1	-	-	-	-	-	-	969	857	-	950	844	-
Stage 2	-	-	-	-	-	-	923	842	-	968	857	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1554	-	-	1587	-	-	797	775	1048	863	777	1018
Mov Capacity-2 Maneuver	-	-	-	-	-	-	797	775	-	863	777	-
Stage 1	-	-	-	-	-	-	963	852	-	944	841	-
Stage 2	-	-	-	-	-	-	874	839	-	959	852	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.8	0.7	9.5	9.3
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	810	1554	-	-	1587	-	-	910
HCM Control Delay, s	9.5	7.33	0	-	7.276	0	-	9.3
HCM Lane V/C Ratio	0.01	0.01	-	-	0.00	-	-	0.07
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.0	0.0	-	-	0.0	-	-	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 6.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	20	8	1	0	13	2	4	11	1	1	17	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	9	1	0	14	2	4	12	1	1	18	29
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	16	0	0	10	0	0	92	69	9	74	68	15
Stage 1	-	-	-	-	-	-	53	53	-	15	15	-
Stage 2	-	-	-	-	-	-	39	16	-	59	53	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1602	-	-	1610	-	-	892	822	1073	916	823	1065
Stage 1	-	-	-	-	-	-	960	851	-	1005	883	-
Stage 2	-	-	-	-	-	-	976	882	-	953	851	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1602	-	-	1610	-	-	843	810	1073	895	811	1065
Mov Capacity-2 Maneuver	-	-	-	-	-	-	843	810	-	895	811	-
Stage 1	-	-	-	-	-	-	947	839	-	991	883	-
Stage 2	-	-	-	-	-	-	929	882	-	925	839	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	5	0	9.4	9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	831	1602	-	-	1610	-	-	949
HCM Control Delay, s	9.4	7.278	0	-	0	-	-	9
HCM Lane V/C Ratio	0.02	0.01	-	-	-	-	-	0.05
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.2

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	11	31	7	3	20	9	5	5	3	2	4	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	34	8	3	22	10	5	5	3	2	4	12
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	32	0	0	41	0	0	102	99	38	99	98	27
Stage 1	-	-	-	-	-	-	61	61	-	33	33	-
Stage 2	-	-	-	-	-	-	41	38	-	66	65	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1580	-	-	1568	-	-	879	791	1034	883	792	1048
Stage 1	-	-	-	-	-	-	950	844	-	983	868	-
Stage 2	-	-	-	-	-	-	974	863	-	945	841	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1580	-	-	1568	-	-	859	783	1034	869	784	1048
Mov Capacity-2 Maneuver	-	-	-	-	-	-	859	783	-	869	784	-
Stage 1	-	-	-	-	-	-	942	837	-	975	866	-
Stage 2	-	-	-	-	-	-	956	861	-	928	834	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.6	0.7	9.3	8.9
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	860	1580	-	-	1568	-	-	950
HCM Control Delay, s	9.3	7.296	0	-	7.301	0	-	8.9
HCM Lane V/C Ratio	0.02	0.01	-	-	0.00	-	-	0.02
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.1

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
7: Park St. /Park St. & Blanding Ave.

PM2020Baseline(NP)  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	179	68	20	20	153	248	0	1118	26	0	1209	393
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.99			0.92			1.00			0.96	
Flt Protected		0.97			1.00			1.00			1.00	
Satd. Flow (prot)		1784			1710			3527			3409	
Flt Permitted		0.43			0.98			1.00			1.00	
Satd. Flow (perm)		793			1677			3527			3409	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	74	22	22	166	270	0	1215	28	0	1314	427
RTOR Reduction (vph)	0	4	0	0	16	0	0	2	0	0	38	0
Lane Group Flow (vph)	0	287	0	0	442	0	0	1241	0	0	1703	0
Turn Type	Perm	NA		Perm	NA			NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)		25.7			25.7			33.5			33.5	
Effective Green, g (s)		25.7			25.7			33.5			33.5	
Actuated g/C Ratio		0.38			0.38			0.50			0.50	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		303			641			1758			1699	
v/s Ratio Prot								0.35			c0.50	
v/s Ratio Perm		c0.36			0.26							
v/c Ratio		0.95			0.69			0.71			1.00	
Uniform Delay, d1		20.1			17.4			13.0			16.9	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		37.2			3.1			2.4			22.5	
Delay (s)		57.3			20.5			15.5			39.3	
Level of Service		E			C			B			D	
Approach Delay (s)		57.3			20.5			15.5			39.3	
Approach LOS		E			C			B			D	

Intersection Summary

HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	67.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



**Intersection**

Intersection Delay, s/veh	21.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	54	86	33	118	211	24	105	157	92	59	123	81
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	59	93	36	128	229	26	114	171	100	64	134	88
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	14.6	24.7	23.4	17.6
HCM LOS	B	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	30%	31%	33%	22%
Vol Thru, %	44%	50%	60%	47%
Vol Right, %	26%	19%	7%	31%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	354	173	353	263
LT Vol	157	86	211	123
Through Vol	92	33	24	81
RT Vol	105	54	118	59
Lane Flow Rate	385	188	384	286
Geometry Grp	1	1	1	1
Degree of Util (X)	0.696	0.379	0.71	0.541
Departure Headway (Hd)	6.632	7.258	6.783	6.816
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	550	498	537	532
Service Time	4.632	5.276	4.783	4.83
HCM Lane V/C Ratio	0.7	0.378	0.715	0.538
HCM Control Delay	23.4	14.6	24.7	17.6
HCM Lane LOS	C	B	C	C
HCM 95th-tile Q	5.4	1.8	5.7	3.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	52	277	28	18	130	4	16	19	16	2	21	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	57	301	30	20	141	4	17	21	17	2	23	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	146	0	0	332	0	0	631	614	316	631	628	143
Stage 1	-	-	-	-	-	-	429	429	-	183	183	-
Stage 2	-	-	-	-	-	-	202	185	-	448	445	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1436	-	-	1227	-	-	394	407	724	394	400	905
Stage 1	-	-	-	-	-	-	604	584	-	819	748	-
Stage 2	-	-	-	-	-	-	800	747	-	590	575	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1436	-	-	1227	-	-	351	380	724	350	374	905
Mov Capacity-2 Maneuver	-	-	-	-	-	-	351	380	-	350	374	-
Stage 1	-	-	-	-	-	-	574	555	-	779	735	-
Stage 2	-	-	-	-	-	-	748	734	-	527	547	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.1	0.9	14.5	13.2
HCM LOS	-	-	B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	433	1436	-	-	1227	-	-	478
HCM Control Delay, s	14.5	7.61	0	-	7.982	0	-	13.2
HCM Lane V/C Ratio	0.13	0.04	-	-	0.02	-	-	0.08
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th-tile Q, veh	0.4	0.1	-	-	0.0	-	-	0.3

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 5.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	79	156	67	276	237	47
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	86	170	73	300	258	51
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

		Major 1		Major 2	
Conflicting Flow All	729	283	309	0	0
Stage 1	283	-	-	-	-
Stage 2	446	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	390	756	1252	-	-
Stage 1	765	-	-	-	-
Stage 2	645	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	363	756	1252	-	-
Mov Capacity-2 Maneuver	363	-	-	-	-
Stage 1	765	-	-	-	-
Stage 2	600	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	16.9	1.6	0
HCM LOS	C	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1252	-	554	-	-
HCM Control Delay, s	8.053	0	16.9	-	-
HCM Lane V/C Ratio	0.06	-	0.46	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th-tile Q, veh	0.2	-	2.4	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 3.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	10	3	24	3	1	0	10	25	6	3	36	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	3	26	3	1	0	11	27	7	3	39	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	106	108	47	120	113	30	54	0	0	34	0	0
Stage 1	53	53	-	52	52	-	-	-	-	-	-	-
Stage 2	53	55	-	68	61	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	873	782	1022	855	777	1044	1551	-	-	1578	-	-
Stage 1	960	851	-	961	852	-	-	-	-	-	-	-
Stage 2	960	849	-	942	844	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	866	775	1022	825	770	1044	1551	-	-	1578	-	-
Mov Capacity-2 Maneuver	866	775	-	825	770	-	-	-	-	-	-	-
Stage 1	953	849	-	954	846	-	-	-	-	-	-	-
Stage 2	952	843	-	913	842	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9	9.5	1.8	0.4
HCM LOS	A	A	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1551	-	-	951	811	1578	-	-
HCM Control Delay, s	7.337	0	-	9	9.5	7.286	0	-
HCM Lane V/C Ratio	0.01	-	-	0.04	0.01	0.00	-	-
HCM Lane LOS	A	A	-	A	A	A	A	-
HCM 95th-tile Q, veh	0.0	-	-	0.1	0.0	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 12: Broadway & Tilden Way

