Appendix I

Draft Hydrology and Hydraulics Study Report for the East-West Connector Project

East-West Connector Project
In the Cities of Union City and Fremont, Alameda County, California

Draft Hydrology and Hydraulics Study Report

Submitted to:

Alameda County Transportation Authority

T·Y·LIN INTERNATIONAL

Prepared by:

WRECO

March 2009

East-West Connector Project
In the Cities of Union City and Fremont,
Alameda County, California

Draft Hydrology and Hydraulic Study Report

Prepared for:
Alameda County Transportation Authority

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

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Date

March 2009

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Executive Summary

The East-West Connector (EWC) Project is located in Alameda County between Interstate 880 (I-880) to the west and Mission Boulevard/State Route 238 (SR 238) to the east. The Project is 3.0 mi long and is located in the Cities of Fremont and Union City. The proposed EWC Project alignment would provide a four-lane roadway from the Mission Boulevard/State Route 238 (SR 238) and the Appian Way Intersection to the east, to Paseo Padre Parkway to the west. The EWC Project would also widen both Paseo Padre Parkway and Decoto Road from four to six lanes.

The purpose of this study is to provide hydrologic and hydraulic analysis of the creeks in the vicinity of the Project area, and to evaluate potential changes in flood hydrology and hydraulics in relation to the proposed EWC Project's roadway and structure improvements. The potential impacts associated with the Project were analyzed, and recommendations or alternative designs were proposed to mitigate these impacts.

There are three waterway crossings within the Project limits of the EWC Project. Alameda County Flood Control and Water Conservation District's (ACFC & WCD) Line M Channel, Old Alameda Creek, and the Alameda Creek Flood Control Channel (ACFCC). The proposed Project alignment would cross Old Alameda Creek at two separate locations. The alignment also crosses the ACFCC east of the Paseo Padre Parkway. In addition, the new alignment would impact a portion of the existing Line M Channel.

The following are the hydraulic modifications identified for this Project: 1) a new bridge would be constructed over the ACFCC; 2) two new bridges would be built over the Old Alameda Creek Channel; 3) a new Line M Diversion Pipe would be constructed connecting Old Alameda Creek and the Line M Channel; 4) the replacement of the impacted section of the Line M Channel under the new roadway alignment with a new culvert (approximately 1,100 ft of the Line M Channel would be replaced by double 10-ft by 5-ft box culverts); 5) the removal of existing detention basins under the proposed roadway alignment; 6) the installation of a new pump station for capturing and discharging water from the depressed roadway section; and 7) new drainage systems and modification or extensions of existing systems would be designed for the new roadway alignment as well as for the widened city streets.

The new roadway alignment crosses a section of the Line M Channel, which is identified within the 100-year Federal Emergency Management Agency (FEMA) flood boundary. The flooding along the Line M Channel may be caused by backwater effects from an existing undersized channel. To help relieve the existing capacity issues that the Line M Channel is experiencing, the City of Union City and the ACFC & WCD entered into an agreement, (through a Memorandum of Understanding [MOU]), for the construction of a new Line M Diversion Pipe to bypass a portion of the flows from the existing Line M Channel and discharge these flows into Old Alameda Creek. In addition, the Pipe would

be sized to collect flows from existing detention basins impacted by the new EWC Project alignment (MOU, 2004).
The additional flows from the new Line M Diversion Pipe and the two proposed bridges over Old Alameda Creek would raise the existing water surface elevation (WSE) at Old Alameda Creek by 1.04 ft. Because of the ample existing available volume in Old Alameda Creek additional flow from the Line M Channel diversion pipeline would have minimal impact on the hydraulic capacity of the channel. The 100 year WSE would be contained within the channel, with ample freeboard (at least 15 ft) between 100-year water surface elevation and channel banks. There are flap gates at the downstream end of the Old Alameda Creek that would help in regulating or subsiding any substantial impacts on the hydrology and hydraulics of ACFCC due to added flows in the Old Alameda Creek. Even with the use of the flap gates, Old Alameda Creek has ample capacity to store the proposed additional flows. This capacity was formed because Old Alameda Creek was part of the main flood carrying channel prior to the construction of Alameda Flood Control Channel.

Based on the scour calculations performed at the two bridge locations, there would be approximately 16 ft of scour depth due to pier and contraction at Bridge Location #1. Whereas, there would be no scouring due to the bridge at Bridge Location #2 as the bridge abutments are not causing any obstruction to the flow conveyance in the channel.

The proposed bridge over the ACFCC would raise the water surface profile slightly, but the 100-year WSE, as well as the Maximum Probable Flood (MPF), would pass under the proposed bridge. The ACFC & WCD recommends 1 ft of freeboard above the MPF for the ACFCC; however, hydraulic analysis results showed that this guideline was not met for both the existing and proposed conditions. The maximum pier scour depth for the ACFCC bridge was calculated as 7.75 ft and the scour depth at the Abutment#1 (south of new roadway) was calculated as 20.7 ft.

New drainage systems with new outfalls into Old Alameda Creek would be designed per Alameda County and Cities of Union City and Fremont Criteria to accommodate the runoff from the proposed new roadway alignment. Existing drainage facilities throughout the EWC Project limits would be extended, replaced, repaired, and/or improved as necessary to provide proper drainage for the increased runoff of the widened areas.

The objective of the drainage design is to limit the design WSEs and velocities to no greater than the existing conditions, or to what can be handled by the existing conditions, at the boundary of the EWC Project. In addition, the EWC Project’s design goal is to maintain pre-construction storm water discharge flows by metering or detaining these flows to pre-construction rates prior to discharge to a receiving water body. Although there are diversions proposed for this Project, these diversions are proposed to enhance and restore wetlands and habitats within Old Alameda Creek as well as relieve existing flooding issues along the Line M Channel.

Acronyms

ACFC & WCD	Alameda County Flood Control and Water Conservation District
ACFCC	Alameda Creek Flood Control Channel
ACHHM	Alameda County Hydrology and Hydraulics Manual
ACTA	Alameda County Transportation Authority
EIR/EIS	Environmental Impact Report/ Environmental Impact Statement
EWC	East-West Connector
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map (FIRM)
FIS	Flood Insurance Study (FIS)
HEC-RAS	Hydrologic Engineering Center-River Analysis System
HGL	Hydraulic Grade Line
MPF	Maximum Probable Flood
NAVD	North American Vertical Datum
NGVD	National Geodetic Vertical Datum
PG&E	Pacific Gas and Electric Company
PSSC	Pacific States Steel Corporation
RTP	Bay Area’s Regional Transportation Plan
UPPR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
WSE	Water Surface Elevation

1 GENERAL DESCRIPTION

1.1 Project Description

The EWC Project is located in Alameda County between Interstate 880 (I-880) to the west and Mission Boulevard/State Route 238 (SR 238) to the east (Figure 1). The EWC Project is 3.0 mi long and is located in the cities of Fremont and Union City. Both cities are in the lower portion of the Alameda Creek Watershed. The overall objectives of the EWC Project include:

- Provision of turn lanes on Mission Boulevard/SR 238 for a distance of approximately 1,000 ft north and south of the Mission Boulevard and Appian Way Intersection.
- Constructing a new four-lane roadway from the Intersection of Appian Way and Mission Boulevard to Alvarado-Niles Road.
- Reconstructing Alvarado-Niles Road to accommodate the new East-West Connector roadway.
- Constructing new four-lane roadway from Alvarado Niles Road to PaseoPadre Parkway.
- Widening the Paseo Padre Parkway to six lanes from Isherwood Way to Decoto Road.
- Widening of Decoto Road to six lanes from Paseo Padre Parkway to Cabrillo Drive.

Implementation of the above improvements will result in:

- Improved mobility and congestion relief.
- Reduced travel time for commuters.
- Additional access to constructed and planned projects.
- Improved emergency response by decreasing local traffic congestion.
- Reduced congestion-related accidents.

1.2 Project Hydraulic Modifications

The following are the major hydraulic modifications identified for the EWC Project:

- A new bridge constructed over the Alameda Creek Flood Control Channel (ACFCC).
- Two new bridges built over the Old Alameda Creek.
- A new Line M Diversion Pipe constructed connecting the Old Alameda Creek and the Zone 5 Line M Channel.
- Replacement of the impacted section of the Line M Channel under the new roadway alignment with a new culvert.
- Removal of existing detention basins along the proposed new roadway alignment.

- Installation of a new pump station for capturing and discharging water from the depressed roadway section.
- An on-site storm drain system designed for the new alignment.
- Modifications to storm drains on Decoto Road and Paseo Padre Parkway.

1.3 Purpose of Study

The purposes of this study are: to provide hydrologic and hydraulic analysis for water ways in the vicinity of the Project area; to propose hydraulic modifications and design for the bridges, culverts and pump stations; and to evaluate potential changes in flood hydrology and hydraulics in relation to the proposed EWC Project and structure improvements. The potential impacts associated with the Project were analyzed in the study, and recommendations or alternative designs were proposed to mitigate these impacts.

1.4 Project History

In the 1960s, Caltrans formulated a long term plan to provide a parallel route to I-880. This included the construction of a freeway, commonly referred to as the "Hayward Bypass" (Bypass) to connect Mission Boulevard to I-580. The Bypass would have its northern terminus at I-580, and would connect to Mission Boulevard/SR 238 at Industrial Parkway. As a companion project, Caltrans proposed to realign State Route 84 (SR 84) as a six-lane freeway from Mission Boulevard near Appian Way to the I-880/Decoto Road Interchange in the Cities of Fremont and Union City. Caltrans preserved the right-of–way (R/W) along the proposed SR 84 alignment corridor and the Route 84 Realignment Project was included in the Bay Area's Regional Transportation Plan (RTP).

By the 1980s, the traffic congestion increased on both I-880 and the East-West travel corridors in the general area including Decoto Road, Peralta Boulevard, Thornton Avenue, and Mowry Avenue. The congestion was expected to significantly worsen as a result of projected growth in Fremont, Union City and the surrounding areas. In the 1980s, funding became available and environmental studies for both projects commenced. Both projects encountered significant local opposition, which prolonged the environmental review processes. In 2002, Caltrans and the FHWA completed a final combined Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Route 84 Realignment Project. However, the document was not certified due to continued local opposition over the alignment location and its potential to result in environmental impacts to the surrounding communities. At the same time, Caltrans decided not to proceed with the project.

In order to address the projected and on-going traffic congestion problems in the SR 84 area, the Alameda County Transportation Authority (ACTA) assumed the lead agency role for the Route 84 Realignment Project. Upon assuming the lead, ACTA worked with the City of Fremont, City of Union City, and local community members and organizations to redefine the purpose of the Project and to develop alternative alignment options. A conceptual alternative, which was designated along Decoto Road to Alvarado-Niles Road to the historic parkway alignment to Mission Boulevard, was analyzed in early 2004. However, this alternative was found to be unacceptable. Two additional conceptual alternatives were considered, “Option 2” and “Option 4/6.” Through further preliminary design, environmental constraints studies and community input, Option 2 was developed further and became the proposed project alignment. In general, the proposed EWC Project alignment would provide a new four-lane roadway from the Mission Boulevard/SR 238 and Appian Way Intersection on the east, to Paseo Padre Parkway on the west, and widening of both Paseo Padre Parkway and Decoto Road to six lanes.

1.5 Description of Creek Crossings

The proposed Project alignment would cross Old Alameda Creek at two separate locations (shown as Bridge Location #1 and Bridge Location #2 in Figure 3). The alignment also crosses the ACFCC east of the Paseo Padre Parkway (see Figure 3). The creek crossings would be constructed as two separate concrete bridges supported by abutments and/or intermediate piers. The channel crossing would be constructed as a slab bridge supported by two piers at Bridge Location #1 and as clear span at Bridge Location #2. The new alignment would also pass over the Line M Channel. Approximately 1,100 ft of the Line M Channel would be replaced by double 10-ft by 5-ft box culverts.

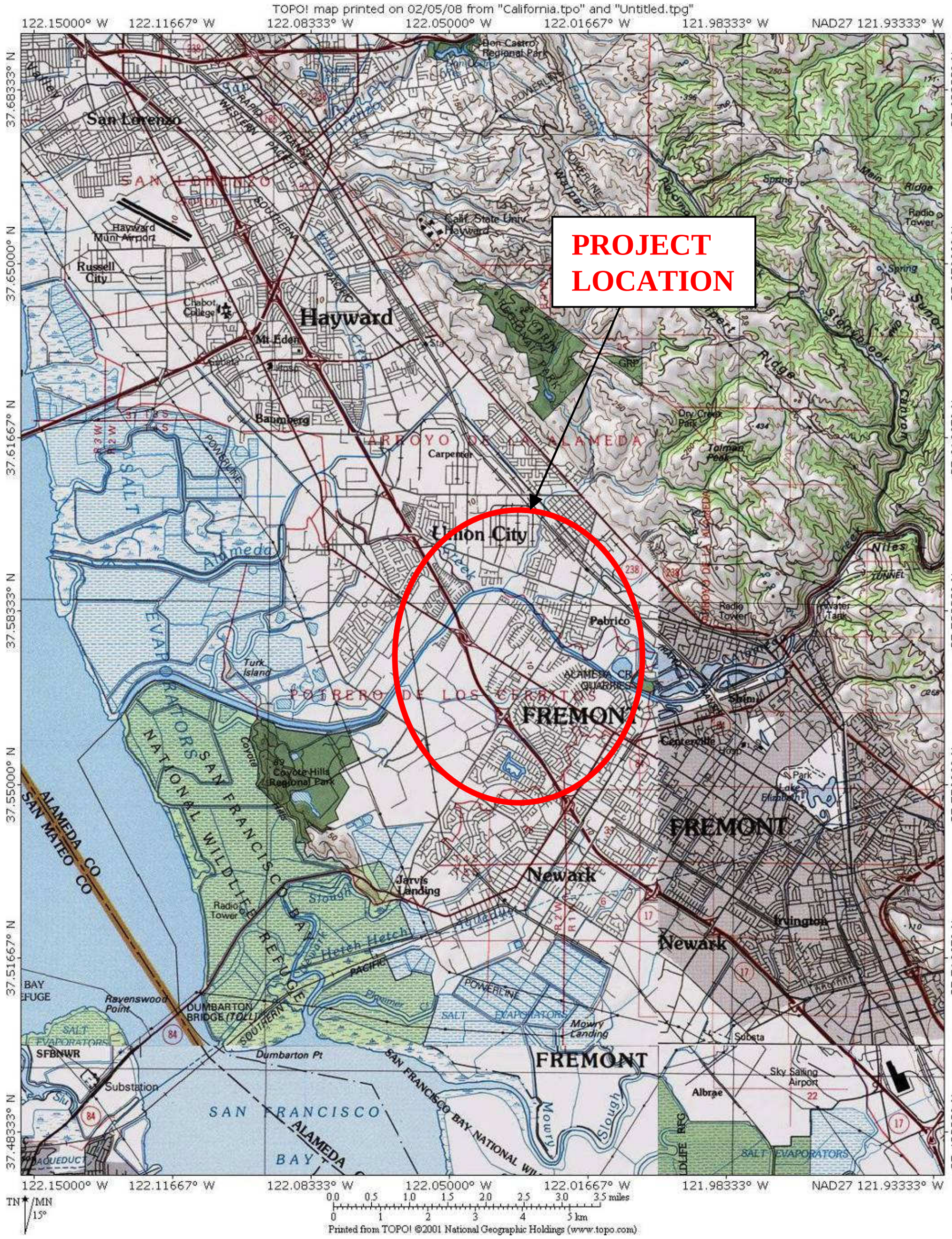


Figure 1. Location Map

Source: United States Geological Survey

Figure 2. Vicinity Map

Source: United States Geological Survey

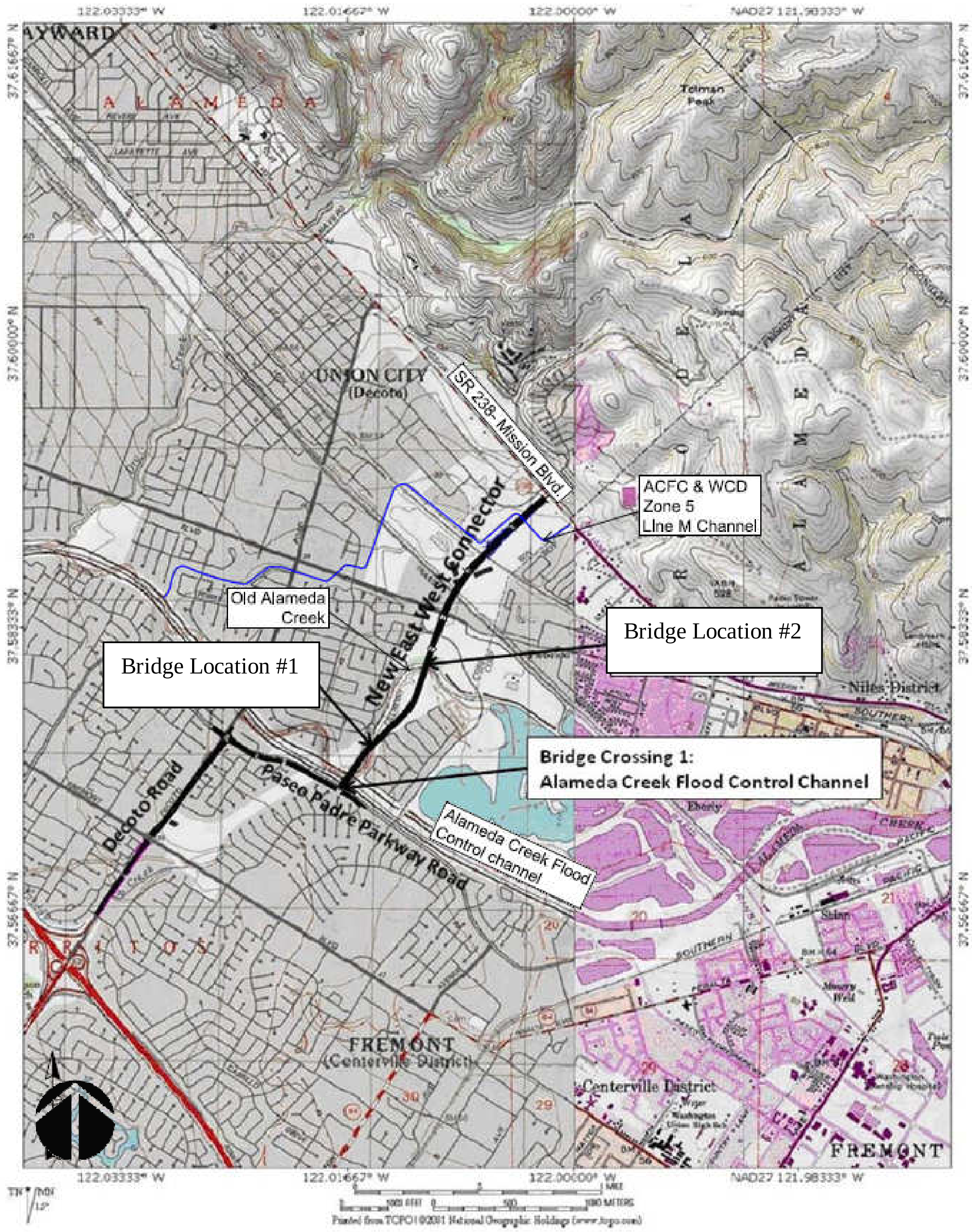


Figure 3. Creek and Channel Crossings Map

Source: United States Geological Survey

1.6 Geographical References

- U.S. Geological Survey, Union City, CA Quadrangle (Current as of 1994)
- U.S. Geological Survey, Fremont, CA Quadrangle (Current as of 1994)

1.7 Climate

The rainy season for the study area generally extends between October 15th and April 15th, however, most flooding occurs from December through March (Caltrans, 2003). The mean annual precipitation for the Project area is 16.5 in. (see Figure 5). The major drainage basin in the Project area is Alameda Creek Watershed, which is the largest watershed in the Southern San Francisco Bay Region draining nearly 700 mi².

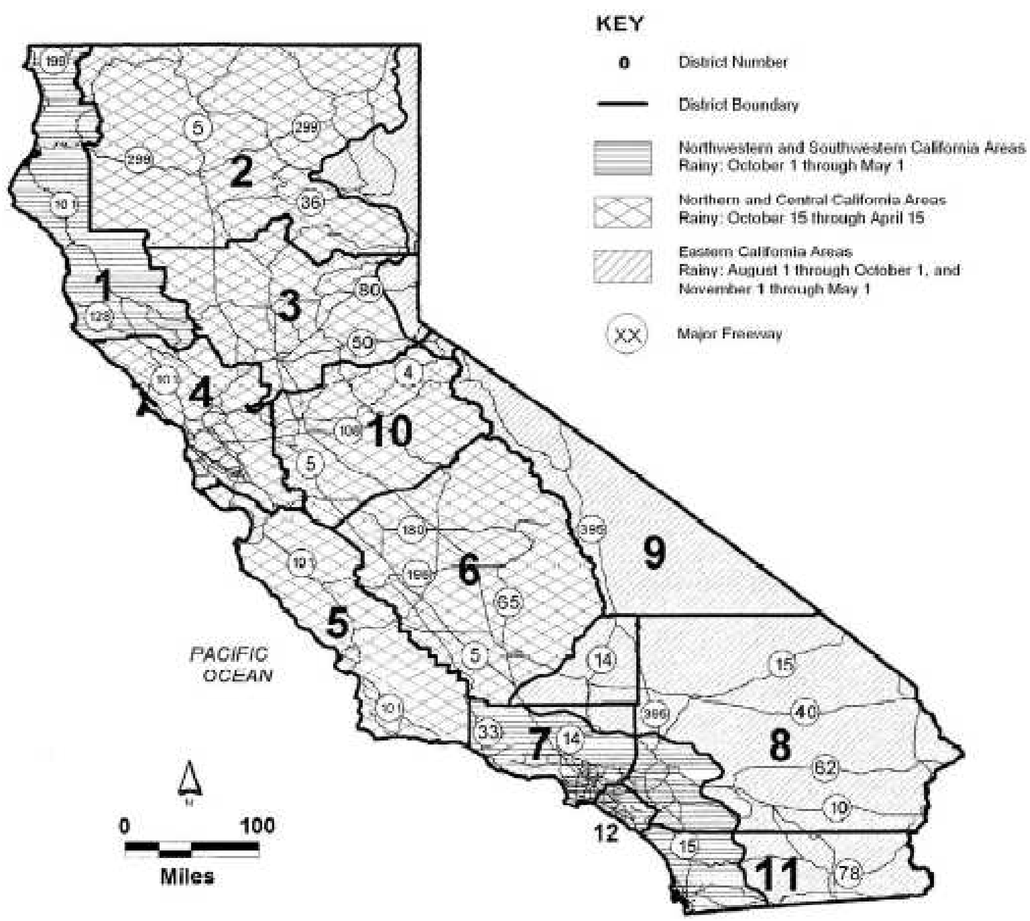


Figure 4. Designation of Rainy Seasons

Source: California Department of Transportation

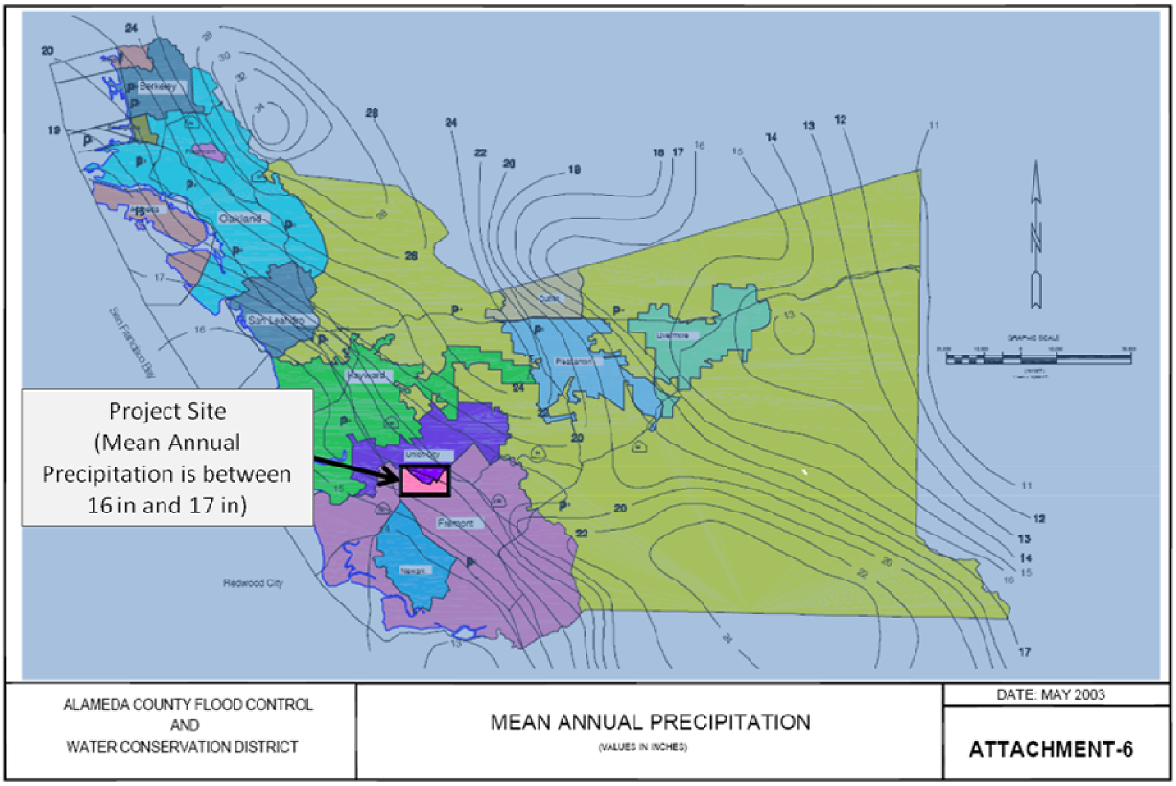


Figure 5. Mean Annual Precipitation Map for Alameda County

Source: Alameda County Flood Control and Water Conservation District

1.8 Traffic

Traffic data recorded in 2006 was obtained from Caltrans (2006) for the following roadways within the Project limits:

- Decoto Road
- Paseo Padre Parkway
- Fremont Boulevard
- Mission Boulevard

Table 1. Traffic Volume of Local Streets within the Project Limits

Location Description	ADT
Decoto Road	210,000
Fremont Boulevard	206,000
Thornton Road/ Paseo Padre Parkway	67,000
Mission Boulevard	12600

(Caltrans, 2006)

2 FLOODPLAIN RISK ASSESSMENT

2.1 Federal Emergency Management Agency Data

The new roadway alignment crosses Line M Channel, which is identified within the 100-year flood boundary. The Federal Emergency Management Agency (FEMA) Flood Insurance Report Map (FIRM), community panel Number 0600140010 C, shows a floodplain area southwest of Mission Boulevard (see Figure 6). The Line M Channel bed and sides are mainly unlined with earthen embankments. Table 2 lists peak discharge, drainage area, and water surface elevation (WSE) obtained from the FEMA Flood Insurance Study (FIS) report. The channel drains 1.53 mi² of residential areas and surrounding local streets, including Mission Boulevard.

Table 2. FEMA FIS Hydraulic Data Line M Channel

Reach	100-Year Peak Discharge cfs	Drainage Area mi²	Water Surface Elevation ft	Source
Line M Channel (800 ft upstream of Southern Pacific Railroad	520	1.53	46.9	FEMA FIS : Union City Vertical datum : ft NGVD

2.2 Description of Flood Sources

According to FEMA FIS, the principle flooding problem in the vicinity of the Project site is caused by sheet flow and interior drainage. The sheet flooding events could occur very frequently. Figure 6 shows the 100-year floodplain for the Line M Channel. The flooding along the Line M Channel is likely caused by the existing undersized channel.

Due to the frequent flooding events in the 1950s (1955 and 1958 particularly) along the Alameda Creek, the Alameda Creek Flood Control Project was initiated in the mid-1960s by the United States Army Corp of Engineers (USACE), and was completed in the mid-1970s. The natural channel bottom of the creek has been modified with desiltation and slurry sills for evenly distributed flows. Channel slopes were provided with riprap for erosion control. Also, levees were built on both sides of the channel in low lying areas to provide protection against flows in excess of 100-year. However, there are no levees within the EWC Project limits.

2.3 Map of Floodplain

The floodplain associated with Line M Channel within the study area is shown in the two main flood plain zones mapped for the Line M (see Figure 6) [Zone X (light purple) and Zone-AH (dark purple)]. Based on FEMA's description, Zone X shows the areas above the base flood or above the 500-year flood, with minimal to moderate flood hazard.

Zone AH is areas with shallow flooding. Zone AE areas are within the base flood, a flood having a 1% chance of being equaled or exceeded in any given year (100-year storm event).

For ACFCC, flow appears to be confined within the banks on both sides shown in Figure 6, as documented in the FIS report.

2.4 Traffic Interruptions for Base Flood (Q_{100})

The FEMA Flood Insurance Rate Map (FIRM) (see Appendix A) illustrates existing floodplains within the Project area. Figure 6 shows that if no improvements are proposed to the Line M Channel, the EWC roadway has the potential to be inundated. However, based on the hydraulic calculations (see Section 4.3); traffic interruptions due to a 100-year flood event would not be present because the roadway elevations are higher than the 100-year WSE at the crossing. Hydraulic improvements proposed in this Project would also help in alleviating flooding in the nearby local streets.

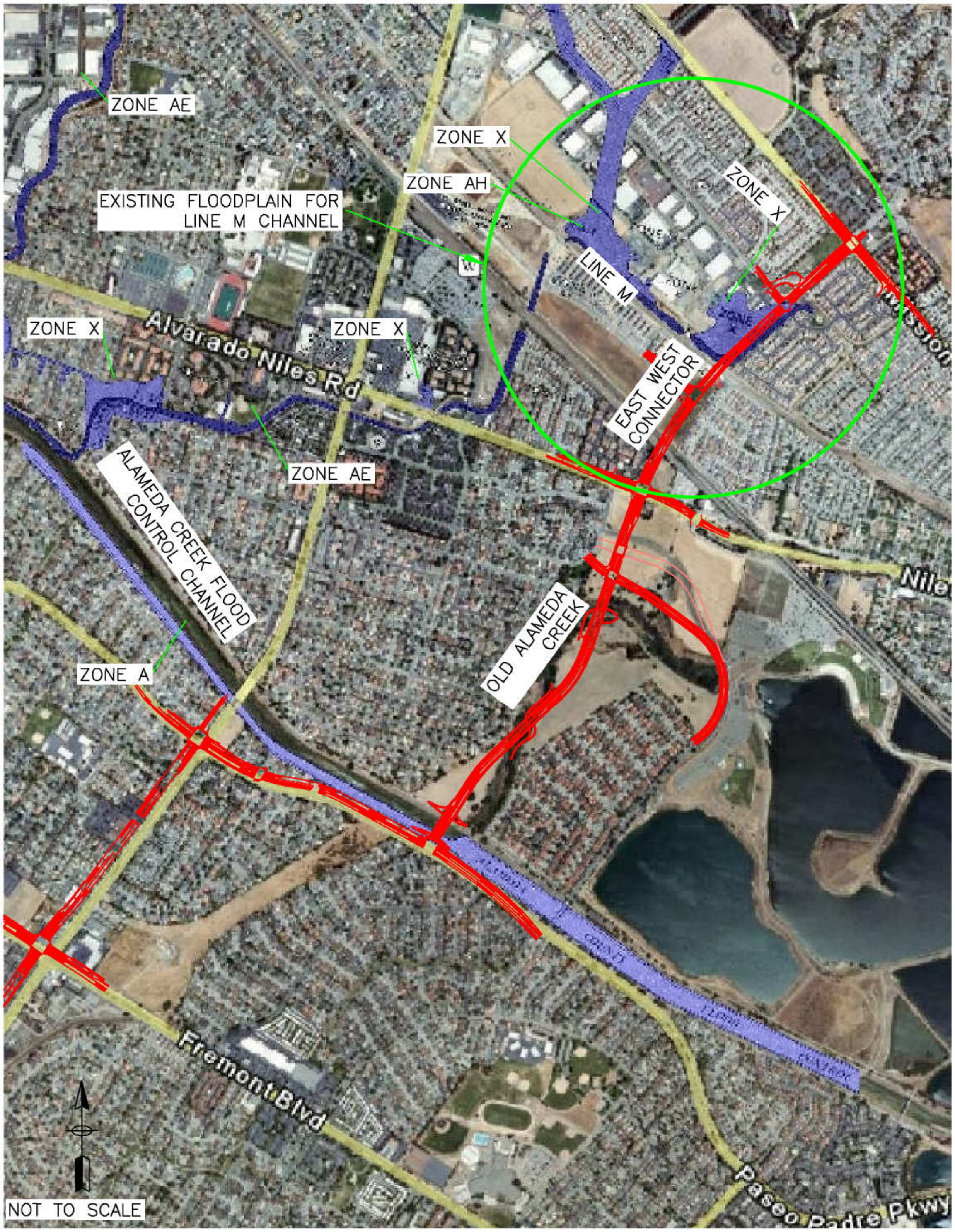


Figure 6. Map of Floodplain

Source: FEMA FIRM, Google Earth and T.Y. Lin International

2.5 Impacts on Natural and Beneficial Floodplain Values

Natural and beneficial floodplain values shall include, but are not limited to: fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

Impacts on natural and beneficial floodplain values were assessed by evaluating the area of potential impacts to USACE wetlands, delineated by ICF Jones and Stokes (Jones and Stokes, 2008). Designated wetland areas identified in the vicinity of the Project site were not within the FEMA delineated floodplain areas or other natural and beneficial uses.

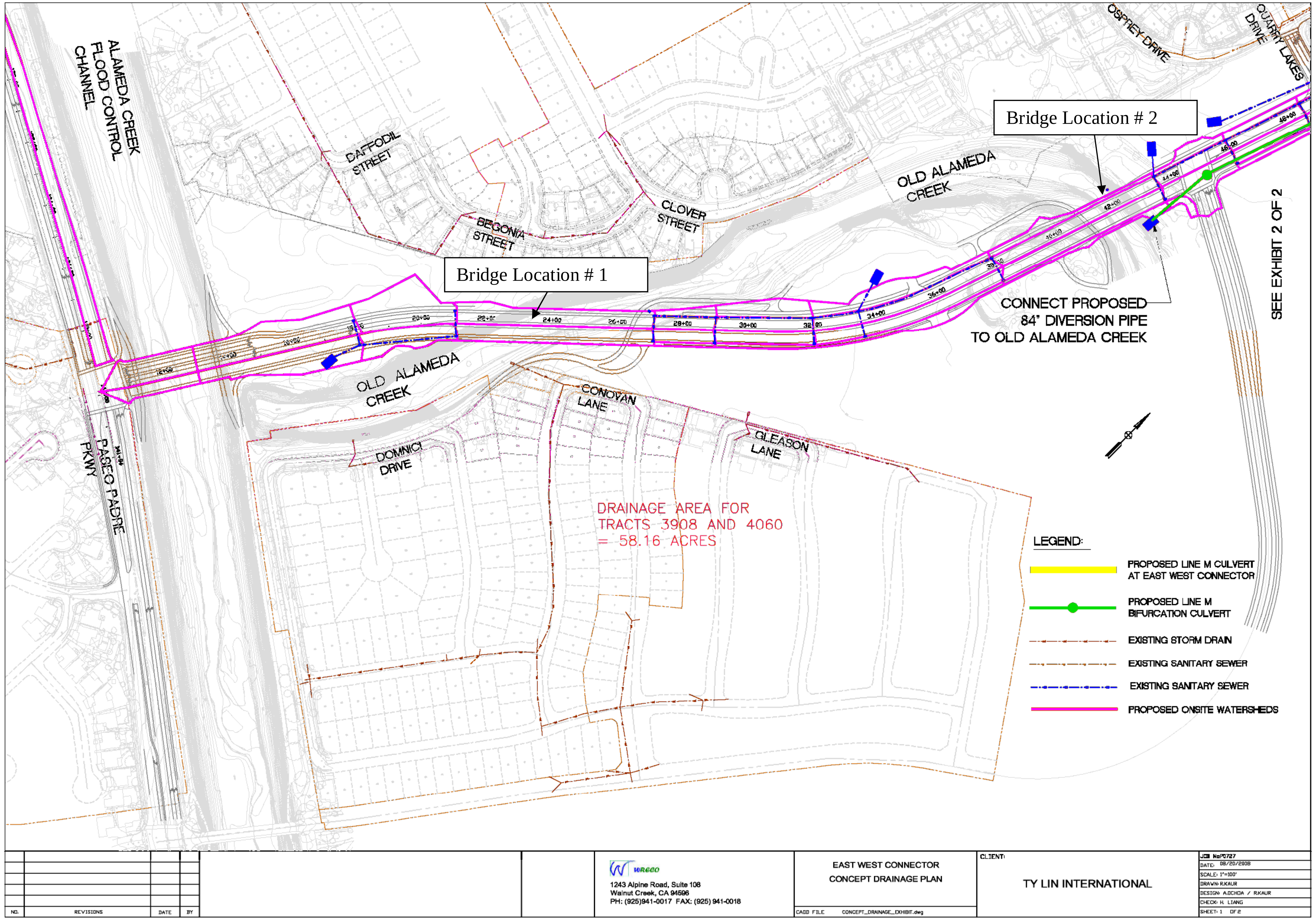


Figure 7. Onsite and Offsite Watershed and Drainage Plan-1

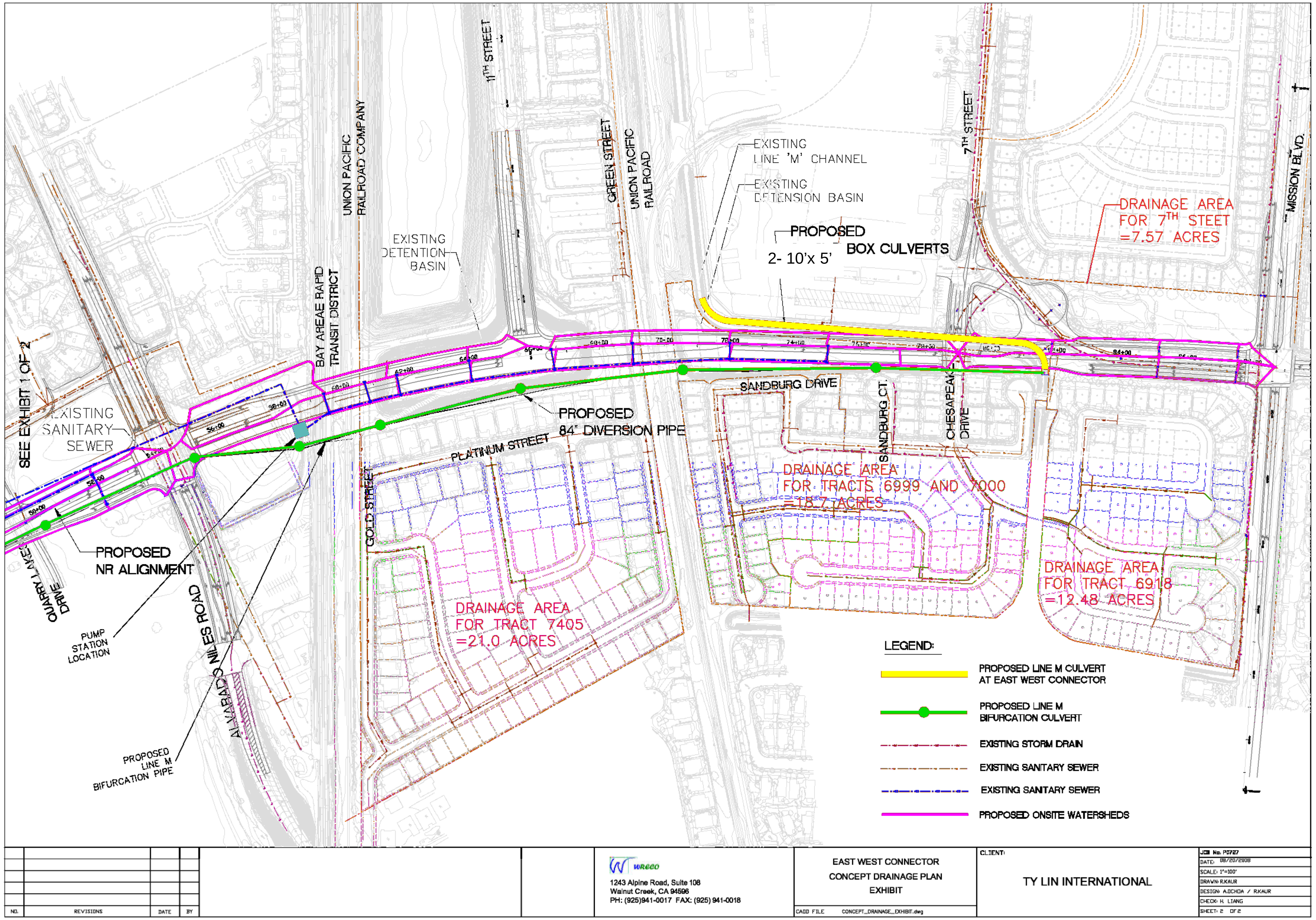


Figure 8. Onsite and Offsite Watershed and Drainage Plan-2

3 HYDROLOGY

The following section describes the hydrologic analysis for the drainage areas involved in the Project. The design discharges for different channels are estimated from different sources such as: FEMA FIS, as-builts from Alameda County Flood Control and Water Conservation District (ACFC & WCD) and USACE. Discharge from the local tracts is calculated using Alameda County's hydrologic criteria. The following section describes the hydrologic condition of the Project site from upstream to downstream.