PM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕		↕	↕↕			↕	↕		↕	↕
Volume (vph)	56	368	7	260	510	7	13	250	168	64	288	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor		0.95		1.00	0.95			1.00	1.00		1.00	1.00
Frt		1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected		0.99		0.95	1.00			1.00	1.00		0.99	1.00
Satd. Flow (prot)		3507		1770	3532			1858	1583		1846	1583
Flt Permitted		0.81		0.95	1.00			0.98	1.00		0.89	1.00
Satd. Flow (perm)		2862		1770	3532			1822	1583		1665	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	61	400	8	283	554	8	14	272	183	70	313	45
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	103	0	0	25
Lane Group Flow (vph)	0	467	0	283	561	0	0	286	80	0	383	20
Turn Type	Perm	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		3	8			2			6	
Permitted Phases	4						2		2	6		6
Actuated Green, G (s)		15.1		14.2	33.3			32.1	32.1		32.1	32.1
Effective Green, g (s)		15.1		14.2	33.3			32.1	32.1		32.1	32.1
Actuated g/C Ratio		0.21		0.19	0.45			0.44	0.44		0.44	0.44
Clearance Time (s)		4.0		4.0	4.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		588		342	1602			796	692		728	692
v/s Ratio Prot				c0.16	0.16							
v/s Ratio Perm		c0.16						0.16	0.05		c0.23	0.01
v/c Ratio		0.79		0.83	0.35			0.36	0.12		0.53	0.03
Uniform Delay, d1		27.7		28.4	13.0			13.8	12.2		15.1	11.8
Progression Factor		1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		7.3		15.1	0.1			1.3	0.3		2.7	0.1
Delay (s)		35.0		43.5	13.2			15.0	12.6		17.8	11.8
Level of Service		D		D	B			B	B		B	B
Approach Delay (s)		35.0			23.3			14.1			17.2	
Approach LOS		D			C			B			B	

**Intersection Summary**

HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	73.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	25	284	5	4	241	27	2	0	4	32	0	32
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	27	309	5	4	262	29	2	0	4	35	0	35
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	291	0	0	314	0	0	669	666	311	653	653	277
Stage 1	-	-	-	-	-	-	366	366	-	285	285	-
Stage 2	-	-	-	-	-	-	303	300	-	368	368	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1271	-	-	1246	-	-	371	380	729	380	387	762
Stage 1	-	-	-	-	-	-	653	623	-	722	676	-
Stage 2	-	-	-	-	-	-	706	666	-	652	621	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1271	-	-	1246	-	-	346	369	729	369	375	762
Mov Capacity-2 Maneuver	-	-	-	-	-	-	346	369	-	369	375	-
Stage 1	-	-	-	-	-	-	636	607	-	703	673	-
Stage 2	-	-	-	-	-	-	671	663	-	631	605	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.1	11.8	13.4
HCM LOS	-	-	B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	533	1271	-	-	1246	-	-	497
HCM Control Delay, s	11.8	7.894	0	-	7.899	0	-	13.4
HCM Lane V/C Ratio	0.01	0.02	-	-	0.00	-	-	0.14
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th-tile Q, veh	0.0	0.1	-	-	0.0	-	-	0.5

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 14: Broadway & Buena Vista

PM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	1	104	111	15	66	8	85	433	7	22	505	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.93			0.99			1.00			1.00	
Flt Protected		1.00			0.99			0.99			1.00	
Satd. Flow (prot)		1733			1824			1844			1855	
Flt Permitted		1.00			0.94			0.85			0.97	
Satd. Flow (perm)		1731			1733			1587			1806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	113	121	16	72	9	92	471	8	24	549	10
RTOR Reduction (vph)	0	97	0	0	7	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	138	0	0	90	0	0	570	0	0	582	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		6.8			6.8			19.0			19.0	
Effective Green, g (s)		6.8			6.8			19.0			19.0	
Actuated g/C Ratio		0.20			0.20			0.56			0.56	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		348			348			892			1015	
v/s Ratio Prot												
v/s Ratio Perm		c0.08			0.05			c0.36			0.32	
v/c Ratio		0.40			0.26			0.64			0.57	
Uniform Delay, d1		11.7			11.4			5.1			4.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.7			0.4			3.5			2.4	
Delay (s)		12.5			11.8			8.6			7.1	
Level of Service		B			B			A			A	
Approach Delay (s)		12.5			11.8			8.6			7.1	
Approach LOS		B			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	33.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 15: Park St. & Tilden Wy.

PM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↗	↖
Volume (vph)	124	316	36	152	356	40	28	509	74	60	613	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	0.98		1.00	0.98			0.98			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1770	3485		1770	3486			3467			3471	
Flt Permitted	0.45	1.00		0.50	1.00			0.91			0.86	
Satd. Flow (perm)	843	3485		926	3486			3147			3005	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	135	343	39	165	387	43	30	553	80	65	666	84
RTOR Reduction (vph)	0	16	0	0	16	0	0	14	0	0	11	0
Lane Group Flow (vph)	135	366	0	165	414	0	0	649	0	0	804	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	15.5	15.5		15.5	15.5			30.4			30.4	
Effective Green, g (s)	15.5	15.5		15.5	15.5			30.4			30.4	
Actuated g/C Ratio	0.29	0.29		0.29	0.29			0.56			0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	242	1002		266	1002			1774			1694	
v/s Ratio Prot		0.10			0.12							
v/s Ratio Perm	0.16			c0.18				0.21			c0.27	
v/c Ratio	0.56	0.36		0.62	0.41			0.37			0.47	
Uniform Delay, d1	16.3	15.3		16.6	15.5			6.5			7.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.8	0.2		4.4	0.3			0.6			1.0	
Delay (s)	19.1	15.5		21.1	15.8			7.0			8.0	
Level of Service	B	B		C	B			A			A	
Approach Delay (s)		16.4			17.3			7.0			8.0	
Approach LOS		B			B			A			A	

Intersection Summary

HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	53.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



**Intersection**

Intersection Delay, s/veh 2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	13	113	33	26	24	4	16	4	17	0	5	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	123	36	28	26	4	17	4	18	0	5	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	30	0	0	159	0	0	257	256	141	265	272	28
Stage 1	-	-	-	-	-	-	169	169	-	85	85	-
Stage 2	-	-	-	-	-	-	88	87	-	180	187	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1583	-	-	1420	-	-	696	648	907	688	635	1047
Stage 1	-	-	-	-	-	-	833	759	-	923	824	-
Stage 2	-	-	-	-	-	-	920	823	-	822	745	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1583	-	-	1420	-	-	675	629	907	655	616	1047
Mov Capacity-2 Maneuver	-	-	-	-	-	-	675	629	-	655	616	-
Stage 1	-	-	-	-	-	-	825	751	-	914	808	-
Stage 2	-	-	-	-	-	-	895	807	-	793	738	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	3.7	10	10.5
HCM LOS	-	-	B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	758	1583	-	-	1420	-	-	661
HCM Control Delay, s	10	7.295	0	-	7.587	0	-	10.5
HCM Lane V/C Ratio	0.05	0.01	-	-	0.02	-	-	0.01
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th-tile Q, veh	0.2	0.0	-	-	0.1	-	-	0.0

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	8	39	79	3	7	23	17	488	14	28	580	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	42	86	3	8	25	18	530	15	30	630	24
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	1294	1286	642	1342	1290	538	654	0	0	546	0	0
Stage 1	703	703	-	575	575	-	-	-	-	-	-	-
Stage 2	591	583	-	767	715	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	139	164	474	129	163	543	933	-	-	1023	-	-
Stage 1	428	440	-	503	503	-	-	-	-	-	-	-
Stage 2	493	499	-	395	434	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	120	152	474	78	151	543	933	-	-	1023	-	-
Mov Capacity-2 Maneuver	120	152	-	78	151	-	-	-	-	-	-	-
Stage 1	416	420	-	489	489	-	-	-	-	-	-	-
Stage 2	450	485	-	277	414	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	33.9	21.1	0.3	0.4
HCM LOS	D	C	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	933	-	-	257	259	1023	-	-
HCM Control Delay, s	8.936	0	-	33.9	21.1	8.627	0	-
HCM Lane V/C Ratio	0.02	-	-	0.53	0.14	0.03	-	-
HCM Lane LOS	A	A	-	D	C	A	A	-
HCM 95th-tile Q, veh	0.1	-	-	2.9	0.5	0.1	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
18: Park St. & Santa Clara Ave.