3.1 Line M

The Line M Channel is located within the FEMA study area as shown in Figure 6. For the existing condition, the total watershed area flowing into the Line M Channel upstream of the Project site is 1.53 mi² (FEMA, 2000). The 100-year discharge for the Line M Channel upstream of the new roadway was obtained from the FEMA FIS Report as 520 cfs. Flows along the channel, at other nodes, were obtained from USACE's HEC-1 model provided by ACFC & WCD, shown in the Figure 9. Sub-Watershed Drainage Nodes for Line M Channel

. Table 3 shows different flows obtained for the existing condition and for the proposed condition with 260 cfs diverting upstream of the Project.

Table 3. Summary of flows at different nodes in the Line M Channel

	Flow At Zone 5 Line M Node								
	MA	MB	MC	MD	MD (FP Storage)	ME	MF	MG	MH
Scenario	(cfs)								
Existing Flows	549	522	893	1198	720	815	987	1074	1049
Proposed EWC Condition - with RCB under proposed roadway and 260 cfs diverted to 84-96 in. Bifurcation Pipe (minus FP-2, FP-3, Ch-2)	549	294	672	986	704	833	1002	1083	1165

*FP: Flood-Plain Storage
**Ch: Channel Storage

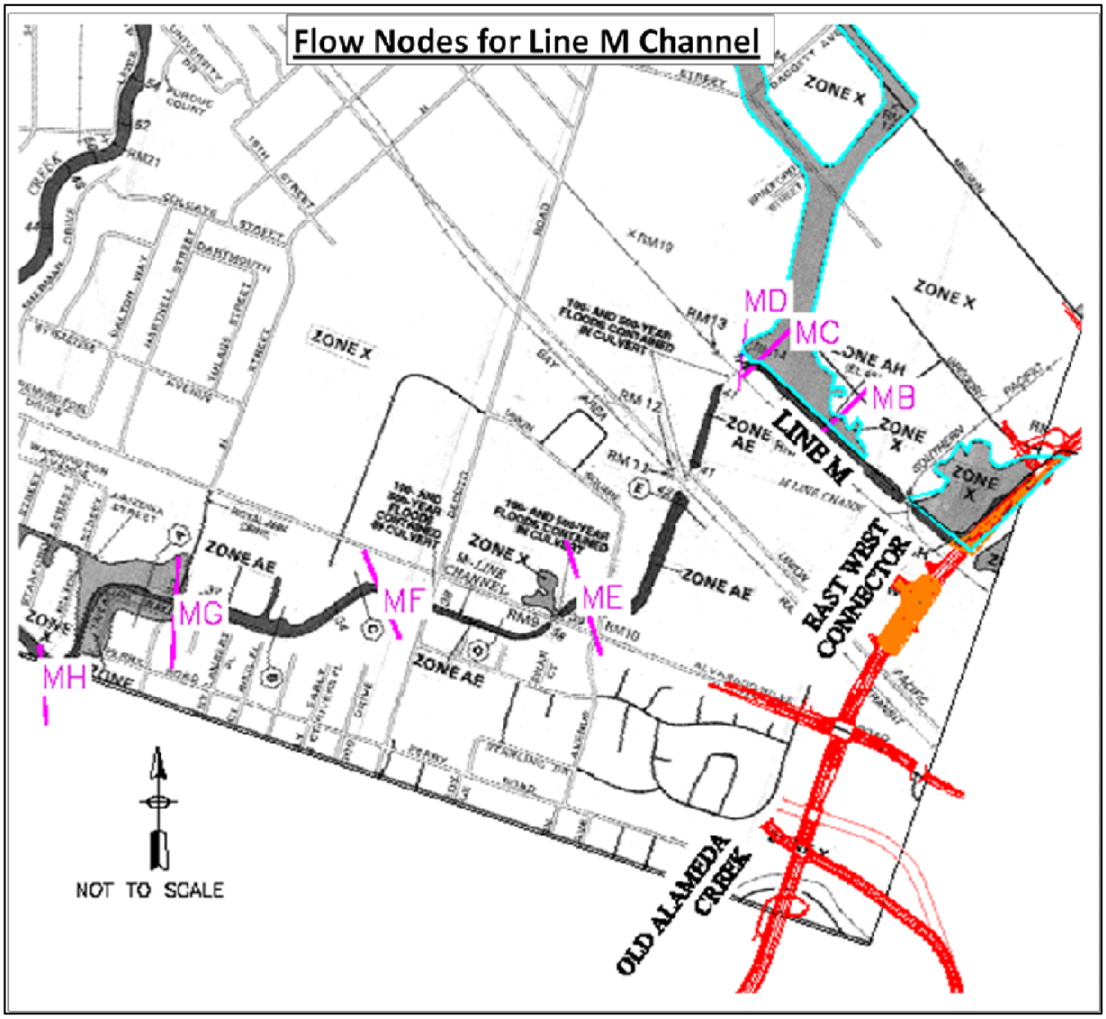


Figure 9. Sub-Watershed Drainage Nodes for Line M Channel

In the past, with growing development along the Line M Channel, measures were adopted to minimize impacts to the channel. Recent developments include projects within the PG&E site, Harrison and McKesson Properties, town home areas in the Pacific States Steel Corporation (PSSC) site, the business park area in the site, and Eleventh Street. These developments were built in the watershed contributing to Line M Channel. WRECO, along with Mark Thomas and Co. and Ruggen-Jensen-Azar & Associates (RJA), were responsible for performing hydrological analysis for these new developments. A basin called “New Basin” was designed to meter post-development flows to pre-development flows. The design criteria used for the basin was the 15-year storm event. This basin was constructed between Union Pacific Railroad (UPRR) company tracks and Green Street (see Figure 8) to store excess runoff volume resulting from developments in the nearby areas. This detention basin has total volume capacity of approximately 46 ac-ft and 100-yr WSE of 34.2 while maintaining a 4-ft freeboard. Tract 7504 discharges into this basin with a drainage area of 21 ac.

There is a second existing detention and wetland mitigation basin (Basin-2C) northeast of UPRR that also contributes flow to the Line M Channel. Tracts discharging to this basin are 6999, 7000 and part of the Seventh Street drainage system, with a drainage area of approximately 25 ac. Volume capacity for this basin is 13.5 ac-ft (based on personal communication with Rohin Saleh of the ACFC & WCD). Land cover for all these tracts is considered to be residential with landscaping.

The discharge (Q_{100}) for the tracts was calculated using the Rational Method:

$$Q = CiA$$ **(Equation 1)**

Where:

Q = peak flow (cfs)
C = runoff coefficient
i = rainfall intensity (in./hr)
A = area (ac)

$$Ci = \left[0.8 - (C + Cs) X \left[1 - \frac{1}{\frac{1}{e^{i}} + \ln(i+1)} \right] \right]$$ **(Equation 2)**

Where:

Ci = Rainfall Intensity Factor
C= Basic runoff coefficient estimated from the land cover
Cs= Slope adjustment factor (zero for C>/=0.8 and Overland Slope <1)
i = rainfall intensity (in./hr)

The slope adjustment factor is added to the basic runoff coefficient to determine the composite runoff coefficient used in Equation 1. The intensity was estimated from the Intensity Duration Charts for a 100-year event (Alameda County Hydrology and Hydraulics Manual [ACHHM]) with respect to the time of concentration. Time of concentration was calculated as the sum of time from roof to gutter, gutter flow time, and pipe flow time for the longest storm drain system. Roof to gutter time was taken as 5 min. (ACHHM, 2003). Gutter time was estimated as 0.50 min. for the estimated longitudinal gutter slope of 0.005% (as-built Tract 7405, profile sheet 6). Pipe flow was calculated for the longest system as 8.5 min.(
Table 6). Adding all the times given, the time of concentration was calculated to be 14 min.

Table 4. Time through longest pipe system for Tract 7405

Street	Station Begin	Station End	LF	Slope	Pipe Size	Pipe Size	Manning's n	Hydraulic Radius	V=(1.486*(R^2/3) *(S^1/2))/n	Pipe Time
				ft/ft	in.	ft		ft	ft/sec	min
Silver Street	1800	2200								
			200	0.002	15	1.2	0.012	0.31	2.55	1.31
			96	0.002	18	1.5	0.012	0.37	2.88	0.56
			133	0.0015	24	2.0	0.012	0.50	3.02	0.73
Nickel Street	100	800								0.00
			46	0.0015	24	2.0	0.012	0.50	3.02	0.25
			149	0.001	30	2.5	0.012	0.62	2.86	0.87
			323	0.001	30	2.5	0.012	0.62	2.86	1.88
			80	0.001	30	2.5	0.012	0.62	2.86	0.47
			92	0.001	30	2.5	0.012	0.62	2.86	0.54
Gold Street	1500	1600								0.00
										0.00
			170	0.001	30	2.5	0.012	0.62	2.86	0.99
Gold to Outfall										0.00
			15	0.001	42	3.5	0.012	0.87	3.58	0.07
			39	0.001	42	3.5	0.012	0.87	3.58	0.18
			119	0.001	42	3.5	0.012	0.87	3.58	0.55
			112	0.043	42	3.5	0.012	0.87	23.49	0.08
			1574							**8.47**

For the post development of the EWC Project, it is proposed to divert half of Line M Channel's 100-year flow to a new Diversion Pipe. Therefore, 260 cfs is expected to flow through the existing Line M Channel in the proposed Project conditions. The culvert would be sized to accommodate flows from the two existing detention basins, as well as half of the flow from the Line M Channel. Tracts 7405, 7000 and 6999, originally flowing to the detention basins, would be diverted to the proposed Diversion Pipe. The total 100-year flow expected through the culvert is 354 cfs (see Figure 8).

Table 5. Discharge (100-year) calculations for the Tracts flowing into the detention basins

For Tract 7405

C=	0.59	
Length of the longest pipe=	1574.00	ft
Total Tc=	13.98	min
Intensity at Tc=	2.73	in./hr
Area (Tract 7405) =	21.08	Acres
C (Composite)=	0.65	
Ci=	0.06	
Q=	37.5	cfs

Total Q from the above tract contributing to the "New Basin"= **37.5 cfs**

Similarly, Q for the "Basin 2C" (contributed from Tracts : 7000, 6999 and from Seventh Street) was calculated = **45 cfs**

Total Q to the Line M Diversion Pipe(Q100) = (½*(Line M Q100) + 37.43 cfs+45 cfs)= **342.5 cfs**

3.2 Old Alameda Creek

The Old Alameda Creek Channel traverses the Project site from the southeast to northwest. Old Alameda Creek's discharges are composed of discharges from the Line N-12 Channel and from the drainage systems of local tracts 4060 and 3908 (shown in Figure 7). Line N-12 Channel is contained in a 54-in. circular pipe and discharges into Old Alameda Creek. The 100-year storm event (Q_{100}) discharge for the channel is estimated as 129 cfs based on the as-builts (ACFC & WCD, Zone 5, CB-602, 1979). The discharges (Q_{100}) for the two tracts were calculated using the Rational Method (Equation 1). For calculation purposes, it is assumed that runoff from tracts 4060 and 3908 enters Old Alameda Creek between the two proposed crossings with the new roadway.

Time of concentration was calculated as the sum of time from roof to gutter, gutter flow time, and pipe flow time for the longest storm drain system. Roof to gutter time was taken as 5 min. (ACHHM, 2003). Gutter time was estimated as 0.70 min. for the assumed longitudinal gutter slope of 0.005%. Pipe flow was calculated for the longest system as 8.19 min. (see

Table 6). Summing all the times, time of concentration was calculated as 13.89 min. As the as-built information for these tracts was not available, pipe slopes were assumed based on the average slopes of the nearby tracts.

The flow from the two tracts was calculated as 121 cfs (see Table 7).

Table 6. Pipe flow calculations for Tracts 4060

	LF	Slope (S)	Pipe Size	Pipe Size	n	Hydraulic Radius (R)	V=(1.486*(R^2 /3)*(S^1/2))/n	Pipe Time
	ft	ft/ft	in	ft		ft		min
	525.581	0.002	15	1.2	0.012	0.31	2.55	3.43
	176	0.002	18	1.5	0.012	0.37	2.88	1.02
	619.509	0.0015	21	1.7	0.012	0.44	2.76	3.74
Total	**1321.09**							**8.19**

Table 7. Discharge Calculations for Tracts 4060 and 3908 for Old Alameda Creek

Total Tc= 13.98 min		
Intensity at Tc= 2.74 in./hr	(Alameda Hydrology and Hydraulics Manual,2003)	
Area=	59.32	acres
C=	0.59	
Ci=	0.06	
C (Composite) =	0.65	
Q=	**105.81**	cfs

Once the Line M Diversion Pipe is constructed, the total flow in Old Alameda Creek, as measured between the creek crossings, would be equal to the sum of flows from Line N-12, local tracts 4060 and 3908, and the Line M Diversion Pipe. The total 100-year flow through the Old Alameda Creek for the proposed conditions is estimated to be 604 cfs. The flow from the diversion pipe would be routed to Old Alameda Creek through a new wetland basin proposed along the creek between Quarry Lakes Drive and the creek's over bank.

There are recharge ponds upstream of the creek within the East Bay Regional Quarry Lakes Park, which were not considered to be contributing any flows to Old Alameda Creek (Personal communication with Rohin Saleh, ACPWA, May, 2008).

3.3 Alameda Creek Flood Control Channel

Historically, Alameda Creek has been a major source of flooding. Since Alameda County Flood Control was found, waterways in the area have been altered to reduce flooding impacts in the area. The construction of the Alameda Creek Flood Control Project began in 1965 by USACE, and was completed in 1973. This Project was undertaken because frequent flooding events produced overflow of Alameda Creek in 1952 and 1955. Some of the modifications included: riprap on channel slopes and desiltation and slurry sills for even distribution of flow. Along with in-channel improvements, levees were built on both sides of the creek to protect low-lying areas from tidal inundation and to improve the channel capacity to transmit 100-year flow. Alameda Creek's Watershed covers an area of approximately 695 mi^2 (Alameda County Water District, 2004). The Maximum Probable Flood (MPF) estimated from USACE as-builts is 52,000 cfs.

Figure 9. Old Alameda Creek and ACFCC with respect to the EWC Project Alignment.

A summary of the existing design discharges for the three creeks in the vicinity of the Project is determined from different sources. Table 8 lists the existing design discharges associated with these creeks.

Table 8. Summary of Existing Design Discharges for 100-year storm event for the channels

Reach	Peak Discharge (cfs)	Source
Line M Channel (800 ft upstream of Southern Pacific Railroad	520	100-year flow: FEMA FIS, Union City
ACFCC	52,000	MPF flow from as built : USACE' 1967
Old Alameda Creek	240	Sum of 100-year flows from Line M, Line N-12 channel

A new drainage system would be constructed to collect and convey the additional discharge from the new roadway.

Table 9. Summary of Proposed Flows for Different Recurrence Intervals

Recurrence Interval (years)	Total Q Line M (cfs) u/s EWC	Fraction Q staying in Line M (cfs)	Fraction Q going to Line M diversion pipe (cfs)	Q Detention New-Basin (cfs)	Q Detention Basin 2-C (cfs)	Q Line M diversion Pipe (cfs)	Q Line N12 (cfs)	Q direct from Tracts 4060 and 3908 (cfs)	Q Old Alameda Creek (cfs)
	(1)=(2)+(3)	(2)	(3)	(4)	(5)	(6)=(3)+(4)+(5)	(7)	(8)	(9)=(6)+(7)+(8)
2	227	113	113	16	20	149	52	46	252
5	292	146	146	21	25	193	67	59	325
10	347	174	174	25	30	229	80	71	385
15	371	186	186	27	32	244	92	75	412
25	419	210	210	30	36	276	104	85	465
100	520	260	260	37	45	342	129	106	577

3.4 Roadway Drainage

The EWC Project is comprised of new roadway sections, new bridges, and widening of existing city streets. New drainage systems with new outfalls into Old Alameda Creek would be proposed within the proposed new roadway alignment. Existing drainage systems within these areas would need to be modified or extended to accommodate the proposed widened roadway and to maintain existing drainage patterns.

Preliminary drainage systems were laid out along the EWC Project based on plans, profiles and typical cross-sections provided by T.Y.Lin International (See Figure 7 and Figure 8). Inlets were generally located at the low points, flips, as well as upstream and downstream of bridge decks. Approximately 22 acres of the shed area would be added through new roadway. All new drainage systems would have to accommodate the increased flow from the additional impervious areas.

In the design phase, the drainage design criteria for the EWC Project generally would be based on procedures presented in the Alameda County Hydrology and Hydraulics Manual (ACFC & WCD, June 2003). Both Cities follow mainly ACFC & WCD's criteria. The final on-site hydrology calculations for the EWC Project should utilize the Rational Method to predict storm water runoff. Rainfall intensities should be obtained from Attachment 9 of the Alameda County Hydrology and Hydraulics Manual. As per ACFC & WCD's criteria, drainage areas less than 50 acres are considered secondary facilities and all secondary facilities are designed for a 10-year recurrence interval. However, City of Union City uses recurrence interval of 25 years for the design of drainage facilities (Phone communication with Engineering Division, City of Union City: 08/21/2008). In addition, The City of Union City recommends a minimum time of concentration of 10 min for paved areas.

For storm drains discharging into the proposed infiltration basins, WSE in the infiltration basin systems would be used as the design tail water. Preliminary watersheds have been delineated for post-construction condition (Appendix H).

4 HYDRAULIC ANALYSIS

The following section describes the hydraulic analysis conducted to guide the design of hydraulic structures involved in this Project. This analysis is the basis of determining bridge openings required to convey the MPF through the ACFCC, and determining culverts sizes to convey 100-year storm event flows through the Line M Channel and the proposed Line M Diversion Pipe. Hydraulic Analysis starts from the downstream end of the Project, at the ACFCC, and continues upstream.

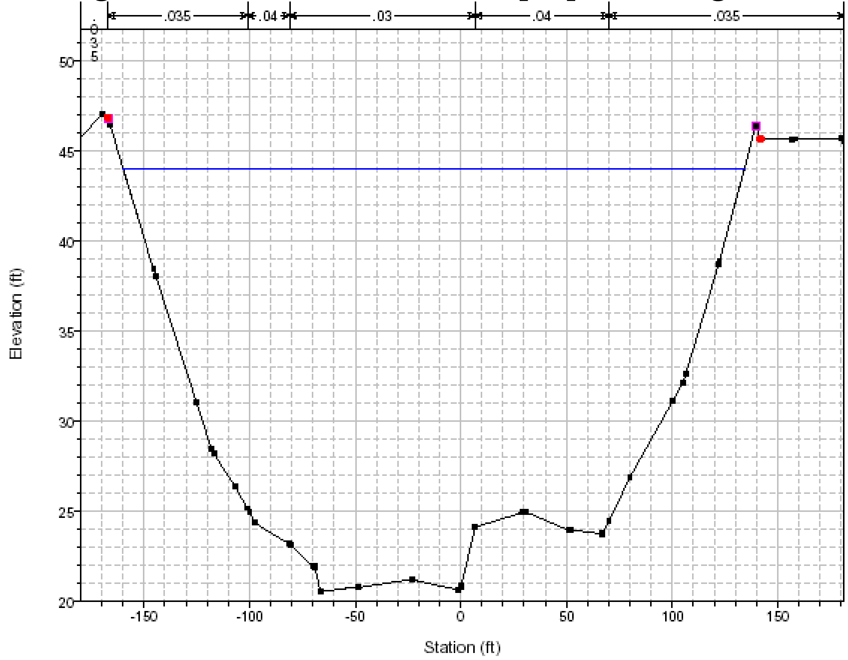
4.1 Alameda Creek Flood Control Channel

The hydraulic analysis for the ACFCC involved a standard step, backwater calculation using the USACE's HEC-RAS computer program to provide flow characteristics such as water surface profiles and flow velocities. Two alternatives were provided by TY Lin International, as shown in and . The existing condition (no bridge), and proposed condition (7-Span Slab Bridge), were modeled using the HEC-RAS computer program.

Eleven cross-sections, distributed over a 1,250 ft reach of the ACFCC in the vicinity of the Project site, were obtained from surveys provided by TY Lin International. The upstream control was established using cross sections from the ACFC & WD's Study for the Decommission of the Rubber Dam, No. 2. The downstream control was set as the normal depth with USACE's design bed slope of 0.001618 ft/ft. Manning's 'n' values were 0.035 for the banks, 0.03 for the low flow channel, and 0.04 for the terraces inside the channel. These values were used in the hydraulic model to estimate energy losses in the flow due to friction. The MPF flow rate of 52,000 cfs (obtained from the USACE as-built plan "Local Protection Works-Coastal Plain Plan of Improvements") was used in the model (USACE, 1967). The pier widths were doubled in the model to take into account potential debris blockage. Expansion and contraction coefficients used to represent the existing channel were 0.3 and 0.1, and, for the proposed bridge, 0.5 and 0.3, respectively.

The existing elevation for MPF in ACFCC at the proposed bridge site is 44.06 ft. The design criteria for the flood control channel suggested by the ACFC & WCD is the MPF with 1 ft of freeboard (Existing elevation plus 1 ft of freeboard is 45.21 ft). The existing top of the channel banks is approximately 46 to 46.5 ft. The cross section at the location of the bridge for the existing condition is shown Figure 10. Shown in the Figure 11 is a cross section on the upstream face of the bridge.

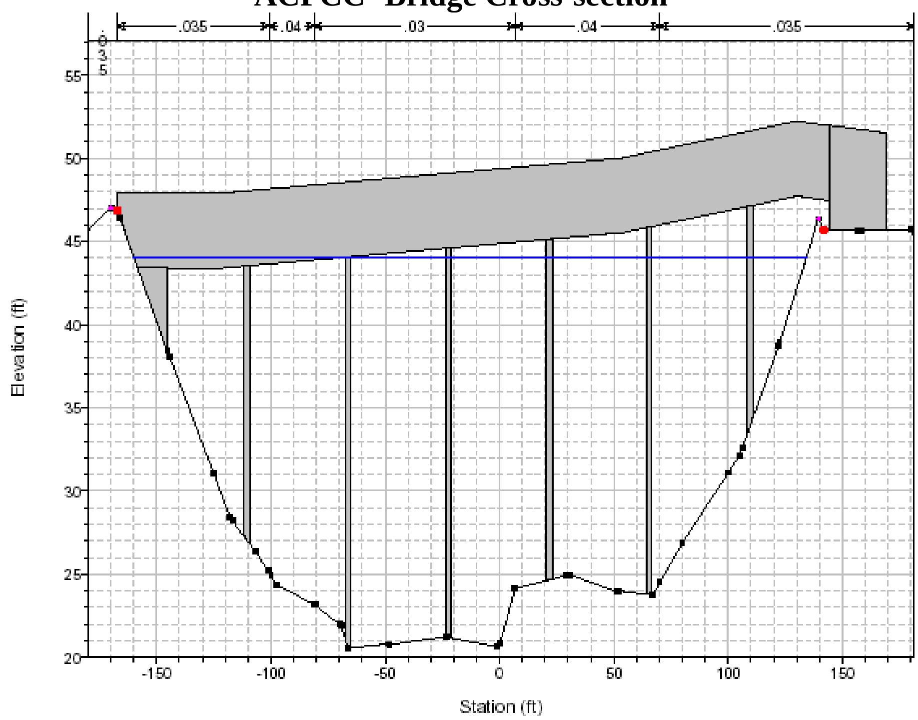
Existing condition cross section at the proposed bridge location



Note: Elevation shown is MPF, not MPF +1

Figure 10. Existing Condition of ACFCC (no bridge)

ACFCC- Bridge Cross-section



Note: Elevation shown is MPF

Figure 11. Proposed Condition of ACFCC (with bridge)

The water surface shown is the MPF. The MPF elevation is 44.86 ft (NAVD). Note that part of the bridge structure is below the WSE of the MPF. The proposed bridge passes the MPF with the proposed condition, though the MPF plus 1 ft of freeboard would be slightly above the bridge's soffit near the southern abutment.

A comparison of these results is shown in the Table 10.

Table 10. Hydraulic Summary of Results at the Proposed Bridge Site

Case	MPF Elevation at the Upstream Face (ft NAVD)	Vel. Upstream Face (ft/s)	Vel. Downstream Face (ft/s)
Existing	44.06	10.41	10.35
Proposed (2x pier width)	44.86	9.94	10.35

The proposed bridges would increase the upstream water surface. The flow velocities would be slightly decreased for Alternative 1 and increased for Alternative 2. It is estimated that this change would extend as far upstream as the ACWD's Rubber Dam, No. 2.

Generally, with the two proposed bridge design alternatives, the MPF is contained within the existing channel banks (46 and 46.5 ft). The 1 ft freeboard criteria suggested by the ACFC & WCD cannot be obtained with the proposed bridge structures. However, the proposed bridge would have an insignificant increase in WSE in comparison to the existing condition.

4.2 Old Alameda Creek

For the existing condition, hydraulic analysis for Old Alameda Creek was performed using the HEC-RAS computer program. 100-year flows coming from the Line N-12 channel and from the two local tracts 4060 and 3908 were used (see Figure 7). The channel geometry was provided by ACFC & WCD and the bridge geometry was based on the roadway profile provided by T.Y. Lin International on December 27, 2007. The Manning's 'n' of 0.04 for compacted soils was used in the equation. The analysis involved standard step backwater calculations with two tail WSE scenarios:

- WSE of 28.3 ft NAVD, based on a 10-year estimated discharge of 5000 cfs in ACFCC. A 10-year design criterion for the tail water elevation was determined from USACE's Table of Frequencies for Coincidental Occurrence. The selected frequency is based on the approximated watershed area ratio for the ACFCC to the Old Alameda of 1,000:1. There are existing flap gates at the outfall pipes from Old Alameda Creek to the ACFCC. This condition may occur in the absence or failure of these existing flap gates.

- WSE of 24.36 ft NAVD at the top of the pipe (19.66 ft at the bottom of the pipe + 48 in. pipe + 2.7 ft for datum shift from NGVD to NAVD), from As-Builts (U.S.

Army Engineer District, 1973). This condition assumes the existing flap gates are closed.

The water surface profiles in Old Alameda Creek for both alternatives show that, based on the 100-year event design criteria, the flow is contained within the existing channel banks and there is enough freeboard (approximately 16 ft) available along the complete length of the creek (Figure 12 and Figure 14).

The 2006 Memorandum of Understanding (MOU) proposes improvements in the Line M Channel to handle the storm water during the peak storm events. This agreement between ACFC & WCD and the City of Union City, also proposed a new diversion pipe with adequate capacity to convey excess flows from the Line M channel to Old Alameda Creek (Appendix C). In addition, the hydraulic analysis performed shows that Old Alameda Creek has ample capacity to accommodate additional flows. As proposed in the MOU, a new Diversion Pipe system is proposed connecting the Line M Channel (just upstream of the intersection of the new East-West Connector and the Line M Channel) to Old Alameda Creek. This new Diversion Pipe system would ease the capacity constraints of the existing Line M Channel. Based on the model results, diversion flow from the Diversion Pipe to the Creek would raise the WSE in the creek by 1.04 ft for the tail water elevation scenario of 24.36 and by 0.11 ft for the tail water elevation scenario of 28.3. Even with this increase, the hydraulic grade line (HGL) for Old Alameda Creek is well contained with ample freeboard of at least 15 ft between the water surface and the creek banks.

There are flap gates at the downstream end of the Old Alameda Creek that would help in regulating or subsiding any substantial impacts on the hydrology and hydraulics of ACFCC due to added flows in the tributary creek. Even with the use of the flap gates, Old Alameda Creek has ample capacity to store the proposed additional flows. This capacity was formed because Old Alameda Creek was part of the main flood carrying channel prior to the construction of Alameda Flood Control Channel.

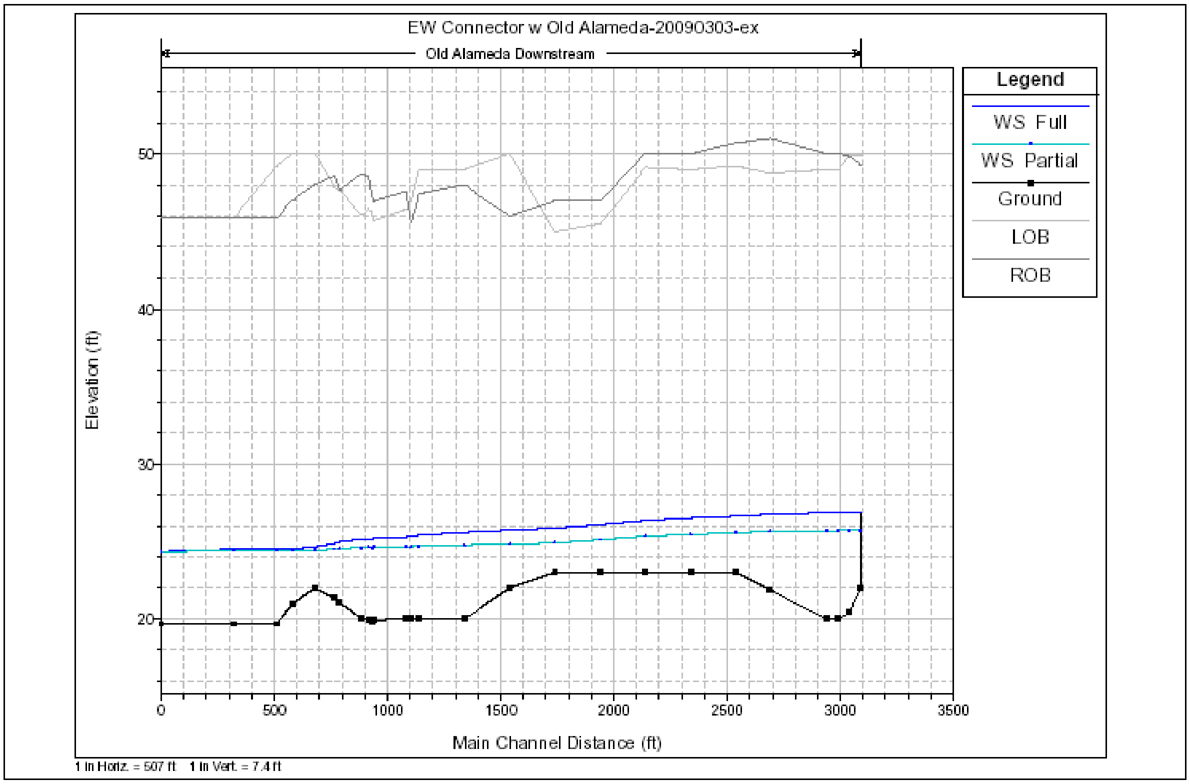


Figure 12. Existing water surface profile for the Old Alameda Creek at WS=24.36 ft

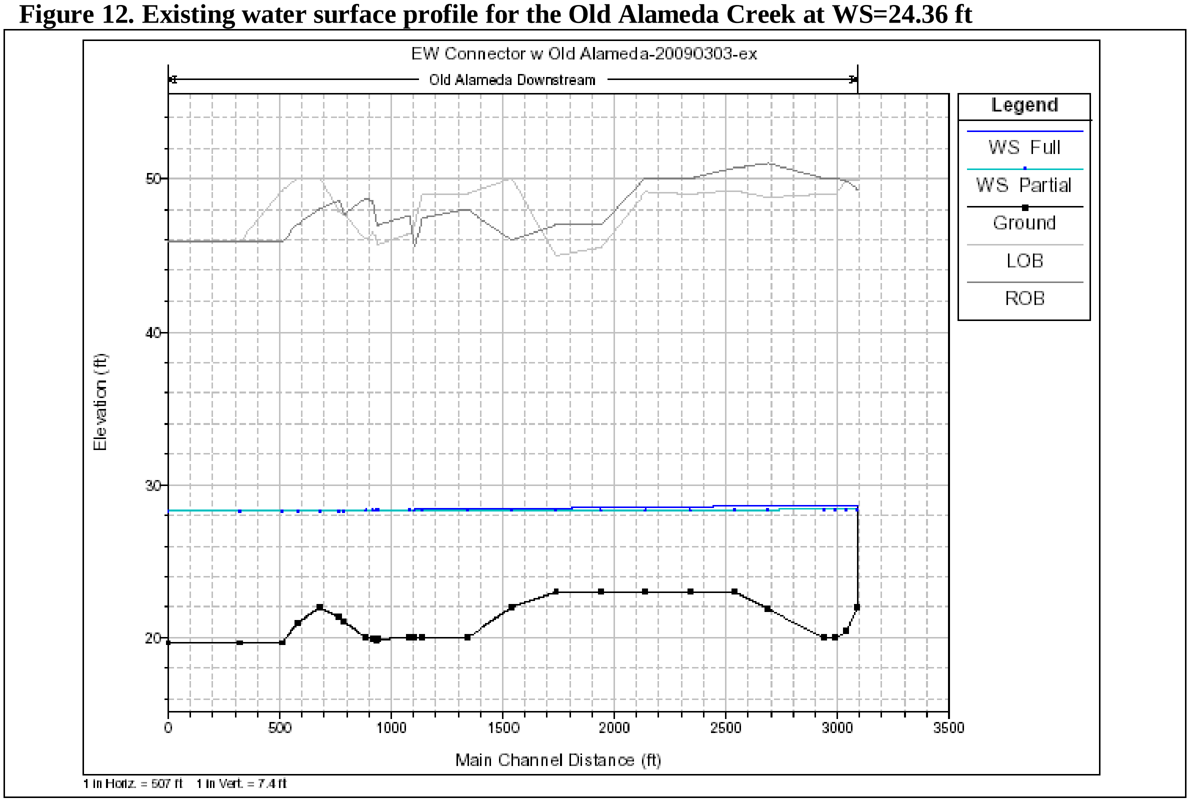


Figure 13. Existing water surface profile for the Old Alameda Creek at WS=28.3ft

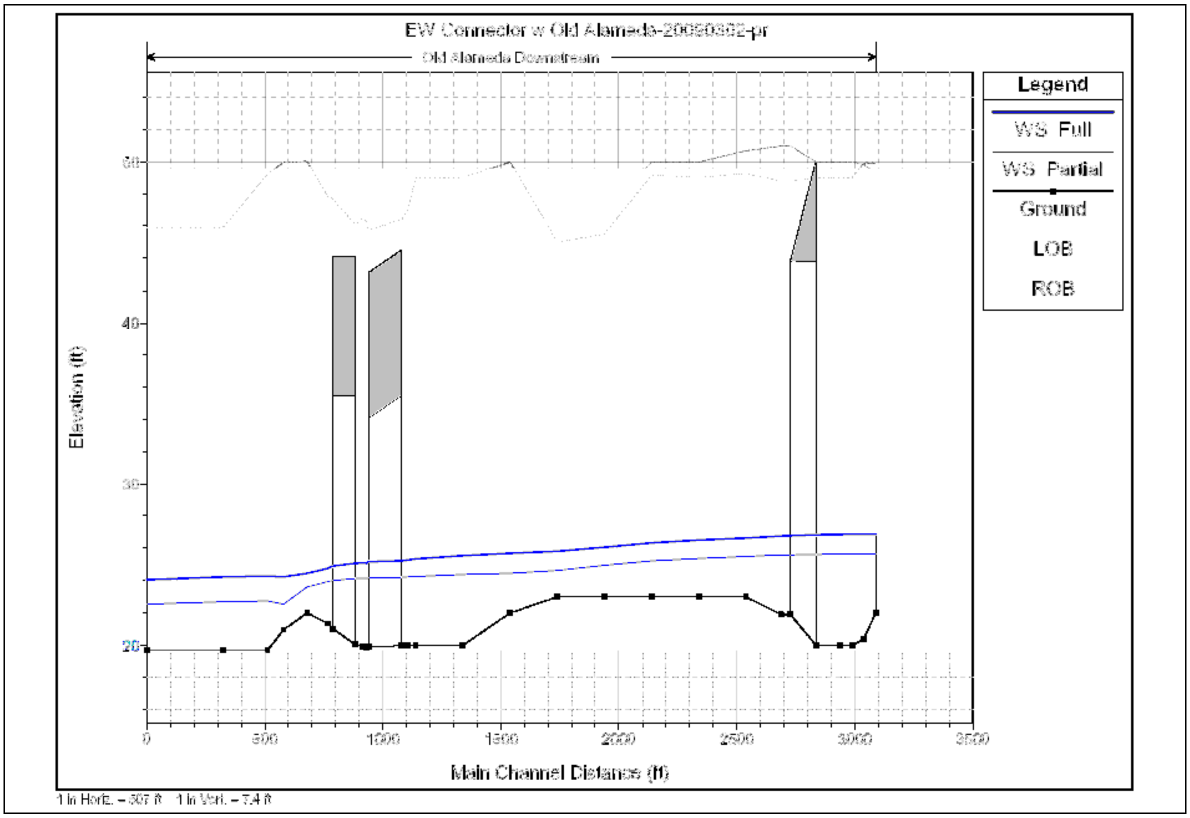


Figure 14. Proposed water surface profile for the Old Alameda Creek at WS=24.6ft

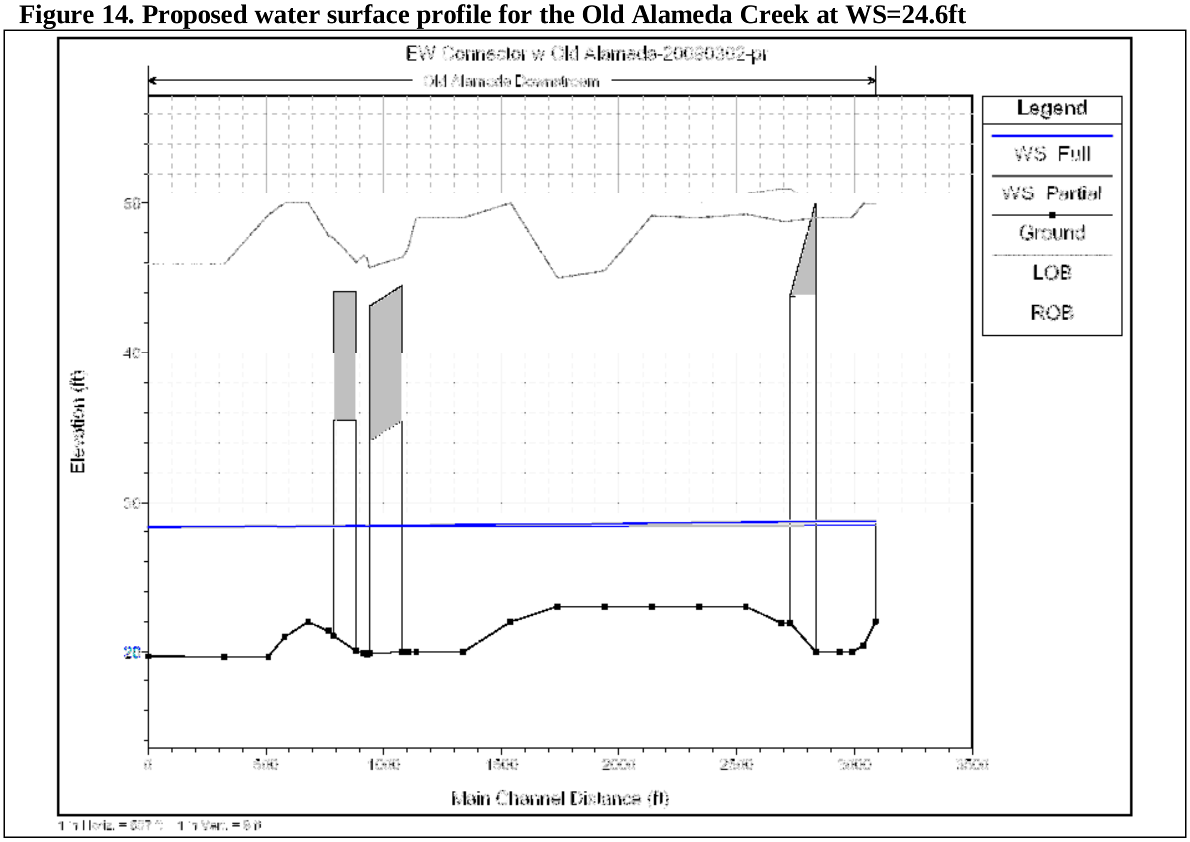


Figure 15. Proposed water surface profile for the Old Alameda Creek at WS=28.3ft

4.3 Line M

A HEC-RAS model was developed for the Line M Channel for analyzing the channel hydraulics for a 100-year flow event. The flows shown in Table 3 were used in the analysis. Geometry data for the channel was provided by the ACFC & WCD, and the geometry for the existing culverts was determined from the as-builts (Mark Thomas, 2006) and existing HEC-2 model (also provided by ACFC & WCD). For the existing 100-year flows, Figure 18 illustrates that the water surface profile is higher than the channel banks. The FIS study also confirms flooding problems for the Line M Channel (see Figure 6). In an effort to reduce the existing flooding problems in the Line M Channel, half of the 100-year flow (i.e., 260 cfs) was proposed to be diverted to a new culvert. Figure 16 shows the water surface profile for the proposed condition with existing flows and with 260 cfs diverted upstream of the project site. Partially diverting flow would lower the WSE by 2.4 ft.