PM2020Baseline(NP)

2/16/2016



















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	15	303	41	4	265	78	4	550	38	6	690	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.98			0.97			0.99			0.98	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1830			1805			3504			3476	
Flt Permitted		0.98			1.00			0.95			0.95	
Satd. Flow (perm)		1800			1798			3335			3307	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	329	45	4	288	85	4	598	41	7	750	99
RTOR Reduction (vph)	0	9	0	0	19	0	0	6	0	0	13	0
Lane Group Flow (vph)	0	381	0	0	358	0	0	637	0	0	843	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		16.3			16.3			29.2			29.2	
Effective Green, g (s)		16.3			16.3			29.2			29.2	
Actuated g/C Ratio		0.30			0.30			0.55			0.55	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		548			547			1820			1804	
v/s Ratio Prot												
v/s Ratio Perm		c0.21			0.20			0.19			c0.26	
v/c Ratio		0.70			0.65			0.35			0.47	
Uniform Delay, d1		16.4			16.1			6.8			7.4	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		3.8			2.8			0.5			0.9	
Delay (s)		20.2			19.0			7.4			8.3	
Level of Service		C			B			A			A	
Approach Delay (s)		20.2			19.0			7.4			8.3	
Approach LOS		C			B			A			A	

Intersection Summary

HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	53.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 20: Peterson St. & Chapman St.

PM2020Baseline(NP)  
 2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 25: Glascock St. & Peterson St.

PM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 28: Park St. & Clement Ave.

PM2020Baseline(NP)  
 2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR				
Lane Configurations					↔			↑↑			↑↑					
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Total Lost time (s)																
Lane Util. Factor																
Frt																
Flt Protected																
Satd. Flow (prot)																
Flt Permitted																
Satd. Flow (perm)																
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92				
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Turn Type	Perm															
Protected Phases					8						2		6			
Permitted Phases					8											
Actuated Green, G (s)																
Effective Green, g (s)																
Actuated g/C Ratio																
Clearance Time (s)																
Lane Grp Cap (vph)																
v/s Ratio Prot																
v/s Ratio Perm																
v/c Ratio																
Uniform Delay, d1																
Progression Factor																
Incremental Delay, d2																
Delay (s)																
Level of Service																
Approach Delay (s)	0.0			0.0			0.0			0.0						
Approach LOS	A			A			A			A						
<b>Intersection Summary</b>																
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A									
HCM 2000 Volume to Capacity ratio	0.00															
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0									
Intersection Capacity Utilization	0.0%			ICU Level of Service			A									
Analysis Period (min)	15															
c Critical Lane Group																

# HCM Signalized Intersection Capacity Analysis

PM2020Baseline(NP)

32: Park St. & Eagle Ave.

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR				
Lane Configurations					↔			↑↑			↑↑					
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Total Lost time (s)																
Lane Util. Factor																
Frt																
Flt Protected																
Satd. Flow (prot)																
Flt Permitted																
Satd. Flow (perm)																
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92				
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Turn Type	Perm															
Protected Phases					8						2		6			
Permitted Phases					8											
Actuated Green, G (s)																
Effective Green, g (s)																
Actuated g/C Ratio																
Clearance Time (s)																
Lane Grp Cap (vph)																
v/s Ratio Prot																
v/s Ratio Perm																
v/c Ratio																
Uniform Delay, d1																
Progression Factor																
Incremental Delay, d2																
Delay (s)																
Level of Service																
Approach Delay (s)	0.0			0.0			0.0			0.0						
Approach LOS	A			A			A			A						

## Intersection Summary

HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
43: Everett St. & Blanding Ave.

PM2020Baseline(NP)

2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



















# HCM Signalized Intersection Capacity Analysis

PM2020Baseline(NP)

















## 48: Broadway

2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
49: Everett St. & Santa Clara Ave.

PM2020Baseline(NP)  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Fr <sub>t</sub>												
Fl <sub>t</sub> Protected												
Satd. Flow (prot)												
Fl <sub>t</sub> Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm								
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d <sub>1</sub>												
Progression Factor												
Incremental Delay, d <sub>2</sub>												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

**Intersection**

Intersection Delay, s/veh -

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0		0	0	
Median Width	0		12			12
Grade, %	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0
Number of Lanes	0	1	1	0	1	0

**Major/Minor**

			Major 1	Major 2		
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	-	-	0	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

**Approach**

	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBT	NBR	WBLn1	SBL	SBT
Cap, veh/h	-	-	-	-	-
HCM Control Delay, s	-	-	0	0	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Lane LOS	-	-	A	A	-
HCM 95th-tile Q, veh	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 7.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	10	1	7	1	4	1	1	15	0	4	39	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	1	8	1	4	1	1	16	0	4	42	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	5	0	0	9	0	0	59	35	5	42	37	5
Stage 1	-	-	-	-	-	-	27	27	-	7	7	-
Stage 2	-	-	-	-	-	-	32	8	-	35	30	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1616	-	-	1611	-	-	937	857	1078	961	855	1078
Stage 1	-	-	-	-	-	-	990	873	-	1015	890	-
Stage 2	-	-	-	-	-	-	984	889	-	981	870	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1616	-	-	1611	-	-	889	850	1078	941	848	1078
Mov Capacity-2 Maneuver	-	-	-	-	-	-	889	850	-	941	848	-
Stage 1	-	-	-	-	-	-	983	867	-	1008	889	-
Stage 2	-	-	-	-	-	-	930	888	-	956	864	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4	1.2	9.3	9.4
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	852	1616	-	-	1611	-	-	881
HCM Control Delay, s	9.3	7.243	0	-	7.236	0	-	9.4
HCM Lane V/C Ratio	0.02	0.01	-	-	0.00	-	-	0.06
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.0	-	-	0.2

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh -

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0
Number of Lanes	0	0	0	0	1	0	0	1	0	0	0	0

**Major/Minor**

	Minor 1			Major 1		
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	0	-	-	-	-
Stage 2	0	0	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	-	-	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	-	-
Mov Capacity-1 Maneuver	-	0	-	-	-	-
Mov Capacity-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

**Approach**

	WB	NB
HCM Control Delay, s	0	0
HCM LOS	A	-

**Minor Lane / Major Mvmt**

	NBL	NBT	NBR	WBLn1
Cap, veh/h	-	-	-	-
HCM Control Delay, s	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-
HCM Lane LOS	A	-	-	A
HCM 95th-tile Q, veh	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	7	0	0	15	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	8	0	0	16	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	0	0	0	8	0	0	4	0	0
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	8	0	-	4	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	-	-	-	1011	-	-	1017	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	1013	-	-	1018	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	1013	-	-	1018	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	31	0	1	0	8	0	2	32	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	34	0	1	0	9	0	2	35	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	1	0	0	0	0	0	85	68	0	72	68	1
Stage 1	-	-	-	-	-	-	0	0	-	68	68	-
Stage 2	-	-	-	-	-	-	85	68	-	4	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1622	-	-	-	-	-	901	823	-	919	823	1084
Stage 1	-	-	-	-	-	-	-	-	-	942	838	-
Stage 2	-	-	-	-	-	-	923	838	-	1018	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1622	-	-	-	-	-	872	823	-	-	823	1084
Mov Capacity-2 Maneuver	-	-	-	-	-	-	872	823	-	-	823	-
Stage 1	-	-	-	-	-	-	-	-	-	942	838	-
Stage 2	-	-	-	-	-	-	885	838	-	1018	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	1622	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	-	-	-	-
HCM 95th-tile Q, veh	-	0.0	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 5.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	11	11	14	0	17	8	0	0	0	0	0	82
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	12	15	0	18	9	0	0	0	0	0	89
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	27	0	0	27	0	0	110	70	20	66	74	23
Stage 1	-	-	-	-	-	-	43	43	-	23	23	-
Stage 2	-	-	-	-	-	-	67	27	-	43	51	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1587	-	-	1587	-	-	868	821	1058	927	816	1054
Stage 1	-	-	-	-	-	-	971	859	-	995	876	-
Stage 2	-	-	-	-	-	-	943	873	-	971	852	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1587	-	-	1587	-	-	790	814	1058	921	809	1054
Mov Capacity-2 Maneuver	-	-	-	-	-	-	790	814	-	921	809	-
Stage 1	-	-	-	-	-	-	963	852	-	987	876	-
Stage 2	-	-	-	-	-	-	863	873	-	963	845	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.2	0	0	8.7
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	0	1587	-	-	1587	-	-	1054
HCM Control Delay, s	0	7.286	0	-	0	-	-	8.7
HCM Lane V/C Ratio	-	0.01	-	-	-	-	-	0.09
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	0.3

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



HCM Signalized Intersection Capacity Analysis  
7: Park St. /Park St. & Blanding Ave.