The new roadway alignment would impact approximately 1,115 ft of the Line M Channel. This channel section would be replaced by two box culverts (10-ft span by 5-ft height), as shown in Figure 19. Hydraulic analysis of the Line M Channel using the proposed double box culverts showed that the HGL for the flow of 260 cfs is contained within the channel at the Project site with less than a foot of freeboard. With the existing flows the site would be inundated with high probability events such as a 25-year event. The diversion of 260 cfs would significantly lower the WSE, thus improving the capacity issues of the existing condition for flows with different recurrence intervals (10- to 100-year).

Expansion and contraction coefficients used to represent the proposed double box culverts were 1 and 0.75 respectively. As a conservative approach, a Manning's n was assumed to be 0.018 to account for surface roughness of a cast-in-place culvert.

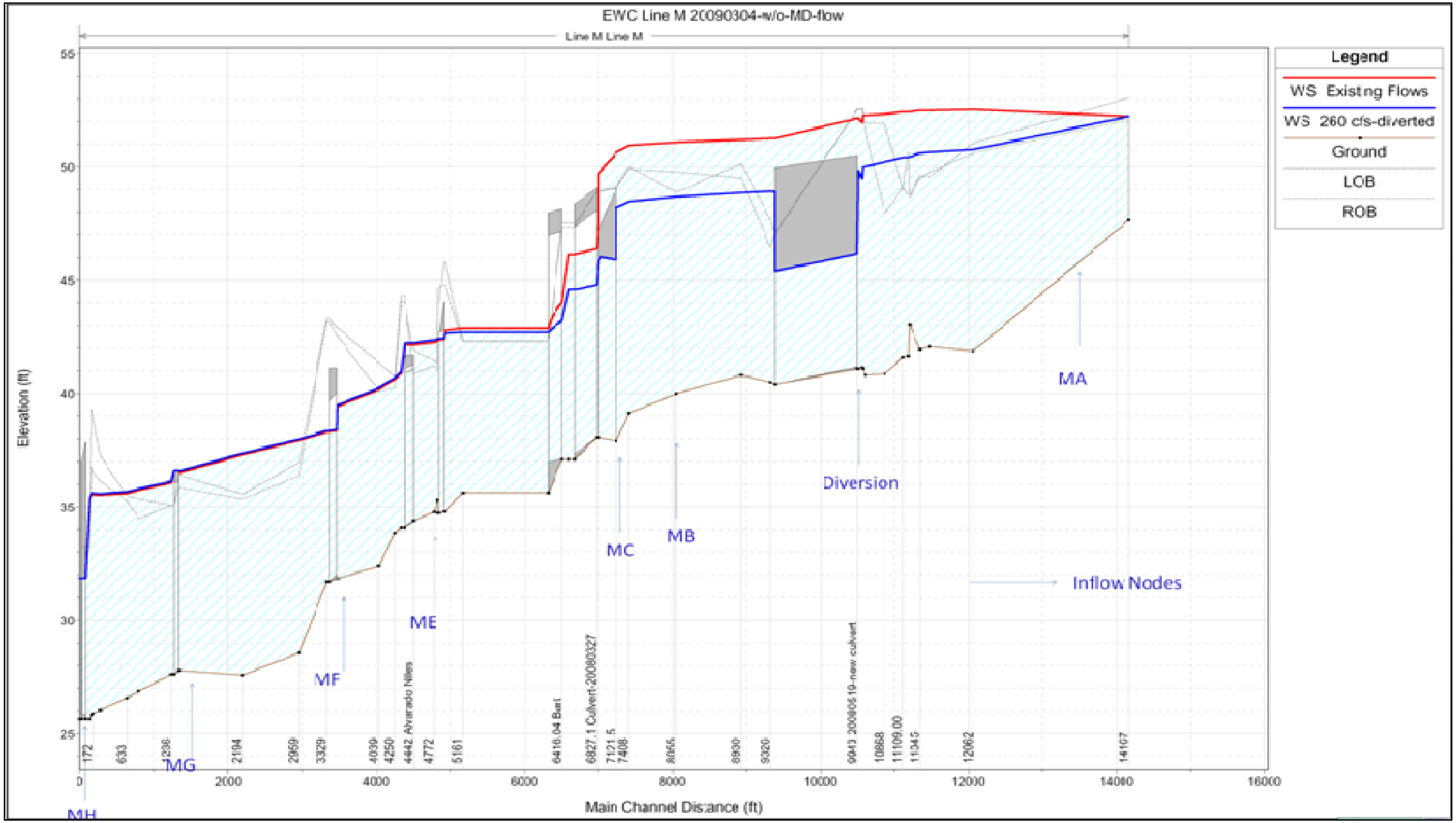
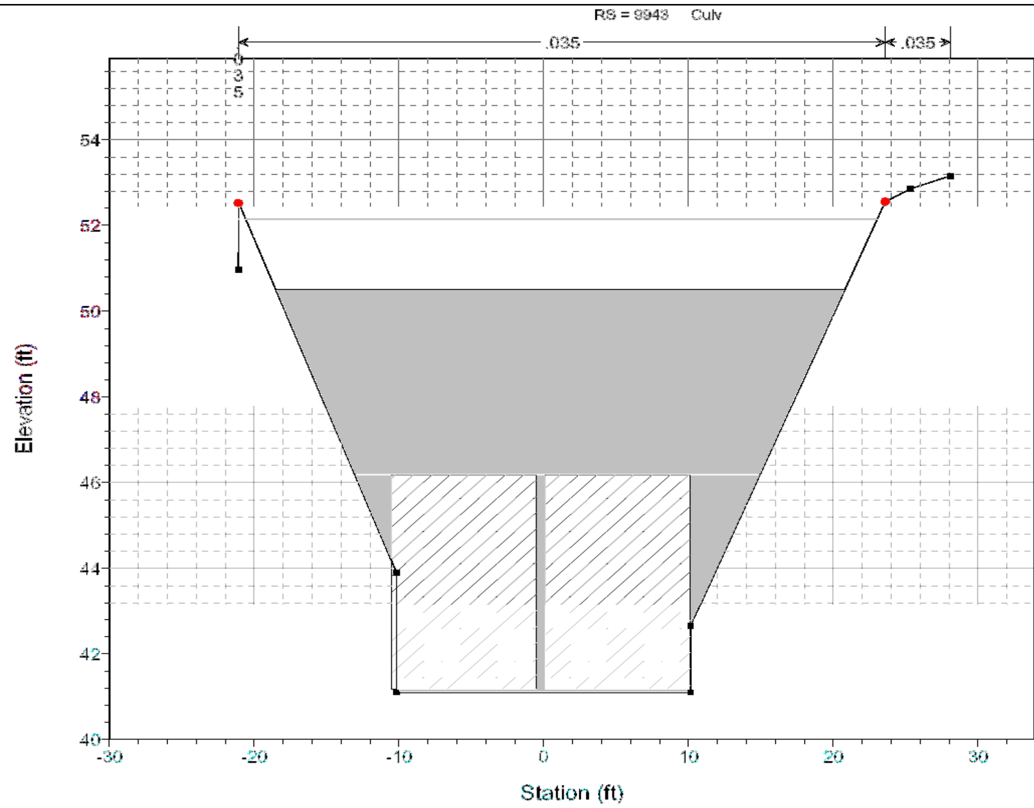


Figure 16. Zone-5 Line M Channel Water Surface Elevation profile with existing and proposed flows.



Double Box Culverts: 10 ft (Span) X 5ft (Height)

Figure 17. Proposed Box Culvert Cross-section for the Line M

4.4 Line M Diversion Pipe

The Line M Diversion Pipe is proposed as a diversion pipe, per MOU, to relieve the existing flooding in the Line M Channel. In addition, as previously mentioned, the proposed new roadway alignment would impact the existing detention basins. Therefore, the runoff from the local tracts would also need to be included in the new Diversion Pipe (see Figure 8). Two alternatives for the Diversion Pipe were evaluated:

- Alternative 1 is to divert full flow i.e. 520 cfs + 84 cfs through this new culvert to Old Alameda Creek (i.e., flow determined from FEMA FIS report plus excess flow generated by removed detention basins (New Bain and Baisn 2-C))
- Alternative 2 is to divert partial flow from Line M Channel to Old Alameda Creek. In this case, a design criterion is to pass half of the 100-year flow (260 cfs) plus the flow from the two detention basins (84 cfs) to Old Alameda Creek

Various scenarios were tested for these alternatives using different culvert types (box and pipe), sizes (6 ft to 9 ft), upstream inverts (40 ft to 45 ft), slopes (0.15% to 0.6%), etc. Also potential conflicts with existing utilities, groundwater depths, and upstream and downstream WSE were considered during the hydraulic analysis.

Alternative 2 was selected, and the culvert system configuration for the selected alternative is shown in Figure 21. A drop in the pipe system profile, at Sta-27+51 (see Figure 20.), would be included to achieve the minimum clearance of 5 ft between the crown of the culvert and base of the railway tracks (UPRR, 1990). The downstream invert elevation was set to 28 ft NAVD. The diversion pipe would outfall into the proposed wetland mitigation site. The normal depth at the downstream end was assumed as a boundary condition for the hydraulics simulations.

Based on multiple hydraulic iterations, considering both upstream and downstream conditions, the pipe size selected for the culvert was 96 in. 8ft) from Sta: 0+00 to Sta: 22+50. For the culvert upstream of Sta: 22+50, the pipe size selected was 84 in. (7 ft). There is an existing Union Sanitary District's sanitary sewer pipe (whose invert is at 32.73 NAVD) that crosses the diversion pipe at Sta: 11+13. In order to avoid any potential cross-contamination with this sanitary sewer line, it is proposed to double contain this pipe using steel sheeting. Proposed fin of grade for the segments of the culvert proposed under the roadway were estimated from the roadway profile, provided by T.Y. Lin International for the off-site segments of the culvert. Top of grade was approximated based on the existing contour data for segments outside the roadway grading plan.

Table 11. Summary Table for Hydraulic Parameters for Line M Diversion Pipe

Station u/s	Pipe Size	Ave. Velocity	Full Capacity	Pipe Length	Inv Ele up	Inv Ele dn	Pipe Slope	Manning's n	HGL-u/s	HGL-d/s	Critical Depth	Minor Loss
	(in)	(ft/s)	(cfs)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)	(ft)	(ft)
2+18.5	96	8.26	365.13	218.5	28.35	28	0.16	0.013	34.16	34.51	4.57	0.33
7+19.8	96	7.97	352.88	501.3	29.2	28.45	0.15	0.013	34.83	35.59	4.57	0.15
11+10.3	96	7.93	354.62	390.5	29.89	29.3	0.15	0.013	35.73	36.31	4.57	0.15
12+23.3	96	6.82	347.94	110	30.05	29.89	0.15	0.013	42.65	42.8	4.57	0.26
15+51.7	96	6.82	352.4	328.4	30.59	30.1	0.15	0.013	43.06	43.53	4.57	0.14
18+07.5	96	6.82	351.63	255.8	30.98	30.6	0.15	0.013	43.66	44.03	4.57	0.11
22+50.9	96	6.07	441.84	443.4	32.04	31	0.23	0.013	44.29	44.78	4.31	0.1
27+51.0	84	7.93	347.6	500.1	33.62	32.14	0.3	0.013	44.88	46.02	4.47	0.15
33+41.8	84	6.76	347.76	590.8	38.37	36.62	0.3	0.013	46.43	47.41	4.12	0.11
38+57.6	84	6.76	348	515.8	40	38.47	0.3	0.013	47.52	48.37	4.12	0.71

Figure 20. Conceptual Line M Diversion Pipe System and calculated HGL for Q100s

4.5 Roadway Drainage

Hydraulic and hydrological analysis was performed for the new roadway drainage system during the 50 % design phase, to analyze the capacity of the storm drainage system. The 25-year rainfall frequency was used for the design of the on-site drainage facilities. For the depressed section of the new roadway, a 50-year rainfall frequency was used per City of Union City's recommendation. The hydrology and hydraulic design for the Project was based on the criteria presented in ACPWA's Engineering Design Guidelines and ACHHM general criteria. Based on their criteria, the minimum pipe size for the storm drain system should be 18 in. The proposed longitudinal drainage pipes should be installed atleast 6 feet from the face of the curb. Manholes should be placed along main longitudinal drainage pipe at the corresponding inlet locations. Maximum spacing between manholes should not be greater than 400 ft. Minimum and maximum velocities for closed conduits should be 3 ft/sec and 10 ft/sec respectively. Minimum slope for drainage pipes should be 0.0007 ft/ft. The hydrologic design calculations for the Project utilized the Rational Method to predict storm water runoff. The runoff coefficient (C) value in the hydrology calculations were 0.9 for all paved areas and 0.6 to 0.8 for the unpaved areas (ACHHM).

Pipe sizes were calculated using the Hydra flow Storm Sewer 2008 computer program. Preliminary layout and calculations for the drainage facilities are covered in Appendix E. Manning's n value was considered as 0.013 for all the proposed systems assuming smooth interior pipes. The drainage inlets were placed at the most efficient locations considering the outfall and sag locations. The detailed preliminary inlet capacity calculations are included in Appendix F. The method used for these calculations were based on the FHWA Hydraulic Engineering Circular Number 22 (HEC-22) Publication for Highway Pavement Drainage. Preliminary pavement calculations (Appendix G) were used to determine the longitudinal slope of the roadway and the cross-slopes of the shoulders. These pavement calculations were based on the roadway profile, typical sections and super elevation diagram provided by T.Y.Lin International.

Since the Project would result in the creation of more than one acre of impervious area, the Project is required to consider hydromodification mitigation to address increases in flow from impervious areas. Three basins are proposed at the site along with TreeWells for hydromodification mitigation. (Appendix-I). Basins were designed at the locations where there was enough area available along the new roadway within the Project R/W. The basins were sized using Bay Area Hydrology Model (BAHM).

The preliminary construction cost for the proposed drainage improvements is anticipated to be $18 million. Contingency and mobilization cost would be added to the overall total project cost and is not considered in the drainage cost estimate shown in Appendix J. These costs are based on unit costs from the *2007 Contract Cost Data* (Caltrans, 2007) . Pump station is proposed for the depressed section of the new roadway (Drainage plan DSS-19). Pump capacity and rates would follow CALTRANS design standards. Per

CALTRANS Standards, the required minimum storage volume would be as the flow volume for the 2-year, 20-minute storm.

5 SCOUR ANALYSIS

WRECO performed scour analysis on the bridges at two locations (Bridge Location #1 and Bridge Location#2) in Old Alameda Creek and a bridge over the ACFCC for the structural stability of the proposed bridges. The Scour criteria used to evaluate the preliminary design of the bridge was the Federal Highway Administration Hydraulic Engineering Circular 18 (HEC-18), *Evaluating Scour at Bridges* (Fourth Edition).

5.1 Design Criteria

The design storm used for estimating the bridge scour for the bridges over Old Alameda Creek was the 100-year design storm. For the ACFCC, MPF event was used in the scour analysis. USACE's HEC-RAS model was used to estimate the existing and proposed conditions with the bridges. The cross-sections were cut along the creek using the survey data provided by T.Y.Lin International. The bridge geometry and pier locations were based on the Bridge General Plans, also provided by T.Y.Lin International.

5.2 Existing Channel Bed

The channel bed material was assumed to be fine sand based on the communication with Parikh Consultants. Since the boring information was not available at this time, d_{50} for the channel is assumed to be 0.00164 ft (0.05mm).

5.3 Long-Term Bed Elevation Change

Channel bed elevation may fluctuate over time as a result of changes in local sediment transport capacity and availability. When more sediment is supplied by watershed erosion and upstream channel flow than can be transported locally, the channel bed aggrades and when the sediment transport exceeds the supply, then channel degrades. Only channel degradation is considered for the purposes of analyzing scour.

The long-term bed elevation change is anticipated to be negligible because of the shallow slopes of Old Alameda Creek, low velocities (1 to 3.5 cfs) and highly vegetated reaches. Also, at the downstream end of the creek (at the confluence with ACFCC), there are flap gates that would function as a grade control structure and hence would reduce the potential of any channel instabilities leading to channel degradation.

Long term bed elevation change was assessed for the ACFCC by comparing the existing survey cross-sectional geometry to that of the AS-BUILTS USACE (1967) at the same station location. Channel aggradation seemed to be prevalent along the channel stretch of the proposed project. The example cross-section is shown in Figure 18. Even though the deposited sediments have not significantly reduced the width of the channel, it has impacted the grade of the channel and has shifted the thalweg more towards south.

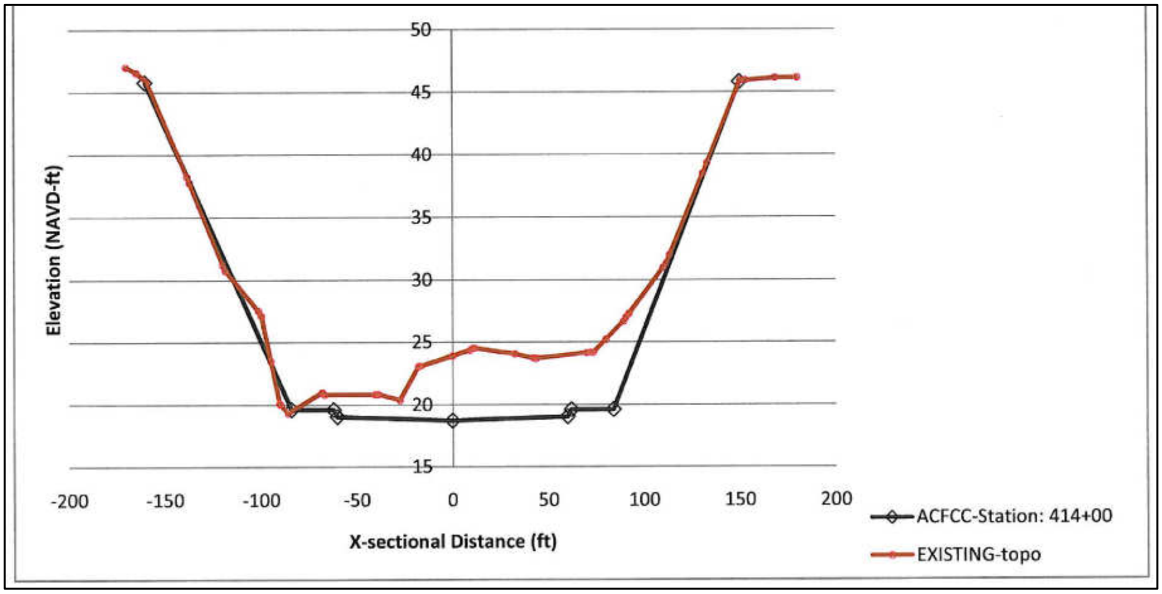


Figure 18. Cross-sections at the ACFCC bridge location (USACE (1967) and Existing survey)

5.4 Contraction Scour

Contraction scour occurs when the flow area of a stream at flood stage is reduced, either by a natural contraction of the stream channel or by a bridge. It also occurs when overbank flow is forced back to the channel by roadway embankments at the approaches to a bridge. From the continuity equation, a decrease in flow area results in an increase in average velocity and bed shear stress through the contraction. Hence, there is an increase in erosive forces in the contraction section, and more bed material is removed from the contracted reach than is transported into the reach. This increase in transport of bed material from the reach lowers the natural bed elevation. As the bed elevation is lowered, the flow area increases and thus the velocity and shear stress decrease until relative equilibrium is reached; i.e., the quantity of bed material that is transported into the reach is equal to that removed from the reach, or the bed shear stress is decreased to a value such that no sediment is transported out of the reach. Contraction scour, in a natural channel or at a bridge crossing, involves removal of material from the bed across all or most of the channel width (FHWA 2001).

At the Bridge Location #1, the approach velocity exceeded the critical velocity for the entraining sediment, therefore, live bed contraction scour is expected across the bridge waterway. A modified version of Laursen's 1960 equation was used for estimating the contraction scour and is written as:

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{6/7} \left(\frac{W_1}{W_2}\right)^{k_1} \qquad y_s = y_2 - y_o$$

Where:
y_s = Average contraction scour depth (ft)
y_2 = Average depth in the contracted section (ft)
y_1 = Average depth in the upstream main channel (ft)
y_0 = Existing depth in the contracted channel before scour (ft)
Q_1 = Flow in the upstream channel transporting sediment (cfs)
Q_2 = Flow in the contracted channel (cfs)
W_1 = Bottom width of the upstream main channel (ft)
W_2 = Bottom width of the contracted channel (ft)
k_1 = exponent determined from shear velocity and fall velocity

The computed contraction depth for the proposed bridge design at Bridge Location #1 is 2.08 ft.

At the Bridge Location #2, the approach velocity was calculated to be less than the critical sediment velocity. For this condition, clear water contraction is more probable at the bridge waterway section, therefore, The Laursen equation given below was used for estimating scour for this bridge:

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3} W^2}\right]^{3/7} \qquad y_s = y_2 - y_o$$

Where:
y_s = Average contraction scour depth (ft)
y_2 = Average depth in the contracted section (ft)
y_0 = Existing depth in the contracted channel before scour (ft)
Q = Flow through the bridge (cfs)
W = Bottom width of the contracted channel (ft)
k_u = 0.0077 (in English units)

The computed contraction depth based on the above equation for proposed Bridge Location #2 is negligible because the proposed bridge does not introduce any obstruction that would contract the conveyance of the existing channel for the 100-year storm event.

For the ACFCC, contraction scour was calculated to be 1.70 ft. Since the average channel velocity was greater than the permissible velocity of the sediment, live bed contraction scour was considered for this bridge.

5.5 Pier Scour

Pier scour is a localized phenomenon and is caused by the erosive force exerted by the high velocity vortex at the upstream face of the pier. Determinant factors for the pier scour are hydraulics characteristics such as flow velocity and flow depth, width and shape of the pier, angle of attack of the flow with respect to the pier axis and bed material characteristics. There are a total of four piers for two parallel bridges proposed at Bridge Location #1. The General Plan (Figure 19) shows the positioning of the piers with respect to the bridges. All the four piers are oval shaped with dimensions of 8.5 ft x17 ft. As a conservative approach, these piers were assumed to be circular with a diameter of 17 ft and angle of attack at the pier face (17 ft) was considered to be zero. Flow depth and velocity were obtained from the hydraulic analysis results using HEC-RAS. The Colorado State University (CSU) equation was used for calculating maximum scour depth and can be written as:

$$\frac{y_s}{y_1} = 2.0 K_1 K_2 K_3 K_4 \left[\frac{a}{y_1}\right]^{0.65} F_{r1}{}^{0.43}$$

Where:
y_s = Pier scour depth (ft)
y_1 = Flow depth directly upstream of the pier (ft)
K_1 = Correction factor for pier nose shape
K_2 = Correction factor for angle of attack of flow
K_3 = Correction factor for bed condition
K_4 = Correction factor for armoring by bed material size
a= Pier width (ft)
F_{r1} = Froud number directly upstream of the pier

The maximum pier scour calculated based on the above equation is 13.62 ft at the Old Alameda Bridge Location #1. The proposed bridge at Old Alameda Bridge Location #2 would be a single-span bridge and would not have piers and thus, no pier scour was calculated. The maximum scour at the ACFCC bridge piers was calculated as 7.72 ft.

5.6 Abutment Scour

Scour occurs at bridge abutments when abutments and embankments obstruct flow. The obstruction to flow forms a horizontal vortex that starts at the upstream end of the abutment and runs along the toe of the abutment and a vertical vortex at the downstream end of the abutment.

Since the water surface in the Old Alameda Creek channel is below the abutment edges, and the spacing between the abutments did not cause any obstruction to the flow, abutment scour was not considered for both bridge locations. Scour would occur at one of the abutments (Abutment#1) of the ACFCC. Scour depth for the abutment was calculated using Froehlich's Live Bed Abutment Scour Equation is estimated to be 20.62 ft.

5.7 Total Scour

The total estimated scour will be the sum of the long-term bed change, contraction scour, and local abutment scour. The total scour depth at the two Old Alameda Creek bridge locations are shown in Table 12 and for ACFCC is shown in Table 13

Table 12. Scour Summary for the Old Alameda Creek Bridges

Bridge Location #	Left/ Right	Water Surface Elevation at the upstream face (ft)	Average Velocity (ft/sec)	Pier Station (per GP)	Pier Scour Depth (ft)	Contraction Scour (ft)	Total Scour (ft)
1	left	25.29	3.25			1.54	
				23+85	10.85		12.4
				25+50	12.45		14
1	Right	25.15	2.93			2.08	
				22+15	13.62		15.7
				23+80	11.27		13.35
2	NA	26.85	1.37	NA	NA	0	0

Table 13. Scour Summary for the ACFCC Bridge

Location	**Bridge component**	**Local Scour**	**Contraction Scour**	**Total Scour**
Left Overbank	Left Abutment #1	20.62	1.70	**22.32**
Channel	Pier #2	7.41	1.70	**9.11**
	Pier #3	7.75	1.70	**9.44**
	Pier #4	7.72	1.70	**9.41**
	Pier #5	7.55	1.70	**9.25**
	Pier #6	7.60	1.70	**9.29**
	Pier #7	6.90	1.70	**8.60**
Right Overbank	Right Abutment #8	0.00	1.70	**1.70**

5.8 Scour Protection Recommendations

The foundation piles of the new piers should be installed below the estimated scour depths to withstand the erosive force generated by the flow velocity. Scour countermeasures are not proposed at the bridge locations.

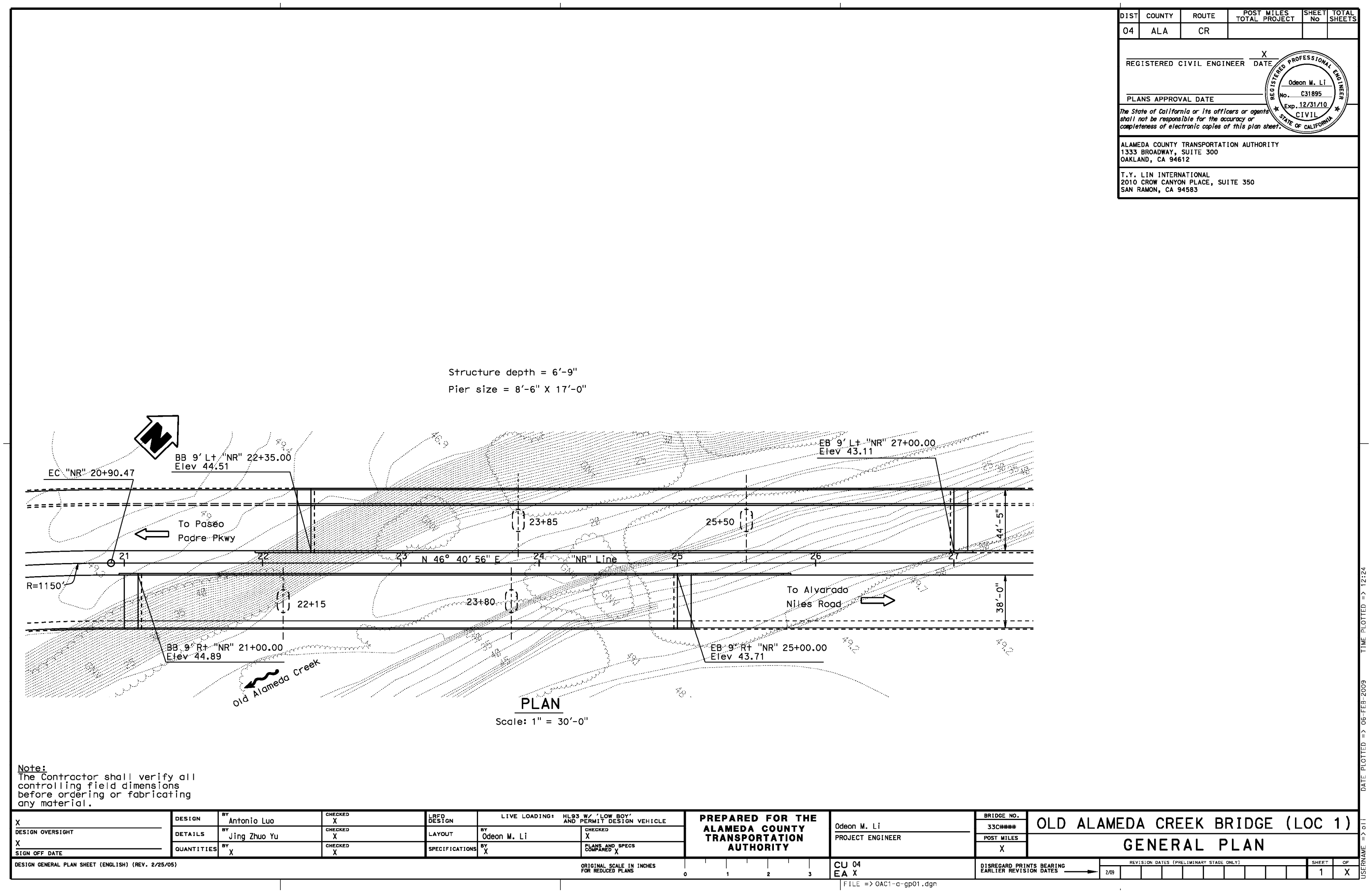


Figure 19. General Plan: Bridge Location #1 on Old Alameda Creek

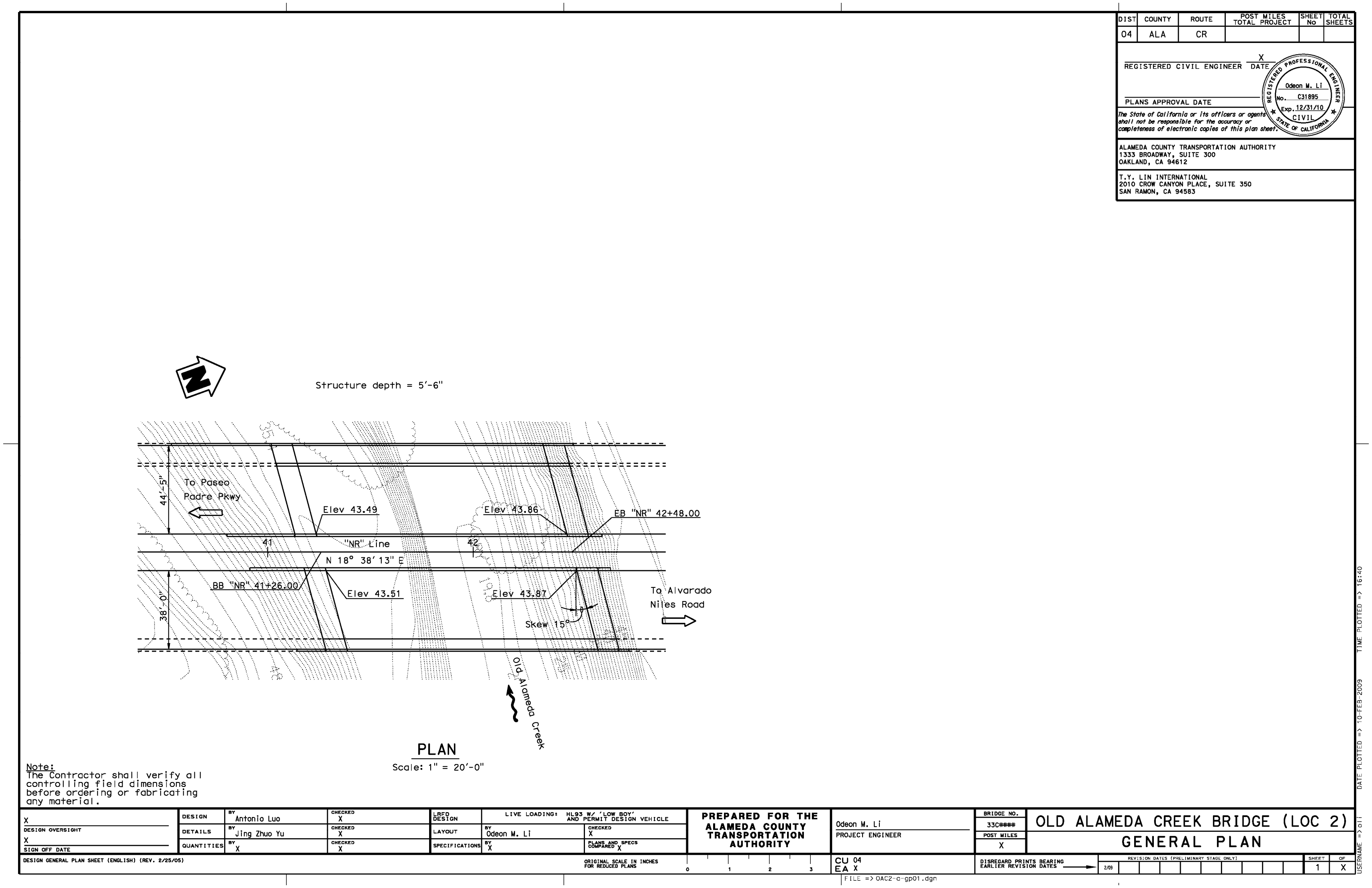


Figure 20. General Plan: Bridge Location #2 on Old Alameda Creek

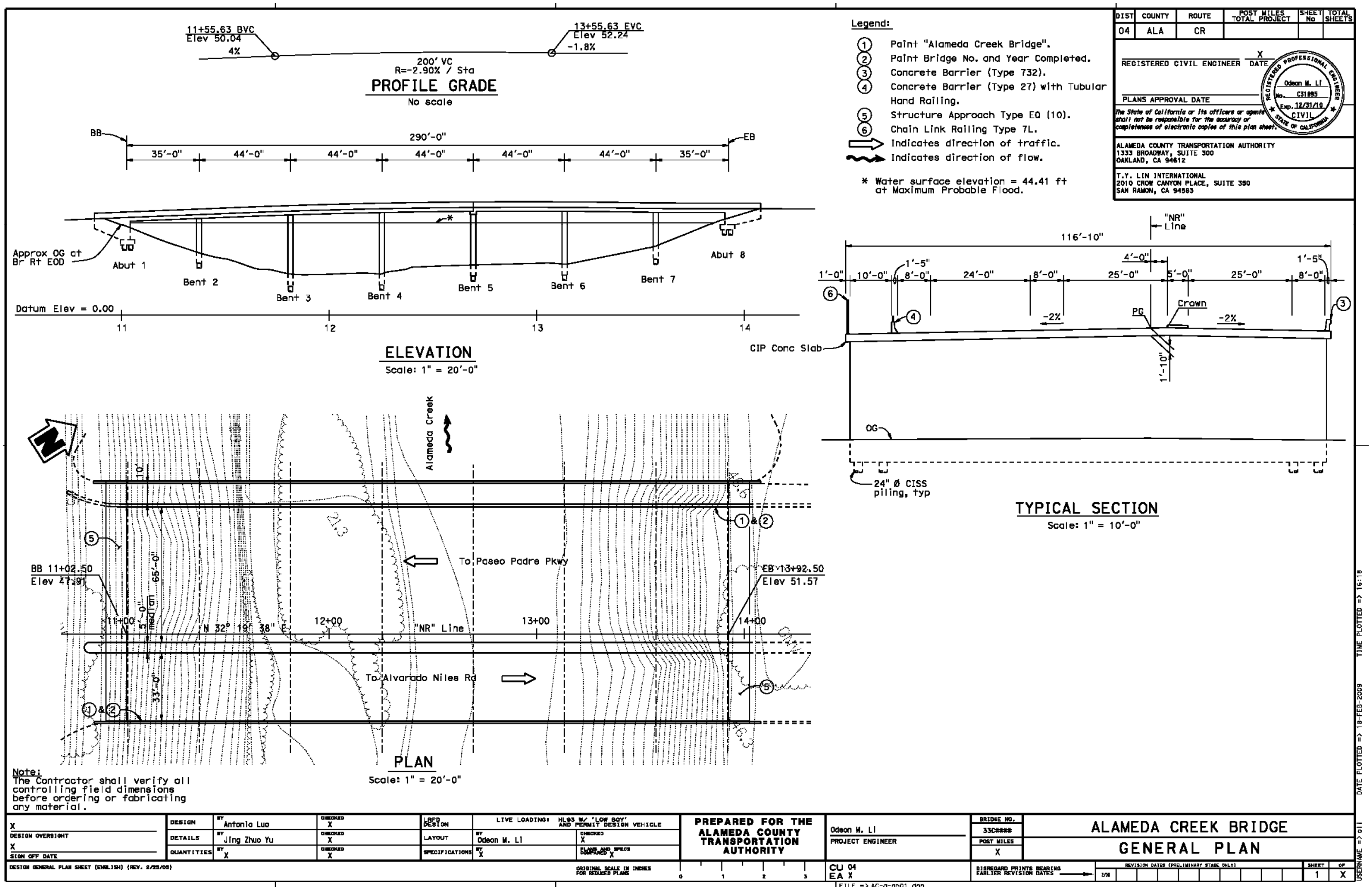


Figure 21. General Plan: ACFCC Bridge

6 DISCUSSION AND RECOMMENDATIONS

The new East-West Connector alignment would cross ACFCC once, and would cross Old Alameda Creek at two other locations to the east of Paseo Padre Parkway. Preliminary hydraulic analyses were performed on both channels.

A new 7-span bridge crossing is proposed at ACFCC . Proposed condition was evaluated and compared to the existing conditions with no bridge. The proposed structure would reduce the flow conveyance area and would potentially affect the water surface profile upstream of the bridge, which is unavoidable. The proposed bridge can pass the 100-year design flow of 31,000 cfs with more than 1 ft of freeboard. However, it cannot pass the USACE's MPF of 52,000 cfs with the required free board. The ACFCC has adequate capacity to convey both the 100-year and MPF. The proposed new bridge would have only a very slight increase to the water profile and a very small change to the flow velocity. Therefore, the proposed bridge would have an insignificant impact to the existing flow conveyance.

The existing Old Alameda Creek is currently receiving runoff from two local tracts and Zone 5's Line N-12. The upstream groundwater recharge basins do not contribute flows to this stretch of Old Alameda Creek in the vicinity of the crossing of the East-West Connector. The existing 100-year flow for Old Alameda Creek is 250 cfs. With the proposed Diversion from Zone 5's Line M and runoff from local residential developments (Tract 7405), the additional runoff to be discharged to Old Alameda Creek would be 342.5 cfs. This additional flow would be routed via a proposed wetland site along the northern (upstream) stretch of the channel. Additional flow from the Line M Diversion Pipe would have minimal impact to the hydraulic capacity of the channel and would be contained within the channel, with at least 1 ft of freeboard. In addition the added discharge could be used to enhance the existing Old Alameda Creek habitat and restore more riparian habitat to mitigate the wetland impacts from the proposed EWC Project.

The diversion pipe for Line M was proposed based on the agreement between ACFC & WCD and Union City to help address the flooding issues of the existing Line M Channel, and to mitigate additional discharge produced by two impacted detention basins due to the construction of the project. This diversion pipe used to convey flows from Line M to Old Alameda Creek is proposed to be a 96-in. pipe with a smooth interior.

The existing Line M has flooding problems due to the capacity constraints in the channel downstream of the East-West Connector alignment. With the implementation of the new Diversion Pipe, part of the flow would be diverted to Old Alameda Creek. With this diversion, flooding would be relieved in the vicinity of the Project site, and thus, is an improvement over the existing condition. Also, approximately 1,100 ft of the Line M Channel would be replaced by double box culverts (10 ft by 5 ft) for the flow conveyance in the impacted Line M Channel under the new road alignment.

With the proposed diversion pipe from Zone 5 Line M Channel and runoff from local residential developments (Tracts 7405, 6999, 7000 and part of 7th Street), the additional runoff to be discharged to Old Alameda Creek would be 342 cfs. Additional flow from the Line M Channel diversion pipeline would have minimal impact on the hydraulic capacity of the channel and would be contained within the channel, with ample freeboard between 100-year water surface elevation and channel banks.

New drainage systems with new outfalls into Old Alameda Creek would be proposed for the EWC Project to accommodate the proposed new roadway alignment. The new drainage system would be designed mainly for a 25 year storm event. At the depressed location, both proposed drainage and pump storage would meet 50-year storm event condition. Existing drainage facilities throughout the EWC Project limits, would be extended, replaced, repaired, and/or improved as necessary to provide proper drainage for the increase runoff of the widened areas.

The objective of the drainage design is to limit the design WSEs and velocities to no greater than the existing conditions, or to what can be handled by the existing conditions, at the boundary of the EWC Project. In addition, the EWC Project’s design goal is to maintain pre-construction storm water discharge flows by metering or detaining these flows to pre-construction rates prior to discharge to a receiving water body.

7 REFERENCES

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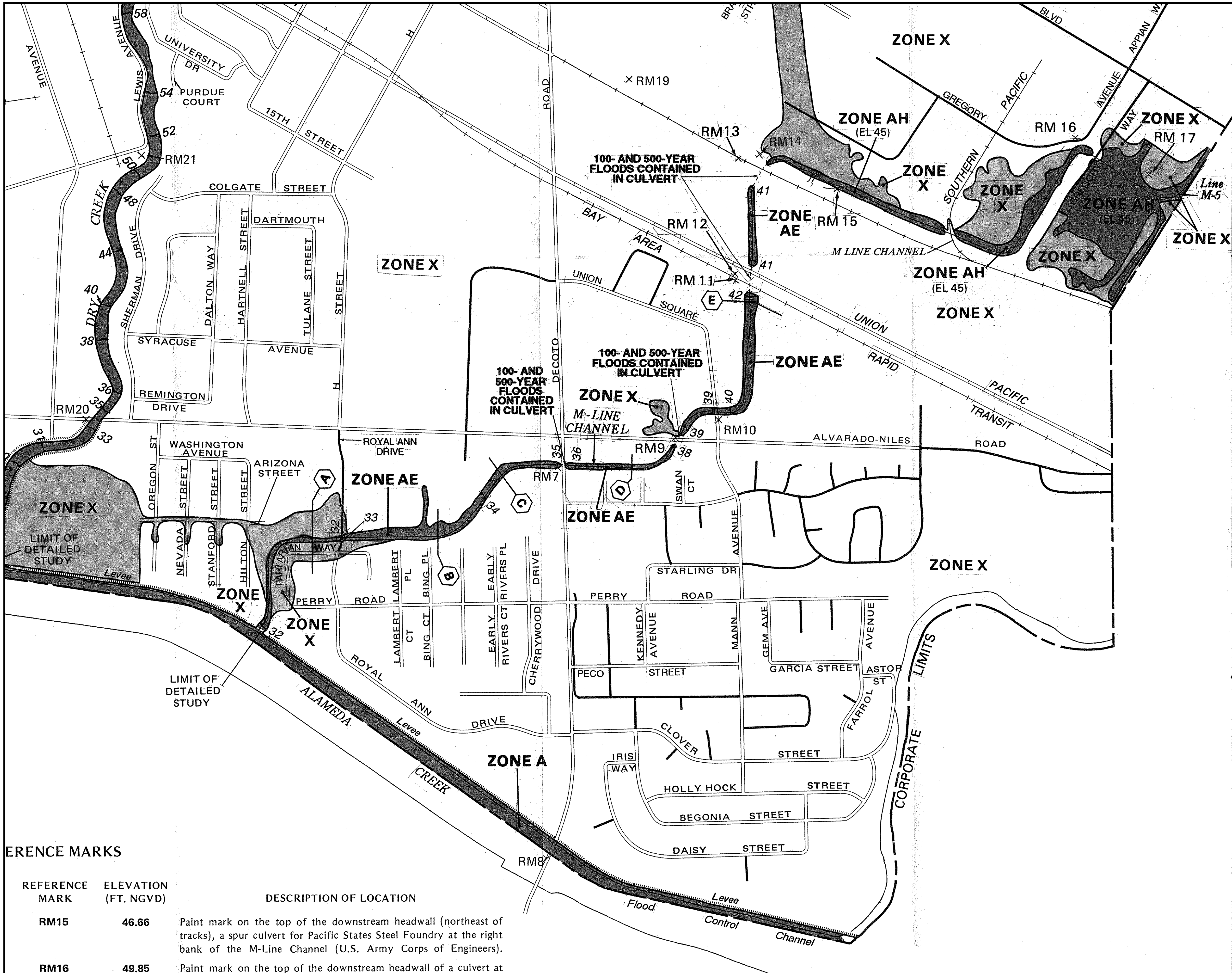
Appendix A FEMA Floodplain Map



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding; velocities also determined.

ZONE A99 To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 | Identified 1990 | Otherwise Protected Areas

†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

Floodplain Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

~~513~~ Base Flood Elevation Line; Elevation in Feet*

(D)——(D) Cross Section Line

(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*

RM 7× Elevation Reference Mark

ERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM15	46.66	Paint mark on the top of the downstream headwall (northeast of tracks), a spur culvert for Pacific States Steel Foundry at the right bank of the M-Line Channel (U.S. Army Corps of Engineers).
RM16	49.85	Paint mark on the top of the downstream headwall of a culvert at Heckett Engineering Company at the right bank of the M-Line

Appendix B Project Photographs

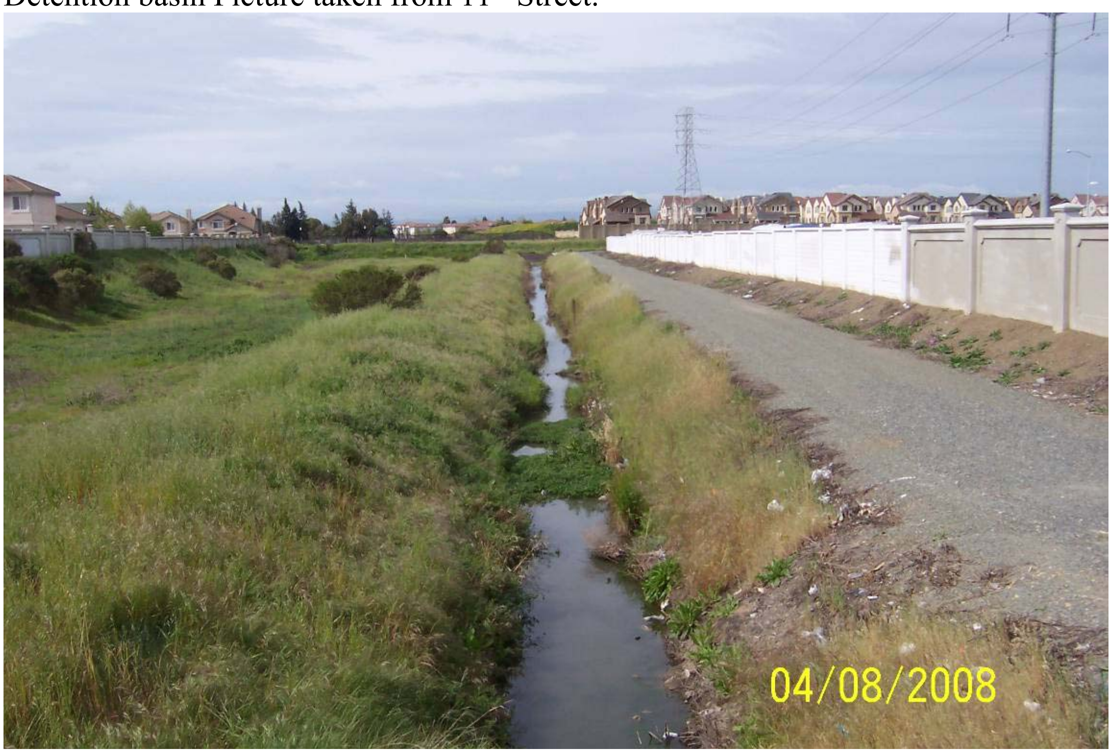
Detention basin near 11th Street

Pump Station next to Detention basin near 11th Street and Green Street

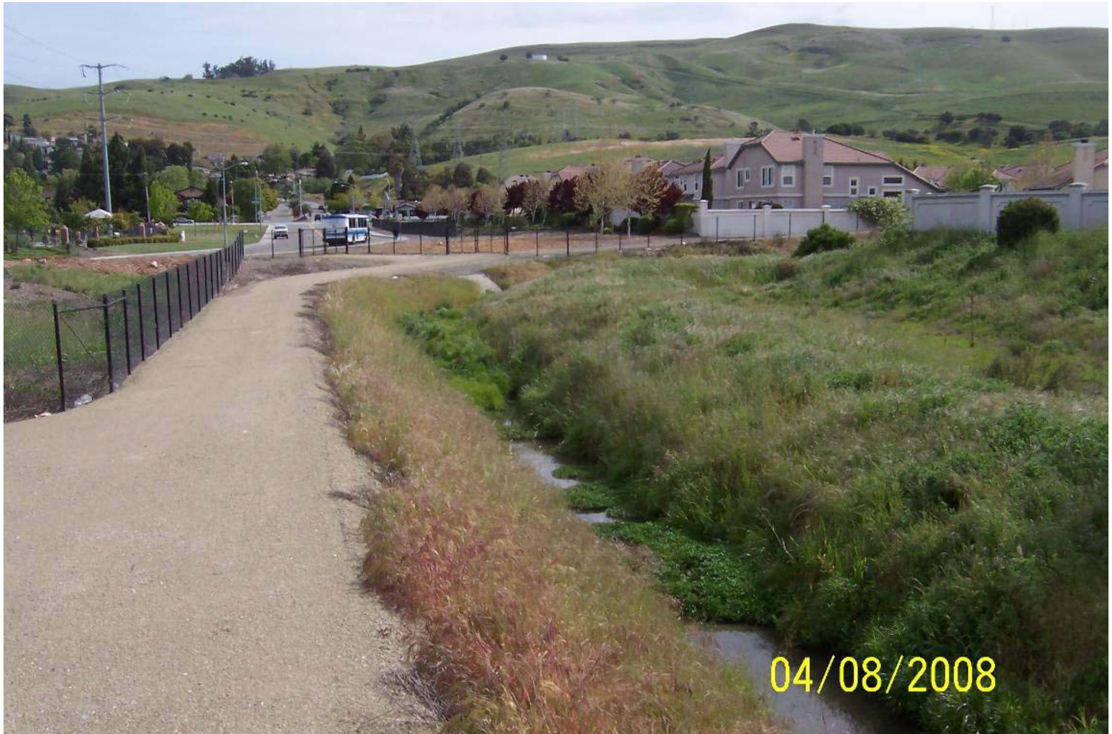
Pipe from the pump station to detention basin

A 42” Outfall into the detention basin from Tract 7405.

Detention basin Picture taken from 11th Street.



Line M Channel near Chesapeake Drive looking towards rail road and Green Street.



Line M Channel from Chesapeake Drive looking towards 7th Street.

Two cross culverts under Chesapeake Drive.

Chesapeake Drive Bridge.

Upstream side of three cross culverts connecting Old Alameda Creek and Alameda Creek Flood Control Channel.

Upstream side of three cross culverts connecting Old Alameda Creek and Alameda Creek Flood Control Channel.

Maintenance structure for three cross culverts connecting Old Alameda Creek and Alameda Creek Flood Control Channel.

Downstream side of the three cross culverts in Alameda Creek Flood Control Channel

Flap gates on the downstream side of three cross culverts in Alameda Creek Flood Control Channel

Another picture of flap gates on the downstream side of three cross culverts in Alameda Creek Flood Control Channel

Flap gates on the downstream side of three cross culverts in Alameda Creek Flood Control Channel, taken from Paseo Padre Pkwy

Appendix C Memorandum of Understanding between ACFC & WCD and City of Union City

JOINT AGREEMENT
Between City of Union City and Alameda County Flood Control and Water Conservation District
State of California
For
The Specific Infrastructure Improvements for a Detention Basin and Construction of a Box Culvert at the 11th Street Crossing and Zone 5 Line M Flood Control Channel

1. This Joint Agreement (hereinafter "the Agreement") is made and entered into on the 11th day of May, 2004 between the City of Union City, hereinafter referred to as "City" and the Alameda County Flood Control and Water Conservation District, hereinafter referred to as "District". The Agreement is made for purpose of jointly submitting an application to the Economic Development Administration (EDA), United States Department of Commerce, for a Public Works and Development Facilities grant in the amount of $3,190,589.

   The City and the District are requesting financial assistance from the EDA to construct certain improvements related to the City's infrastructure construction project (herein also "the project") including a detention basin that will detain storm water during peak storms and to enable the vacant land to be developed and to convert a portion of the District's Zone 5 Line M flood control channel into a box culvert. The Line M channel that would be boxed is located between the now vacant PG&E and PSSC properties. The existing Line M channel has a concrete lined bottom and sides and earthen slopes. For geotechnical purposes, the District requires 20-foot setbacks from the Line M channel. Boxing the portion of the Line M channel between the PSSC and PG&E properties, will alleviate the need for the 20-foot setback and enable the development of new economic enterprises by increasing the amount of developable land on the PG&E property. The top of the box would be landscaped, thereby improving the aesthetics of the development and creating a useable pedestrian and bicycle path.

   The project involves the upgrade and drainage capacity enhancement, to ensure the effective new mixed-use development of 87 acres of remediated "brownsfield" land, with the objective of expanding the economic base of Union City and creating new higher paying jobs.

2. The City Community Redevelopment Agency is under contract to purchase the portion of the PSSC property where the detention basin will be constructed. Upon acceptance of the drainage improvements by the City and the District, the City will assume responsibility for the ownership and

maintenance of the detention basin and all the improvements to be made on top of the box culvert (including but not limited to landscaping, roadway pavement, pedestrian and bicycle pathways) for the entirety of its useful life. The District holds the easement for the Line M channel, and will assume responsibility for the ownership and maintenance of the box culvert structure, including clearing siltation and debris to maintain the flow capacity throughout the entirety of its useful life. In the event that there is any subsequent change in governmental maintenance and operation, the EDA shall be so informed.

3. The parties to the Agreement, the City and the District, hereby agree jointly and separately as follows:

   a. The requirements set forth in the Public Works Application forms, Pre-application and Application, and all applicable exhibits to these forms.

   b. The Award documents which include:

      (1) The Financial Assistance Award.
      (2) The ED-508 Budget accompanying the Award.
      (3) The Special Award Conditions and Standard Terms and Conditions for Public Works and Development Facilities accompanying the Award.
      (4) The EDA publication, **Requirements for Approved Construction Projects,** which is sent to Recipients after EDA receives an executed original Award.

   c. The provisions of the United States Statutes codified in the United States Code and EDA regulations codified in the Code of Federal Regulations **(CFR)** and any **Federal Register** announcements applicable to EDA Public Works projects.

4. The parties to the Agreement understand that they will be bounded jointly and separately by the application forms and award documents that they have executed and the applicable statutes and regulations as provided in the Agreement, and that the two parties to the Agreement agree to each submit the following application material with original signatures:

   a. A front page Application (SF-424).
   b. Assurances, (two separate forms)
   c. A Civil Rights Status Report (if necessary).
   d. Form ED-612, "Current and Projected Employee Data" (Items 1-4, 8 and 9 completed)
   e. Drug-Free Workplace and Lobbying Certificate.

5. State the responsibilities of the parties in the administration of the grant by setting forth:

   a. The City will be responsible for filing EDA project reports.
   b. The City will be responsible for the receipt and distribution of grant funds and filing EDA financial reports.
   c. The City will be responsible for the design of Line M to the District's standards and procurement of applicable regulatory agency permits.
   d. The City will be responsible for the bidding, award and management of all construction contract(s).
   e. The City will be responsible for all the costs associated with the construction of the drainage improvements.
   f. The District will have no responsibility for the administration or reporting for the grant, or any costs associated with the drainage improvements, except for review of construction documents and the maintenance of the box culvert.

6. INDEMNITY PROVISIONS:

   The City agrees to defend, indemnify, and hold harmless the District, their board of supervisors, their officers, predecessors, successors, assignees, agents, employees, representatives, attorneys, and all persons acting by, through, under or in concert with any of them, and each of them from any and all acts, claims, losses, damages, liabilities or expenses, including reasonable attorney fees incurred in the defense thereof, by whomever asserted arising out of or in any way connected with the project or the City's performance under this Joint Agreement (collectively "Liabilities"), including but not limited to Liabilities for soil contamination or remediation. The only exceptions to the City's duty to defend, indemnify and hold harmless under this provision are:

   a. For those Liabilities arising solely from the negligence or willful misconduct of the District.
   b. For those Liabilities arising from the District's maintenance of the box culvert.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as part of the day and year first above written.

Alameda County Flood Control and
Water Conservation District

By: ______________________
DANIEL WOLDESENBET, Ph.D., P.E.,
COUNTY ENGINEER
ASSISTANT DIRECTOR OF
PUBLIC WORKS

City of Union City

By: ______________________
LARRY CHEEVES,
City Manager

Approved as to Form
RICHARD E. WINNIE, County Counsel

By______________________

C2983

C-2006-230

AGREEMENT BETWEEN

ALAMEDA COUNTY FLOOD CONTROL AND

WATER CONSERVATION DISTRICT (DISTRICT)

AND

CITY OF UNION CITY

TO FUND CASTRO VALLEY CREEK DAY-LIGHTING AS A MITIGATION FOR ZONE 5 LINE M CULVERTING IN UNION CITY

RECITALS

This funding AGREEMENT is made this 1st ~~12~~ day of August ~~July~~, 2006, in the City of Union City, State of California, by and between the City of Union City, hereinafter referred to as "City" and the Alameda County Flood Control and Water Conservation District hereinafter referred to as "District" a political subdivision of the State of California for City to provide funding for the project located at Zone 2 Line J in Castro Valley as mitigation for impacts associated with a City project at Zone 5 line M in Union City. City and District hereby agree as follows:

Whereas the Project would daylight approximately 300 linear feet of culverted section of Zone 2 Line J (Castro Valley Creek) between Castro Valley Boulevard to the north and Norbridge Avenue to the south, hereinafter refer to as the "Project"; and.

Whereas The Project is on a District owned and maintained flood control facility designated Zone 2 Line J (Castro Valley Creek) portions of which have been culverted and located adjacent and westerly of a County General Services Administration (GSA) owned property that is to be used for a public library scheduled for construction in the summer of 2007; and

Whereas this portion of Zone 2 Line J currently flows through a 6-foot high by 12-foot wide concrete box culvert designed to convey a 25-year storm event and to allow surface conveyance over the culvert during a larger storm event which extends from Norbridge Avenue to about 300 feet upstream. The remaining 1000-foot section upstream beyond the culvert to Castro Valley Boulevard is a natural earthen reconstructed channel; and

Whereas the City, has a job creation development project ("development") in Union City that involves culverting 700 linear feet of an existing District Flood Control facility, Line M in District Zone 5 as part of its office and high density housing development of the adjacent parcels in compliance to Court order; and

Whereas such development would permanently result in 700 linear feet (.23 acres) impact to US and State waters under federal and State environmental laws resulting in a need to provide compensatory mitigation to offset the impacts; and

Whereas the City has sought District's assistance to mitigate the development impacts by removing an existing 300-foot culvert and restoring and enhancing an approximately 900-foot section of Line J (Castro Valley Creek) between Norbridge Avenue to the south and Castro Valley Boulevard to the North; and

Whereas the project will include planting of native vegetation acceptable to regulatory agencies as identified in conceptual plan and described in the mitigation and monitoring plan for the project; and

Whereas the purpose of this Agreement is to provide a mechanism for the City to satisfy their development impact mitigation requirement as an adequate mitigation upon which certification/permits would be issued, and as discussed in the Mitigated Negative Declaration for the Zone 5 Line M development project and in this agreement.

NOW THEREFORE in consideration of promises and acts described herein, the parties agree as follows:

SECTION 1

DEFINITIONS:

1. Project is defined as all activities associated with removal, reconstruction of Line J and maintenance and monitoring requirements to satisfy the mitigation requirements of the City's actions on Zone 5 line M in Union City. (*Attachment A*)
3. Implementation of the project shall begin no later than the Summer of 2007.
4. The City's development project (on Zone 5 Line M channel) involves removing 490 LF of concrete-lined open channel between the Union Pacific Railroad (UPRR) tracks (Niles subdivision) and the UPRR tract (Oakland subdivision) and replacing it with a reinforced concrete box culvert that is under design. The culvert would consist of two sections, a 300-foot length upstream of the 11^{th} Street crossing (built in 2004) and a 190-foot length downstream of the crossing to the existing double 8-foot diameter reinforced concrete pipe (RCP) under the UPRR (Oakland subdivision) track, resulting in a box culvert of 700 LF total. At the downstream section, a 300-foot transition will be provided from the proposed box culvert to the existing double 8-foot diameter RCP.

   In addition, the City will construct an adequate drainage system that will carry street run-off that will bypass the District's existing facilities.

   The Development (in The City of Union City) resulted in permanent impacts to 700 linear feet (.23 acres) of Waters of The US /state requiring a compensatory mitigation.

SECTION II

DISTRICT AGREES:

1. To acquire right of way (permanent and temporary easements if necessary) for the project implementation; and

2. To make the project available to the City as a mitigation site for the impacts of their Development project in the city of Union City; and

3. To undertake the design, demolishing, reconstruction and enhancement of the restored creek based on hydrological data, need for sediment transport through the system and appropriate erosion and deposition patterns to ensure maximum stream function. The day-lighted creek will continue to provide flood protection at or above current capacity while increasing the functional values of the creek along the project reach; and

4. To Revise the draft conceptual plan, prepare final design, construction design plans, bid packages and award the project for the culvert day-lighting; and

5. To Provide labor, material, tools and equipment for the project, including advertising, award, contract administration, surveying, engineering, and other resources including material acceptance sampling and testing, construction staking and survey, and staff for satisfactory completion of the project; and

6. To obtain all local, state and federal approvals and permits for construction of the project; and

7. To prepare Mitigation and Monitoring Plan and submit Regulatory Agency Permit Applications (Army Corps, RWQCB and DFG) for the project; and

8. To assume all the maintenance and monitoring responsibilities of the project per Regulatory Agency permit conditions of the project; and

10. To follow Economic Development Administration Award No. 07-01-0553 procedures including EDA staff review of design, documentation of competitive bidding for construction, and signage.

11. Provide signage during construction crediting the Community Redevelopment Agency of the City of Union City for financing the day lighting project.

12. The District will pay for the cost of installing an oversize pipe with adequate capacity to convey excess storm flows from the Line M Channel to Old Alameda Creek and will accept a maintenance easement from the City.

13. The District agrees that City's future M Street right-of-way in the development can co-exist with the Line M easement.

SECTION III

CITY OF UNION CITY AGREES:

1. To cause the construction and maintenance of a street drainage system and pumping facility in the Development to carry the flows underneath the highway (which highway) and install an adequate drainage system as part of the Local Roadway Improvement Option 2 project *(Attachment* B).

2. To grant the District a permanent easement to maintain the Line M bypass structure near the future Local Roadway Improvements Option 2.

3. To provide not to "Exceed funds" in the amount of $500,000 in an escrow account for the construction cost of the Line J day-lighting project; and

4. To implement all other Best Management Practices (BMPs) and other declarations described in City's Mitigated Negative Declaration for the Development and any other regulatory agency permit conditions for the Development; and

5. Notwithstanding anything to the contrary herein, the District shall not, without prior consent from the City, settle any claim which does not include as an unconditional term thereof, a release of CITY from all liability in connection therewith and a dismissal with prejudice of such suit, claim action or proceedings.

SECTION IV

IT IS MUTUALLY AGREED TO AS FOLLOWS:

A. Indemnity Provisions

1. The City agrees to defend, indemnify, and hold harmless the District (with legal counsel reasonably acceptable to the District), its Board of Supervisors, its predecessors, successors, assignees, agents, departments, officials, representatives, employees and all persons acting by, through, under or in concert with any of them, and each of them (collectively "District Indemnitees") from any and all acts, claims, liabilities and losses by whomever asserted, arising out of City's performance under this Agreement except those arising by reason of the sole negligence or willful misconduct of the District Indemnitees.

2. The District agrees to defend, indemnify, and hold harmless the City, its council members, its predecessors, successors, assignees, agents, departments, officials,

representatives, employees and all persons acting by, through, under or in concert with any of them, and each of them (collectively "City Indemnitees") from any and all acts, claims, liabilities and losses by whomever asserted, arising out of District's performance under this Agreement except those arising by reason of the sole negligence or willful misconduct of the City Indemnitees.

B. Employer/Employee Relationship

No relationship of employer and employee is created by this Agreement, it being understood that City and District shall act hereunder independently of one another; and that personnel employed or contracted by the City shall not have any claim under this Agreement or otherwise against District for seniority, vacation time, vacation pay, sick leave, personal time off, overtime, health insurance, medical care, hospital care, retirement benefits, Social Security, disability, Workers' Compensation, or unemployment insurance benefits, civil service protection, or employee benefits of any kind; that City shall be solely liable for and obligated to pay directly all applicable taxes, including, but not limited to, Federal and State income taxes, and in connection therewith City shall indemnify and hold District harmless from any and all liability which City may incur because of City's failure to pay such taxes; that City does, by this Agreement, agree to perform his/her said work and functions at all times in strict accordance with currently approved methods and practices in his/her field and that the sole interest of District is to ensure that said service shall be performed and rendered in a competent, efficient, timely and satisfactory manner and in accordance with the standards required by the agency concerned.

Personnel employed or contracted by the District shall not have any claim under this Agreement or otherwise against City for seniority, vacation time, vacation pay, sick leave, personal time off, overtime, health insurance, medical care, hospital care, retirement benefits, Social Security, disability, Workers' Compensation, or unemployment insurance benefits, civil service protection, or employee benefits of any kind; District shall be solely liable for and obligated to pay directly all applicable taxes, including, but not limited to, Federal and State income taxes, and in connection therewith District shall indemnify and hold City harmless from any and all liability which District may incur because of District's failure to pay such taxes; that District does, by this Agreement; agree to perform his/her said work and functions at all times in strict accordance with currently approved methods and practices in his/her field and that the sole interest of City is to ensure that said service shall be performed and rendered in a competent, efficient, timely and satisfactory manner and in accordance with the standards required by the agency concerned.

C. Amendments

If, during the term of this Agreement it becomes necessary to amend or add to the terms and conditions of this Agreement, such amendments or additions shall be approved by the governing boards of District and City. However, any specific interpretations of the provisions of this Agreement, may be made by and between District and City by means of a memorandum of understanding jointly executed by the Directors of Public Works of District and City, or by equivalent officials, and such memorandum or memoranda shall be deemed incorporated herein and be deemed of equal force and effect with any of the terms and conditions contained herein.

D. Conformity With Law and Safety

District and City shall each observe and comply with all applicable laws, ordinances, codes and regulations of governmental agencies, including federal, state, municipal and local governing bodies having jurisdiction over the scope of services or any part hereof, including all provisions of the California Occupational Safety and Health Act, and all federal, state, municipal and local safety regulations. All services performed by each party to this Agreement must be in accordance with these laws, ordinances, codes, and regulations.

E. Term of Agreement.

The parties in this Agreement agree to work together in the spirit of cooperation and good faith and shall use their best efforts to accomplish the particular obligations set forth herein. Wherever and whenever mutual agreement is provided for in this Agreement, no party shall unreasonably withhold their approval.

In the event of any disagreement concerning the interpretation or implementation of this Agreement, the parties shall make good faith efforts to resolve their differences, which efforts may include utilizing non-binding arbitration, with costs to be borne equally by the two contracting parties. Each party shall bear its own attorneys' fees and costs. [This term is very flexible when it comes to the parties' options in time of dispute. Non-binding arbitration is not required by this term. This is fine as long as you are aware that the other party may elect to take you to court instead of arbitrating]

F. Insurance/Self Insurance

District and City are self-insured as to any questions under this Agreement. No policies or bonds are required of either party as to any provisions of this Agreement.

G. Workers Compensation

City is aware of and will comply with the requirements of Section 3700 of the Labor Code of the State of California at City's own cost and expense and further, neither City nor its carrier shall be entitled to recover from District any costs, settlements, or expenses of Workers' Compensation claims arising out of this Agreement.

District is aware of and will comply with the requirements of Section 3700 of the Labor Code of the State of California at District's own cost and expense and further, neither District nor its carrier shall be entitled to recover from City any costs, settlements, or expenses of Workers' Compensation claims arising out of this Agreement.

H Choice of Law

This Agreement and any dispute arising from the relationship between the parties to this Agreement, shall be governed by the laws of the State of California, excluding any laws that direct the application of another jurisdiction's laws.

Notices

All notices required under this Agreement must be in writing, and may be given either personally or by registered or certified mail (return receipt requested), or by facsimile. Any party hereto may at any time, by giving ten (10) days written notice to the other party hereto, designate any other person or address in substitution of the address to which such notice shall be given. Such notices shall be given to the parties at their address set forth below:

District
Daniel Woldesenbet
Acting Director, Public Works Agency
399 Elmhurst Street
Hayward, CA 94544
Fax: (510) 782-1939

City of Union City
Larry Cheeves
City Manager,
City of Union City
Ca 94587
Fax: (510) 441-2943

J. Execution

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the dates shown below their respective authorized signatures.

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, a political subdivision of the State of California

By: [signature]
President, The Board of Supervisors

Date: AUG - 1 2006

CITY OF UNION CITY, a Municipal Corporation of the State of California

By: [signature] for LC
City Manager

Date: 18 JULY 06

Resolution No. 3218-06 C.M.S.

Approved as to form:
Richard E. Winnie, County Counsel

By: Cenarez Braman
Deputy County Counsel

Approved as to form:
Michael Riback, City Attorney

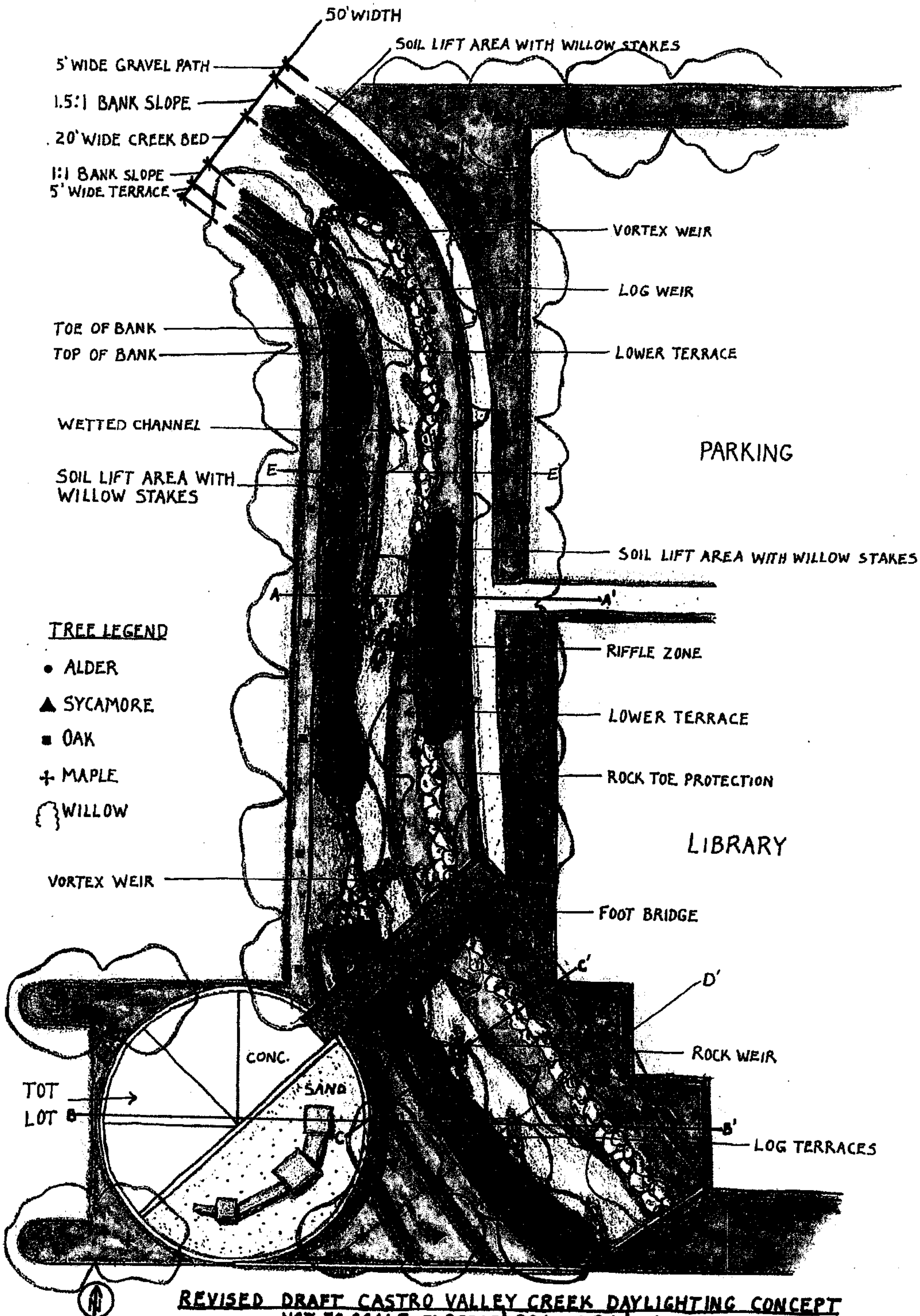
By: [signature]
Office of the City Attorney

I hereby certify under penalty of perjury that the President of the Board of Supervisors was duly authorized to execute this document on behalf of the County of Alameda by a majority vote of the Board AUG - 1 2006 and that a copy has been delivered to the President as provided by Government Code Section 25103.

ATTEST:
CRYSTAL HISHIDA GRAFF, Clerk of the Board of Supervisors
County of Alameda, State of California

By: R. Caballero Date: AUG - 1 2006

ATTACMENT A



REVISED DRAFT CASTRO VALLEY CREEK DAYLIGHTING CONCEPT
NOT TO SCALE ≈ 300 LF | DRAWN: PM | 4/7/06

ATTACHMENT B

RESOLUTION NO. NO. 3148-06

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF UNION CITY APPROVING IN CONCEPT THE MEMORANDUM OF UNDERSTANDING FOR ROUTE 84 RE-ALIGNMENT (OPTION 2) PROJECT

WHEREAS, presentation has been made to the City Council of the City of Union City of the proposed Memorandum of Understanding (MOU) between Alameda County Transportation Authority (ACTA), State Department of Transportation (Caltrans), and the Cities of Fremont and Union City for the delivery and funding of the Route 84 Realignment – Local Roadway Improvements (Option 2) Project, as listed in Exhibit A;

WHEREAS, the MOU documents each agency's conditions for proceeding with the development and construction of Option 2;

WHEREAS, the MOU outlines the funding nexus and requirements for both Option 2 and the I-880/Mission Interchange Projects;"

WHEREAS, any minor wording changes will be corrected in the final version.

WHEREAS, although all parties have been working together on the MOU, the State's attorney has yet to comment on the language. In the spirit of cooperation and timeliness, the City Council of the City of Union City is to consider the MOU and approve in concept;

WHEREAS, in the event that the final version of the MOU is materially changed, it will be brought back to the City Council for reconsideration and final approval.

NOW, THEREFORE, BE IT RESOLVED, by the City Council of the City of Union City, as follows:

That the City Council of the City of Union City hereby authorizes the City Manager to execute the hereinabove mentioned MOU in its final form on behalf of the City of Union City.

PASSED, APPROVED AND ADOPTED by the City Council of the City of Union City at a regular meeting held on the 28th day of March 2006 by the following vote:

AYES: Councilmembers, Fernandez, Navarro, Valle, Mayor Green
NOES: None
ABSENT: Councilmember Dutra-Vernaci
ABSTAIN: None

MARK GREEN
Mayor

ATTEST:

KAREN DIAZ
City Clerk

APPROVED AS TO FORM:

MICHAEL RIBACK
City Attorney

EXHIBIT A
Resolution No. 3148-06

MEMORANDUM OF UNDERSTANDING

FOR THE

FUNDING AND DELIVERY

OF THE

I-880/ROUTE 262 (MISSION BOULEVARD) THE MISSION/I-880 COMPLETION PROJECT IN FREMONT

AND

LOCAL ROADWAY IMPROVEMENT (OPTION 2) PROJECT IN FREMONT AND UNION CITY

BY AND BETWEEN

THE ALAMEDA COUNTY TRANSPORTATION AUTHORITY, THE CALIFORNIA DEPARTMENT OF TRANSPORTATION, AND THE CITIES OF UNION CITY AND FREMONT

This Memorandum of Understanding (MOU) between the Alameda County Transportation Authority (ACTA), California Department of Transportation (Caltrans), the City of Union City, and the City of Fremont, dated for convenience on__________, outlines the general commitment of funding and general roles and responsibilities of each agency for the development and delivery of the I-880/Route 262 (Mission Boulevard) Interchange Phase 1B Project ("Mission/I-880 Completion Project") and the Local Roadway Improvement Project ("Option 2") in Fremont and Union City. The Mission/I-880 Completion Project and Option 2 are both defined in Exhibit A.

This MOU constitutes a guide to the respective intentions and policies of the parties involved. Funding commitments to provide for the deposit of funds for specific work phases or project effort committing machine or personnel time will be covered by one or more separate cooperative agreements as may be necessary. Therefore, contingent on full support and consensus for the development and eventual construction of the Option 2 by the Cities of Union City and Fremont, it is understood that:

CALTRANS

1. Caltrans is committed to work closely with ACTA and the Cities of Union City and Fremont using flexibility provided by the approved AB 1462 to redirect funds from the sale of State-owned lands purchased for the Historic Parkway Project to fund State highway improvements, in Alameda County as specified in AB 1462.

2. Caltrans will support directing up to $42.35 million, derived from sale of State-owned lands in the Historic Parkway Corridor and consistent with the provisions of AB 1462, for the Mission/I-880 Completion Project. The funding needs for the Mission/I-880 Completion Project are currently estimated at $42.35 million, and will be jointly determined based on potential savings from the Phase 1A project and potential funding from other sources.

3. Caltrans will support using AB 1462 funding to bring existing State Route 84 between I-880 and State Route 238 (Mission Boulevard) to a state of good repair before relinquishing it to the City of Fremont, as defined in Section 73 of the Streets and Highways Code. The cost to relinquish will be established through the development of a Project Scope Summary Report (PSSR) to be prepared by Caltrans and coordinated with the City of Fremont.

4. Caltrans will work with ACTA and the Cities of Fremont and Union City to utilize AB 1462 funding for State Route 238 (Mission Boulevard) in the vicinity of the Historic Parkway project so that Option 2 can be constructed utilizing previously committed local funds, namely Measure B funds and local matching funds.

5. Caltrans will work with ACTA, the Cities of Fremont and Union City, as well as other local and regional partners to develop a priority list of projects on State highways, in Alameda County as specified in AB 1462, in order to fully utilize any remaining AB 1462 funds.

6. Caltrans would recommend to the California Transportation Commission to program State funding derived from the sale of State-owned land in the Historic Parkway Corridor for the Mission/I-880 Completion Project as part of the development of the list of priority projects on State highways in accordance with AB 1462.

7. Caltrans agrees to relinquish existing Route 84 between I-880 and Route 238 (Mission Boulevard) to Fremont, once funding becomes available and Caltrans completes its obligations to bring the facility to a state of good repair in accordance with section 73 of the Streets and Highways Code.

8. Caltrans will work with the appropriate regional transportation planning agencies to expeditiously amend the regional traffic model to remove the planned State Route 84 in the Historic Parkway Corridor between I-880 and State Route 238 (Mission Boulevard) and include Option 2 as the replacement project.

9. Caltrans will work with the Cities of Fremont and Union City to amend their respective General Plans to ensure that the State's excess lands are appropriately zoned prior to sale.

10. Caltrans would not declare the State-owned lands located in Fremont and Union City as excess until such time the final environmental document ("EIR") for Option 2 is certified by the lead agency and accepted by all local jurisdictions and Fremont and Union City have agreed to allow Option 2 to proceed to construction.

11. Caltrans would withdraw as the project sponsor for the Route 84 project that is identified in the 1986 Measure B Expenditure Plan as soon as the amendment to that Expenditure Plan modifying the Rt. 84 Project as described in this Agreement has been approved.

12. Caltrans will proceed with the sale of the State-owned lands purchased for the Historic Parkway Project within the Historic Corridor, but will return all proceeds to the State Highway Account if local consensus cannot be reached and Option 2 is not constructed by the date required by AB 1462.

ACTA

13. ACTA is committed to program $70 million of Measure B sales tax revenue, plus any interest earned on this amount (estimated to be $3 million for a $73 million total) and the proceeds from the sale of the property ACTA owns in the Route 84 historic alignment (estimated to be worth approximately $15 million) for the delivery of Option 2. Neither Fremont nor Union City will be responsible for any costs for Option 2 above the approximately $88 Million committed by ACTA.

14. ACTA will be the project sponsor of Option 2 and to take the lead in the project development, environmental review process and implementation process, adhering to all state and federal regulations for environmental review, but utilize the appropriate City design standards for project development and construction. The ACTA Board will review and certify the final environmental document. Staff members from Caltrans, the Cities of Fremont and Union City, as well as others, will be a part of a technical advisory team to help define the scope and review the administrative draft of the EIR and guide the project development of the project. In addition, a policy committee comprised of a Caltrans representative and elected officials from Fremont, Union City and ACTA will also be formed to oversee the development of the project.

(a) The EIR will address, among other things, the following issues:

(i) How neighborhood traffic will access the new road.

(ii) How the new alignment adjacent to the creek will avoid significant impacts on the creek and mitigate the impacts it can't avoid.

(iii) Documenting traffic mitigation benefits of the new alignment.

(iv) Using the most updated travel model for the traffic analysis.

(v) The relative sound levels on all adjacent residential neighborhoods.