C3AMBaseline+Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	277	13	5	616	54	435	0	1726	424	0	666	237
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		1.00			0.95			0.97			0.96	
Flt Protected		0.96			0.97			1.00			1.00	
Satd. Flow (prot)		1775			1716			3434			3400	
Flt Permitted		0.50			0.72			1.00			1.00	
Satd. Flow (perm)		921			1277			3434			3400	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	14	5	670	59	473	0	1876	461	0	724	258
RTOR Reduction (vph)	0	1	0	0	2	0	0	29	0	0	48	0
Lane Group Flow (vph)	0	319	0	0	1200	0	0	2308	0	0	934	0
Turn Type	Perm	NA		Perm	NA			NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)		34.0			34.0			33.0			33.0	
Effective Green, g (s)		34.0			34.0			33.0			33.0	
Actuated g/C Ratio		0.45			0.45			0.44			0.44	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		417			578			1510			1496	
v/s Ratio Prot								c0.67			0.27	
v/s Ratio Perm		0.35			c0.94							
v/c Ratio		0.77			2.08			1.53			0.62	
Uniform Delay, d1		17.2			20.5			21.0			16.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		8.2			490.5			241.3			2.0	
Delay (s)		25.4			511.0			262.3			18.2	
Level of Service		C			F			F			B	
Approach Delay (s)		25.4			511.0			262.3			18.2	
Approach LOS		C			F			F			B	

Intersection Summary

HCM 2000 Control Delay	258.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.80		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	126.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Intersection												
Intersection Delay, s/veh	42.6											
Intersection LOS	E											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	7	459	0	0	961	94	0	0	0	28	0	91
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	499	0	0	1045	102	0	0	0	30	0	99
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	21.4	55.5	0	11.1
HCM LOS	C	F	-	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	2%	0%	24%
Vol Thru, %	100%	98%	91%	0%
Vol Right, %	0%	0%	9%	76%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	466	1055	119
LT Vol	0	459	961	0
Through Vol	0	0	94	91
RT Vol	0	7	0	28
Lane Flow Rate	0	507	1147	129
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0.735	1	0.225
Departure Headway (Hd)	7.142	5.226	4.952	6.263
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	694	734	573
Service Time	5.215	3.252	3.006	4.302
HCM Lane V/C Ratio	0	0.731	1.563	0.225
HCM Control Delay	10.2	21.4	55.5	11.1
HCM Lane LOS	N	C	F	B
HCM 95th-tile Q	0	6.5	16.4	0.9

Notes  
 - : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	103	0	0	0	0	0	0	0	0	0	0	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	112	0	0	0	0	0	0	0	0	0	0	25
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	0	0	0	237	224	0	224	224	0
Stage 1	-	-	-	-	-	-	224	224	-	0	0	-
Stage 2	-	-	-	-	-	-	13	0	-	224	224	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	-	-	-	717	675	-	732	675	-
Stage 1	-	-	-	-	-	-	779	718	-	-	-	-
Stage 2	-	-	-	-	-	-	1007	-	-	779	718	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	675	-	-	675	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	675	-	-	675	-
Stage 1	-	-	-	-	-	-	779	718	-	-	-	-
Stage 2	-	-	-	-	-	-	1007	-	-	779	718	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	-
HCM LOS	-	-	A	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	0	-	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 4.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	15	0	0	0	0	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	0	0	0	0	16
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

	Major 1				Major 2	
Conflicting Flow All	8	8	16	0	-	0
Stage 1	8	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	1013	1074	1602	-	-	-
Stage 1	1015	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-	-
Mov Capacity-1 Maneuver	1013	1074	1602	-	-	-
Mov Capacity-2 Maneuver	1013	-	-	-	-	-
Stage 1	1015	-	-	-	-	-
Stage 2	-	-	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1602	-	1013	-	-
HCM Control Delay, s	0	-	8.6	-	-
HCM Lane V/C Ratio	-	-	0.02	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th-tile Q, veh	0.0	-	0.0	-	-

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	29	0	0	10	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	32	0	0	11	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	5	0	0	16	0	0	0	0	0	0	0	0
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	5	0	-	16	0	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	1016	-	-	999	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	1017	-	-	1004	-	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	1017	-	-	1004	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	-	-	0	0
HCM LOS	-	-	-	-




















Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	0	-	-	-	-	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	-	-	A	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 12: Broadway & Tilden Way

C3AMBaseline+Prj.  
 2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	217	0	20	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)									4.0		4.0	
Lane Util. Factor									1.00		1.00	
Flt									0.85		1.00	
Flt Protected									1.00		1.00	
Satd. Flow (prot)									1583		1863	
Flt Permitted									1.00		1.00	
Satd. Flow (perm)									1583		1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	236	0	22	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	236	0	22	0
Turn Type	Perm			Prot			Perm		Perm	Perm	NA	Perm
Protected Phases		4		3	8			2			6	
Permitted Phases	4						2		2	6		6
Actuated Green, G (s)									51.0		51.0	
Effective Green, g (s)									51.0		51.0	
Actuated g/C Ratio									1.00		1.00	
Clearance Time (s)									4.0		4.0	
Vehicle Extension (s)									3.0		3.0	
Lane Grp Cap (vph)									1583		1863	
v/s Ratio Prot											0.01	
v/s Ratio Perm									c0.15			
v/c Ratio									0.15		0.01	
Uniform Delay, d1									0.0		0.0	
Progression Factor									1.00		1.00	
Incremental Delay, d2									0.2		0.0	
Delay (s)									0.2		0.0	
Level of Service									A		A	
Approach Delay (s)		0.0			0.0			0.2			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			0.2		HCM 2000 Level of Service				A			
HCM 2000 Volume to Capacity ratio			0.19									
Actuated Cycle Length (s)			51.0		Sum of lost time (s)				12.0			
Intersection Capacity Utilization			23.4%		ICU Level of Service				A			
Analysis Period (min)			15									
c	Critical Lane Group											

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	129	0	0	122	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	140	0	0	133	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	133	0	0	140	0	0	273	273	140	273	273	133
Stage 1	-	-	-	-	-	-	140	140	-	133	133	-
Stage 2	-	-	-	-	-	-	133	133	-	140	140	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1452	-	-	1443	-	-	679	634	908	679	634	916
Stage 1	-	-	-	-	-	-	863	781	-	870	786	-
Stage 2	-	-	-	-	-	-	870	786	-	863	781	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1452	-	-	1443	-	-	679	634	908	679	634	916
Mov Capacity-2 Maneuver	-	-	-	-	-	-	679	634	-	679	634	-
Stage 1	-	-	-	-	-	-	863	781	-	870	786	-
Stage 2	-	-	-	-	-	-	870	786	-	863	781	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	0
HCM LOS	-	-	A	A

















Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	0	1452	-	-	1443	-	-	0
HCM Control Delay, s	0	0	-	-	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 14: Broadway & Buena Vista

C3AMBaseline+Prj.  
 2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	117	0	0	42	0	210	6	0	20	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.86			0.86			1.00			0.96	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1611			1611			1855			1784	
Flt Permitted		1.00			1.00			1.00			1.00	
Satd. Flow (perm)		1611			1611			1855			1784	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	127	0	0	46	0	228	7	0	22	10
RTOR Reduction (vph)	0	114	0	0	41	0	0	2	0	0	3	0
Lane Group Flow (vph)	0	13	0	0	5	0	0	233	0	0	29	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		3.5			3.5			22.2			22.2	
Effective Green, g (s)		3.5			3.5			22.2			22.2	
Actuated g/C Ratio		0.10			0.10			0.66			0.66	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		167			167			1221			1175	
v/s Ratio Prot		c0.01			0.00			c0.13			0.02	
v/s Ratio Perm												
v/c Ratio		0.08			0.03			0.19			0.02	
Uniform Delay, d1		13.6			13.6			2.2			2.0	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.2			0.1			0.3			0.0	
Delay (s)		13.8			13.6			2.6			2.0	
Level of Service		B			B			A			A	
Approach Delay (s)		13.8			13.6			2.6			2.0	
Approach LOS		B			B			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			7.0					HCM 2000 Level of Service			A	
HCM 2000 Volume to Capacity ratio			0.18									
Actuated Cycle Length (s)			33.7					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			25.3%					ICU Level of Service			A	
Analysis Period (min)			15									
c	Critical Lane Group											



HCM Signalized Intersection Capacity Analysis  
15: Park St. & Tilden Wy.