(vi) Constructing sound walls as warranted by sound studies, along adjacent residential streets, including Decoto Road, Paseo Padre Parkway, and within the segment behind Mission Lakes and the following Union City streets: Mahogany Ln, Cascades

Cir., Sandburg Dr., Chesapeake Ct., Sandburg Ct., Platinum St., Monterra Ter., Osprey Dr., Astor St., Clover St., Begonia St., Daffodil Way, Daisy St., and Oak Tree Ct.

(vii) Evaluating the affect of noise and traffic on existing homes fronting on Paseo Padre Parkway and others on Decoto Road and in the Mission Lakes Subdivision [add Union City streets], potential mitigation, and appropriate remedies, including possible acquisition of these homes.

(viii) Providing funding for double-pane windows for houses along the Option 2 route where needed to meet noise requirements identified in the EIR.

(b) The following potential alternatives, with the appropriate level of information, will be included in the environmental document:

(i) Option 2.

(ii) Option 2 with two access points for new homes behind existing Mission Lakes development.

(iii) Option 2 with access point(s) to Union City neighborhoods.

(iv) Historic alignment in Union City up to Alvarado-Niles Road.

(v) TSM (which may summarize results from previous EIR/S for comparison purposes).

(c) In designing the project, ACTA will consider the following respective concerns of Fremont and of Union City:

Fremont:

(i) An alignment that will not move any closer to the Mission Lakes neighborhood than was generally shown at the Option 2 community meetings, keeping the roadway alignment as far from existing Mission Lakes homes as physically and environmentally possible.

(ii) Providing reasonable median improvements, including landscaping and irrigation, throughout the alignment on Decoto, Paseo Padre Parkway, and along the historic alignment within Fremont.

(iii) The upgrade of intersections at Fremont/Decoto and Decoto/Paseo Padre in order to optimize capacity and traffic flow.

Union City:

(iv) An alignment that will move farther from Union City neighborhoods than was generally shown at the Option 2 community meetings, keeping the roadway alignment as far from existing adjacent homes in Union City as physically and environmentally possible.

(v) Providing reasonable median improvements throughout the alignment and on Mission Boulevard and on the following streets in Union City: Mahogany Ln, Cascades Cir., Sandburg Dr., Chesapeake Ct., Sandburg Ct., Platinum St., Monterra Ter., Osprey Dr., Astor St., Clover St., Begonia St., Daffodil Way, Daisy St., and Oak Tree Ct.

For both Cities:

(vi) Making all traffic signals within the Option 2 alignment interconnected and connecting those signals to each City's Traffic Management center.

15. ACTA is committed to initiate an amendment to the 1986 Measure B Expenditure Plan to replace the Route 84 Historic Parkway with Option 2.

16. ACTA supports Caltrans' position on local consensus and the use of the sale of State-owned land.

17. ACTA, as the project sponsor, will acquire the right of way needed to construct Option 2 that is owned by Caltrans, the City of Fremont, and Union City at fair market value, appraised at its highest and best use.

18. ACTA will advance funds for the construction of the Mission/I-880 Completion Project to the extent allowed by its Capital Budget, provided that the provisions for repayment of any such advance include a reasonable interest rate, sufficient security and that such advance does not negatively impact ACTA's ability to fully fund Option 2 if is approved by Fremont and Union City, or all elements of the Union City Segment if Option 2 is not approved by Fremont and Union City. In no event shall such advance exceed $20 million (as stated in Section 37(c) plus any excess 1986 Measure B funds from Phase 1A unless and until Fremont has accepted the final environmental document for Option 2 and its agreement to allow Option 2 to proceed to construction. Other terms of such advance, consistent with the provisions of this section, will be the subject of a separate agreement among Caltrans, ACTA, Santa Clara Valley Transportation Authority and Fremont ("Mission/880 Interchange Coop").

UNION CITY

19. Union City will agree to pay its fair share of the required local match. This share would be determined by the ratio of lane mileage of new roadway within Fremont and Union City.

20. Union City will have the right to review and comment on the Mission/880 Interchange Coop before it is finalized.

21. Union City will support efforts to ensure that the environmental impact studies will be conducted fairly and equitably, without bias for or against either Fremont or Union City.

22. Union City will formally consider the construction of Option 2 contingent upon its review and acceptance of the environmental document and mitigation of potential significant impacts of the project or findings of overriding considerations, which shall be made in Union City's sole discretion, all as required by applicable state and federal regulations and procedures.

CITY OF FREMONT

23. Fremont will fairly and openly consider the environmental review and project development of Option 2.

24. Fremont will support efforts to ensure that the environmental impact studies will be conducted fairly and equitably, without bias for or against either Fremont or Union City.

25. Fremont will formally consider the construction of Option 2 contingent upon its review and acceptance of the environmental document and mitigation of potential significant impacts of the project or findings of overriding considerations, which shall be made in Fremont's sole discretion, all as required by applicable state and federal regulations and procedures.

26. Fremont agrees that if does not agree to allow Option 2 to proceed to construction, Caltrans will no longer be obligated to contribute $42.35 million to the Mission/880 Interchange Project and Caltrans may proceed with the sale of State-owned lands governed by AB 1462 and all proceeds of such sales will go to the State Highway Account.

27. Fremont agrees that if it does not accept the final environmental document for Option 2 and does not allow Option 2 to proceed to construction, Fremont will refund all the proceeds, plus interest, derived from the sale of the State-owned lands that were expended by any party on the Mission/I-880 Completion Project with the written permission of Fremont pursuant to the terms of the Mission/880 Interchange Coop.

28. Fremont agrees to accept relinquishment of existing Route 84 between I-880 and Route 238 (Mission Boulevard) once funding becomes available and Caltrans brings the facility to a State of Good repair in accordance with Section 73 of the Streets and Highways code.

29. Fremont will not be required to pay any portion of the local match for the Project.

ALL PARTIES

30. All parties understand that the environmental document for Option 2 shall include the Historic Parkway Segment in Union City as an alternative, and that the Union City Segment will be implemented if Option 2 is not chosen as the preferred alternative at the conclusion of the environmental process.

31. All parties agree that the optimal alignment of the Option 2 project between Alvarado Niles Road and Paseo Padre Parkway shall be based upon the best traffic engineering standards, taking into account environmental impacts and community concerns.

32. All parties will work cooperatively to fund and deliver both Option 2 and the Mission/I-880 Completion Project.

33. All parties will support the full and fair evaluation of Option 2 and, subject to the discretionary certification or acceptance of the Environmental Impact Report, endorse an Amendment to the 1986 Measure B Expenditure Plan to replace the Route 84 Historic Parkway with Option 2.

34. Conditioned upon Option 2 proceeding to final design and construction, all parties will support the use of AB 1462 funds for the Mission/880 Interchange Project, for bringing existing Route 84 to a state of good repair prior to relinquishment as provided in this Agreement and for use on Route 238 at the intersection with Option 2, and then for the other pars of Route 238 related to Option 2 in Union City and Fremont, and after those uses for a priority list of projects to be developed by ACTA, Fremont, Union City and Caltrans, as previously described in this Agreement.

35. If any party does not approve or accept the Environmental Impact Report, then all parties will endorse an Amendment to the 1986 Measure B Expenditure Plan to replace the Route 84 Historic Parkway that incorporates the elements described in Section 38 below.

36. All parties will support reprogramming $10 million of State Transportation Improvement Program (STIP) funds previously programmed for the Route 84 Historic Parkway Project to Option 2. ACTA will sign the PSR/PR that is required by the use of STIP funds on Option 2, providing that all parties have certified or accepted the EIR.

37. All parties will cooperate with Fremont if it takes action to ban trucks on the Option 2 alignment within the Fremont City limits.

38. All parties understand that if at the end of the environmental process for Option 2, which will be conducted fairly and equitably, in adherence to state and/or federal environmental guidelines and regulations, and ACTA has certified the environmental document in accordance with this MOU, that there is no local consensus to move the project into the final design and eventual construction phases, the following actions will occur:

(a) ACTA would program $46 million in Measure B funds to Union City to complete the portion of the Historic Parkway in that City.

(b) ACTA would program $9 million in Measure B funds for the mitigation of potential impacts from constructing the Union City segment of the Historic Parkway.

(c) ACTA would program the remaining funds from the sources described in Paragraph 13 above among the Cities of Newark, Union City, and Fremont based on the roadway mileage and population formula, resulting in about $4.2 million for Newark, $5.8 million for Union City, and $20.0 million for Fremont (or the equivalent percentages based on the actual money available). Once these funds are redistributed, no further Measure B funding would be available for any projects in the Tri-City area. Therefore, no additional 1986 Measure B funds will be available for the Mission/I-880 Completion Project.

(d) Any AB 1462 funds expended on the Mission/I-880 Completion Project would be returned to Caltrans by the jurisdiction that does not approve Option 2.

(e) All proceeds from the sale of State owned lands will be returned to the State Highway Account.

(f) Measure B funds expended on the environmental clearance effort of Option 2 will be deducted from the portion of the $30 million of Measure B funds that would be programmed to the jurisdiction that does not approve Option 2.

EXHIBIT A

Mission/880 Completion Project

The Mission/880 Completion Project proposes to complete several elements of the current project to reconstruct the I-880/Mission Boulevard (Route 262) Interchange and widen the I-880 Freeway. These elements are technically integrated and interdependent and cannot be implemented individually and include the following:

1. Widening of Mission Boulevard (Route 262) to six lanes from Warm Springs Boulevard to I-880.

2. Reconstruction of the Kato on and off-ramps connecting Warm Springs Boulevard to the widened Mission Boulevard.

3. Construct a new replacement railroad underpassing structure to carry Union Pacific Railroad rail traffic.

4. Construct a new railroad underpassing structure to carry BART rail traffic.

5. Construct two new grade separated railroad underpassing structures over the existing Warren Avenue: one underpassing structure will be for BART, the other for UPRR.

6. Reconstruct the portion of the Warren Avenue that would be affected by the grade separation.

7. Relocation of an existing truck-rail transfer facility located southerly and adjacent to Warren Avenue.

8. Construct and reconstruct all necessary railroad tracks and railroad facilities to provide for continuous railroad and BART operating facilities between Mission Boulevard (Route 262) and Warren Avenue.

9. Relocate and/or remove all existing structures and utilities to accomplish all of the above.

Option 2

Option 2 Project proposes the construct the following, at a minimum:

1. Provide one additional lane in each direction on Decoto Road between approximately I-880 and Paseo Padre Parkway

2. Provide one additional lane in each direction on Paseo Padre Parkway between Decoto Road and the approximate location of the Historical Parkway Corridor.

3. Provide intersection improvements on Decoto Road and Paseo Padre Parkway as required by the traffic technical studies and the environmental document to be prepared for the Option 2 project.

4. Construct a new 4 lane roadway between Paseo Padre Parkway and Mission Boulevard (Route 238) with median and shoulders width appropriate for this type of facility.

5. Construct grade separated underpassing structures between the new 4-lane roadway and the existing BART and UPRR railroad tracks.

6. Construct all intersection improvements on the new 4-lane roadway between Paseo Padre Parkway and Mission Boulevard, inclusive of new intersections at Paseo Padre Parkway, Alvarado Niles Road and Mission Boulevard. Additional intersection(s) with the new 4-lane roadway may be added during the environmental phase of the project development.

7. Construct appurtenance drainage facilities required to for the project.

8. Construct noise barriers where required by the environmental document.

9. Where possible Option 2 can be constructed in phase. The new 4-lane roadway segment between Alvarado-Niles Road and Mission Boulevard could be considered as and defined as the Option 2 project to move forward into final design and construction.

ALAMEDA COUNTY BOARD OF SUPERVISORS

** MINUTE ORDER **

The following was action taken by the Board of Supervisors on ***August 1, 2006***

Approved as Recommended ☑ **Other** ☐

Unanimous ☐ **Haggerty** ☐ **Lai-Bitker** ☒ **Miley** ☐ **Steele** ☐ **Carson** ☐ **4**

Vote Key: N=No; A=Abstain; X=Excused

Documents accompanying this matter:

☐ **Resolution(s)**____________

☐ **Ordinance(s)** ____________

☑ **Contract(s)** C-2006-230

File No. 21198

Item No. 39

Copies sent to:

E & C Environmental Services

Special Notes:

I certify that the foregoing is a correct copy of a Minute Order adopted by the Board of Supervisors, Alameda County, State of California.

ATTEST:
Crystal Hishida Graff, Clerk of the Board
Board of Supervisors

By: R. Caballero
Deputy

AGENDA_____August 1, 2006

COUNTY OF ALAMEDA
PUBLIC WORKS AGENCY
399 Elmhurst Street • Hayward, CA 94544-1395
(510) 670-5480

July 19, 2006

The Honorable Board of Supervisors
County Administration Building
1221 Oak Street
Oakland, CA 94612

Dear Board Members:

SUBJECT: APPROVAL OF MEMORANDUM OF UNDERSTANDING AGREEMENT BETWEEN ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT AND THE CITY OF UNION CITY, CALIFORNIA

RECOMMENDATION:

Approve and authorize the President of the Board to execute a Memorandum of Understanding (MOU) agreement between Alameda County Flood Control and Water Conservation District (District) and City of Union City (City). Under the terms of the MOU, Union City will provide the District an amount not to exceed $500,000 for implementation of a Mitigation Project within the District's facility.

SUMMARY/DISCUSSION:

The City of Union City has a development project that involves culverting 700 linear feet of an existing District flood control facility, Line M in District Zone 5, as part of its office and high density housing development. This development would permanently result in 700 linear feet (23 acres) impact to U.S. and State waters under federal and state environmental laws resulting in a need to provide compensatory mitigation to offset the impacts.

To this end, the City sought the District's assistance to obtain regulatory agency permits and has agreed to mitigate the development impacts by funding the restoration and enhancements of approximately a 900-foot section of Castro Valley Creek between Norbridge Avenue and Castro Valley Boulevard. The work includes removal of 300 feet of concrete culvert and planting and replacing exotic species with native vegetation.

The District proposes to start construction of the mitigation project in the spring of 2007 and complete by June 2007. It is, therefore, requested that your Board authorize the District to accept

City funds and to proceed with the development of design plan drawings and specifications and bid package to award the project.

FINANCING:

The estimated cost of the mitigation project is covered by the funds provided by the City under this MOU. Union City is funding the construction cost only. There is no impact on the County General Fund.

Yours truly,

Daniel Woldesenbet, Ph.D., P.E.
Acting Director of Public Works

DW/KA/rbr

Attachments

c: County Counsel
Auditor-Controller
City of Union City

Appendix D Scour Calculations

Local Pier Scour

Pier-1 (Pier 1 in HEC RAS model)

Full flow at RS 1219

Parameter	Description	Req'd input		
	Units: English or Metric	>	English	
	Water surface elevation at pier	>>	25.34	ft
	Ground elevation at pier	>>	22.1	ft
y_1	Water depth at pier		3.24	
v_1	Mean velocity of flow directly upstream of pier	>>	3.05	ft/s
L	Pier length	>	17	ft
a	Pier width	>	17	ft
L/a	Length to width ratio		1.00	ft/ft
	Pier nose shape	>>>	Cylinder	
K_1	Correction factor for pier nose shape		1	
θ	Angle of attack	>	0	°
K_2	Correction factor for angle of attack of flow	**Eq 6.4**	1.00	
K_3	Correction factor for bed condition	>	1.1	Clear water
D_{50}	Grain size for which 50% of the bed material is finer	>	0.00164	ft
D_{95}	Grain size for which 95% of the bed material is finer	>	1	ft
V_R	$V_R=(V_1-V_{icD50})/(V_{cD50}-V_{icD95})>0$	**Eq 6.6**	1.00	
V_{icD50}	Approach velocity required to initiate scour at the pier for the grain size D_{50}	**Eq 6.7**	0.63	ft/s
V_{icD95}	Approach velocity required to initiate scour at the pier for the grain size D_{95}	**Eq 6.7**	7.54	ft/s
V_{cD50}	Critical velocity for incipient motion for the grain size D_{50}	**Eq 6.8**	1.60	ft/s
V_{cD95}	Critical velocity for incipient motion for the grain size D_{95}	**Eq 6.8**	13.59	ft/s
K_u	6.19 if SI units and 11.17 if English units	**p 6.6**	11.17	
K_4	Correction factor for armoring by bed material size	**Eq 6.5**	1.00	
g	Gravitational constant = 9.81 if SI units and 32.2 if English units	**p 6.4**	32.2	ft/s^2
F_{r1}	Froude number	**p 6.4**	0.30	
$y_{s\ pier}$	Pier scour depth	**Eq 6.1**	12.45	ft

Local Pier Scour

Pier-2

Full flow at RS 1063

Parameter	Description	Req'd input		
	Units: English or Metric	>	English	
	Water surface elevation at pier	>>	25.24	ft
	Ground elevation at pier	>>	21.79	ft
y_1	Water depth at pier		3.45	
v_1	Mean velocity of flow directly upstream of pier	>>	2.17	ft/s
L	Pier length	>	17	ft
a	Pier width	>	17	ft
L/a	Length to width ratio		1.00	ft/ft
	Pier nose shape	>>>	Cylinder	
K_1	Correction factor for pier nose shape		1	
θ	Angle of attack	>	0	°
K_2	Correction factor for angle of attack of flow	Eq 6.4	1.00	
K_3	Correction factor for bed condition	>	1.1	Clear water
D_{50}	Grain size for which 50% of the bed material is finer	>	0.00164	ft
D_{95}	Grain size for which 95% of the bed material is finer	>	1	ft
V_R	$V_R=(V_1-V_{iCD50})/(V_{cD50}-V_{icD95})>0$	Eq 6.6	1.00	
V_{icD50}	Approach velocity required to initiate scour at the pier for the grain size D_{50}	Eq 6.7	0.64	ft/s
V_{icD95}	Approach velocity required to initiate scour at the pier for the grain size D_{95}	Eq 6.7	7.62	ft/s
V_{cD50}	Critical velocity for incipient motion for the grain size D_{50}	Eq 6.8	1.62	ft/s
V_{cD95}	Critical velocity for incipient motion for the grain size D_{95}	Eq 6.8	13.73	ft/s
K_u	6.19 if SI units and 11.17 if English units	p 6.6	11.17	
K_4	Correction factor for armoring by bed material size	Eq 6.5	1.00	
g	Gravitational constant = 9.81 if SI units and 32.2 if English units	p 6.4	32.2	ft/s^2
F_{r1}	Froude number	p 6.4	0.21	
$y_{s\ pier}$	Pier scour depth	Eq 6.1	10.85	ft

Local Pier Scour

Pier-3

Full flow at RS 1039

Parameter	Description	Req'd input		
	Units: English or Metric	>	English	
	Water surface elevation at pier	>>	25.17	ft
	Ground elevation at pier	>>	21.93	ft
y_1	Water depth at pier		3.24	
v_1	Mean velocity of flow directly upstream of pier	>>	2.42	ft/s
L	Pier length	>	17	ft
a	Pier width	>	17	ft
L/a	Length to width ratio		1.00	ft/ft
	Pier nose shape	>>>	Cylinder	
K_1	Correction factor for pier nose shape		1	
θ	Angle of attack	>	0	°
K_2	Correction factor for angle of attack of flow	Eq 6.4	1.00	
K_3	Correction factor for bed condition	>	1.1	Clear water
D_{50}	Grain size for which 50% of the bed material is finer	>	0.00164	ft
D_{95}	Grain size for which 95% of the bed material is finer	>	1	ft
V_R	$V_R=(V_1-V_{icD50})/(V_{cD50}-V_{icD95})>0$	Eq 6.6	1.00	
V_{icD50}	Approach velocity required to initiate scour at the pier for the grain size D_{50}	Eq 6.7	0.63	ft/s
V_{icD95}	Approach velocity required to initiate scour at the pier for the grain size D_{95}	Eq 6.7	7.54	ft/s
V_{cD50}	Critical velocity for incipient motion for the grain size D_{50}	Eq 6.8	1.60	ft/s
V_{cD95}	Critical velocity for incipient motion for the grain size D_{95}	Eq 6.8	13.59	ft/s
K_u	6.19 if SI units and 11.17 if English units	p 6.6	11.17	
K_4	Correction factor for armoring by bed material size	Eq 6.5	1.00	
g	Gravitational constant = 9.81 if SI units and 32.2 if English units	p 6.4	32.2	ft/s^2
F_{r1}	Froude number	p 6.4	0.24	
$y_{s\ pier}$	Pier scour depth	Eq 6.1	11.27	ft

Local Pier Scour

Pier-4

Full flow at RS 888.16

Parameter	Description	Req'd input		
	Units: English or Metric	>	English	
	Water surface elevation at pier	>>	24.86	ft
	Ground elevation at pier	>>	21.37	ft
y_1	Water depth at pier		3.49	
v_1	Mean velocity of flow directly upstream of pier	>>	3.67	ft/s
L	Pier length	>	17	ft
a	Pier width	>	17	ft
L/a	Length to width ratio		1.00	ft/ft
	Pier nose shape	>>>	Cylinder	
K_1	Correction factor for pier nose shape		1	
θ	Angle of attack	>	0	°
K_2	Correction factor for angle of attack of flow	Eq 6.4	1.00	
K_3	Correction factor for bed condition	>	1.1	Clear water
D_{50}	Grain size for which 50% of the bed material is finer	>	0.00164	ft
D_{95}	Grain size for which 95% of the bed material is finer	>	1	ft
V_R	$V_R=(V_1-V_{icD50})/(V_{cD50}-V_{icD95})>0$	Eq 6.6	1.00	
V_{icD50}	Approach velocity required to initiate scour at the pier for the grain size D_{50}	Eq 6.7	0.64	ft/s
V_{icD95}	Approach velocity required to initiate scour at the pier for the grain size D_{95}	Eq 6.7	7.64	ft/s
V_{cD50}	Critical velocity for incipient motion for the grain size D_{50}	Eq 6.8	1.62	ft/s
V_{cD95}	Critical velocity for incipient motion for the grain size D_{95}	Eq 6.8	13.76	ft/s
K_u	6.19 if SI units and 11.17 if English units	p 6.6	11.17	
K_4	Correction factor for armoring by bed material size	Eq 6.5	1.00	
g	Gravitational constant = 9.81 if SI units and 32.2 if English units	p 6.4	32.2	ft/s^2
F_{r1}	Froude number	p 6.4	0.35	
$y_{s\ pier}$	Pier scour depth	Eq 6.1	13.62	ft

Contraction Scour

Live-Bed or Clear-Water Contraction Scour?

Full flow at RS 1125

Parameter	Description	Req'd input		
	Units: English or Metric	>	English	
	Station upstream of the bridge	>>	1195	
	Water surface elevation at upstream station	>>	25.34	ft
	Ground elevation at upstream station	>>	20	ft
y	Average depth of flow upstream of the bridge		5.34	ft
D	Particle size for V_c			ft
D_{50}	Particle size in a mixture of which 50 percent are smaller	>	0.00164	ft
K_u	6.19 if SI units and 11.17 if English units		11.17	
V_c	Critical velocity		1.74	ft/s
V	Mean velocity in the channel	>>	3.05	ft/s
	If V_c>V, Clear-Water, If V_c<V, Live-Bed		Live-Bed Contraction	

Live-Bed Contraction Scour

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{6/7}\left(\frac{W_1}{W_2}\right)^{k_1}$$

$$y_s = y_2 - y_o$$

Parameter	Description	Req'd input		
	Station upstream of the bridge		1195	
	Water surface elevation at upstream station		25.34	ft
	Ground elevation at upstream station		20	ft
y_1	Average depth in the upstream main channel		5.34	
	Station at upstream face of bridge	>>	1195	
	Water surface elevation at upstream face of bridge	>>	25.29	ft
	Ground elevation at upstream face of bridge	>>	20	ft
y_o	Existing depth in the contracted section before scour		5.29	ft
Q_1	Flow in the upstream channel transporting sediment	>>	660	ft^3/s
Q_2	Flow in contracted channel	>>	660	ft^3/s
W_1	Bottom width of upstream main channel that is transporting bed material	>>	48.65	ft
W_2	Bottom width of main channel in contracted section	>>	51.06	ft
	Pier width	>	17	ft
	Number of piers	>	1	
	Total pier width	>	17	ft
k_1	Factor for mode of bed material transport	>	0.69	
y_2	Average depth in the contracted section		6.83	ft
Y_s	Average live bed contraction scour depth		1.54	ft

Contraction Scour

Live-Bed or Clear-Water Contraction Scour?

Full flow at RS 958

Parameter	Description	Req'd input		
	Units: English or Metric	>	English	
	Station upstream of the bridge	>>	1008	
	Water surface elevation at upstream station	>>	25.26	ft
	Ground elevation at upstream station	>>	20	ft
y	Average depth of flow upstream of the bridge		5.26	ft
D	Particle size for V_c			ft
D_{50}	Particle size in a mixture of which 50 percent are smaller	>	0.00164	ft
K_u	6.19 if SI units and 11.17 if English units		11.17	
V_c	Critical velocity		1.74	ft/s
V	Mean velocity in the channel	>>	2.42	ft/s
	If V_c>V, Clear-Water, If V_c<V, Live-Bed		Live-Bed Contraction	

Live-Bed Contraction Scour

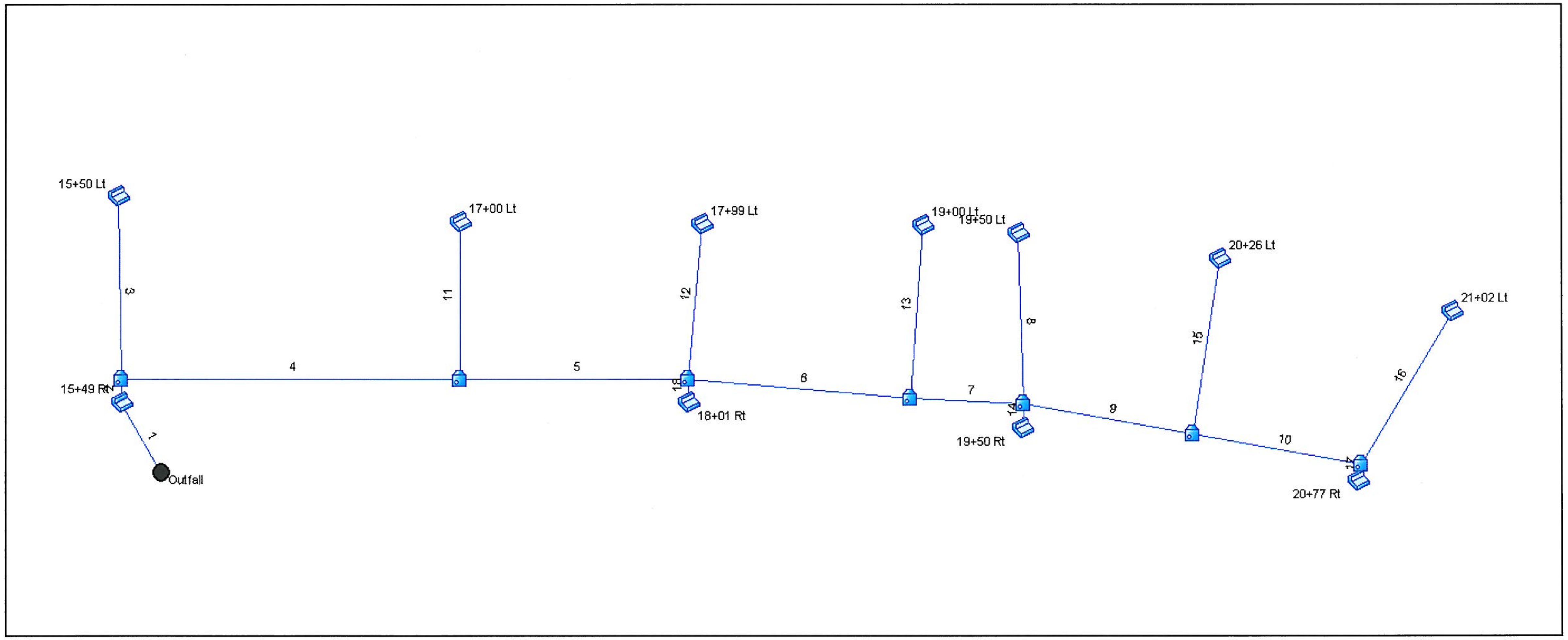
$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{6/7} \left(\frac{W_1}{W_2}\right)^{k_1}$$

$$y_s = y_2 - y_o$$

Parameter	Description	Req'd input		
	Station upstream of the bridge		1008	
	Water surface elevation at upstream station		25.26	ft
	Ground elevation at upstream station		20	ft
y_1	Average depth in the upstream main channel		5.26	
	Station at upstream face of bridge	>>	1008	
	Water surface elevation at upstream face of bridge	>>	25.24	ft
	Ground elevation at upstream face of bridge	>>	20	ft
y_o	Existing depth in the contracted section before scour		5.24	ft
Q_1	Flow in the upstream channel transporting sediment	>>	660	ft^3/s
Q_2	Flow in contracted channel	>>	660	ft^3/s
w_1	Bottom width of upstream main channel that is transporting bed material	>>	78.41	ft
w_2	Bottom width of main channel in contracted section	>>	65.6	ft
	Pier width	>	17	ft
	Number of piers	>	1	
	Total pier width	>	17	ft
k_1	Factor for mode of bed material transport	>	0.69	
y_2	Average depth in the contracted section		7.32	ft
Y_s	Average live bed contraction scour depth		2.08	ft

Appendix E Hydra flow Runs

System -1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17+99 Lt
19+00 Lt
19+50 Lt
20+26 Lt
21+02 Lt
15+49 Rt
18+01 Rt
19+50 Rt
20+77 Rt
Outfall
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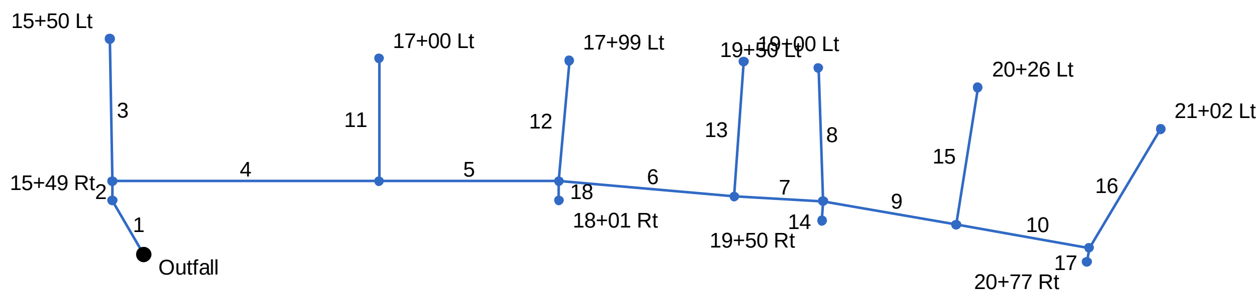
18

EWC 3.13



Project File: Drainage Area 1.stm	Number of lines: 18	Date: 03-31-2009

Storm Sewer Tabulation

Station Line	Station To Line	Len (ft)	Drng Area Incr (ac)	Drng Area Total (ac)	Rnoff coeff (C)	Area x C Incr	Area x C Total	Tc Inlet (min)	Tc Syst (min)	Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe Size (in)	Pipe Slope (%)	Invert Elev Dn (ft)	Invert Elev Up (ft)	HGL Elev Dn (ft)	HGL Elev Up (ft)	Grnd / Rim Elev Dn (ft)	Grnd / Rim Elev Up (ft)	Line ID
1	End	35.0	0.22	2.79	0.90	0.20	2.42	5.0	16.7	2.0	4.86	19.87	1.55	24	0.77	36.25	36.52	43.00	43.02	48.00	48.02	
2	1	11.0	0.00	2.57	0.00	0.00	2.22	5.0	16.6	2.0	4.48	28.12	1.43	24	1.55	36.92	37.09	43.05	43.06	48.02	48.34	
3	2	80.0	0.45	0.45	0.89	0.40	0.40	5.0	5.0	3.9	1.57	19.89	0.89	18	3.59	36.99	39.86	43.11	43.13	48.34	47.36	
4	2	150.0	0.00	2.12	0.00	0.00	1.82	5.0	14.7	2.2	3.94	12.66	1.25	24	0.31	36.99	37.46	43.10	43.14	48.34	46.21	
5	4	101.0	0.00	1.78	0.00	0.00	1.53	5.0	13.2	2.3	3.51	15.43	1.12	24	0.47	37.36	37.83	43.17	43.20	46.21	45.58	
6	5	99.0	0.00	1.27	0.00	0.00	1.09	5.0	12.1	2.4	2.62	5.78	1.48	18	0.30	37.73	38.03	43.21	43.28	45.58	45.28	
7	6	50.0	0.00	1.04	0.00	0.00	0.89	5.0	11.4	2.5	2.21	6.64	1.25	18	0.40	37.93	38.13	43.32	43.34	45.28	45.13	
8	7	75.0	0.10	0.10	0.88	0.09	0.09	5.0	5.0	3.9	0.34	15.05	0.20	18	2.05	38.03	39.57	43.39	43.39	45.13	44.57	
9	7	76.0	0.00	0.74	0.00	0.00	0.62	5.0	9.4	2.8	1.73	7.33	0.98	18	0.49	38.03	38.40	43.38	43.40	45.13	44.90	
10	9	76.0	0.00	0.45	0.00	0.00	0.38	5.0	7.5	3.1	1.20	8.08	0.68	18	0.59	38.30	38.75	43.42	43.43	44.90	44.75	
11	4	69.0	0.34	0.34	0.86	0.29	0.29	5.0	5.0	3.9	1.15	22.93	0.65	18	4.77	37.36	40.65	43.18	43.19	46.21	45.65	
12	5	68.0	0.23	0.23	0.84	0.19	0.19	5.0	5.0	3.9	0.76	19.31	0.43	18	3.38	37.73	40.03	43.23	43.23	45.58	45.03	
13	6	76.0	0.23	0.23	0.86	0.20	0.20	5.0	5.0	3.9	0.77	16.12	0.44	18	2.36	37.93	39.72	43.34	43.35	45.28	44.72	
14	7	11.0	0.20	0.20	0.88	0.18	0.18	5.0	5.0	3.9	0.69	16.75	0.39	18	2.55	38.03	38.31	43.39	43.39	45.13	44.81	
15	9	78.0	0.29	0.29	0.83	0.24	0.24	5.0	5.0	3.9	0.94	12.07	0.53	18	1.32	38.30	39.33	43.42	43.43	44.90	44.33	
16	10	78.0	0.28	0.28	0.83	0.23	0.23	5.0	5.0	3.9	0.91	7.98	0.52	18	0.58	38.65	39.10	43.44	43.45	44.75	44.10	
17	10	8.0	0.17	0.17	0.89	0.15	0.15	5.0	5.0	3.9	0.59	6.43	0.34	18	0.37	38.65	38.68	43.44	43.44	44.75	44.43	
18	5	11.0	0.28	0.28	0.90	0.25	0.25	5.0	5.0	3.9	0.99	16.75	0.56	18	2.55	37.73	38.01	43.23	43.23	45.58	45.26	

EWC 3.13 | Number of lines: 18 | Run Date: 03-31-2009

NOTES: Intensity = 10.21 / (Inlet time + 0.30) ^ 0.57; Return period = 25 Yrs. ; c = cir e = ellip b = box

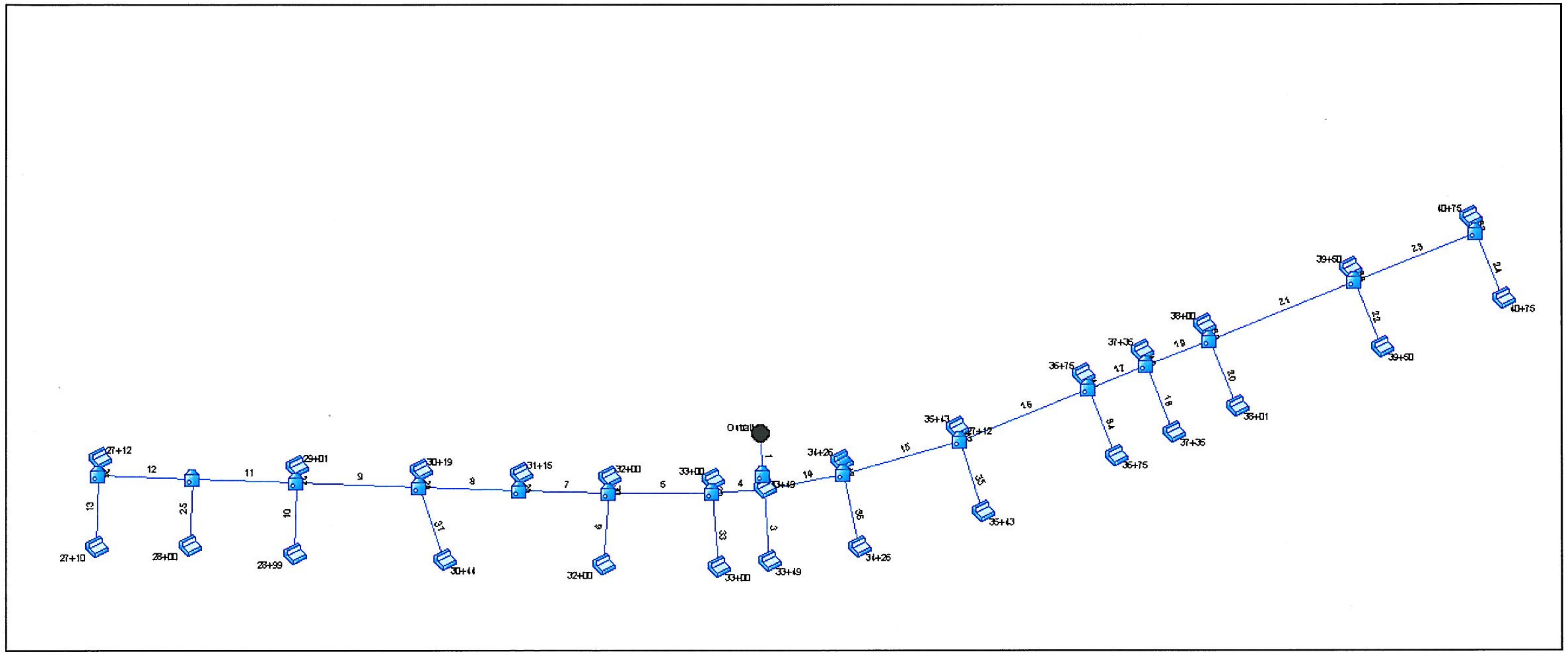
MyReport

Line No.	Line Size (in)	Vel Ave (ft/s)	Capac Full (cfs)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	n-val Pipe	HGL Dn (ft)	HGL Up (ft)	Crit Depth (ft)	Minor Loss (ft)	Defl Ang (Deg)
1	24	1.55	19.87	35.0	36.52	36.25	0.77	0.013	43.00	43.02	0.78	0.03	-120.0
2	24	1.43	28.12	11.0	37.09	36.92	1.55	0.013	43.05	43.06	0.75	0.03	30.0
3	18	0.89	19.89	80.0	39.86	36.99	3.59	0.013	43.11	43.13	0.48	0.01	-1.0
4	24	1.25	12.66	150.0	37.46	36.99	0.31	0.013	43.10	43.14	0.70	0.02	90.0
5	24	1.12	15.43	101.0	37.83	37.36	0.47	0.013	43.17	43.20	0.66	0.02	0.0
6	18	1.48	5.78	99.0	38.03	37.73	0.30	0.013	43.21	43.28	0.62	0.03	5.0
7	18	1.25	6.64	50.0	38.13	37.93	0.40	0.013	43.32	43.34	0.57	0.02	-2.0
8	18	0.20	15.05	75.0	39.57	38.03	2.05	0.013	43.39	43.39	0.22	0.00	-95.0
9	18	0.98	7.33	76.0	38.40	38.03	0.49	0.013	43.38	43.40	0.50	0.01	7.0
10	18	0.68	8.08	76.0	38.75	38.30	0.59	0.013	43.42	43.43	0.42	0.01	0.0
11	18	0.65	22.93	69.0	40.65	37.36	4.77	0.013	43.18	43.19	0.41	0.01	-90.0
12	18	0.43	19.31	68.0	40.03	37.73	3.38	0.013	43.23	43.23	0.33	0.00	-85.0
13	18	0.44	16.12	76.0	39.72	37.93	2.36	0.013	43.34	43.35	0.34	0.00	-91.0
14	18	0.39	16.75	11.0	38.31	38.03	2.55	0.013	43.39	43.39	0.32	0.00	90.0
15	18	0.53	12.07	78.0	39.33	38.30	1.32	0.013	43.42	43.43	0.37	0.00	-91.0
16	18	0.52	7.98	78.0	39.10	38.65	0.58	0.013	43.44	43.45	0.36	0.00	-69.0
17	18	0.34	6.43	8.0	38.68	38.65	0.37	0.013	43.44	43.44	0.29	0.00	90.0
18	18	0.56	16.75	11.0	38.01	37.73	2.55	0.013	43.23	43.23	0.38	0.00	90.0

EWC 3.13	Number of lines: 18	Date: 03-31-2009

NOTES: i Inlet control; ** Critical depth

System-2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31+15
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33+00
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33+49
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28+99
37
30+44
6
32+00
33
33+00
3
33+49
36
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37+35
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38+01
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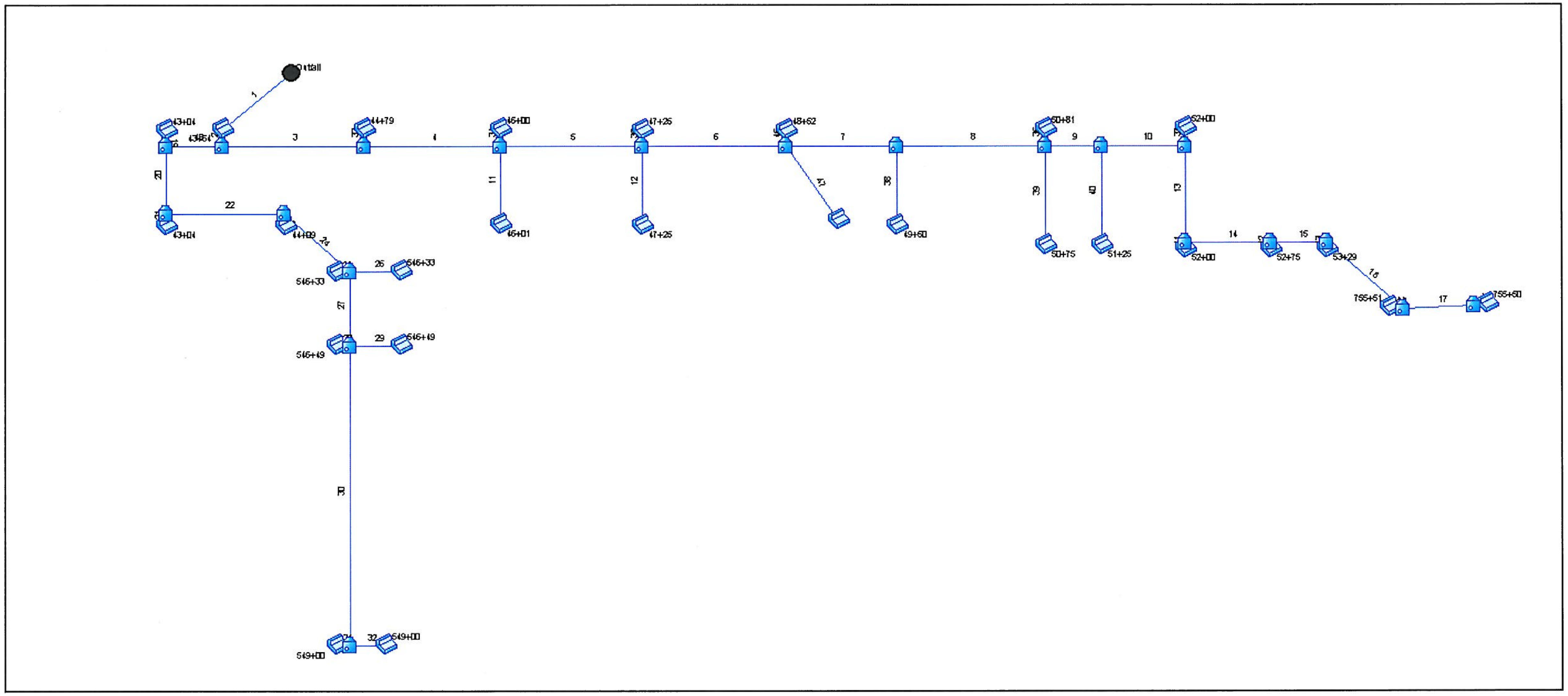
39+50
24
40+75
1

System- 3



Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	79.0	0.20	5.47	0.84	0.17	4.83	5.0	20.1	1.8	19.46	48.63	2.75	36	0.53	37.10	37.52	42.00	42.07	43.00	43.27	
2	1	14.0	0.00	5.27	0.00	0.00	4.66	5.0	20.0	1.8	18.80	50.42	2.66	36	0.57	37.42	37.50	42.22	42.23	43.27	43.75	
3	2	125.0	0.00	3.62	0.00	0.00	3.22	5.0	19.3	1.9	13.13	25.41	2.68	30	0.38	37.40	37.88	42.34	42.47	43.75	44.13	
4	3	121.0	0.00	3.44	0.00	0.00	3.05	5.0	18.5	1.9	12.50	25.29	2.55	30	0.38	37.78	38.24	42.59	42.70	44.13	44.49	
5	4	125.0	0.00	3.07	0.00	0.00	2.73	5.0	17.6	2.0	11.22	24.61	2.29	30	0.36	38.14	38.59	42.82	42.91	44.49	44.84	
6	5	127.0	0.00	2.58	0.00	0.00	2.30	5.0	16.5	2.0	9.53	44.42	1.94	30	1.17	38.49	39.98	43.02	43.09	44.84	45.23	
7	6	98.0	0.00	2.20	0.00	0.00	1.95	5.0	15.5	2.1	8.19	20.71	1.67	30	0.26	39.02	39.27	43.16	43.20	45.23	45.52	
8	7	131.0	0.00	1.97	0.00	0.00	1.75	5.0	14.0	2.2	7.15	25.59	1.46	30	0.39	39.17	39.68	43.25	43.29	45.52	45.93	
9	8	50.0	0.00	1.72	0.00	0.00	1.52	5.0	11.4	2.5	6.11	28.41	1.24	30	0.48	39.58	39.82	43.33	43.35	45.93	46.32	
10	9	75.0	0.00	1.55	0.00	0.00	1.37	5.0	8.9	2.9	5.37	28.02	1.09	30	0.47	39.72	40.07	43.37	43.39	46.32	46.57	
11	4	70.0	0.17	0.17	0.86	0.15	0.15	5.0	5.0	3.9	0.57	12.36	0.32	18	1.39	38.14	39.11	42.90	42.90	44.49	44.11	
12	5	71.0	0.30	0.30	0.87	0.26	0.26	5.0	5.0	3.9	1.02	12.40	0.58	18	1.39	38.49	39.48	43.07	43.08	44.84	44.48	
13	10	86.0	0.00	1.32	0.00	0.00	1.16	5.0	8.3	3.0	4.56	7.60	2.58	18	0.52	39.97	40.42	43.41	43.57	46.57	45.67	
14	13	75.0	0.00	1.13	0.00	0.00	1.00	5.0	7.7	3.1	3.90	6.86	2.21	18	0.43	40.32	40.64	43.70	43.80	45.67	45.89	
15	14	50.0	0.00	1.03	0.00	0.00	0.91	5.0	7.3	3.2	3.55	8.00	2.01	18	0.58	40.54	40.83	43.89	43.95	45.89	46.08	
16	15	90.0	0.00	0.82	0.00	0.00	0.72	5.0	6.4	3.4	2.81	8.36	1.59	18	0.63	40.73	41.30	44.04	44.10	46.08	48.80	
17	16	62.0	0.00	0.43	0.00	0.00	0.37	5.0	5.2	3.8	1.43	17.89	0.89	18	2.90	41.20	43.00	44.17	44.18	48.80	48.25	
18	2	50.0	0.00	1.65	0.00	0.00	1.45	5.0	16.9	2.0	5.67	38.03	1.16	30	0.86	37.40	37.83	42.43	42.44	43.75	43.58	
19	18	13.0	0.09	0.09	0.84	0.08	0.08	5.0	5.0	3.9	0.30	20.39	0.17	18	3.77	37.73	38.22	42.48	42.48	43.58	43.22	
20	18	60.0	0.00	1.56	0.00	0.00	1.37	5.0	16.3	2.0	5.37	16.26	1.71	24	0.52	37.73	38.04	42.46	42.49	43.58	43.54	
21	20	11.0	0.16	0.16	0.83	0.13	0.13	5.0	5.0	3.9	0.52	16.75	0.29	18	2.55	37.94	38.22	42.58	42.58	43.54	43.22	
22	20	105.0	0.00	1.40	0.00	0.00	1.24	5.0	15.2	2.1	4.85	14.30	1.54	24	0.40	37.94	38.36	42.54	42.59	43.54	43.86	

System 3 | Number of lines: 47 | Run Date: 03-31-2009

NOTES: Intensity = 10.21 / (Inlet time + 0.30) ^ 0.57; Return period = 25 Yrs. ; Total flows limited to inlet captured flows. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	22	11.0	0.30	0.30	0.89	0.27	0.27	5.0	5.0	3.9	1.05	16.75	0.59	18	2.55	38.26	38.54	42.66	42.66	43.86	43.54	
24	22	77.0	0.00	1.10	0.00	0.00	0.97	5.0	14.6	2.2	3.81	7.47	2.15	18	0.51	38.26	38.65	42.63	42.73	43.86	44.40	
25	24	12.0	0.09	0.09	0.87	0.08	0.08	5.0	5.0	3.9	0.31	6.78	0.17	18	0.42	38.55	38.60	42.88	42.88	44.40	44.10	
26	24	45.0	0.07	0.07	0.90	0.06	0.06	5.0	5.0	3.9	0.25	7.83	0.14	18	0.56	38.55	38.80	42.88	42.88	44.40	43.80	
27	24	66.0	0.00	0.94	0.00	0.00	0.83	5.0	14.0	2.2	3.25	16.09	1.84	18	2.35	38.55	40.10	42.82	42.89	44.40	45.85	
28	27	12.0	0.39	0.39	0.86	0.34	0.34	5.0	5.0	3.9	1.31	6.78	0.74	18	0.42	40.00	40.05	42.98	42.99	45.85	45.55	
29	27	45.0	0.23	0.23	0.90	0.21	0.21	5.0	5.0	3.9	0.81	7.83	0.46	18	0.56	40.00	40.25	42.99	42.99	45.85	45.25	
30	27	265.0	0.00	0.32	0.00	0.00	0.29	5.0	7.1	3.2	1.13	5.95	0.64	18	0.32	40.00	40.85	42.99	43.02	45.85	46.60	
31	30	12.0	0.19	0.19	0.90	0.17	0.17	5.0	5.0	3.9	0.67	6.78	0.38	18	0.42	40.75	40.80	43.03	43.03	46.60	46.30	
32	30	32.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	3.9	0.46	9.28	0.26	18	0.78	40.75	41.00	43.03	43.03	46.60	46.00	
33	3	14.0	0.18	0.18	0.90	0.16	0.16	5.0	5.0	3.9	0.63	13.16	0.36	18	1.57	37.78	38.00	42.69	42.69	44.13	43.75	
34	4	14.0	0.20	0.20	0.90	0.18	0.18	5.0	5.0	3.9	0.71	13.16	0.40	18	1.57	38.14	38.36	42.90	42.90	44.49	44.11	
35	5	13.0	0.19	0.19	0.90	0.17	0.17	5.0	5.0	3.9	0.67	14.27	0.38	18	1.85	38.49	38.73	43.07	43.07	44.84	44.48	
36	8	14.0	0.15	0.15	0.90	0.14	0.14	5.0	5.0	3.9	0.53	13.16	0.30	18	1.57	39.58	39.80	43.36	43.36	45.93	45.55	
37	10	15.0	0.23	0.23	0.90	0.21	0.21	5.0	5.0	3.9	0.81	18.19	0.46	18	3.00	39.97	40.42	43.42	43.42	46.57	46.17	
38	7	71.0	0.23	0.23	0.90	0.21	0.21	5.0	5.0	3.9	1.03	25.46	0.33	24	1.27	39.17	40.07	43.28	43.29	45.52	45.07	
39	8	89.0	0.10	0.10	0.89	0.09	0.09	5.0	5.0	3.9	0.52	16.78	0.17	24	0.55	39.58	40.07	43.36	43.36	45.93	45.07	
40	9	89.0	0.17	0.17	0.89	0.15	0.15	5.0	5.0	3.9	0.73	16.95	0.23	24	0.56	39.72	40.22	43.39	43.39	46.32	45.22	
41	13	6.0	0.19	0.19	0.89	0.17	0.17	5.0	5.0	3.9	0.66	15.46	0.37	18	2.17	40.32	40.45	43.77	43.77	45.67	45.45	
42	14	6.0	0.10	0.10	0.90	0.09	0.09	5.0	5.0	3.9	0.35	15.46	0.20	18	2.17	40.54	40.67	43.95	43.95	45.89	45.67	
43	15	6.0	0.21	0.21	0.90	0.19	0.19	5.0	5.0	3.9	0.74	15.46	0.42	18	2.17	40.73	40.86	44.07	44.07	46.08	45.86	
44	17	12.0	0.43	0.43	0.85	0.37	0.37	5.0	5.0	3.9	1.43	6.78	0.91	18	0.42	42.90	42.95	44.18	44.18	48.25	47.95	

System 3 | Number of lines: 47 | Run Date: 03-31-2009

NOTES: Intensity = 10.21 / (Inlet time + 0.30) ^ 0.57; Return period = 25 Yrs. ; Total flows limited to inlet captured flows. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
45	16	12.0	0.39	0.39	0.90	0.35	0.35	5.0	5.0	3.9	1.38	16.60	0.78	18	2.50	41.20	41.50	44.17	44.17	48.80	48.50	
46	6	13.0	0.30	0.30	0.90	0.27	0.27	5.0	5.0	3.9	1.06	14.27	0.60	18	1.85	38.88	39.12	43.20	43.20	45.23	44.87	
47	6	81.0	0.08	0.08	0.90	0.07	0.07	5.0	5.0	3.9	0.28	11.55	0.16	18	1.21	39.02	40.00	43.20	43.20	45.23	45.00	

System 3	Number of lines: 47	Run Date: 03-31-2009

NOTES: Intensity = 10.21 / (Inlet time + 0.30) ^ 0.57; Return period = 25 Yrs. ; Total flows limited to inlet captured flows. ; c = cir e = ellip b = box

MyReport

Line No.	Line Size (in)	Vel Ave (ft/s)	Capac Full (cfs)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	n-val Pipe	HGL Dn (ft)	HGL Up (ft)	Crit Depth (ft)	Minor Loss (ft)	Defl Ang (Deg)
1	36	2.75	48.63	79.0	37.52	37.10	0.53	0.013	42.00	42.07	1.41	0.14	140.0
2	36	2.66	50.42	14.0	37.50	37.42	0.57	0.013	42.22	42.23	1.38	0.11	-50.0
3	30	2.68	25.41	125.0	37.88	37.40	0.38	0.013	42.34	42.47	1.21	0.11	-90.0
4	30	2.55	25.29	121.0	38.24	37.78	0.38	0.013	42.59	42.70	1.18	0.10	0.0
5	30	2.29	24.61	125.0	38.59	38.14	0.36	0.013	42.82	42.91	1.12	0.08	0.0
6	30	1.94	44.42	127.0	39.98	38.49	1.17	0.013	43.02	43.09	1.03	0.06	0.0
7	30	1.67	20.71	98.0	39.27	39.02	0.26	0.013	43.16	43.20	0.96	0.04	0.0
8	30	1.46	25.59	131.0	39.68	39.17	0.39	0.013	43.25	43.29	0.89	0.03	0.0
9	30	1.24	28.41	50.0	39.82	39.58	0.48	0.013	43.33	43.35	0.83	0.02	0.0
10	30	1.09	28.02	75.0	40.07	39.72	0.47	0.013	43.37	43.39	0.77	0.02	0.0
11	18	0.32	12.36	70.0	39.11	38.14	1.39	0.013	42.90	42.90	0.29	0.00	90.0
12	18	0.58	12.40	71.0	39.48	38.49	1.39	0.013	43.07	43.08	0.39	0.01	90.0
13	18	2.58	7.60	86.0	40.42	39.97	0.52	0.013	43.41	43.57	0.82	0.10	90.0
14	18	2.21	6.86	75.0	40.64	40.32	0.43	0.013	43.70	43.80	0.75	0.08	-90.0
15	18	2.01	8.00	50.0	40.83	40.54	0.58	0.013	43.89	43.95	0.72	0.06	0.0
16	18	1.59	8.36	90.0	41.30	40.73	0.63	0.013	44.04	44.10	0.64	0.04	41.0
17	18	0.89	17.89	62.0	43.00	41.20	2.90	0.013	44.17	44.18	0.46	0.00	-44.0
18	30	1.16	38.03	50.0	37.83	37.40	0.86	0.013	42.43	42.44	0.80	0.02	90.0
19	18	0.17	20.39	13.0	38.22	37.73	3.77	0.013	42.48	42.48	0.21	0.00	90.0
20	24	1.71	16.26	60.0	38.04	37.73	0.52	0.013	42.46	42.49	0.82	0.05	-90.0
21	18	0.29	16.75	11.0	38.22	37.94	2.55	0.013	42.58	42.58	0.28	0.00	0.0
22	24	1.54	14.30	105.0	38.36	37.94	0.40	0.013	42.54	42.59	0.78	0.04	-90.0
23	18	0.59	16.75	11.0	38.54	38.26	2.55	0.013	42.66	42.66	0.39	0.01	87.0

System 3	Number of lines: 47	Date: 03-31-2009

NOTES: i Inlet control; ** Critical depth ; System flows limited to inlet captured flows.

MyReport

Line No.	Line Size (in)	Vel Ave (ft/s)	Capac Full (cfs)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	n-val Pipe	HGL Dn (ft)	HGL Up (ft)	Crit Depth (ft)	Minor Loss (ft)	Defl Ang (Deg)
24	18	2.15	7.47	77.0	38.65	38.26	0.51	0.013	42.63	42.73	0.74	0.07	42.0
25	18	0.17	6.78	12.0	38.60	38.55	0.42	0.013	42.88	42.88	0.21	0.00	133.0
26	18	0.14	7.83	45.0	38.80	38.55	0.56	0.013	42.88	42.88	0.19	0.00	-42.0
27	18	1.84	16.09	66.0	40.10	38.55	2.35	0.013	42.82	42.89	0.69	0.05	48.0
28	18	0.74	6.78	12.0	40.05	40.00	0.42	0.013	42.98	42.99	0.44	0.01	90.0
29	18	0.46	7.83	45.0	40.25	40.00	0.56	0.013	42.99	42.99	0.34	0.00	-90.0
30	18	0.64	5.95	265.0	40.85	40.00	0.32	0.013	42.99	43.02	0.41	0.01	0.0
31	18	0.38	6.78	12.0	40.80	40.75	0.42	0.013	43.03	43.03	0.31	0.00	90.0
32	18	0.26	9.28	32.0	41.00	40.75	0.78	0.013	43.03	43.03	0.26	0.00	-90.0
33	18	0.36	13.16	14.0	38.00	37.78	1.57	0.013	42.69	42.69	0.30	0.00	-90.0
34	18	0.40	13.16	14.0	38.36	38.14	1.57	0.013	42.90	42.90	0.32	0.00	-90.0
35	18	0.38	14.27	13.0	38.73	38.49	1.85	0.013	43.07	43.07	0.31	0.00	-90.0
36	18	0.30	13.16	14.0	39.80	39.58	1.57	0.013	43.36	43.36	0.28	0.00	-90.0
37	18	0.46	18.19	15.0	40.42	39.97	3.00	0.013	43.42	43.42	0.34	0.00	-90.0
38	24	0.33	25.46	71.0	40.07	39.17	1.27	0.013	43.28	43.29	0.36	0.00	90.0
39	24	0.17	16.78	89.0	40.07	39.58	0.55	0.013	43.36	43.36	0.26	0.00	90.0
40	24	0.23	16.95	89.0	40.22	39.72	0.56	0.013	43.39	43.39	0.30	0.00	90.0
41	18	0.37	15.46	6.0	40.45	40.32	2.17	0.013	43.77	43.77	0.31	0.00	0.0
42	18	0.20	15.46	6.0	40.67	40.54	2.17	0.013	43.95	43.95	0.23	0.00	90.0
43	18	0.42	15.46	6.0	40.86	40.73	2.17	0.013	44.07	44.07	0.33	0.00	90.0
44	18	0.91	6.78	12.0	42.95	42.90	0.42	0.013	44.18	44.18	0.46	0.01	0.0
45	18	0.78	16.60	12.0	41.50	41.20	2.50	0.013	44.17	44.17	0.45	0.01	144.0
46	18	0.60	14.27	13.0	39.12	38.88	1.85	0.013	43.20	43.20	0.39	0.01	-90.0

System 3	Number of lines: 47	Date: 03-31-2009

NOTES: i Inlet control; ** Critical depth ; System flows limited to inlet captured flows.

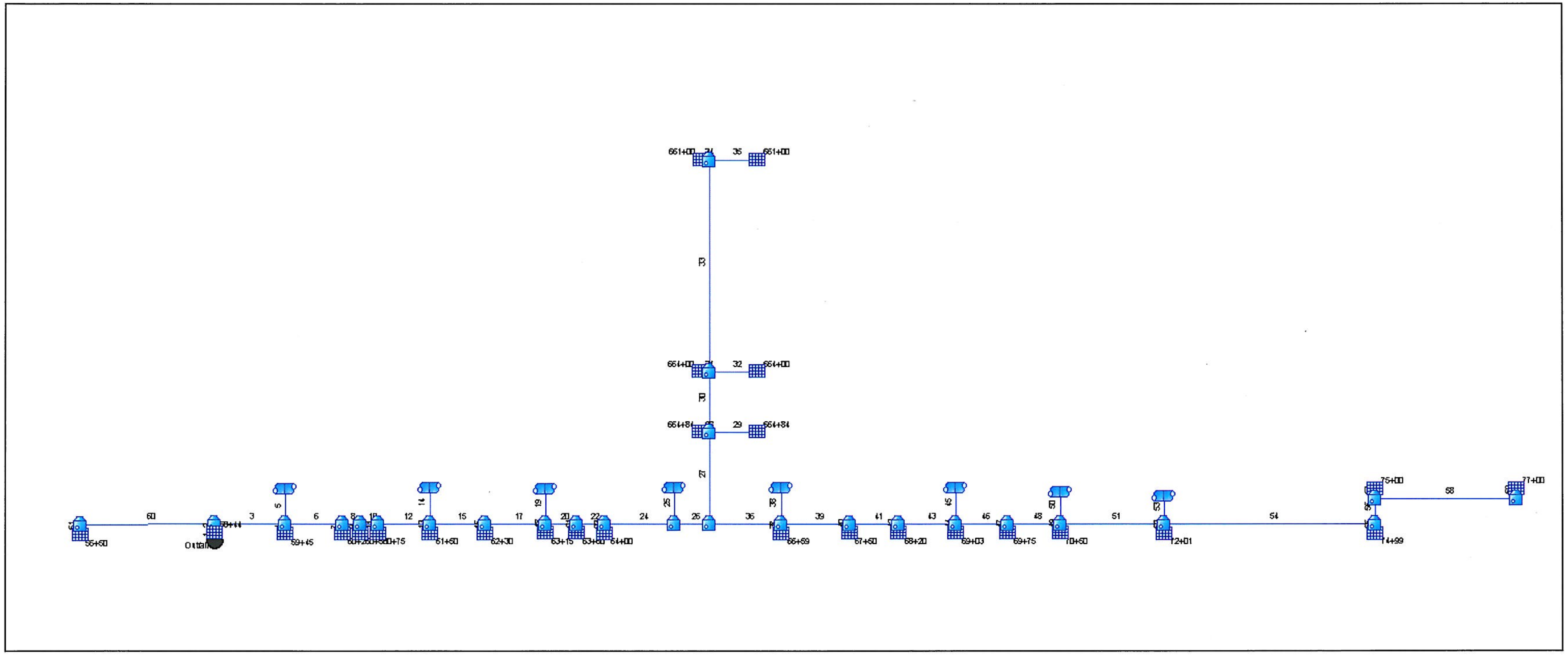
MyReport

Line No.	Line Size (in)	Vel Ave (ft/s)	Capac Full (cfs)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	n-val Pipe	HGL Dn (ft)	HGL Up (ft)	Crit Depth (ft)	Minor Loss (ft)	Defl Ang (Deg)
47	18	0.16	11.55	81.0	40.00	39.02	1.21	0.013	43.20	43.20	0.20	0.00	55.0

System 3	Number of lines: 47	Date: 03-31-2009

NOTES: i Inlet control; ** Critical depth ; System flows limited to inlet captured flows.

__System-4 (Depressed Section)__



Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	11.2	0.16	9.85	0.90	0.14	8.21	5.0	61.5	1.1	20.68	156.7	0.62	78	0.09	-5.00	-4.99	25.00	25.00	37.24	26.51	
2	1	13.0	0.00	9.69	0.00	0.00	8.07	5.0	61.2	1.1	18.28	145.4	0.55	78	0.08	-4.99	-4.98	25.00	25.00	26.51	26.87	
3	2	101.0	0.00	9.39	0.00	0.00	7.80	5.0	58.6	1.1	17.22	139.8	0.61	72	0.11	-4.98	-4.87	25.01	25.01	26.87	24.00	
4	3	15.0	0.11	0.11	0.90	0.10	0.10	5.0	5.0	4.4	0.43	4.70	0.25	18	0.20	-1.37	-1.34	25.02	25.02	24.00	23.60	
5	3	46.0	1.14	1.14	0.81	0.92	0.92	5.0	5.0	4.4	4.05	5.14	2.29	18	0.24	-1.37	-1.26	25.02	25.09	24.00	24.71	
6	3	80.0	0.00	8.14	0.00	0.00	6.78	5.0	56.8	1.1	16.23	106.2	0.68	66	0.10	-4.87	-4.79	25.02	25.02	24.00	23.04	
7	6	14.0	0.15	0.15	0.90	0.14	0.14	5.0	5.0	4.4	0.59	4.86	0.33	18	0.21	-1.29	-1.26	25.03	25.03	23.04	22.66	
8	6	25.0	0.00	7.99	0.00	0.00	6.64	5.0	56.3	1.1	16.12	94.99	0.68	66	0.08	-4.79	-4.77	25.03	25.03	23.04	22.96	
9	8	14.0	0.10	0.10	0.90	0.09	0.09	5.0	5.0	4.4	0.61	5.61	0.35	18	0.29	-1.27	-1.23	25.04	25.04	22.96	22.58	
10	8	25.0	0.00	7.89	0.00	0.00	6.55	5.0	55.7	1.1	15.84	116.3	0.67	66	0.12	-4.27	-4.24	25.03	25.03	22.96	23.03	
11	10	14.0	0.12	0.12	0.90	0.11	0.11	5.0	5.0	4.4	0.98	4.86	0.56	18	0.21	-1.24	-1.21	25.04	25.04	23.03	22.65	
12	10	74.0	0.00	7.77	0.00	0.00	6.45	5.0	53.9	1.2	15.34	103.3	0.65	66	0.09	-4.24	-4.17	25.04	25.04	23.03	23.40	
13	12	14.0	0.11	0.11	0.90	0.10	0.10	5.0	5.0	4.4	0.91	4.86	0.52	18	0.21	-1.17	-1.14	25.05	25.05	23.40	23.02	
14	12	47.0	0.88	0.88	0.74	0.65	0.65	5.0	5.0	4.4	2.85	5.31	1.62	18	0.26	-1.17	-1.05	25.05	25.08	23.40	24.16	
15	12	79.0	0.00	6.78	0.00	0.00	5.70	5.0	51.9	1.2	14.13	106.9	0.59	66	0.10	-4.17	-4.09	25.05	25.05	23.40	23.83	
16	15	14.0	0.11	0.11	0.90	0.10	0.10	5.0	5.0	4.4	0.93	4.86	0.53	18	0.21	-1.09	-1.06	25.06	25.06	23.83	23.45	
17	15	85.0	0.00	6.67	0.00	0.00	5.60	5.0	50.1	1.2	13.66	79.91	0.70	60	0.09	-4.09	-4.01	25.06	25.06	23.83	24.24	
18	17	13.0	0.06	0.06	0.90	0.05	0.05	5.0	5.0	4.4	0.51	5.83	0.29	18	0.31	-1.01	-0.97	25.07	25.07	24.24	23.88	
19	17	46.0	0.63	0.63	0.72	0.45	0.45	5.0	5.0	4.4	1.99	5.36	1.13	18	0.26	-1.01	-0.89	25.07	25.08	24.24	24.99	
20	17	44.0	0.00	5.98	0.00	0.00	5.09	5.0	49.0	1.2	12.84	87.80	0.65	60	0.11	-4.01	-3.96	25.07	25.07	24.24	24.46	
21	20	13.0	0.05	0.05	0.90	0.05	0.05	5.0	5.0	4.4	0.40	5.04	0.22	18	0.23	-0.96	-0.93	25.08	25.08	24.46	24.10	
22	20	40.0	0.00	5.93	0.00	0.00	5.04	5.0	48.3	1.2	12.64	62.19	0.80	54	0.10	-3.46	-3.42	25.08	25.08	24.46	24.65	

Project File: Claire_ Drainage Area 4 (depressed section).stm	Number of lines: 61	Run Date: 03-31-2009

NOTES: Intensity = 10.99 / (Inlet time + 0.10) ^ 0.56; Return period = 50 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
23	22	14.0	0.36	0.36	0.90	0.32	0.32	5.0	5.0	4.4	2.73	4.86	1.54	18	0.21	-0.92	-0.89	25.09	25.10	24.65	24.27	
24	22	99.0	0.00	5.57	0.00	0.00	4.72	5.0	46.1	1.3	11.09	62.50	0.70	54	0.10	-3.42	-3.32	25.09	25.09	24.65	25.13	
25	24	48.0	0.31	0.31	0.86	0.27	0.27	5.0	5.0	4.4	1.17	5.25	0.66	18	0.25	-0.82	-0.70	25.10	25.11	25.13	25.91	
26	24	50.0	0.00	5.26	0.00	0.00	4.45	5.0	45.2	1.3	10.81	45.43	0.86	48	0.10	-3.32	-3.27	25.10	25.10	25.13	25.36	
27	26	130.0	0.00	1.42	0.00	0.00	1.28	5.0	11.7	2.7	5.63	5.29	3.19	18	0.25	-0.77	-0.44	25.12	25.49	25.36	27.30	
28	27	14.0	0.10	0.10	0.90	0.09	0.09	5.0	5.0	4.4	0.77	4.86	0.44	18	0.21	-0.44	-0.41	25.80	25.80	27.30	26.90	
29	27	67.0	0.08	0.08	0.90	0.07	0.07	5.0	5.0	4.4	0.49	5.29	0.27	18	0.25	-0.44	-0.27	25.80	25.81	27.30	27.05	
30	27	85.0	0.00	1.24	0.00	0.00	1.12	5.0	11.1	2.8	4.72	5.22	2.67	18	0.25	-0.44	-0.23	25.69	25.87	27.30	30.15	
31	30	14.0	0.39	0.39	0.90	0.35	0.35	5.0	5.0	4.4	2.54	5.61	1.44	18	0.29	-0.23	-0.19	26.06	26.06	30.15	29.75	
32	30	67.0	0.28	0.28	0.90	0.25	0.25	5.0	5.0	4.4	1.62	5.29	0.92	18	0.25	-0.23	-0.06	26.08	26.09	30.15	29.85	
33	30	301.0	0.00	0.57	0.00	0.00	0.51	5.0	6.7	3.7	1.98	5.31	1.12	18	0.26	-0.23	0.54	26.07	26.18	30.15	44.30	
34	33	12.0	0.29	0.29	0.90	0.26	0.26	5.0	5.0	4.4	1.14	5.25	0.65	18	0.25	0.54	0.57	26.21	26.21	44.30	43.90	
35	33	67.0	0.28	0.28	0.90	0.25	0.25	5.0	5.0	4.4	1.17	5.29	0.66	18	0.25	0.54	0.71	26.21	26.22	44.30	44.05	
36	26	101.0	0.00	3.84	0.00	0.00	3.17	5.0	43.2	1.3	7.15	31.66	0.74	42	0.10	-2.77	-2.67	25.12	25.12	25.36	27.50	
37	36	14.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	4.4	0.92	4.86	0.52	18	0.21	-0.67	-0.64	25.14	25.14	27.50	27.12	
38	36	47.0	0.49	0.49	0.76	0.37	0.37	5.0	5.0	4.4	1.63	5.31	0.92	18	0.26	-0.67	-0.55	25.13	25.14	27.50	28.27	
39	36	97.0	0.00	3.22	0.00	0.00	2.69	5.0	40.9	1.4	6.20	30.65	0.64	42	0.09	-2.67	-2.58	25.13	25.14	27.50	26.73	
40	39	13.0	0.11	0.11	0.90	0.10	0.10	5.0	5.0	4.4	0.72	5.83	0.41	18	0.31	-0.58	-0.54	25.15	25.15	26.73	26.37	
41	39	70.0	0.00	3.11	0.00	0.00	2.59	5.0	39.1	1.4	5.87	31.82	0.61	42	0.10	-2.58	-2.51	25.14	25.15	26.73	26.76	
42	41	13.0	0.12	0.12	0.90	0.11	0.11	5.0	5.0	4.4	0.79	5.83	0.45	18	0.31	-0.51	-0.47	25.16	25.16	26.76	26.40	
43	41	81.0	0.00	2.99	0.00	0.00	2.48	5.0	37.0	1.4	5.51	33.54	0.57	42	0.11	-2.51	-2.42	25.15	25.16	26.76	27.47	
44	43	13.0	0.09	0.09	0.90	0.08	0.08	5.0	5.0	4.4	0.55	5.04	0.31	18	0.23	-0.42	-0.39	25.16	25.16	27.47	27.11	

Project File: Claire_ Drainage Area 4 (depressed section).stm | Number of lines: 61 | Run Date: 03-31-2009

NOTES: Intensity = 10.99 / (Inlet time + 0.10) ^ 0.56; Return period = 50 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
45	43	47.0	0.30	0.30	0.76	0.23	0.23	5.0	5.0	4.4	1.00	5.08	0.57	18	0.23	-0.42	-0.31	25.16	25.17	27.47	28.27	
46	43	73.0	0.00	2.60	0.00	0.00	2.17	5.0	35.4	1.5	4.94	20.65	0.70	36	0.10	-1.92	-1.85	25.16	25.17	27.47	28.75	
47	46	13.0	0.09	0.09	0.90	0.08	0.08	5.0	5.0	4.4	0.65	5.04	0.37	18	0.23	-0.35	-0.32	25.18	25.18	28.75	28.39	
48	46	75.0	0.00	2.51	0.00	0.00	2.09	5.0	33.7	1.5	4.61	20.38	0.65	36	0.09	-1.85	-1.78	25.17	25.18	28.75	30.76	
49	48	13.0	0.22	0.22	0.90	0.20	0.20	5.0	5.0	4.4	1.42	5.83	0.80	18	0.31	-0.28	-0.24	25.18	25.19	30.76	30.40	
50	48	41.0	0.36	0.36	0.76	0.27	0.27	5.0	5.0	4.4	1.20	5.44	0.68	18	0.27	-0.28	-0.17	25.18	25.19	30.76	31.51	
51	48	148.0	0.00	1.93	0.00	0.00	1.62	5.0	29.2	1.6	3.55	21.23	0.50	36	0.10	-1.78	-1.63	25.19	25.19	30.76	36.86	
52	51	14.0	0.34	0.34	0.90	0.31	0.31	5.0	5.0	4.4	2.25	5.61	1.27	18	0.29	-0.13	-0.09	25.19	25.20	36.86	36.48	
53	51	35.0	0.49	0.49	0.82	0.40	0.40	5.0	5.0	4.4	1.76	5.33	1.00	18	0.26	-0.13	-0.04	25.19	25.20	36.86	37.38	
54	51	299.0	0.00	1.10	0.00	0.00	0.91	5.0	14.0	2.5	2.25	21.47	0.32	36	0.10	-1.63	-1.32	25.20	25.20	36.86	51.65	
55	54	14.0	0.58	0.58	0.78	0.45	0.45	5.0	5.0	4.4	1.98	4.86	1.12	18	0.21	0.18	0.21	25.20	25.21	51.65	51.27	
56	54	35.0	0.00	0.52	0.00	0.00	0.46	5.0	13.1	2.6	1.17	5.33	0.66	18	0.26	0.18	0.27	25.20	25.21	51.65	51.33	
57	56	14.0	0.31	0.31	0.87	0.27	0.27	5.0	5.0	4.4	1.18	4.86	0.67	18	0.21	0.27	0.30	25.21	25.21	51.33	50.95	
58	56	200.0	0.00	0.21	0.00	0.00	0.19	5.0	5.5	4.2	0.78	5.30	0.44	18	0.26	0.27	0.78	25.22	25.23	51.33	50.59	
59	58	14.0	0.21	0.21	0.89	0.19	0.19	5.0	5.0	4.4	0.82	4.86	0.46	18	0.21	0.78	0.81	25.23	25.23	50.59	50.21	
60	2	190.0	0.00	0.30	0.00	0.00	0.27	5.0	5.2	4.3	2.13	5.33	1.20	18	0.26	-1.48	-0.99	25.01	25.09	26.87	35.43	
61	60	15.0	0.30	0.30	0.90	0.27	0.27	5.0	5.0	4.4	2.15	5.42	1.22	18	0.27	-0.99	-0.95	25.11	25.12	35.43	35.03	

Project File: Claire_ Drainage Area 4 (depressed section).stm	Number of lines: 61	Run Date: 03-31-2009

NOTES: Intensity = 10.99 / (Inlet time + 0.10) ^ 0.56; Return period = 50 Yrs. ; c = cir e = ellip b = box

MyReport

Line No.	Line Size (in)	Vel Ave (ft/s)	Capac Full (cfs)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	n-val Pipe	HGL Dn (ft)	HGL Up (ft)	Crit Depth (ft)	Minor Loss (ft)	Defl Ang (Deg)
1	78	0.62	156.69	11.2	-4.99	-5.00	0.09	0.013	25.00	25.00	1.19	0.00	-90.0
2	78	0.55	145.43	13.0	-4.98	-4.99	0.08	0.013	25.00	25.00	1.11	0.00	0.0
3	72	0.61	139.79	101.0	-4.87	-4.98	0.11	0.013	25.01	25.01	1.10	0.01	90.0
4	18	0.25	4.70	15.0	-1.34	-1.37	0.20	0.013	25.02	25.02	0.25	0.00	90.0
5	18	2.29	5.14	46.0	-1.26	-1.37	0.24	0.013	25.02	25.09	0.77	0.08	-90.0
6	66	0.68	106.21	80.0	-4.79	-4.87	0.10	0.013	25.02	25.02	1.10	0.01	0.0
7	18	0.33	4.86	14.0	-1.26	-1.29	0.21	0.013	25.03	25.03	0.29	0.00	90.0
8	66	0.68	94.99	25.0	-4.77	-4.79	0.08	0.013	25.03	25.03	1.09	0.01	0.0
9	18	0.35	5.61	14.0	-1.23	-1.27	0.29	0.013	25.04	25.04	0.30	0.00	90.0
10	66	0.67	116.34	25.0	-4.24	-4.27	0.12	0.013	25.03	25.03	1.08	0.01	0.0
11	18	0.56	4.86	14.0	-1.21	-1.24	0.21	0.013	25.04	25.04	0.38	0.00	90.0
12	66	0.65	103.30	74.0	-4.17	-4.24	0.09	0.013	25.04	25.04	1.07	0.01	0.0
13	18	0.52	4.86	14.0	-1.14	-1.17	0.21	0.013	25.05	25.05	0.36	0.00	90.0
14	18	1.62	5.31	47.0	-1.05	-1.17	0.26	0.013	25.05	25.08	0.64	0.04	-90.0
15	66	0.59	106.88	79.0	-4.09	-4.17	0.10	0.013	25.05	25.05	1.02	0.01	0.0
16	18	0.53	4.86	14.0	-1.06	-1.09	0.21	0.013	25.06	25.06	0.37	0.00	90.0
17	60	0.70	79.91	85.0	-4.01	-4.09	0.09	0.013	25.06	25.06	1.03	0.01	0.0
18	18	0.29	5.83	13.0	-0.97	-1.01	0.31	0.013	25.07	25.07	0.27	0.00	90.0
19	18	1.13	5.36	46.0	-0.89	-1.01	0.26	0.013	25.07	25.08	0.54	0.02	-90.0
20	60	0.65	87.80	44.0	-3.96	-4.01	0.11	0.013	25.07	25.07	1.00	0.01	0.0
21	18	0.22	5.04	13.0	-0.93	-0.96	0.23	0.013	25.08	25.08	0.24	0.00	90.0
22	54	0.80	62.19	40.0	-3.42	-3.46	0.10	0.013	25.08	25.08	1.02	0.01	0.0
23	18	1.54	4.86	14.0	-0.89	-0.92	0.21	0.013	25.09	25.10	0.63	0.04	90.0

Project File: Claire_ Drainage Area 4 (depressed section).stm | Number of lines: 61 | Date: 03-31-2009