C3AMBaseline+Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↕	
Volume (vph)	479	0	19	0	0	0	35	1184	0	0	612	354
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0						4.0			4.0	
Lane Util. Factor	1.00	0.95						0.95			0.95	
Frt	1.00	0.85						1.00			0.94	
Flt Protected	0.95	1.00						1.00			1.00	
Satd. Flow (prot)	1770	3008						3534			3345	
Flt Permitted	0.76	1.00						0.90			1.00	
Satd. Flow (perm)	1410	3008						3181			3345	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	521	0	21	0	0	0	38	1287	0	0	665	385
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	124	0
Lane Group Flow (vph)	521	8	0	0	0	0	0	1325	0	0	926	0
Turn Type	Perm	NA		Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.5	25.5						30.1			30.1	
Effective Green, g (s)	25.5	25.5						30.1			30.1	
Actuated g/C Ratio	0.40	0.40						0.47			0.47	
Clearance Time (s)	4.0	4.0						4.0			4.0	
Vehicle Extension (s)	3.0	3.0						3.0			3.0	
Lane Grp Cap (vph)	565	1206						1505			1583	
v/s Ratio Prot		0.00									0.28	
v/s Ratio Perm	c0.37							c0.42				
v/c Ratio	0.92	0.01						0.88			0.58	
Uniform Delay, d1	18.1	11.4						15.1			12.2	
Progression Factor	1.00	1.00						1.00			1.00	
Incremental Delay, d2	20.7	0.0						7.7			1.6	
Delay (s)	38.8	11.4						22.8			13.8	
Level of Service	D	B						C			B	
Approach Delay (s)		37.7			0.0			22.8			13.8	
Approach LOS		D			A			C			B	

Intersection Summary

HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	63.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 4.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	10	20	47	26	0	0	0	29	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	22	51	28	0	0	0	32	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	28	0	0	33	0	0	152	152	22	168	163	28
Stage 1	-	-	-	-	-	-	22	22	-	130	130	-
Stage 2	-	-	-	-	-	-	130	130	-	38	33	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1585	-	-	1579	-	-	815	740	1055	796	729	1047
Stage 1	-	-	-	-	-	-	996	877	-	874	789	-
Stage 2	-	-	-	-	-	-	874	789	-	977	868	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1585	-	-	1579	-	-	794	716	1055	753	705	1047
Mov Capacity-2 Maneuver	-	-	-	-	-	-	794	716	-	753	705	-
Stage 1	-	-	-	-	-	-	996	877	-	874	763	-
Stage 2	-	-	-	-	-	-	845	763	-	948	868	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	4.7	8.5	0
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	1055	1585	-	-	1579	-	-	0
HCM Control Delay, s	8.5	0	-	-	7.356	0	-	0
HCM Lane V/C Ratio	0.03	-	-	-	0.03	-	-	-
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.0	-	-	0.1	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	52	0	0	29	0	210	15	0	125	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	57	0	0	32	0	228	16	0	136	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	394	387	142	407	385	236	149	0	0	245	0	0
Stage 1	142	142	-	236	236	-	-	-	-	-	-	-
Stage 2	252	245	-	171	149	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	566	547	906	555	549	803	1432	-	-	1321	-	-
Stage 1	861	779	-	767	710	-	-	-	-	-	-	-
Stage 2	752	703	-	831	774	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	544	547	906	520	549	803	1432	-	-	1321	-	-
Mov Capacity-2 Maneuver	544	547	-	520	549	-	-	-	-	-	-	-
Stage 1	861	779	-	767	710	-	-	-	-	-	-	-
Stage 2	722	703	-	779	774	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.2	9.7	0	0
HCM LOS	A	A	-	-

















Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1432	-	-	906	803	1321	-	-
HCM Control Delay, s	0	-	-	9.2	9.7	0	-	-
HCM Lane V/C Ratio	-	-	-	0.06	0.04	-	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th-tile Q, veh	0.0	-	-	0.2	0.1	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

















HCM Signalized Intersection Capacity Analysis  
18: Park St. & Santa Clara Ave.

C3AMBaseline+Prj.  
2/16/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	75	198	18	17	279	546	26	604	21	119	518	62	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0			4.0			4.0			4.0		
Lane Util. Factor		1.00			1.00			0.95			0.95		
Frt		0.99			0.91			1.00			0.99		
Flt Protected		0.99			1.00			1.00			0.99		
Satd. Flow (prot)		1823			1698			3515			3463		
Flt Permitted		0.59			0.99			0.91			0.69		
Satd. Flow (perm)		1088			1685			3208			2405		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	82	215	20	18	303	593	28	657	23	129	563	67	
RTOR Reduction (vph)	0	4	0	0	89	0	0	4	0	0	11	0	
Lane Group Flow (vph)	0	313	0	0	825	0	0	704	0	0	748	0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		4			8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)		28.0			28.0			29.0			29.0		
Effective Green, g (s)		28.0			28.0			29.0			29.0		
Actuated g/C Ratio		0.43			0.43			0.45			0.45		
Clearance Time (s)		4.0			4.0			4.0			4.0		
Vehicle Extension (s)		3.0			3.0			3.0			3.0		
Lane Grp Cap (vph)		468			725			1431			1073		
v/s Ratio Prot													
v/s Ratio Perm		0.29			0.49			0.22			0.31		
v/c Ratio		0.67			1.14			0.49			0.70		
Uniform Delay, d1		14.8			18.5			12.8			14.5		
Progression Factor		1.00			1.00			1.00			1.00		
Incremental Delay, d2		3.6			78.1			1.2			3.8		
Delay (s)		18.4			96.6			14.0			18.2		
Level of Service		B			F			B			B		
Approach Delay (s)		18.4			96.6			14.0			18.2		
Approach LOS		B			F			B			B		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			43.7									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.91										
Actuated Cycle Length (s)			65.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			104.1%									ICU Level of Service	G
Analysis Period (min)			15										
c	Critical Lane Group												

















HCM Signalized Intersection Capacity Analysis  
20: Peterson St. & Chapman St.

C3AMBaseline+Prj.  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service		A						
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)		8.0						
Intersection Capacity Utilization	0.0%			ICU Level of Service		A						
Analysis Period (min)	15											
c Critical Lane Group												
















HCM Signalized Intersection Capacity Analysis  
 25: Glascock St. & Peterson St.

C3AMBaseline+Prj.  
 2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												
















HCM Signalized Intersection Capacity Analysis  
28: Park St. & Clement Ave.

C3AMBaseline+Prj.  
2/16/2016

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)														
Lane Util. Factor														
Frt														
Flt Protected														
Satd. Flow (prot)														
Flt Permitted														
Satd. Flow (perm)														
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Turn Type	Perm													
Protected Phases					8					2				
Permitted Phases					8									
Actuated Green, G (s)														
Effective Green, g (s)														
Actuated g/C Ratio														
Clearance Time (s)														
Lane Grp Cap (vph)														
v/s Ratio Prot														
v/s Ratio Perm														
v/c Ratio														
Uniform Delay, d1														
Progression Factor														
Incremental Delay, d2														
Delay (s)														
Level of Service														
Approach Delay (s)	0.0			0.0			0.0			0.0				
Approach LOS	A			A			A			A				
<b>Intersection Summary</b>														
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A							
HCM 2000 Volume to Capacity ratio	0.00													
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0							
Intersection Capacity Utilization	0.0%			ICU Level of Service			A							
Analysis Period (min)	15													
c Critical Lane Group														

HCM Signalized Intersection Capacity Analysis  
 32: Park St. & Eagle Ave.

















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














														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)														
Lane Util. Factor														
Frt														
Flt Protected														
Satd. Flow (prot)														
Flt Permitted														
Satd. Flow (perm)														
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Turn Type	Perm													
Protected Phases					8					2				
Permitted Phases					8									
Actuated Green, G (s)														
Effective Green, g (s)														
Actuated g/C Ratio														
Clearance Time (s)														
Lane Grp Cap (vph)														
v/s Ratio Prot														
v/s Ratio Perm														
v/c Ratio														
Uniform Delay, d1														
Progression Factor														
Incremental Delay, d2														
Delay (s)														
Level of Service														
Approach Delay (s)	0.0			0.0			0.0			0.0				
Approach LOS	A			A			A			A				
<b>Intersection Summary</b>														
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A							
HCM 2000 Volume to Capacity ratio	0.00													
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0							
Intersection Capacity Utilization	0.0%			ICU Level of Service			A							
Analysis Period (min)	15													
c Critical Lane Group														



HCM Signalized Intersection Capacity Analysis  
 43: Everett St. & Blanding Ave.

















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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
49: Everett St. & Santa Clara Ave.

C3AMBaseline+Prj.  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Fr1												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm								
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

**Intersection**

Intersection Delay, s/veh -

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0		0	0	
Median Width	0		12			12
Grade, %	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0
Number of Lanes	0	1	1	0	1	0

**Major/Minor**

			Major 1		Major 2	
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	-	-	0	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

**Approach**

	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBT	NBR	WBLn1	SBL	SBT
Cap, veh/h	-	-	-	-	-
HCM Control Delay, s	-	-	0	0	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Lane LOS	-	-	A	A	-
HCM 95th-tile Q, veh	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 8.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	8	3	2	4	0	3	6	29	4	8	36	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	3	2	4	0	3	7	32	4	9	39	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	3	0	0	5	0	0	60	34	4	50	33	2
Stage 1	-	-	-	-	-	-	22	22	-	10	10	-
Stage 2	-	-	-	-	-	-	38	12	-	40	23	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1619	-	-	1616	-	-	936	859	1080	950	860	1082
Stage 1	-	-	-	-	-	-	996	877	-	1011	887	-
Stage 2	-	-	-	-	-	-	977	886	-	975	876	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1619	-	-	1616	-	-	885	852	1080	914	853	1082
Mov Capacity-2 Maneuver	-	-	-	-	-	-	885	852	-	914	853	-
Stage 1	-	-	-	-	-	-	990	872	-	1005	885	-
Stage 2	-	-	-	-	-	-	919	884	-	930	871	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.5	4.1	9.3	9.3
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	876	1619	-	-	1616	-	-	908
HCM Control Delay, s	9.3	7.236	0	-	7.234	0	-	9.3
HCM Lane V/C Ratio	0.05	0.01	-	-	0.00	-	-	0.07
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.2	0.0	-	-	0.0	-	-	0.2