NOTES: ** Critical depth

MyReport

Line No.	Line Size (in)	Vel Ave (ft/s)	Capac Full (cfs)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	n-val Pipe	HGL Dn (ft)	HGL Up (ft)	Crit Depth (ft)	Minor Loss (ft)	Defl Ang (Deg)
24	54	0.70	62.50	99.0	-3.32	-3.42	0.10	0.013	25.09	25.09	0.96	0.01	0.0
25	18	0.66	5.25	48.0	-0.70	-0.82	0.25	0.013	25.10	25.11	0.41	0.01	-90.0
26	48	0.86	45.43	50.0	-3.27	-3.32	0.10	0.013	25.10	25.10	0.97	0.01	0.0
27	18	3.19	5.29	130.0	-0.44	-0.77	0.25	0.013	25.12	25.49	0.91	0.16	-90.0
28	18	0.44	4.86	14.0	-0.41	-0.44	0.21	0.013	25.80	25.80	0.34	0.00	-90.0
29	18	0.27	5.29	67.0	-0.27	-0.44	0.25	0.013	25.80	25.81	0.27	0.00	90.0
30	18	2.67	5.22	85.0	-0.23	-0.44	0.25	0.013	25.69	25.87	0.83	0.11	0.0
31	18	1.44	5.61	14.0	-0.19	-0.23	0.29	0.013	26.06	26.06	0.61	0.03	-90.0
32	18	0.92	5.29	67.0	-0.06	-0.23	0.25	0.013	26.08	26.09	0.49	0.01	90.0
33	18	1.12	5.31	301.0	0.54	-0.23	0.26	0.013	26.07	26.18	0.54	0.02	0.0
34	18	0.65	5.25	12.0	0.57	0.54	0.25	0.013	26.21	26.21	0.41	0.01	-90.0
35	18	0.66	5.29	67.0	0.71	0.54	0.25	0.013	26.21	26.22	0.41	0.01	90.0
36	42	0.74	31.66	101.0	-2.67	-2.77	0.10	0.013	25.12	25.12	0.82	0.01	0.0
37	18	0.52	4.86	14.0	-0.64	-0.67	0.21	0.013	25.14	25.14	0.37	0.00	90.0
38	18	0.92	5.31	47.0	-0.55	-0.67	0.26	0.013	25.13	25.14	0.49	0.01	-90.0
39	42	0.64	30.65	97.0	-2.58	-2.67	0.09	0.013	25.13	25.14	0.76	0.01	0.0
40	18	0.41	5.83	13.0	-0.54	-0.58	0.31	0.013	25.15	25.15	0.32	0.00	90.0
41	42	0.61	31.82	70.0	-2.51	-2.58	0.10	0.013	25.14	25.15	0.74	0.01	0.0
42	18	0.45	5.83	13.0	-0.47	-0.51	0.31	0.013	25.16	25.16	0.34	0.00	90.0
43	42	0.57	33.54	81.0	-2.42	-2.51	0.11	0.013	25.15	25.16	0.72	0.01	0.0
44	18	0.31	5.04	13.0	-0.39	-0.42	0.23	0.013	25.16	25.16	0.28	0.00	90.0
45	18	0.57	5.08	47.0	-0.31	-0.42	0.23	0.013	25.16	25.17	0.38	0.00	-90.0
46	36	0.70	20.65	73.0	-1.85	-1.92	0.10	0.013	25.16	25.17	0.71	0.01	0.0

Project File: Claire_ Drainage Area 4 (depressed section).stm	Number of lines: 61	Date: 03-31-2009

NOTES: ** Critical depth

MyReport

Line No.	Line Size (in)	Vel Ave (ft/s)	Capac Full (cfs)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (%)	n-val Pipe	HGL Dn (ft)	HGL Up (ft)	Crit Depth (ft)	Minor Loss (ft)	Defl Ang (Deg)
47	18	0.37	5.04	13.0	-0.32	-0.35	0.23	0.013	25.18	25.18	0.31	0.00	90.0
48	36	0.65	20.38	75.0	-1.78	-1.85	0.09	0.013	25.17	25.18	0.68	0.01	0.0
49	18	0.80	5.83	13.0	-0.24	-0.28	0.31	0.013	25.18	25.19	0.45	0.01	90.0
50	18	0.68	5.44	41.0	-0.17	-0.28	0.27	0.013	25.18	25.19	0.42	0.01	-90.0
51	36	0.50	21.23	148.0	-1.63	-1.78	0.10	0.013	25.19	25.19	0.60	0.00	0.0
52	18	1.27	5.61	14.0	-0.09	-0.13	0.29	0.013	25.19	25.20	0.57	0.03	90.0
53	18	1.00	5.33	35.0	-0.04	-0.13	0.26	0.013	25.19	25.20	0.51	0.02	-90.0
54	36	0.32	21.47	299.0	-1.32	-1.63	0.10	0.013	25.20	25.20	0.48	0.00	0.0
55	18	1.12	4.86	14.0	0.21	0.18	0.21	0.013	25.20	25.21	0.54	0.02	90.0
56	18	0.66	5.33	35.0	0.27	0.18	0.26	0.013	25.20	25.21	0.41	0.01	-90.0
57	18	0.67	4.86	14.0	0.30	0.27	0.21	0.013	25.21	25.21	0.41	0.01	0.0
58	18	0.44	5.30	200.0	0.78	0.27	0.26	0.013	25.22	25.23	0.34	0.00	90.0
59	18	0.46	4.86	14.0	0.81	0.78	0.21	0.013	25.23	25.23	0.35	0.00	-90.0
60	18	1.20	5.33	190.0	-0.99	-1.48	0.26	0.013	25.01	25.09	0.56	0.02	-90.3
61	18	1.22	5.42	15.0	-0.95	-0.99	0.27	0.013	25.11	25.12	0.56	0.02	-89.7

Project File: Claire_ Drainage Area 4 (depressed section).stm	Number of lines: 61	Date: 03-31-2009

NOTES: ** Critical depth

Appendix F Inlet Capacity Calculations

East-West Connector Project

New Roadway Drainage Inlet Calculations- LT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"
In#	**Inlet number:**												
		(Input Data Required)											
HYDROLOGY COMPUTATION:													
	Begin Station		44+79	46+00	47+25	48+52	50+81	52+00	54+35	54+35	59+45	63+00	64+00
	End Station		43+54	44+79	46+00	47+25	48+52	50+81	52+00	59+45	61+75	61+75	63+00
St	Structure location station:	>>	43+54	44+79	46+00	47+25	48+52	50+81	52+00	59+45	60+50	61+75	63+00
N	Notes		<-	<-	<-	<-	<-	<-	HP	->	LP	<-	<-
	Off-site contributing watershed area (acres):	>>	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.29	0.20	0.18
	On-site contributing watershed area (acres)	>>	0.16	0.18	0.20	0.19	0.30	0.15	0.23	0.79	0.28	0.11	0.09
Ar	**Contributing watershed area (acres):**		**0.20**	**0.18**	**0.20**	**0.19**	**0.30**	**0.15**	**0.23**	**1.14**	**0.58**	**0.31**	**0.27**
C	Composite Runoff Coefficient "C":	>>	0.84	0.90	0.90	0.90	0.90	0.90	0.90	0.81	0.76	0.72	0.72
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94	3.94	3.94	3.94	3.94	3.94	4.41	4.41	4.41	4.41
Qa	Subarea discharge Q (ft^3/s):		0.66	0.65	0.69	0.69	1.08	0.53	0.80	4.10	1.92	1.00	0.85
qq	Previous by-pass flow (ft^3/s):	>	0.06	0.07	0.08	0.15	0.03	0.07			0.00	0.00	0.00
Qadd	Discharge added by operator (ft3/s)	>											
Qt	**Total discharge Q (ft^3/s):**		**0.72**	**0.72**	**0.77**	**0.84**	**1.11**	**0.61**	**0.80**	**4.10**	**1.92**	**1.00**	**0.85**
SHOULDER AND GUTTER CONFIGURATION:													
n	Manning's n:	>>	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0236	0.0044	0.0050	0.0050
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1	1	1	1	1	3	3	3	3
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1	1	1	1	1	1	2	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Slotted	Slotted	Slotted	Slotted
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1	1	1	1	1	1	2	2	2	2
Gw	Grate width (in):	>	24.0	24.0	24.0	24.0	24.0	24.0	24.0				
Gl	Grate length (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0				
	3 or 4 sided weir?	>											
Lco	Curb opening length provided (ft)	>								510.00	230.00	125.00	100.00
Ls	Slotted drain length provided: (ft)	>								494.06	222.81	121.09	96.88
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
	Available Flooded Width (ft)	>	8.00	8.00	8.00	8.00	8.00	8.00	8.00	0.00	0.00	0.00	0.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**7.97**	**7.98**	**8.21**	**8.47**	**9.41**	**7.49**	**8.31**	**10.42**	**-----**	**8.21**	**7.73**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**6.17**	**6.18**	**6.47**	**6.79**	**7.91**	**5.56**	**6.59**	**9.08**	**-----**	**6.47**	**5.87**
Du/s	Depth at flowline before inlet (ft)		0.23	0.23	0.23	0.24	0.26	0.22	0.24	0.29	-----	0.23	0.22
Au/s	Water cross-area before inlet (ft^2):		0.54	0.54	0.57	0.62	0.78	0.47	0.59	0.98	-----	0.57	0.50
Vu/s	Velocity for total discharge before inlet (ft/s)		1.33	1.33	1.35	1.36	1.42	1.30	1.35	4.18	-----	1.74	1.70
Eod	Ratio of gutter depression flow to total Q (Eod)		91%	91%	90%	88%	82%	94%	89%	76%	-----	90%	93%
Se	Equivalent cross-slope (ft/ft):		0.052	0.052	0.051	0.051	0.049	0.053	0.051	0.046	-----	0.051	0.052
GRATE INLETS ON-GRADE:													
Eog	Ratio of grate frontal flow to total flow:		82%	82%	80%	78%	71%	86%	79%	-----	-----	-----	-----
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.59	0.59	0.62	0.66	0.79	0.52	0.64	-----	-----	-----	-----
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73	8.73	8.73	8.73	8.73	8.73	-----	-----	-----	-----
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00	1.00	1.00	1.00	1.00	1.00	-----	-----	-----	-----
Qs	Side flow in ft^3/s (Qs):		0.13	0.13	0.15	0.18	0.32	0.08	0.16	-----	-----	-----	-----
Gle	Effective grate length w/ 25% clogging (in):		27	27	27	27	27	27	27	-----	-----	-----	-----
Rs	Fraction of side flow interception (Rs):		57%	57%	56%	55%	53%	58%	56%	-----	-----	-----	-----
E	Grate Efficiency (E):		92%	92%	91%	90%	86%	94%	91%	-----	-----	-----	-----
Qi	**Total flow intercepted (ft^3/s):**		**0.66**	**0.66**	**0.71**	**0.76**	**0.96**	**0.57**	**0.73**	**-----**	**-----**	**-----**	**-----**
Qb	**Grate flow-by (ft^3/s):**		**0.05**	**0.06**	**0.07**	**0.08**	**0.15**	**0.03**	**0.07**	**-----**	**-----**	**-----**	**-----**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE:	**(No clogging factor)**												
Lt	Length required for total interception (ft):		-----	-----	-----	-----	-----	-----	-----	26.59	-----	8.70	8.04
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----	-----	-----	-----	-----	4.1	-----	1.0	0.9
El	Efficiency for providged length L		-----	-----	-----	-----	-----	-----	-----	100%	-----	100%	100%
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**0.0**	**-----**	**0.0**	**0.0**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:													
	Grate Inlets												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Slotted drains												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	0.03	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	0.04	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	0.00	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	0.00	-----	-----
	Curb opening inlets												
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft)	>									400.00		
g1	approach grade #1 (%):	>									-7.00		
g2	approach grade #2 (%):	>									0.50		
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

East-West Connector Project

New Roadway Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"
In#	**Inlet number:**												
		(Input Data Required)											
HYDROLOGY COMPUTATION:													
	Begin Station		49+50	50+75	51+25	52+00	52+75	53+29	54+35	54+35	56+50	58+44	59+45
	End Station		49+00	49+50	50+75	51+25	52+00	52+75	53+29	56+50	58+44	59+45	60+25
St	Structure location station:	>>	49+00	49+50	50+75	51+25	52+00	52+75	53+29	56+50	58+44	59+45	60+25
N	Notes		<-	<-	<-	<-	<-	<-	HP	->	->	->	->
	Off-site contributing watershed area (acres):	>>	0.00	0.00	0.01	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00
	On-site contributing watershed area (acres)	>>	0.08	0.23	0.09	0.14	0.17	0.10	0.21	0.30	0.16	0.11	0.15
Ar	**Contributing watershed area (acres):**		**0.08**	**0.23**	**0.10**	**0.17**	**0.19**	**0.10**	**0.21**	**0.30**	**0.16**	**0.11**	**0.15**
C	Composite Runoff Coefficient "C":	>>	0.90	0.90	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.90
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94	3.94	3.94	3.94	3.94	3.94	4.41	4.41	4.41	4.41
Qa	Subarea discharge Q (ft^3/s):		0.29	0.83	0.36	0.58	0.67	0.34	0.75	1.19	0.64	0.45	0.60
qq	Previous by-pass flow (ft^3/s):	>	0.08	0.01	0.04	0.05	0.02	0.03	0.15	0.17	0.03	0.21	0.13
Qadd	Discharge added by operator (ft3/s)	>											
Qt	**Total discharge Q (ft^3/s):**		**0.38**	**0.84**	**0.39**	**0.63**	**0.69**	**0.37**	**0.90**	**1.36**	**0.67**	**0.65**	**0.73**
SHOULDER AND GUTTER CONFIGURATION:													
n	Manning's n:	>>	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.015
S	Longitudinal slope S (ft/ft):	>>	0.0010	0.0011	0.0030	0.0030	0.0030	0.0030	0.0623	0.0743	0.0424	0.0236	0.0067
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1	1	1	1	1	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1	1	1	1	1	1	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1	1	1	1	1	1	1	2	2	2
Gw	Grate width (in):	>	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>											
Lco	Curb opening length provided (ft)	>											
Ls	Slotted drain length provided: (ft)	>											
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200	0.0200	0.0200	0.0095	0.0028	0.0125	0.0125	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055	0.055	0.055	0.044	0.038	0.047	0.047	0.055	0.055
	Available Flooded Width (ft)	>	8.00	8.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00	8.00	8.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**7.69**	**10.20**	**6.38**	**7.59**	**7.85**	**9.90**	**16.82**	**7.45**	**6.35**	**5.11**	**6.75**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**5.81**	**8.83**	**4.06**	**5.68**	**6.02**	**6.33**	**6.94**	**3.92**	**2.77**	**2.72**	**4.57**
Du/s	Depth at flowline before inlet (ft)		0.22	0.28	0.19	0.22	0.22	0.16	0.12	0.15	0.13	0.15	0.20
Au/s	Water cross-area before inlet (ft^2):		0.49	0.94	0.32	0.48	0.52	0.35	0.22	0.25	0.18	0.20	0.37
Vu/s	Velocity for total discharge before inlet (ft/s)		0.76	0.89	1.23	1.31	1.33	1.06	4.03	5.39	3.71	3.22	2.00
Eod	Ratio of gutter depression flow to total Q (Eod)		93%	78%	99%	94%	92%	95%	98%	100%	100%	100%	98%
Se	Equivalent cross-slope (ft/ft):		0.052	0.047	0.054	0.053	0.052	0.042	0.037	0.047	0.047	0.055	0.054
GRATE INLETS ON-GRADE:													
Eog	Ratio of grate frontal flow to total flow:		85%	66%	95%	85%	83%	89%	96%	97%	63%	73%	61%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.32	0.55	0.37	0.54	0.57	0.33	0.87	1.32	0.43	0.48	0.44
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.06	0.29	0.02	0.09	0.12	0.04	0.03	0.04	0.24	0.17	0.29
Gle	Effective grate length w/ 25% clogging (in):		27	27	27	27	27	27	27	27	27	27	27
Rs	Fraction of side flow interception (Rs):		79%	71%	62%	58%	57%	62%	11%	9%	16%	22%	40%
E	Grate Efficiency (E):		97%	90%	98%	94%	93%	96%	97%	98%	69%	79%	76%
Qi	**Total flow intercepted (ft^3/s):**		**0.36**	**0.75**	**0.39**	**0.59**	**0.64**	**0.35**	**0.87**	**1.33**	**0.46**	**0.52**	**0.56**
Qb	**Grate flow-by (ft^3/s):**		**0.01**	**0.08**	**0.01**	**0.04**	**0.05**	**0.02**	**0.03**	**0.03**	**0.21**	**0.13**	**0.17**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)													
Lt	Length required for total interception (ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
El	Efficiency for providged length L:		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:													
	Grate Inlets												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Slotted drains												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets												
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft)	>											
g1	approach grade #1 (%):	>											
g2	approach grade #2 (%):	>											
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

East-West Connector Project

New Roadway Drainage Inlet Calculations- LT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"
In#	**Inlet number:**												
		(Input Data Required)											
HYDROLOGY COMPUTATION:													
	Begin Station		65+00	66+53	68+00	69+03	70+49	72+00	75+00	77+00	78+49	79+00	80+50
	End Station		64+00	65+00	66+53	68+00	69+03	70+49	72+00	75+00	77+00	80+50	81+85
St	Structure location station:	>>	64+00	65+00	66+53	68+00	69+03	70+49	72+00	75+00	77+00	80+50	81+85
N	Notes		<-	<-	<-	<-	<-	<-	<-	<-	HP	->	->
	Off-site contributing watershed area (acres):	>>	0.23	0.04	0.15	0.09	0.15	0.18	0.19	0.08	0.04	0.10	0.07
	On-site contributing watershed area (acres)	>>	0.13	0.27	0.15	0.10	0.15	0.17	0.30	0.24	0.17	0.18	0.14
Ar	**Contributing watershed area (acres):**		**0.35**	**0.31**	**0.30**	**0.19**	**0.30**	**0.36**	**0.49**	**0.31**	**0.21**	**0.28**	**0.21**
C	Composite Runoff Coefficient "C":	>>	0.72	0.86	0.76	0.77	0.76	0.76	0.82	0.87	0.89	0.86	0.87
Ic	Precipitation intensity (in/hr):	>>	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		1.13	1.18	1.01	0.63	1.01	1.19	1.77	1.19	0.80	0.94	0.70
qq	Previous by-pass flow (ft^3/s):	>	0.00	0.09	0.00	0.00	0.00	0.00	0.43	0.17			0.07
Qadd	Discharge added by operator (ft3/s)	>											
Qt	**Total discharge Q (ft^3/s):**		**1.13**	**1.26**	**1.01**	**0.63**	**1.01**	**1.19**	**2.20**	**1.37**	**0.80**	**0.94**	**0.77**
SHOULDER AND GUTTER CONFIGURATION:													
n	Manning's n:	>>	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0050	0.0050	0.0032	0.0027	0.0178	0.0300	0.0472	0.0500	0.0575	0.0090	0.0090
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	3	3	3	3	3	3	3	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1	1	1	1	1	1	1	1	1
ID	Inlet description:	>	Slotted	Slotted	Slotted	Slotted	Slotted	Slotted	Slotted	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	2	2	2	2	2	2	2	1	1	1	1
Gw	Grate width (in):	>								24.0	24.0	24.0	24.0
Gl	Grate length (in):	>								36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>											
Lco	Curb opening length provided (ft)	>	100.00	153.00	147.00	103.00	146.00	151.00	300.00				
Ls	Slotted drain length provided: (ft)	>	96.88	148.22	142.41	99.78	141.44	146.28	290.63				
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0117	0.0200	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in)	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055	0.055	0.020	0.020	0.012	0.020	0.020	0.055	0.055
	Available Flooded Width (ft)	>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	6.00	6.00	6.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**8.59**	**8.96**	**8.98**	**7.75**	**6.49**	**6.26**	**10.13**	**6.00**	**4.79**	**7.18**	**6.67**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**6.93**	**7.37**	**7.40**	**5.89**	**6.49**	**6.26**	**10.13**	**6.00**	**4.79**	**5.16**	**4.46**
Du/s	Depth at flowline before inlet (ft)		0.24	0.25	0.25	0.22	0.13	0.13	0.12	0.12	0.10	0.21	0.19
Au/s	Water cross-area before inlet (ft^2):		0.64	0.70	0.70	0.50	0.42	0.39	0.60	0.36	0.23	0.42	0.36
Vu/s	Velocity for total discharge before inlet (ft/s)		1.77	1.80	1.44	1.25	2.39	3.03	3.67	3.80	3.51	2.22	2.16
Eod	Ratio of gutter depression flow to total Q (Eod)		88%	85%	85%	93%	81%	82%	61%	84%	93%	96%	98%
Se	Equivalent cross-slope (ft/ft)		0.050	0.050	0.050	0.052	0.020	0.020	0.012	0.020	0.020	0.053	0.054
GRATE INLETS ON-GRADE:													
Eog	Ratio of grate frontal flow to total flow:		-----	-----	-----	-----	-----	-----	-----	66%	76%	89%	93%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		-----	-----	-----	-----	-----	-----	-----	0.90	0.61	0.83	0.71
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		-----	-----	-----	-----	-----	-----	-----	8.73	8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		-----	-----	-----	-----	-----	-----	-----	1.00	1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		-----	-----	-----	-----	-----	-----	-----	0.46	0.19	0.11	0.05
Gle	Effective grate length w/ 25% clogging (in)		-----	-----	-----	-----	-----	-----	-----	27	27	27	27
Rs	Fraction of side flow interception (Rs):		-----	-----	-----	-----	-----	-----	-----	7%	8%	35%	37%
E	Grate Efficiency (E):		-----	-----	-----	-----	-----	-----	-----	69%	78%	93%	96%
Qi	**Total flow intercepted (ft^3/s):**		-----	-----	-----	-----	-----	-----	-----	**0.94**	**0.63**	**0.87**	**0.73**
Qb	**Grate flow-by (ft^3/s):**		-----	-----	-----	-----	-----	-----	-----	**0.43**	**0.17**	**0.07**	**0.03**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE:	**(No clogging factor)**												
Lt	Length required for total interception (ft):		9.25	9.78	7.80	5.89	22.46	28.17	57.68	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		1.1	1.3	1.0	0.6	1.0	1.2	2.2	-----	-----	-----	-----
El	Efficiency for providged length L		100%	100%	100%	100%	100%	100%	100%	-----	-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	-----	-----	-----	-----
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:													
	Grate Inlets												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Slotted drains												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets												
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft)	>											
g1	approach grade #1 (%):	>											
g2	approach grade #2 (%):	>											
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

East-West Connector Project

New Roadway Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"
In#	**Inlet number:**												
		(Input Data Required)											
HYDROLOGY COMPUTATION:													
	Begin Station		60+25	61+50	62+30	63+15	63+60	64+00	66+59	67+50	68+20	69+03	69+75
	End Station		60+75	60+75	61+50	62+30	63+15	63+60	64+00	66+59	67+50	68+20	69+03
St	Structure location station:	>>	60+50	60+75	61+50	62+30	63+15	63+60	64+00	66+59	67+50	68+20	69+03
N	Notes		LP	<-	<-	<-	<-	<-	<-	<-	<-	<-	<-
	Off-site contributing watershed area (acres):	>>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	On-site contributing watershed area (acres)	>>	0.10	0.12	0.11	0.11	0.06	0.05	0.36	0.13	0.11	0.12	0.09
Ar	**Contributing watershed area (acres):**		**0.10**	**0.12**	**0.11**	**0.11**	**0.06**	**0.05**	**0.36**	**0.13**	**0.11**	**0.12**	**0.09**
C	Composite Runoff Coefficient "C":	>>	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Ic	Precipitation intensity (in/hr):	>>	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41
Qa	Subarea discharge Q (ft^3/s):		0.40	0.49	0.44	0.42	0.24	0.18	1.41	0.52	0.45	0.50	0.36
qq	Previous by-pass flow (ft^3/s):	>	0.29	0.10	0.08	0.06	0.13	0.46	0.14	0.11	0.11	0.07	0.17
Qadd	Discharge added by operator (ft3/s)	>											
Qt	**Total discharge Q (ft^3/s):**		**0.70**	**0.58**	**0.52**	**0.47**	**0.37**	**0.64**	**1.55**	**0.63**	**0.56**	**0.56**	**0.53**
SHOULDER AND GUTTER CONFIGURATION:													
n	Manning's n:	>>	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
S	Longitudinal slope S (ft/ft):	>>	0.0032	0.0062	0.0056	0.0050	0.0050	0.0042	0.0688	0.0105	0.0063	0.0058	0.0011
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1	1	1	1	1	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	2	1	1	1	1	1	1	1	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	2	2	2	2	2	2	2	2	2	2	2
Gw	Grate width (in):	>	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>	3										
Lco	Curb opening length provided (ft)	>											
Ls	Slotted drain length provided: (ft)	>											
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
	Available Flooded Width (ft)	>	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**-----**	**6.30**	**6.15**	**6.06**	**5.55**	**6.99**	**5.78**	**5.86**	**6.18**	**6.29**	**8.41**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**-----**	**3.95**	**3.74**	**3.61**	**2.96**	**4.90**	**3.22**	**3.34**	**3.79**	**3.94**	**6.70**
Du/s	Depth at flowline before inlet (ft)		-----	0.18	0.18	0.18	0.16	0.20	0.17	0.17	0.18	0.18	0.24
Au/s	Water cross-area before inlet (ft^2):		-----	0.31	0.30	0.29	0.24	0.40	0.26	0.27	0.30	0.31	0.61
Vu/s	Velocity for total discharge before inlet (ft/s)		-----	1.87	1.76	1.65	1.57	1.60	5.97	2.35	1.87	1.81	0.88
Eod	Ratio of gutter depression flow to total Q (Eod)		-----	99%	100%	100%	100%	97%	100%	100%	100%	99%	89%
Se	Equivalent cross-slope (ft/ft):		-----	0.054	0.055	0.055	0.055	0.054	0.055	0.055	0.055	0.055	0.051
GRATE INLETS ON-GRADE:													
Eog	Ratio of grate frontal flow to total flow:		-----	64%	65%	66%	70%	59%	68%	67%	65%	64%	51%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		-----	0.37	0.34	0.31	0.26	0.38	1.05	0.42	0.36	0.36	0.27
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		-----	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		-----	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		-----	0.21	0.18	0.16	0.11	0.26	0.50	0.21	0.20	0.20	0.26
Gle	Effective grate length w/ 25% clogging (in):		-----	27	27	27	27	27	27	27	27	27	27
Rs	Fraction of side flow interception (Rs):		-----	43%	46%	49%	51%	50%	9%	34%	43%	45%	73%
E	Grate Efficiency (E):		-----	79%	81%	82%	85%	79%	71%	78%	80%	80%	87%
Qi	**Total flow intercepted (ft^3/s):**		**-----**	**0.46**	**0.42**	**0.39**	**0.32**	**0.51**	**1.09**	**0.49**	**0.45**	**0.45**	**0.46**
Qb	**Grate flow-by (ft^3/s):**		**-----**	**0.12**	**0.10**	**0.08**	**0.06**	**0.13**	**0.46**	**0.14**	**0.11**	**0.11**	**0.07**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)													
Lt	Length required for total interception (ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
El	Efficiency for providged length L:		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:													
	Grate Inlets												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		0.13	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		0.16	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		4.52	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		5.97	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Slotted drains												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets												
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft)	>	400.00										
g1	approach grade #1 (%):	>	-7.00										
g2	approach grade #2 (%):	>	0.50										
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		53	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		32.29	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

East-West Connector Project

New Roadway Drainage Inlet Calculations- LT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"
In#	**Inlet number:**									
		(Input Data Required)								
HYDROLOGY COMPUTATION:										
	Begin Station		81+85	82+75	84+50	85+09	85+75	86+50	87+54	88+00
	End Station		82+75	83+75	83+75	84+50	85+09	85+75	86+50	87+54
St	Structure location station:	>>	82+75	83+20	83+75	84+50	85+09	85+75	86+50	87+54
N	Notes		->	LP	<-	<-	<-	<-	<-	<-
	Off-site contributing watershed area (acres):	>>	0.05	0.02	0.04	0.28	0.17	0.15	0.26	0.04
	On-site contributing watershed area (acres)	>>	0.11	0.13	0.10	0.09	0.08	0.10	0.14	0.23
Ar	**Contributing watershed area (acres):**		**0.16**	**0.15**	**0.14**	**0.37**	**0.25**	**0.26**	**0.41**	**0.28**
C	Composite Runoff Coefficient "C":	>>	0.87	0.89	0.87	0.82	0.83	0.84	0.83	0.88
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		0.55	0.51	0.48	1.19	0.81	0.86	1.34	0.97
qq	Previous by-pass flow (ft^3/s):	>	0.03	0.05	0.13	0.03	0.04	0.11	0.04	0.19
Qadd	Discharge added by operator (ft3/s)	>								
Qt	**Total discharge Q (ft^3/s):**		**0.58**	**0.56**	**0.62**	**1.21**	**0.85**	**0.96**	**1.38**	**1.16**
SHOULDER AND GUTTER CONFIGURATION:										
n	Manning's n:	>>	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0048	0.0019	0.0041	0.0098	0.0146	0.0167	0.0221	0.0283
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1	1	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	2	1	1	1	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1	1	1	1	1	1	1
Gw	Grate width (in):	>	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>		3						
Lco	Curb opening length provided (ft)	>								
Ls	Slotted drain length provided: (ft)	>								
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in)	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
	Available Flooded Width (ft)	>	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**6.76**	**-----**	**7.12**	**7.78**	**6.32**	**6.46**	**7.01**	**6.26**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**4.59**	**-----**	**5.07**	**5.94**	**3.98**	**4.18**	**4.93**	**3.91**
Du/s	Depth at flowline before inlet (ft)		0.20	-----	0.21	0.22	0.18	0.19	0.20	0.18
Au/s	Water cross-area before inlet (ft^2):		0.37	-----	0.41	0.51	0.31	0.33	0.40	0.31
Vu/s	Velocity for total discharge before inlet (ft/s)		1.59	-----	1.50	2.39	2.70	2.91	3.45	3.73
Eod	Ratio of gutter depression flow to total Q (Eod)		98%	-----	96%	93%	99%	99%	97%	99%
Se	Equivalent cross-slope (ft/ft)		0.054	-----	0.053	0.052	0.054	0.054	0.054	0.055
GRATE INLETS ON-GRADE:										
Eog	Ratio of grate frontal flow to total flow:		92%	-----	89%	84%	95%	94%	90%	96%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.54	-----	0.55	1.02	0.81	0.91	1.24	1.11
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	-----	8.73	8.73	8.73	8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	-----	1.00	1.00	1.00	1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.05	-----	0.07	0.20	0.04	0.05	0.14	0.05
Gle	Effective grate length w/ 25% clogging (in):		27	-----	27	27	27	27	27	27
Rs	Fraction of side flow interception (Rs):		50%	-----	53%	32%	28%	25%	20%	18%
E	Grate Efficiency (E):		96%	-----	95%	89%	97%	96%	92%	97%
Qi	**Total flow intercepted (ft^3/s):**		**0.56**	**-----**	**0.59**	**1.08**	**0.82**	**0.92**	**1.27**	**1.12**
Qb	**Grate flow-by (ft^3/s):**		**0.02**	**-----**	**0.03**	**0.13**	**0.03**	**0.04**	**0.11**	**0.04**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE:	**(No clogging factor)**									
Lt	Length required for total interception (ft):		-----	-----	-----	-----	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----	-----	-----	-----	-----	-----
El	Efficiency for providged length L:		-----	-----	-----	-----	-----	-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:										
	Grate Inlets									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	0.12	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	0.14	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	3.64	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	4.90	-----	-----	-----	-----	-----	-----
	Slotted drains									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets									
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft)	>		200.00						
g1	approach grade #1 (%):	>		-0.90						
g2	approach grade #2 (%):	>		0.33						
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	163	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	51.94	-----	-----	-----	-----	-----	-----

East-West Connector Project

New Roadway Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"	"NR"
In#	**Inlet number:**												
	(Input Data Required)												
HYDROLOGY COMPUTATION:													
	Begin Station		70+50	72+01	74+99	78+49	79+00	81+80	82+75	84+50	85+09	86+50	87+54
	End Station		69+75	70+50	72+01	74+99	81+80	82+75	83+75	83+75	84+50	85+09	86+50
St	Structure location station:	>>	69+75	70+50	72+01	74+99	81+80	82+75	83+20	83+75	84+50	85+09	86+50
N	Notes		<-	<-	<-	HP	->	->	LP	<-	<-	<-	<-
	Off-site contributing watershed area (acres):	>>	0.00	0.00	0.00	0.25	0.00	0.03	0.04	0.03	0.03	0.08	0.08
	On-site contributing watershed area (acres)	>>	0.09	0.22	0.34	0.32	0.27	0.15	0.17	0.13	0.12	0.22	0.22
Ar	**Contributing watershed area (acres):**		**0.09**	**0.22**	**0.34**	**0.58**	**0.27**	**0.18**	**0.21**	**0.16**	**0.15**	**0.30**	**0.31**
C	Composite Runoff Coefficient "C":	>>	0.90	0.90	0.90	0.78	0.90	0.88	0.88	0.88	0.88	0.87	0.87
Ic	Precipitation intensity (in/hr):	>>	4.41	4.41	4.41	4.41	3.94	3.94	3.94	3.94	3.94	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		0.35	0.87	1.36	1.97	0.95	0.64	0.73	0.56	0.50	1.02	1.05
qq	Previous by-pass flow (ft^3/s):	>	0.41	0.46	0.13			0.07	0.07	0.01	0.07	0.04	0.00
Qadd	Discharge added by operator (ft3/s)	>											
Qt	**Total discharge Q (ft^3/s):**		**0.76**	**1.33**	**1.50**	**1.97**	**0.95**	**0.71**	**0.80**	**0.57**	**0.57**	**1.06**	**1.05**
SHOULDER AND GUTTER CONFIGURATION:													
n	Manning's n:	>>	0.015	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0253	0.0331	0.0491	0.0500	0.0090	0.0044	0.0004	0.0044	0.0098	0.0145	0.0219
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1	1	1	1	1	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1	1	1	1	2	1	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	2	2	2	1	1	1	1	1	1	1	1
Gw	Grate width (in):	>	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>							3	3	3		
Lco	Curb opening length provided (ft)	>											
Ls	Slotted drain length provided: (ft	>											
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in)	>	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
	Available Flooded Width (ft)	>	8.00	8.00	8.00	8.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**5.33**	**6.26**	**6.07**	**6.71**	**7.20**	**7.39**	**-----**	**6.81**	**5.87**	**6.86**	**6.34**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**2.84**	**3.91**	**3.64**	**4.53**	**5.19**	**5.43**	**-----**	**4.66**	**3.35**	**4.74**	**4.01**
Du/s	Depth at flowline before inlet (ft)		0.16	0.18	0.18	0.19	0.21	0.21	-----	0.20	0.17	0.20	0.18
Au/s	Water cross-area before inlet (ft^2):		0.22	0.31	0.29	0.36	0.43	0.45	-----	0.37	0.27	0.38	0.32
Vu/s	Velocity for total discharge before inlet (ft/s)		3.43	4.31	5.17	5.45	2.23	1.57	-----	1.53	2.13	2.78	3.31
Eod	Ratio of gutter depression flow to total Q (Eod)		100%	99%	100%	98%	96%	95%	-----	98%	100%	97%	99%
Se	Equivalent cross-slope (ft/ft)		0.055	0.055	0.055	0.054	0.053	0.053	-----	0.054	0.055	0.054	0.054
GRATE INLETS ON-GRADE:													
Eog	Ratio of grate frontal flow to total flow:		71%	64%	66%	93%	89%	87%	-----	92%	98%	91%	95%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.54	0.85	0.98	1.82	0.84	0.62	-----	0.52	0.56	0.97	1.00
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73	8.73	8.73	8.73	8.73	-----	8.73	8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00	1.00	1.00	1.00	1.00	-----	1.00	1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.22	0.48	0.52	0.15	0.11	0.09	-----	0.05	0.01	0.09	0.05
Gle	Effective grate length w/ 25% clogging (in)		27	27	27	27	27	27	-----	27	27	27	27
Rs	Fraction of side flow interception (Rs):		20%	14%	11%	10%	35%	50%	-----	52%	38%	27%	21%
E	Grate Efficiency (E):		77%	69%	69%	93%	93%	94%	-----	96%	99%	94%	96%
Qi	**Total flow intercepted (ft^3/s):**		**0.59**	**0.92**	**1.04**	**1.84**	**0.88**	**0.66**	**-----**	**0.55**	**0.56**	**0.99**	**1.01**
Qb	**Grate flow-by (ft^3/s):**		**0.17**	**0.41**	**0.46**	**0.13**	**0.07**	**0.05**	**-----**	**0.02**	**0.01**	**0.07**	**0.04**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)													
Lt	Length required for total interception (ft):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
El	Efficiency for providged length L		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**	**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:													
	Grate Inlets												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	0.15	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	0.18	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	5.20	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	6.79	-----	-----	-----	-----
	Slotted drains												
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets												
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft)		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft)	>							200.00				
g1	approach grade #1 (%):	>							-9.00				
g2	approach grade #2 (%):	>							0.33				
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----	-----	-----	-----	21	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----	-----	-----	-----	18.86	-----	-----	-----	-----

East-West Connector Project

New Roadway Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"NR"
In#	**Inlet number:**		
			(Input Data Required)
	HYDROLOGY COMPUTATION:		
	Begin Station		88+74
	End Station		87+54
St	Structure location station:	>>	87+54
N	Notes		<-
	Off-site contributing watershed area (acres):	>>	0.00
	On-site contributing watershed area (acres)	>>	0.12
Ar	**Contributing watershed area (acres):**		**0.12**
C	Composite Runoff Coefficient "C":	>>	0.90
Ic	Precipitation intensity (in/hr):	>>	3.94
Qa	Subarea discharge Q (ft^3/s):		0.43
qq	Previous by-pass flow (ft^3/s):	>	
Qadd	Discharge added by operator (ft3/s)	>	
Qt	**Total discharge Q (ft^3/s):**		**0.43**
	SHOULDER AND GUTTER CONFIGURATION:		
n	Manning's n:	>>	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0520
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1
ID	Inlet description:	>	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1
Gw	Grate width (in):	>	24.0
Gl	Grate length (in):	>	36.0
	3 or 4 sided weir?	>	
Lco	Curb opening length provided (ft)	>	
Ls	Slotted drain length provided: (ft)	>	
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200
W	Width of gutter from flowline (in):	>	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055
	Available Flooded Width (ft)	>	6.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**3.86**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**2.05**
Du/s	Depth at flowline before inlet (ft):		0.11
Au/s	Water cross-area before inlet (ft^2):		0.12
Vu/s	Velocity for total discharge before inlet (ft/s)		3.72
Eod	Ratio of gutter depression flow to total Q (Eod)		100%
Se	Equivalent cross-slope (ft/ft):		0.055
	GRATE INLETS ON-GRADE:		
Eog	Ratio of grate frontal flow to total flow:		100%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.43
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00
Qs	Side flow in ft^3/s (Qs):		0.00
Gle	Effective grate length w/ 25% clogging (in):		27
Rs	Fraction of side flow interception (Rs):		18%
E	Grate Efficiency (E):		100%
Qi	**Total flow intercepted (ft^3/s):**		**0.43**
Qb	**Grate flow-by (ft^3/s):**		**0.00**
	SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)		
Lt	Length required for total interception (ft):		-----
Ci	Interception for provided length L (ft^3/s):		-----
EI	Efficiency for providged length L:		-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**
	INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:		
	Grate Inlets		
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----
	Slotted drains		
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----
	Curb opening inlets		
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----
Lc	Length of the vertical curve (ft)	>	
g1	approach grade #1 (%):	>	
g2	approach grade #2 (%):	>	
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----
Df	Flanking inlets distance (ft):		-----

East-West Connector Project

Quarry Lakes Roadway Drainage Inlet Calculations- LT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"QL"	"QL"	"QL"
In#	**Inlet number:**				
		(Input Data Required)			
HYDROLOGY COMPUTATION:					
	Begin Station		545+68	549+00	551+00
	End Station		546+33	546+49	549+00
St	Structure location station:	>>	546+33	546+49	549+00
N	Notes		<-	<-	<-
	Off-site contributing watershed area (acres):	>>	0.00	0.00	0.00
	On-site contributing watershed area (acres)	>>	0.07	0.23	0.13
Ar	**Contributing watershed area (acres):**		**0.07**	**0.23**	**0.13**
C	Composite Runoff Coefficient "C":	>>	0.90	0.90	0.90
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		0.24	0.82	0.47
qq	Previous by-pass flow (ft^3/s):	>	0.11	0.15	
Qadd	Discharge added by operator (ft3/s)	>			
Qt	**Total discharge Q (ft^3/s):**		**0.36**	**0.97**	**1.10**
SHOULDER AND GUTTER CONFIGURATION:					
n	Manning's n:	>>	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0030	0.0030	0.0030
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1	1
Gw	Grate width (in):	>	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0
	3 or 4 sided weir?	>			
Lco	Curb opening length provided (ft)	>			
Ls	Slotted drain length provided: (ft)	>			
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055
	Available Flooded Width (ft)	>	6.00	6.00	6.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**6.14**	**8.92**	**9.37**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**3.72**	**7.33**	**7.86**
Du/s	Depth at flowline before inlet (ft):		0.18	0.25	0.26
Au/s	Water cross-area before inlet (ft^2):		0.29	0.69	0.77
Vu/s	Velocity for total discharge before inlet (ft/s)		1.21	1.39	1.42
Eod	Ratio of gutter depression flow to total Q (Eod)		100%	85%	83%
Se	Equivalent cross-slope (ft/ft):		0.055	0.050	0.049
GRATE INLETS ON-GRADE:					
Eog	Ratio of grate frontal flow to total flow:		97%	75%	71%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.34	0.72	0.79
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.01	0.25	0.31
Gle	Effective grate length w/ 25% clogging (in):		27	27	27
Rs	Fraction of side flow interception (Rs):		63%	54%	53%
E	Grate Efficiency (E):		99%	88%	86%
Qi	**Total flow intercepted (ft^3/s):**		**0.35**	**0.85**	**0.95**
Qb	**Grate flow-by (ft^3/s):**		**0.00**	**0.11**	**0.15**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE:	**(No clogging factor)**				
Lt	Length required for total interception (ft):		-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----
El	Efficiency for providged length L:		-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:					
	Grate Inlets				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Slotted drains				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Curb opening inlets				
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
Lc	Length of the vertical curve (ft)	>			
g1	approach grade #1 (%):	>			
g2	approach grade #2 (%):	>			
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----