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh -

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0
Number of Lanes	0	0	0	0	1	0	0	1	0	0	0	0

Major/Minor	Minor 1			Major 1		
Conflicting Flow All	0	0	0	0	0	0
Stage 1	0	0	-	-	-	-
Stage 2	0	0	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	-	-	-
Pot Capacity-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	-	-
Mov Capacity-1 Maneuver	-	0	-	-	-	-
Mov Capacity-2 Maneuver	-	0	-	-	-	-
Stage 1	-	0	-	-	-	-
Stage 2	-	0	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	0	0
HCM LOS	A	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	WBLn1
Cap, veh/h	-	-	-	-
HCM Control Delay, s	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-
HCM Lane LOS	A	-	-	A
HCM 95th-tile Q, veh	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	0	0	0	0	2	0	0	61	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	2	0	0	66	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	0	0	0	33	0	0	1	0	0
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	33	0	-	1	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	-	-	-	974	-	-	1022	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	983	-	-	1022	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	983	-	-	1022	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	13	0	2	0	31	9	1	44	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	14	0	2	0	34	10	1	48	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	2	0	0	0	0	0	53	30	0	51	29	1
Stage 1	-	-	-	-	-	-	0	0	-	29	29	-
Stage 2	-	-	-	-	-	-	53	30	-	22	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1620	-	-	-	-	-	946	863	-	948	864	1084
Stage 1	-	-	-	-	-	-	-	-	-	988	871	-
Stage 2	-	-	-	-	-	-	960	870	-	996	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1620	-	-	-	-	-	906	863	-	-	864	1084
Mov Capacity-2 Maneuver	-	-	-	-	-	-	906	863	-	-	864	-
Stage 1	-	-	-	-	-	-	-	-	-	988	871	-
Stage 2	-	-	-	-	-	-	907	870	-	996	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	-
HCM LOS	-	-	-	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	1620	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	-	-	-	-
HCM 95th-tile Q, veh	-	0.0	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined



**Intersection**

Intersection Delay, s/veh 5.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	40	31	7	3	20	9	5	5	3	2	4	55
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	34	8	3	22	10	5	5	3	2	4	60
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	32	0	0	41	0	0	189	162	38	162	161	27
Stage 1	-	-	-	-	-	-	124	124	-	33	33	-
Stage 2	-	-	-	-	-	-	65	38	-	129	128	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1580	-	-	1568	-	-	771	730	1034	803	731	1048
Stage 1	-	-	-	-	-	-	880	793	-	983	868	-
Stage 2	-	-	-	-	-	-	946	863	-	875	790	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1580	-	-	1568	-	-	707	708	1034	778	709	1048
Mov Capacity-2 Maneuver	-	-	-	-	-	-	707	708	-	778	709	-
Stage 1	-	-	-	-	-	-	855	771	-	955	866	-
Stage 2	-	-	-	-	-	-	886	861	-	842	768	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.8	0.7	9.8	8.8
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	763	1580	-	-	1568	-	-	1005
HCM Control Delay, s	9.8	7.343	0	-	7.301	0	-	8.8
HCM Lane V/C Ratio	0.02	0.03	-	-	0.00	-	-	0.07
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th-tile Q, veh	0.1	0.1	-	-	0.0	-	-	0.2

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
7: Park St. /Park St. & Blanding Ave.

C3PM2020Baseline+Prj.  
2/16/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	179	68	20	655	153	248	0	1301	394	0	1209	394
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.99			0.97			0.97			0.96	
Flt Protected		0.97			0.97			1.00			1.00	
Satd. Flow (prot)		1784			1749			3416			3409	
Flt Permitted		0.61			0.68			1.00			1.00	
Satd. Flow (perm)		1123			1218			3416			3409	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	74	22	712	166	270	0	1414	428	0	1314	428
RTOR Reduction (vph)	0	4	0	0	7	0	0	38	0	0	42	0
Lane Group Flow (vph)	0	287	0	0	1141	0	0	1804	0	0	1700	0
Turn Type	Perm	NA		Perm	NA			NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)		34.0			34.0			33.0			33.0	
Effective Green, g (s)		34.0			34.0			33.0			33.0	
Actuated g/C Ratio		0.45			0.45			0.44			0.44	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		509			552			1503			1499	
v/s Ratio Prot								c0.53			0.50	
v/s Ratio Perm		0.26			c0.94							
v/c Ratio		0.56			2.07			1.20			1.13	
Uniform Delay, d1		15.1			20.5			21.0			21.0	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		1.4			486.3			96.8			69.2	
Delay (s)		16.5			506.8			117.8			90.2	
Level of Service		B			F			F			F	
Approach Delay (s)		16.5			506.8			117.8			90.2	
Approach LOS		B			F			F			F	

Intersection Summary

HCM 2000 Control Delay	191.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.64		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	121.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh	52.7
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	54	487	0	0	846	186	0	0	0	182	0	81
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	59	529	0	0	920	202	0	0	0	198	0	88
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	54.2	60.7	0	18.2
HCM LOS	F	F	-	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	10%	0%	69%
Vol Thru, %	100%	90%	82%	0%
Vol Right, %	0%	0%	18%	31%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	541	1032	263
LT Vol	0	487	846	0
Through Vol	0	0	186	81
RT Vol	0	54	0	182
Lane Flow Rate	0	588	1122	286
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0.971	1	0.552
Departure Headway (Hd)	8.391	5.943	5.929	6.954
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	606	617	523
Service Time	6.415	4.026	3.95	4.954
HCM Lane V/C Ratio	0	0.97	1.818	0.547
HCM Control Delay	11.4	54.2	60.7	18.2
HCM Lane LOS	N	F	F	C
HCM 95th-tile Q	0	13.7	15.1	3.3

**Notes**

- : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	329	0	0	0	0	0	0	0	0	0	0	37
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	358	0	0	0	0	0	0	0	0	0	0	40
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	0	0	0	735	715	0	715	715	0
Stage 1	-	-	-	-	-	-	715	715	-	0	0	-
Stage 2	-	-	-	-	-	-	20	0	-	715	715	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	-	-	-	335	356	-	346	356	-
Stage 1	-	-	-	-	-	-	422	434	-	-	-	-
Stage 2	-	-	-	-	-	-	999	-	-	422	434	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	356	-	-	356	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	356	-	-	356	-
Stage 1	-	-	-	-	-	-	422	434	-	-	-	-
Stage 2	-	-	-	-	-	-	999	-	-	422	434	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	-
HCM LOS	-	-	A	-

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	0	-	-	-	0	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	-	A	-	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 4.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	15	0	0	0	0	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None
Storage Length	0	0	0			0
Median Width	12			0	0	
Grade, %	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	0	0	0	0	16
Number of Lanes	1	0	0	1	1	0

**Major/Minor**

		Major 1		Major 2	
Conflicting Flow All	8	8	16	0	-
Stage 1	8	-	-	-	-
Stage 2	0	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-
Pot Capacity-1 Maneuver	1013	1074	1602	-	-
Stage 1	1015	-	-	-	-
Stage 2	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	-	-
Mov Capacity-1 Maneuver	1013	1074	1602	-	-
Mov Capacity-2 Maneuver	1013	-	-	-	-
Stage 1	1015	-	-	-	-
Stage 2	-	-	-	-	-

**Approach**

	EB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A	-	-

**Minor Lane / Major Mvmt**

	NBL	NBT	EBLn1	SBT	SBR
Cap, veh/h	1602	-	1013	-	-
HCM Control Delay, s	0	-	8.6	-	-
HCM Lane V/C Ratio	-	-	0.02	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th-tile Q, veh	0.0	-	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	3	0	0	4	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	3	0	0	4	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	2	0	0	2	0	0	0	0	0	0	0	0
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	2	0	-	2	0	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	1020	-	-	1020	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	1021	-	-	1021	-	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	1021	-	-	1021	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	-	-	0	0
HCM LOS	-	-	-	-




















Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	0	-	-	-	-	0	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	-	-	-	-	A	-	-
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 12: Broadway & Tilden Way

C3PM2020Baseline+Prj.  
 2/16/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	0	0	7	0	0	0	0	0	238	0	41	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0							4.0		4.0		
Lane Util. Factor		0.95							1.00		1.00		
Frt		0.85							0.85		1.00		
Flt Protected		1.00							1.00		1.00		
Satd. Flow (prot)		3008							1583		1863		
Flt Permitted		1.00							1.00		1.00		
Satd. Flow (perm)		3008							1583		1863		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	8	0	0	0	0	0	259	0	45	0	
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	41	0	0	0	
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	218	0	45	0	
Turn Type	Perm	NA		Prot			Perm		Perm	Perm	NA	Perm	
Protected Phases		4		3	8			2			6		
Permitted Phases	4						2		2	6		6	
Actuated Green, G (s)		1.0							47.2		47.2		
Effective Green, g (s)		1.0							47.2		47.2		
Actuated g/C Ratio		0.02							0.84		0.84		
Clearance Time (s)		4.0							4.0		4.0		
Vehicle Extension (s)		3.0							3.0		3.0		
Lane Grp Cap (vph)		53							1329		1564		
v/s Ratio Prot		c0.00									0.02		
v/s Ratio Perm									c0.14				
v/c Ratio		0.00							0.16		0.03		
Uniform Delay, d1		27.1							0.8		0.7		
Progression Factor		1.00							1.00		1.00		
Incremental Delay, d2		0.0							0.3		0.0		
Delay (s)		27.1							1.1		0.8		
Level of Service		C							A		A		
Approach Delay (s)		27.1			0.0			1.1			0.8		
Approach LOS		C			A			A			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			1.7									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.17										
Actuated Cycle Length (s)			56.2									Sum of lost time (s)	12.0
Intersection Capacity Utilization			31.4%									ICU Level of Service	A
Analysis Period (min)			15										
c	Critical Lane Group												

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	104	0	0	66	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	113	0	0	72	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	72	0	0	113	0	0	185	185	113	185	185	72
Stage 1	-	-	-	-	-	-	113	113	-	72	72	-
Stage 2	-	-	-	-	-	-	72	72	-	113	113	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1528	-	-	1476	-	-	776	709	940	776	709	990
Stage 1	-	-	-	-	-	-	892	802	-	938	835	-
Stage 2	-	-	-	-	-	-	938	835	-	892	802	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1528	-	-	1476	-	-	776	709	940	776	709	990
Mov Capacity-2 Maneuver	-	-	-	-	-	-	776	709	-	776	709	-
Stage 1	-	-	-	-	-	-	892	802	-	938	835	-
Stage 2	-	-	-	-	-	-	938	835	-	892	802	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	0
HCM LOS	-	-	A	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	0	1528	-	-	1476	-	-	0
HCM Control Delay, s	0	0	-	-	0	-	-	0
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th-tile Q, veh	-	0.0	-	-	0.0	-	-	-

















**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined






















HCM Signalized Intersection Capacity Analysis  
 14: Broadway & Buena Vista

C3PM2020Baseline+Prj.  
 2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	215	0	0	8	0	230	7	0	41	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.86			0.86			1.00			0.98	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1611			1611			1855			1817	
Flt Permitted		1.00			1.00			1.00			1.00	
Satd. Flow (perm)		1611			1611			1855			1817	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	234	0	0	9	0	250	8	0	45	10
RTOR Reduction (vph)	0	201	0	0	8	0	0	2	0	0	4	0
Lane Group Flow (vph)	0	33	0	0	1	0	0	256	0	0	51	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		4.5			4.5			19.6			19.6	
Effective Green, g (s)		4.5			4.5			19.6			19.6	
Actuated g/C Ratio		0.14			0.14			0.61			0.61	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		225			225			1132			1109	
v/s Ratio Prot		c0.02			0.00			c0.14			0.03	
v/s Ratio Perm												
v/c Ratio		0.15			0.01			0.23			0.05	
Uniform Delay, d1		12.1			11.9			2.8			2.5	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.0			0.5			0.1	
Delay (s)		12.4			11.9			3.3			2.6	
Level of Service		B			B			A			A	
Approach Delay (s)		12.4			11.9			3.3			2.6	
Approach LOS		B			B			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			7.2					HCM 2000 Level of Service			A	
HCM 2000 Volume to Capacity ratio			0.21									
Actuated Cycle Length (s)			32.1					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			32.5%					ICU Level of Service			A	
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis  
15: Park St. & Tilden Wy.

C3PM2020Baseline+Prj.  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	440	0	36	0	0	0	28	833	0	0	883	433
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0						4.0			4.0	
Lane Util. Factor	1.00	0.95						0.95			0.95	
Frt	1.00	0.85						1.00			0.95	
Flt Protected	0.95	1.00						1.00			1.00	
Satd. Flow (prot)	1770	3008						3534			3364	
Flt Permitted	0.76	1.00						0.81			1.00	
Satd. Flow (perm)	1410	3008						2861			3364	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	478	0	39	0	0	0	30	905	0	0	960	471
RTOR Reduction (vph)	0	24	0	0	0	0	0	0	0	0	88	0
Lane Group Flow (vph)	478	15	0	0	0	0	0	935	0	0	1343	0
Turn Type	Perm	NA		Perm			Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.9	23.9						30.1			30.1	
Effective Green, g (s)	23.9	23.9						30.1			30.1	
Actuated g/C Ratio	0.39	0.39						0.49			0.49	
Clearance Time (s)	4.0	4.0						4.0			4.0	
Vehicle Extension (s)	3.0	3.0						3.0			3.0	
Lane Grp Cap (vph)	543	1159						1388			1633	
v/s Ratio Prot		0.00									c0.40	
v/s Ratio Perm	c0.34							0.33				
v/c Ratio	0.88	0.01						0.67			0.82	
Uniform Delay, d1	17.7	11.8						12.2			13.7	
Progression Factor	1.00	1.00						1.00			1.00	
Incremental Delay, d2	15.3	0.0						2.6			4.8	
Delay (s)	33.1	11.8						14.8			18.5	
Level of Service	C	B						B			B	
Approach Delay (s)		31.4			0.0			14.8			18.5	
Approach LOS		C			A			B			B	

Intersection Summary

HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

**Intersection**

Intersection Delay, s/veh 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	26	0	0	0	0	37	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	28	0	0	0	0	40	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow All	0	0	0	0	0	0	57	57	0	77	57	0
Stage 1	-	-	-	-	-	-	0	0	-	57	57	-
Stage 2	-	-	-	-	-	-	57	57	-	20	0	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	-	-	-	-	-	-	940	834	-	912	834	-
Stage 1	-	-	-	-	-	-	-	-	-	955	847	-
Stage 2	-	-	-	-	-	-	955	847	-	999	-	-
Time blocked-Platoon, %	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	-	-	-	-	-	-	-	834	-	-	834	-
Mov Capacity-2 Maneuver	-	-	-	-	-	-	-	834	-	-	834	-
Stage 1	-	-	-	-	-	-	-	-	-	955	847	-
Stage 2	-	-	-	-	-	-	955	847	-	999	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	-	0
HCM LOS	-	-	-	A

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Cap, veh/h	-	-	-	-	-	-	-	-
HCM Control Delay, s	-	0	-	-	-	-	-	0
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Lane LOS	-	A	-	-	-	-	-	A
HCM 95th-tile Q, veh	-	-	-	-	-	-	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

**Intersection**

Intersection Delay, s/veh 1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	79	0	0	23	0	230	14	0	236	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	0		0	0		0	0		0
Median Width		0			0			0			0	
Grade, %		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	86	0	0	25	0	250	15	0	257	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Major/Minor	Minor 2			Minor 1			Major 1			Major 2		
Conflicting Flow All	527	522	257	557	515	258	257	0	0	265	0	0
Stage 1	257	257	-	258	258	-	-	-	-	-	-	-
Stage 2	270	265	-	299	257	-	-	-	-	-	-	-
Follow-up Headway	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Capacity-1 Maneuver	462	459	782	441	464	781	1308	-	-	1299	-	-
Stage 1	748	695	-	747	694	-	-	-	-	-	-	-
Stage 2	736	689	-	710	695	-	-	-	-	-	-	-
Time blocked-Platoon, %	0	0	0	0	0	0	0	-	-	0	-	-
Mov Capacity-1 Maneuver	447	459	782	393	464	781	1308	-	-	1299	-	-
Mov Capacity-2 Maneuver	447	459	-	393	464	-	-	-	-	-	-	-
Stage 1	748	695	-	747	694	-	-	-	-	-	-	-
Stage 2	712	689	-	632	695	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.2	9.8	0	0
HCM LOS	B	A	-	-

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Cap, veh/h	1308	-	-	782	781	1299	-	-
HCM Control Delay, s	0	-	-	10.2	9.8	0	-	-
HCM Lane V/C Ratio	-	-	-	0.11	0.03	-	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th-tile Q, veh	0.0	-	-	0.4	0.1	0.0	-	-

**Notes**

~ : Volume Exceeds Capacity; \$ : Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM Signalized Intersection Capacity Analysis  
 18: Park St. & Santa Clara Ave.

C3PM2020Baseline+Prj.  
 2/16/2016



















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	15	303	41	4	265	328	4	550	38	124	842	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.98			0.93			0.99			0.99	
Flt Protected		1.00			1.00			1.00			0.99	
Satd. Flow (prot)		1830			1724			3504			3473	
Flt Permitted		0.97			1.00			0.95			0.77	
Satd. Flow (perm)		1786			1721			3328			2676	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	329	45	4	288	357	4	598	41	135	915	99
RTOR Reduction (vph)	0	8	0	0	72	0	0	7	0	0	10	0
Lane Group Flow (vph)	0	382	0	0	577	0	0	636	0	0	1139	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		24.0			24.0			29.2			29.2	
Effective Green, g (s)		24.0			24.0			29.2			29.2	
Actuated g/C Ratio		0.39			0.39			0.48			0.48	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		700			674			1587			1276	
v/s Ratio Prot												
v/s Ratio Perm		0.21			0.34			0.19			0.43	
v/c Ratio		0.55			0.86			0.40			0.89	
Uniform Delay, d1		14.4			17.0			10.3			14.6	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.9			10.4			0.8			9.7	
Delay (s)		15.3			27.4			11.1			24.3	
Level of Service		B			C			B			C	
Approach Delay (s)		15.3			27.4			11.1			24.3	
Approach LOS		B			C			B			C	

Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	61.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

















HCM Signalized Intersection Capacity Analysis  
20: Peterson St. & Chapman St.

C3PM2020Baseline+Prj.  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service		A						
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0		Sum of lost time (s)		8.0							
Intersection Capacity Utilization	0.0%		ICU Level of Service		A							
Analysis Period (min)	15											
c Critical Lane Group												
















HCM Signalized Intersection Capacity Analysis  
 25: Glascock St. & Peterson St.

C3PM2020Baseline+Prj.  
 2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
28: Park St. & Clement Ave.
















C3PM2020Baseline+Prj.  
2/16/2016

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)														
Lane Util. Factor														
Fr <sub>t</sub>														
Fl <sub>t</sub> Protected														
Satd. Flow (prot)														
Fl <sub>t</sub> Permitted														
Satd. Flow (perm)														
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Turn Type	Perm													
Protected Phases					8					2				
Permitted Phases					8									
Actuated Green, G (s)														
Effective Green, g (s)														
Actuated g/C Ratio														
Clearance Time (s)														
Lane Grp Cap (vph)														
v/s Ratio Prot														
v/s Ratio Perm														
v/c Ratio														
Uniform Delay, d <sub>1</sub>														
Progression Factor														
Incremental Delay, d <sub>2</sub>														
Delay (s)														
Level of Service														
Approach Delay (s)	0.0			0.0			0.0			0.0				
Approach LOS	A			A			A			A				
<b>Intersection Summary</b>														
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A							
HCM 2000 Volume to Capacity ratio	0.00													
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0							
Intersection Capacity Utilization	0.0%			ICU Level of Service			A							
Analysis Period (min)	15													
c Critical Lane Group														



















HCM Signalized Intersection Capacity Analysis  
 32: Park St. & Eagle Ave.

















C3PM2020Baseline+Prj.  
 2/16/2016

																
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR				
Lane Configurations																
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Total Lost time (s)																
Lane Util. Factor																
Frt																
Flt Protected																
Satd. Flow (prot)																
Flt Permitted																
Satd. Flow (perm)																
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92				
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0				
Turn Type	Perm															
Protected Phases					8						2		6			
Permitted Phases					8											
Actuated Green, G (s)																
Effective Green, g (s)																
Actuated g/C Ratio																
Clearance Time (s)																
Lane Grp Cap (vph)																
v/s Ratio Prot																
v/s Ratio Perm																
v/c Ratio																
Uniform Delay, d1																
Progression Factor																
Incremental Delay, d2																
Delay (s)																
Level of Service																
Approach Delay (s)	0.0			0.0			0.0			0.0						
Approach LOS	A			A			A			A						
<b>Intersection Summary</b>																
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A									
HCM 2000 Volume to Capacity ratio	0.00															
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0									
Intersection Capacity Utilization	0.0%			ICU Level of Service			A									
Analysis Period (min)	15															
c Critical Lane Group																

HCM Signalized Intersection Capacity Analysis  
43: Everett St. & Blanding Ave.

















C3PM2020Baseline+Prj.  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Fr t												
Fl t Protected												
Satd. Flow (prot)												
Fl t Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
<b>Intersection Summary</b>												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	40.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
49: Everett St. & Santa Clara Ave.

C3PM2020Baseline+Prj.  
2/16/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Fr <sub>t</sub>												
Fl <sub>t</sub> Protected												
Satd. Flow (prot)												
Fl <sub>t</sub> Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm								
Protected Phases		4			8			2			6	
Permitted Phases	4			8								
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d <sub>1</sub>												
Progression Factor												
Incremental Delay, d <sub>2</sub>												
Delay (s)												
Level of Service												
Approach Delay (s)		0.0			0.0			0.0			0.0	
Approach LOS		A			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay		0.0			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.00										
Actuated Cycle Length (s)		40.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		0.0%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

**City of Alameda Construction Guidelines for Traffic Lane Controls**

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The Contractor shall maintain at least one lane of traffic in each direction at all times during construction. The full width of the traveled way shall be open for use by public traffic when construction operations are not in progress on working days and times provided. See the charts below for the allowable lane and parking lane closure times:

Chart No. 1 - Lane Requirements for Arterials																									
		A.M.											P.M.												
FROM HOUR TO HOUR	1	1	2	3	4	5	6	7	8	9	1	1	1	1	2	3	4	5	6	7	8	9	1	1	1
	2										0	1	2										0	1	2
Weekdays										1	1	1	1	1	1	2	2								
Weekends										1	1	1	1	1	1	2	2								
Legend:																									
	No work shall be done during this hour																								
1	Provide at least one through traffic lane open in each direction of travel																								
2	Provide at least two adjacent through traffic lanes open in each direction of travel																								

Chart No. 2 - Lane Requirements for Collectors with an ADT ≥ 10,000 vehicles																									
		A.M.											P.M.												
FROM HOUR TO HOUR	1	1	2	3	4	5	6	7	8	9	1	1	1	1	2	3	4	5	6	7	8	9	1	1	1
	2										0	1	2										0	1	2
Weekdays										1	1	1	1	1	1	2	2								
Weekends										1	1	1	1	1	1	2	2								
Legend:																									
	No work shall be done during this hour																								
1	Provide at least one through traffic lane open in each direction of travel																								
2	Provide at least two adjacent through traffic lanes open in each direction of travel																								

Chart No. 3 - Lane Requirements for Collectors with an ADT < 10,000 vehicles																									
		A.M.											P.M.												
FROM HOUR TO HOUR	1	1	2	3	4	5	6	7	8	9	1	1	1	1	2	3	4	5	6	7	8	9	1	1	1
	2										0	1	2										0	1	2
Weekdays										1	1	1	1	1	1	1	1								
Weekends										1	1	1	1	1	1	1	1								
Legend:																									
	No work shall be done during this hour																								
1	Provide at least one through traffic lane open in each direction of travel																								
2	Provide at least two adjacent through traffic lanes open in each direction of travel																								

Chart No. 4 – School Zone																									
FROM HOUR TO HOUR	A.M.												P.M.												
	1	1	2	3	4	5	6	7	8	9	10	11	1	1	2	3	4	5	6	7	8	9	10	11	12
Weekdays										1	1	1	1	1	1										
Weekends										1	1	1	1	1	1										
Legend:																									
	No work shall be done during this hour																								
1	Provide at least one through traffic lane open in each direction of travel																								
2	Provide at least two adjacent through traffic lanes open in each direction of travel																								

The Contractor shall maintain at least one lane of traffic in each direction at all times during construction. The full width of the traveled way shall be open for use by public traffic when construction operations are not in progress on working days and times provided. See the chart below for work hour limitations based on the location of the work:

Chart No. 1 – Work Hour Limitations based on Location (Monday through Friday)																									
Location	From Hour to Hour																								
	A.M.												P.M.												
	1	1	2	3	4	5	6	7	8	9	10	11	1	1	2	3	4	5	6	7	8	9	10	11	12
Arterial									/	X	X	X	X	X	X	/									
Collector, ADT ≥ 10,000 veh.									/	X	X	X	X	X	X	/									
Collector, ADT < 10,000 veh.								X	X	X	X	X	X	X	X										
School Zone								/	X	X	X	X	/												
Safe Route to School, off-street								X	X	X	X	X													
Legend:																									
	No work shall be done during this hour																								
/	Work is allowed to start/end at this half hour																								
X	Work is allowed during this hour																								

Chart No. 1 – Work Hour Limitations based on Location (Monday through Friday)		
Location	Start Time	End Time
Arterial	9:30 AM	4:30 PM
Collector, ADT ≥ 10,000 vehicles	9:30 AM	4:30 PM
Collector, ADT < 10,000 vehicles	8:00 AM	5:00 PM
School Zone	9:30 AM	2:30 PM
Safe Route to School, off-street	9:00 AM	3:00 PM