East-West Connector Project

Quarry Lakes Roadway Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

In#					
	Layout Line:		"QL"	"QL"	"QL"
In#	**Inlet number:**				
		(Input Data Required)			
	HYDROLOGY COMPUTATION:				
	Begin Station		545+68	549+00	551+00
	End Station		546+33	546+49	549+00
St	Structure location station:	>>	546+33	546+49	549+00
N	Notes		<-	<-	<-
	Off-site contributing watershed area (acres):	>>	0.02	0.14	0.00
	On-site contributing watershed area (acres)	>>	0.07	0.25	0.19
Ar	**Contributing watershed area (acres):**		**0.09**	**0.39**	**0.19**
C	Composite Runoff Coefficient "C":	>>	0.87	0.86	0.90
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		0.32	1.34	0.67
qq	Previous by-pass flow (ft^3/s):	>	0.27	0.15	
Qadd	Discharge added by operator (ft3/s)	>			
Qt	**Total discharge Q (ft^3/s):**		**0.59**	**1.49**	**1.10**
	SHOULDER AND GUTTER CONFIGURATION:				
n	Manning's n:	>>	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0030	0.0030	0.0030
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1	1
Gw	Grate width (in):	>	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0
	3 or 4 sided weir?	>			
Lco	Curb opening length provided (ft)	>			
Ls	Slotted drain length provided: (ft)	>			
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055
	Available Flooded Width (ft)	>	8.00	8.00	8.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**7.42**	**10.49**	**9.37**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**5.46**	**9.15**	**7.86**
Du/s	Depth at flowline before inlet (ft):		0.21	0.29	0.26
Au/s	Water cross-area before inlet (ft^2):		0.45	0.99	0.77
Vu/s	Velocity for total discharge before inlet (ft/s)		1.30	1.50	1.42
Eod	Ratio of gutter depression flow to total Q (Eod)		95%	76%	83%
Se	Equivalent cross-slope (ft/ft):		0.053	0.046	0.049
	GRATE INLETS ON-GRADE:				
Eog	Ratio of grate frontal flow to total flow:		87%	64%	71%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.51	0.95	0.79
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.08	0.54	0.31
Gle	Effective grate length w/ 25% clogging (in):		27	27	27
Rs	Fraction of side flow interception (Rs):		59%	49%	53%
E	Grate Efficiency (E):		95%	82%	86%
Qi	**Total flow intercepted (ft^3/s):**		**0.56**	**1.21**	**0.95**
Qb	**Grate flow-by (ft^3/s):**		**0.03**	**0.27**	**0.15**
	SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)				
Lt	Length required for total interception (ft):		-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----
El	Efficiency for providged length L:		-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**
	INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:				
	Grate Inlets				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Slotted drains				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Curb opening inlets				
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
Lc	Length of the vertical curve (ft)	>			
g1	approach grade #1 (%):	>			
g2	approach grade #2 (%):	>			
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----

East-West Connector Project

Alvarado Niles Roadway Drainage Inlet Calculations- LT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"ANR"	"ANR"
In#	**Inlet number:**			
		(Input Data Required)		
	HYDROLOGY COMPUTATION:			
	Begin Station		754+36	757+14
	End Station		752+53	755+50
St	Structure location station:	>>	752+53	755+50
N	Notes		<-	<-
	Off-site contributing watershed area (acres):	>>	0.00	0.21
	On-site contributing watershed area (acres)	>>	0.23	0.22
Ar	**Contributing watershed area (acres):**		**0.23**	**0.43**
C	Composite Runoff Coefficient "C":	>>	0.90	0.85
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		0.80	1.46
qq	Previous by-pass flow (ft^3/s):	>		
Qadd	Discharge added by operator (ft3/s)	>		
Qt	**Total discharge Q (ft^3/s):**		**0.80**	**1.46**
	SHOULDER AND GUTTER CONFIGURATION:			
n	Manning's n:	>>	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0003	0.0003
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1
Gw	Grate width (in):	>	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0
	3 or 4 sided weir?	>		
Lco	Curb opening length provided (ft)	>		
Ls	Slotted drain length provided: (ft)	>		
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055
	Available Flooded Width (ft)	>	5.00	6.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**12.83**	**16.02**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**11.74**	**15.17**
Du/s	Depth at flowline before inlet (ft):		0.34	0.41
Au/s	Water cross-area before inlet (ft^2):		1.54	2.46
Vu/s	Velocity for total discharge before inlet (ft/s)		0.52	0.59
Eod	Ratio of gutter depression flow to total Q (Eod)		64%	52%
Se	Equivalent cross-slope (ft/ft):		0.042	0.038
	GRATE INLETS ON-GRADE:			
Eog	Ratio of grate frontal flow to total flow:		52%	41%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.42	0.59
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.39	0.86
Gle	Effective grate length w/ 25% clogging (in):		27	27
Rs	Fraction of side flow interception (Rs):		85%	81%
E	Grate Efficiency (E):		93%	89%
Qi	**Total flow intercepted (ft^3/s):**		**0.75**	**1.29**
Qb	**Grate flow-by (ft^3/s):**		**0.06**	**0.17**
	SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)			
Lt	Length required for total interception (ft):		-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----
El	Efficiency for providged length L:		-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**
	INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:			
	Grate Inlets			
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
	Slotted drains			
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
	Curb opening inlets			
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
Lc	Length of the vertical curve (ft)	>		
g1	approach grade #1 (%):	>		
g2	approach grade #2 (%):	>		
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----
Df	Flanking inlets distance (ft):		-----	-----

East-West Connector Project

Alvarado Niles Roadway Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"ANR"	"ANR"
In#	**Inlet number:**			
	(Input Data Required)			
	HYDROLOGY COMPUTATION:			
	Begin Station		754+36	760+48
	End Station		752+53	755+51
St	Structure location station:	>>	752+53	755+51
N	Notes		<-	<-
	Off-site contributing watershed area (acres):	>>	0.00	0.00
	On-site contributing watershed area (acres)	>>	0.25	0.39
Ar	**Contributing watershed area (acres):**		**0.25**	**0.39**
C	Composite Runoff Coefficient "C":	>>	0.90	0.90
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		0.90	1.38
qq	Previous by-pass flow (ft^3/s):	>		
Qadd	Discharge added by operator (ft3/s)	>		
Qt	**Total discharge Q (ft^3/s):**		**0.90**	**1.38**
	SHOULDER AND GUTTER CONFIGURATION:			
n	Manning's n:	>>	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0003	0.0003
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1
Gw	Grate width (in):	>	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0
	3 or 4 sided weir?	>		
Lco	Curb opening length provided (ft)	>		
Ls	Slotted drain length provided: (ft)	>		
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055
	Available Flooded Width (ft)	>	6.00	5.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**13.36**	**15.68**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**12.33**	**14.81**
Du/s	Depth at flowline before inlet (ft):		0.35	0.40
Au/s	Water cross-area before inlet (ft^2):		1.68	2.35
Vu/s	Velocity for total discharge before inlet (ft/s)		0.54	0.59
Eod	Ratio of gutter depression flow to total Q (Eod)		62%	53%
Se	Equivalent cross-slope (ft/ft):		0.041	0.038
	GRATE INLETS ON-GRADE:			
Eog	Ratio of grate frontal flow to total flow:		50%	42%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.45	0.57
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.45	0.80
Gle	Effective grate length w/ 25% clogging (in):		27	27
Rs	Fraction of side flow interception (Rs):		85%	81%
E	Grate Efficiency (E):		92%	89%
Qi	**Total flow intercepted (ft^3/s):**		**0.83**	**1.23**
Qb	**Grate flow-by (ft^3/s):**		**0.07**	**0.15**
	SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)			
Lt	Length required for total interception (ft):		-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----
El	Efficiency for providged length L:		-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**
	INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:			
	Grate Inlets			
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
	Slotted drains			
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
	Curb opening inlets			
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft)		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
Lc	Length of the vertical curve (ft)	>		
g1	approach grade #1 (%):	>		
g2	approach grade #2 (%):	>		
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----
Df	Flanking inlets distance (ft):		-----	-----

East-West Connector Project

11th Street Drainage Inlet Calculations- LT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"ES"	"ES"	"ES"
In#	**Inlet number:**				
		(Input Data Required)			
HYDROLOGY COMPUTATION:					
	Begin Station		658+35	661+00	664+00
	End Station		661+00	664+00	664+85
St	Structure location station:	>>	661+00	664+00	664+85
N	Notes		->	->	->
	Off-site contributing watershed area (acres):	>>	0.00	0.00	0.00
	On-site contributing watershed area (acres)	>>	0.28	0.28	0.08
Ar	**Contributing watershed area (acres):**		**0.28**	**0.28**	**0.08**
C	Composite Runoff Coefficient "C":	>>	0.90	0.90	0.90
Ic	Precipitation intensity (in/hr):	>>	4.41	4.41	4.41
Qa	Subarea discharge Q (ft^3/s):		1.13	1.12	0.30
qq	Previous by-pass flow (ft^3/s):	>		0.16	0.20
Qadd	Discharge added by operator (ft3/s)	>			
Qt	**Total discharge Q (ft^3/s):**		**1.13**	**1.28**	**0.50**
SHOULDER AND GUTTER CONFIGURATION:					
n	Manning's n:	>>	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0030	0.0030	0.0030
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1	1
Gw	Grate width (in):	>	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0
	3 or 4 sided weir?	>			
Lco	Curb opening length provided (ft)	>			
Ls	Slotted drain length provided: (ft)	>			
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055
	Available Flooded Width (ft)	>	5.00	5.00	5.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**9.46**	**9.91**	**6.98**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**7.97**	**8.49**	**4.88**
Du/s	Depth at flowline before inlet (ft):		0.26	0.27	0.20
Au/s	Water cross-area before inlet (ft^2):		0.79	0.88	0.39
Vu/s	Velocity for total discharge before inlet (ft/s)		1.43	1.46	1.27
Eod	Ratio of gutter depression flow to total Q (Eod)		82%	79%	97%
Se	Equivalent cross-slope (ft/ft):		0.048	0.048	0.054
GRATE INLETS ON-GRADE:					
Eog	Ratio of grate frontal flow to total flow:		71%	68%	91%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.80	0.86	0.45
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.33	0.41	0.05
Gle	Effective grate length w/ 25% clogging (in):		27	27	27
Rs	Fraction of side flow interception (Rs):		52%	51%	60%
E	Grate Efficiency (E):		86%	84%	96%
Qi	**Total flow intercepted (ft^3/s):**		**0.97**	**1.08**	**0.48**
Qb	**Grate flow-by (ft^3/s):**		**0.16**	**0.20**	**0.02**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE:	**(No clogging factor)**				
Lt	Length required for total interception (ft):		-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----
El	Efficiency for providged length L:		-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:					
	Grate Inlets				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Slotted drains				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Curb opening inlets				
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
Lc	Length of the vertical curve (ft)	>			
g1	approach grade #1 (%):	>			
g2	approach grade #2 (%):	>			
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----

East-West Connector Project

11th Street Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"ES"	"ES"	"ES"
In#	**Inlet number:**				
		(Input Data Required)			
	HYDROLOGY COMPUTATION:				
	Begin Station		658+35	661+00	664+00
	End Station		661+00	664+00	664+85
St	Structure location station:	>>	661+00	664+00	664+85
N	Notes		->	->	->
	Off-site contributing watershed area (acres):	>>	0.00	0.00	0.00
	On-site contributing watershed area (acres)	>>	0.29	0.39	0.10
Ar	**Contributing watershed area (acres):**		**0.29**	**0.39**	**0.10**
C	Composite Runoff Coefficient "C":	>>	0.90	0.90	0.90
Ic	Precipitation intensity (in/hr):	>>	4.41	4.41	4.41
Qa	Subarea discharge Q (ft^3/s):		1.13	1.56	0.41
qq	Previous by-pass flow (ft^3/s):	>		0.16	0.36
Qadd	Discharge added by operator (ft3/s)	>			
Qt	**Total discharge Q (ft^3/s):**		**1.13**	**1.72**	**0.77**
	SHOULDER AND GUTTER CONFIGURATION:				
n	Manning's n:	>>	0.016	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.0030	0.0030	0.0030
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1	1
Gw	Grate width (in):	>	24.0	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0	36.0
	3 or 4 sided weir?	>			
Lco	Curb opening length provided (ft)	>			
Ls	Slotted drain length provided: (ft)	>			
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055	0.055
	Available Flooded Width (ft)	>	5.00	8.00	8.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**9.48**	**11.08**	**8.20**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**7.99**	**9.82**	**6.45**
Du/s	Depth at flowline before inlet (ft):		0.26	0.30	0.23
Au/s	Water cross-area before inlet (ft^2):		0.79	1.12	0.57
Vu/s	Velocity for total discharge before inlet (ft/s)		1.43	1.54	1.35
Eod	Ratio of gutter depression flow to total Q (Eod)		82%	73%	90%
Se	Equivalent cross-slope (ft/ft):		0.048	0.045	0.051
	GRATE INLETS ON-GRADE:				
Eog	Ratio of grate frontal flow to total flow:		71%	60%	80%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.80	1.04	0.62
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.33	0.68	0.15
Gle	Effective grate length w/ 25% clogging (in):		27	27	27
Rs	Fraction of side flow interception (Rs):		52%	47%	56%
E	Grate Efficiency (E):		86%	79%	91%
Qi	**Total flow intercepted (ft^3/s):**		**0.98**	**1.36**	**0.71**
Qb	**Grate flow-by (ft^3/s):**		**0.16**	**0.36**	**0.07**
	SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)				
Lt	Length required for total interception (ft):		-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----	-----
El	Efficiency for providged length L:		-----	-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**	**-----**
	INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:				
	Grate Inlets				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Slotted drains				
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
	Curb opening inlets				
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----
Lc	Length of the vertical curve (ft)	>			
g1	approach grade #1 (%):	>			
g2	approach grade #2 (%):	>			
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----

East-West Connector Project

Mission Boulevard Drainage Inlet Calculations- LT

Job: **P0727**

Designed by: Claire Coughlan **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata **Date:** 3/20/2009

	Layout Line:		"MB"
In#	**Inlet number:**		
			(Input Data Required)
HYDROLOGY COMPUTATION:			
	Begin Station		388+62
	End Station		393+76
St	Structure location station:	>>	393+76
N	Notes		->
	Off-site contributing watershed area (acres):	>>	**0.31**
	On-site contributing watershed area (acres)	>>	1.18
Ar	**Contributing watershed area (acres):**		**1.49**
C	Composite Runoff Coefficient "C":	>>	0.88
Ic	Precipitation intensity (in/hr):	>>	3.94
Qa	Subarea discharge Q (ft^3/s):		5.17
qq	Previous by-pass flow (ft^3/s):	>	
Qadd	Discharge added by operator (ft3/s)	>	
Qt	**Total discharge Q (ft^3/s):**		**5.17**
SHOULDER AND GUTTER CONFIGURATION:			
n	Manning's n:	>>	0.016
S	Longitudinal slope S (ft/ft):	>>	0.003
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1
ID	Inlet description:	>	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1
Gw	Grate width (in):	>	24.0
Gl	Grate length (in):	>	36.0
	3 or 4 sided weir?	>	
Lco	Curb opening length provided (ft)	>	
Ls	Slotted drain length provided: (ft)	>	
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200
W	Width of gutter from flowline (in):	>	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055
	Available Flooded Width (ft)	>	5.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**16.73**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**15.92**
Du/s	Depth at flowline before inlet (ft):		0.42
Au/s	Water cross-area before inlet (ft^2):		2.69
Vu/s	Velocity for total discharge before inlet (ft/s)		1.92
Eod	Ratio of gutter depression flow to total Q (Eod)		50%
Se	Equivalent cross-slope (ft/ft):		0.037
GRATE INLETS ON-GRADE:			
Eog	Ratio of grate frontal flow to total flow:		39%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		2.00
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00
Qs	Side flow in ft^3/s (Qs):		3.17
Gle	Effective grate length w/ 25% clogging (in):		27
Rs	Fraction of side flow interception (Rs):		33%
E	Grate Efficiency (E):		59%
Qi	**Total flow intercepted (ft^3/s):**		**3.05**
Qb	**Grate flow-by (ft^3/s):**		**2.12**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE:		**(No clogging factor)**	
Lt	Length required for total interception (ft):		-----
Ci	Interception for provided length L (ft^3/s):		-----
EI	Efficiency for providged length L:		-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:			
	Grate Inlets		
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----
	Slotted drains		
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----
	Curb opening inlets		
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----
Lc	Length of the vertical curve (ft)	>	
g1	approach grade #1 (%):	>	
g2	approach grade #2 (%):	>	
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----
Df	Flanking inlets distance (ft):		-----

East-West Connector Project

Mission Boulevard Drainage Inlet Calculations- RT

Job: **P0727**

Designed by: Claire Coughlan ☐ **Date:** 3/6/2009
Checked by: Analette Ochoa, Steven Nagata ☐ **Date:** 3/20/2009

	Layout Line:		"MB"	"MB"
In#	**Inlet number:**			
	(Input Data Required)			
HYDROLOGY COMPUTATION:				
	Begin Station		386+22	388+20
	End Station		387+43	393+76
St	Structure location station:	>>	387+43	393+76
N	Notes		->	->
	Off-site contributing watershed area (acres):	>>	**0.18**	**0.13**
	On-site contributing watershed area (acres)	>>	0.19	0.59
Ar	**Contributing watershed area (acres):**		**0.37**	**0.72**
C	Composite Runoff Coefficient "C":	>>	0.85	0.88
Ic	Precipitation intensity (in/hr):	>>	3.94	3.94
Qa	Subarea discharge Q (ft^3/s):		1.23	2.52
qq	Previous by-pass flow (ft^3/s):	>		
Qadd	Discharge added by operator (ft3/s)	>		
Qt	**Total discharge Q (ft^3/s):**		**1.23**	**2.52**
SHOULDER AND GUTTER CONFIGURATION:				
n	Manning's n:	>>	0.016	0.016
S	Longitudinal slope S (ft/ft):	>>	0.003	0.003
IT	Inlet type (1=grate, 2=curb opening, 3=slotted)	>>	1	1
LP	Longitudinal profile (1=on-grade, 2=sag)	>>	1	1
ID	Inlet description:	>	Type 1 DI	Type 1 DI
	Standard Gutter Depression (1=SGD, 2=no SGD	>	1	1
Gw	Grate width (in):	>	24.0	24.0
Gl	Grate length (in):	>	36.0	36.0
	3 or 4 sided weir?	>		
Lco	Curb opening length provided (ft)	>		
Ls	Slotted drain length provided: (ft)	>		
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0200
W	Width of gutter from flowline (in):	>	36.0	36.0
a(t)	Gutter depression from horizontal (in)	>	1.25	1.25
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter		0.055	0.055
	Available Flooded Width (ft)	>	8.00	8.00
Tu/s	**Flooded Width from flowline (ft): at inlet w/o gutter depression**		**9.77**	**12.77**
Tu/s	**Flooded Width from flowline (ft): at inlet w/ gutter depression**		**8.34**	**11.69**
Du/s	Depth at flowline before inlet (ft):		0.27	0.34
Au/s	Water cross-area before inlet (ft^2):		0.85	1.52
Vu/s	Velocity for total discharge before inlet (ft/s)		1.45	1.65
Eod	Ratio of gutter depression flow to total Q (Eod)		80%	64%
Se	Equivalent cross-slope (ft/ft):		0.048	0.042
GRATE INLETS ON-GRADE:				
Eog	Ratio of grate frontal flow to total flow:		69%	52%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		0.84	1.31
Vo	Vo for effective length (P-50, Chart 5) (ft/s)		8.73	8.73
Rf	Fraction of frontal flow intercepted (Rf):		1.00	1.00
Qs	Side flow in ft^3/s (Qs):		0.39	1.21
Gle	Effective grate length w/ 25% clogging (in):		27	27
Rs	Fraction of side flow interception (Rs):		51%	42%
E	Grate Efficiency (E):		85%	72%
Qi	**Total flow intercepted (ft^3/s):**		**1.04**	**1.82**
Qb	**Grate flow-by (ft^3/s):**		**0.19**	**0.69**
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)				
Lt	Length required for total interception (ft):		-----	-----
Ci	Interception for provided length L (ft^3/s):		-----	-----
El	Efficiency for providged length L:		-----	-----
Qs	**Slotted drain or side opening flow-by (ft^3/s):**		**-----**	**-----**
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:				
	Grate Inlets			
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
	Slotted drains			
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
	Curb opening inlets			
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft)		-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft)		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----
Lc	Length of the vertical curve (ft)	>		
g1	approach grade #1 (%):	>		
g2	approach grade #2 (%):	>		
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22)		-----	-----
Df	Flanking inlets distance (ft):		-----	-----

Appendix G Pavement Calculations

WRECO

PROJECT

Pavement Calculations

Job:

Profile Grade Line		Left Shoulder						Right Shoulder							
PGL Station (ft)	PGL Elev. (ft)	t Shldr Elev (w/o gd) (ft)	Lt Shldr Super. (%)	Lt Shldr Width (ft)	Lt TW Super. (%)	Lt TW Width (ft)	U/S Slope (ft/ft)	Rt Shldr Elev (w/o gd) (ft)	Rt Shldr Super. (%)	Rt Shldr Width (ft)	Rt TW Super. (%)	Rt TW Width (ft)	U/S Slope (ft/ft)	/C Dir- Chg+-	Sx
10+00.	43.81	43.727	-5.56	1.5			0.0281	43.727	-5.56	1.5			0.0345	43.727	4.38%
11+00.	47.81	46.537	-5.56	1.5	-2.00	59.5	0.0371	47.177	-5.56	1.5	-2.00	27.5	0.0371	2.810	4.00%
12+00.	51.52	50.251	-5.56	1.5	-2.00	59.5	0.0136	50.891	-5.56	1.5	-2.00	27.5	0.0136	3.714	3.71%
12+93.13	52.79	51.520	-5.56	1.5	-2.00	59.5	0.0127	52.160	-5.56	1.5	-2.00	27.5	0.0009		
13+00.	52.79	51.514	-5.56	1.5	-2.00	59.5	0.0009	52.154	-5.56	1.5	-2.00	27.5	0.0009	1.263	1.26%
14+00.	51.44	50.163	-5.56	1.5	-2.00	59.5	0.0135	50.803	-5.56	1.5	-2.00	27.5	0.0135	-1.351	-1.35%
15+00.	49.64	48.363	-5.56	1.5	-2.00	59.5	0.0180	49.003	-5.56	1.5	-2.00	27.5	0.0180	-1.800	-1.80%
15+49.	48.75	47.481	-5.56	1.5	-2.00	59.5	0.0180	48.121	-5.56	1.5	-2.00	27.5	0.0180	-0.882	-1.80%
15+50.	48.74	47.463	-5.56	1.5	-2.00	59.5	0.0180	48.103	-5.56	1.5	-2.00	27.5	0.0180	-0.018	-1.80%
16+00.	47.88	47.006	-5.56	1.5	-2.00	39.5	0.0091	47.246	-5.56	1.5	-2.00	27.5	0.0171	-0.457	-1.71%
16+50.	47.17	46.300	-5.56	1.5	-2.00	39.5	0.0141	46.540	-5.56	1.5	-2.00	27.5	0.0141	-0.706	-1.41%
17+00.	46.62	45.751	-5.56	1.5	-2.00	39.5	0.0110	45.991	-5.56	1.5	-2.00	27.5	0.0110	-0.549	-1.10%
17+98.77	46.00	45.125	-5.56	1.5	-2.00	39.5	0.0063	45.365	-5.56	1.5	-2.00	27.5	0.0063	-0.626	-0.63%
18+00.	45.99	45.121	-5.56	1.5	-2.00	39.5	0.0032	45.361	-5.56	1.5	-2.00	27.5	0.0032	-0.004	-0.32%
18+01.32	45.99	45.117	-5.56	1.5	-2.00	39.5	0.0031	45.357	-5.56	1.5	-2.00	27.5	0.0031	-0.004	-0.31%
18+75.	45.93	45.059	-5.56	1.5	-2.00	39.5	0.0008	45.299	-5.56	1.5	-2.00	27.5	0.0008	-0.058	-0.08%
19+00.	45.70	44.816	-5.56	1.5	-2.00	39.8	0.0097	45.062	-5.56	1.5	-2.00	27.5	0.0095	-0.243	-0.95%
19+50.	45.55	44.666	-5.56	1.5	-2.00	39.8	0.0030	44.912	-5.56	1.5	-2.00	27.5	0.0030	-0.150	-0.30%
20+00.	45.40	44.508	-5.56	1.5	-2.00	40.2	0.0032	44.762	-5.56	1.5	-2.00	27.5	0.0030	-0.158	-0.30%
20+26.	45.32	44.430	-5.56	1.5	-2.00	40.2	0.0030	44.684	-5.56	1.5	-2.00	27.5	0.0030	-0.236	-0.30%
20+77.	45.16	44.277	-5.56	1.5	-2.00	40.2	0.0030	44.531	-5.56	1.5	-2.00	27.5	0.0030	-0.231	-0.30%
21+00.	45.10	44.204	-5.56	1.5	-2.00	40.4	0.0032	44.202	-5.56	1.5	-2.00	40.5	0.0143	-0.304	-0.30%
21+02.4	45.09	44.195	-5.56	1.5	-2.00	40.5	0.0038	44.195	-5.56	1.5	-2.00	40.5	0.0030	-0.009	-0.30%
21+06.41	45.08	44.185	-5.56	1.5	-2.00	40.4	0.0025	44.183	-5.56	1.5	-2.00	40.5	0.0030	-0.010	-0.30%
22+00.	44.80	43.902	-5.56	1.5	-2.00	40.5	0.0030	43.902	-5.56	1.5	-2.00	40.5	0.0030	-0.283	-0.30%
23+00.	44.50	43.602	-5.56	1.5	-2.00	40.5	0.0030	43.602	-5.56	1.5	-2.00	40.5	0.0030	-0.300	-0.30%
24+00.	44.20	43.302	-5.56	1.5	-2.00	40.5	0.0030	43.302	-5.56	1.5	-2.00	40.5	0.0030	-0.300	-0.30%
25+00.	43.90	43.002	-5.56	1.5	-2.00	40.5	0.0030	43.002	-5.56	1.5	-2.00	40.5	0.0030	-0.300	-0.30%
26+00.	43.60	42.702	-5.56	1.5	-2.00	40.5	0.0030	42.702	-5.56	1.5	-2.00	40.5	0.0030	-0.300	-0.30%
27+00.	43.30	42.402	-5.56	1.5	-2.00	40.5	0.0030	42.402	-5.56	1.5	-2.00	40.5	0.0030	-0.300	-0.30%
27+10.25	43.26	42.371	-5.56	1.5	-2.00	40.5	0.0030	42.371	-5.56	1.5	-2.00	40.5	0.0030	-0.031	-0.30%
27+12.34	43.26	42.365	-5.56	1.5	-2.00	40.5	0.0030	42.365	-5.56	1.5	-2.00	40.5	0.0030	-0.006	-0.30%
28+00.	43.00	42.102	-5.56	1.5	-2.00	40.5	0.0030	42.102	-5.56	1.5	-2.00	40.5	0.0030	-0.263	-0.30%
28+99.37	42.70	41.804	-5.56	1.5	-2.00	40.5	0.0030	41.804	-5.56	1.5	-2.00	40.5	0.0030	-0.298	-0.30%
29+00.	42.70	41.802	-5.56	1.5	-2.00	40.5	0.0030	41.802	-5.56	1.5	-2.00	40.5	0.0030	-0.002	-0.30%
29+00.89	42.69	41.799	-5.56	1.5	-2.00	40.5	0.0030	41.799	-5.56	1.5	-2.00	40.5	0.0030	-0.003	-0.30%
30+00.	42.40	41.502	-5.56	1.5	-2.00	40.5	0.0030	41.502	-5.56	1.5	-2.00	40.5	0.0030	-0.297	-0.30%
30+19.	42.34	41.445	-5.56	1.5	-2.00	40.5	0.0030	41.445	-5.56	1.5	-2.00	40.5	0.0030	-0.057	-0.30%
30+44.	42.26	41.370	-5.56	1.5	-2.00	40.5	0.0030	41.370	-5.56	1.5	-2.00	40.5	0.0030	-0.075	-0.30%
31+00.	42.09	41.201	-5.56	1.5	-2.00	40.5	0.0030	41.201	-5.56	1.5	-2.00	40.5	0.0030	-0.301	-0.30%
31+15.	42.05	41.157	-5.56	1.5	-2.00	40.5	0.0029	41.157	-5.56	1.5	-2.00	40.5	0.0029	-0.288	-0.30%
31+99.73	41.86	40.963	-5.56	1.5	-2.00	40.5	0.0023	40.963	-5.56	1.5	-2.00	40.5	0.0023	-0.238	-0.24%
32+00.	41.86	40.962	-5.56	1.5	-2.00	40.5	0.0018	40.962	-5.56	1.5	-2.00	40.5	0.0018	0.000	-0.18%
32+00.24	41.86	40.962	-5.56	1.5	-2.00	40.5	0.0018	40.962	-5.56	1.5	-2.00	40.5	0.0018	0.000	-0.18%
33+00.	41.74	40.844	-5.56	1.5	-2.00	40.5	0.0012	40.844	-5.56	1.5	-2.00	40.5	0.0012	-0.118	-0.12%
33+48.9	41.72	40.830	-5.56	1.5	-2.00	40.5	0.0003	40.830	-5.56	1.5	-2.00	40.5	0.0003	-0.014	-0.03%
34+00.	41.74	40.845	-5.56	1.5	-2.00	40.5	0.0008	40.845	-5.56	1.5	-2.00	40.5	0.0008	0.016	0.03%
34+26.	41.76	40.865	-5.56	1.5	-2.00	40.5	0.0014	40.865	-5.56	1.5	-2.00	40.5	0.0014	0.020	0.08%
35+00.	41.86	40.967	-5.56	1.5	-2.00	40.5	0.0021	40.967	-5.56	1.5	-2.00	40.5	0.0021	0.122	0.12%
35+43.	41.95	41.056	-5.56	1.5	-2.00	40.5	0.0027	41.056	-5.56	1.5	-2.00	40.5	0.0027	0.191	0.16%
36+00.	42.10	41.208	-5.56	1.5	-2.00	40.5	0.0030	41.208	-5.56	1.5	-2.00	40.5	0.0030	0.241	0.24%
36+75.	42.33	41.433	-5.56	1.5	-2.00	40.5	0.0030	41.433	-5.56	1.5	-2.00	40.5	0.0030	0.377	0.29%
37+00.	42.40	41.508	-5.56	1.5	-2.00	40.5	0.0030	41.508	-5.56	1.5	-2.00	40.5	0.0030	0.300	0.30%
37+35.	42.51	41.613	-5.56	1.5	-2.00	40.5	0.0030	41.613	-5.56	1.5	-2.00	40.5	0.0030	0.180	0.30%
37+99.55	42.70	41.807	-5.56	1.5	-2.00	40.5	0.0030	41.807	-5.56	1.5	-2.00	40.5	0.0030	0.299	0.30%
38+00.	42.70	41.808	-5.56	1.5	-2.00	40.5	0.0030	41.808	-5.56	1.5	-2.00	40.5	0.0030	0.001	0.30%
38+00.93	42.70	41.811	-5.56	1.5	-2.00	40.5	0.0030	41.811	-5.56	1.5	-2.00	40.5	0.0030	0.003	0.30%
39+00.	43.00	42.108	-5.56	1.5	-2.00	40.5	0.0030	42.108	-5.56	1.5	-2.00	40.5	0.0030	0.297	0.30%
39+50.	43.15	42.258	-5.56	1.5	-2.00	40.5	0.0030	42.258	-5.56	1.5	-2.00	40.5	0.0030	0.150	0.30%
40+00.	43.30	42.408	-5.56	1.5	-2.00	40.5	0.0030	42.408	-5.56	1.5	-2.00	40.5	0.0030	0.300	0.30%
40+75.	43.53	42.633	-5.56	1.5	-2.00	40.5	0.0030	42.633	-5.56	1.5	-2.00	40.5	0.0030	0.225	0.30%

WRECO

PROJECT

Pavement Calculations

Job:

Profile Grade Line		Left Shoulder						Right Shoulder							
PGL Station (ft)	PGL Elev. (ft)	Lt Shldr Elev (w/o gd) (ft)	Lt Shldr Super. (%)	Lt Shldr Width (ft)	Lt TW Super. (%)	Lt TW Width (ft)	U/S Slope (ft/ft)	Rt Shldr Elev (w/o gd) (ft)	Rt Shldr Super. (%)	Rt Shldr Width (ft)	Rt TW Super. (%)	Rt TW Width (ft)	U/S Slope (ft/ft)	/C Dir-Chg+-	Sx
41+00.	43.60	42.708	-5.56	1.5	-2.00	40.5	0.0030	42.708	-5.56	1.5	-2.00	40.5	0.0030	0.300	0.30%
42+00.	43.90	43.008	-5.56	1.5	-2.00	40.5	0.0030	43.008	-5.56	1.5	-2.00	40.5	0.0030	0.300	0.30%
42+25.	43.98	43.083	-5.56	1.5	-2.00	40.5	0.0030	43.083	-5.56	1.5	-2.00	40.5	0.0030	0.075	0.30%
43+00.	44.20	43.308	-5.56	1.5	-2.00	40.5	0.0030	43.308	-5.56	1.5	-2.00	40.5	0.0030	0.225	0.30%
43+04.	44.21	43.320	-5.56	1.5	-2.00	40.5	0.0030	43.320	-5.56	1.5	-2.00	40.5	0.0030	0.012	0.30%
43+53.91	44.36	43.470	-5.56	1.5	-2.00	40.5	0.0030	43.470	-5.56	1.5	-2.00	40.5	0.0030	0.150	0.30%
44+00.	44.50	43.608	-5.56	1.5	-2.00	40.5	0.0030	43.608	-5.56	1.5	-2.00	40.5	0.0030	0.138	0.30%
44+09.	44.53	43.635	-5.56	1.5	-2.00	40.5	0.0030	43.635	-5.56	1.5	-2.00	40.5	0.0030	0.027	0.30%
44+79.	44.74	43.845	-5.56	1.5	-2.00	40.5	0.0030	43.845	-5.56	1.5	-2.00	40.5	0.0030	0.210	0.30%
45+00.	44.80	43.908	-5.56	1.5	-2.00	40.5	0.0030	43.908	-5.56	1.5	-2.00	40.5	0.0030	0.300	0.30%
45+50.	44.95	44.058	-5.56	1.5	-2.00	40.5	0.0030	44.058	-5.56	1.5	-2.00	40.5	0.0030	0.423	0.30%
45+99.59	45.10	44.207	-5.56	1.5	-2.00	40.5	0.0030	44.207	-5.56	1.5	-2.00	40.5	0.0030	0.299	0.30%
46+00.	45.10	44.208	-5.56	1.5	-2.00	40.5	0.0030	44.208	-5.56	1.5	-2.00	40.5	0.0030	0.001	0.30%
46+00.75	45.10	44.211	-5.56	1.5	-2.00	40.5	0.0030	44.211	-5.56	1.5	-2.00	40.5	0.0030	0.002	0.30%
47+00.	45.40	44.508	-5.56	1.5	-2.00	40.5	0.0030	44.508	-5.56	1.5	-2.00	40.5	0.0030	0.298	0.30%
47+25.	45.48	44.583	-5.56	1.5	-2.00	40.5	0.0030	44.583	-5.56	1.5	-2.00	40.5	0.0030	0.075	0.30%
47+78.	45.64	44.742	-5.56	1.5	-2.00	40.5	0.0030	44.742	-5.56	1.5	-2.00	40.5	0.0112	0.159	0.30%
48+00.	45.70	44.808	-5.56	1.5	-2.00	40.5	0.0030	44.988	-5.56	1.5	-2.00	31.5	0.0030	0.300	0.30%
48+52.09	45.86	44.965	-5.56	1.5	-2.00	40.5	0.0030	45.145	-5.56	1.5	-2.00	31.5	0.0030	0.156	0.30%
48+53.91	45.86	44.970	-5.56	1.5	-2.00	40.5	0.0030	45.150	-5.56	1.5	-2.00	31.5	0.0010	0.005	0.30%
49+00.	46.00	45.108	-5.56	1.5	-2.00	40.5	0.0030	45.102	-5.56	1.5	-2.00	40.8	0.0010	0.138	0.30%
49+50.	46.15	45.258	-5.56	1.5	-2.00	40.5	0.0030	45.170	-5.56	1.5	-2.00	44.9	0.0011	0.150	0.30%
50+00.	46.30	45.408	-5.56	1.5	-2.00	40.5	0.0030	45.224	-5.56	1.5	-2.00	49.7	0.0009	0.300	0.30%
50+81.	46.54	45.651	-5.56	1.5	-2.00	40.5	0.0030	45.297	-5.56	1.5	-2.00	58.2	0.0026	0.243	0.30%
50+75.	46.53	45.633	-5.56	1.5	-2.00	40.5	0.0030	45.173	-5.56	1.5	-2.00	63.5	0.0207	-0.018	0.30%
51+00.	46.60	45.968	-5.56	1.5	-2.00	27.5	0.0030	45.248	-5.56	1.5	-2.00	63.5	0.0026	0.335	0.30%
51+25.	46.68	46.043	-5.56	1.5	-2.00	27.5	0.0030	45.323	-5.56	1.5	-2.00	63.5	0.0030	0.075	0.30%
51+99.51	46.90	46.267	-5.56	1.5	-2.00	27.5	0.0030	45.547	-5.56	1.5	-2.00	63.5	0.0030	0.299	0.30%
51+99.85	46.90	46.268	-5.56	1.5	-2.00	27.5	0.0030	45.548	-5.56	1.5	-2.00	63.5	0.0030	0.001	0.30%
52+00.	46.90	46.268	-5.56	1.5	-2.00	27.5	0.0030	45.548	-5.56	1.5	-2.00	63.5	0.0030	0.000	0.30%
52+25.	46.98	46.343	-5.56	1.5	-2.00	27.5	0.0030	45.623	-5.56	1.5	-2.00	63.5	0.0030	0.075	0.30%
52+75.	47.13	46.493	-5.56	1.5	-2.00	27.5	0.0030	45.773	-5.56	1.5	-2.00	63.5	0.0030	0.150	0.30%
53+00.	47.20	46.568	-5.56	1.5	-2.00	27.5	0.0034	45.848	-5.56	1.5	-2.00	63.5	0.0039	0.075	0.30%
53+29.	47.29	46.666	-5.56	1.5	-1.96	27.5	0.0287	45.961	-5.56	1.5	-1.96	63.5	0.0623	0.098	0.30%
53+50.	47.35	47.268	-5.56	1.5	-2.00		0.0178	47.268	-5.56	1.5	-2.00		0.0178	0.700	0.30%
54+00.	48.24	48.156	-5.56	1.5	-2.00		0.0241	48.156	-5.56	1.5	-2.00		0.0241	0.888	1.78%
54+35.	49.08	49.000	-5.56	1.5	-2.00		0.0279	49.000	-5.56	1.5	-2.00		0.0279	0.843	2.41%
55+00.	47.27	47.184	-5.56	1.5	-2.00		0.0279	47.184	-5.56	1.5	-2.00		0.0279	-1.815	-2.79%
55+25.	46.30	46.215	-5.56	1.5	0.00		0.0388	46.215	-5.56	1.5	0.00		0.0388	-0.970	-3.88%
55+50.	45.10	45.019	-5.56	1.5		51.5	0.0478	45.019	-5.56	1.5	-2.00		0.0478	-2.165	-4.33%
56+00.	39.72	40.027	-5.56	1.5	0.75	51.5	0.0999	39.262	-5.56	1.5	-0.75	50.5	0.1152	-4.993	-10.76%
56+50.	36.22	36.141	-5.56	1.5		51.5	0.0777	35.131	-5.56	1.5	-2.00	50.5	0.0826	-3.886	-7.00%
57+00.	35.09	35.910	-5.56	1.5	1.75	51.5	0.0046	34.125	-5.56	1.5	-1.75	50.5	0.0201	-0.230	-2.26%
57+70.	30.98	31.798	-5.56	1.5	1.75	51.5	0.0588	30.013	-5.56	1.5	-1.75	50.5	0.0588	-4.113	-5.88%
58+00.	29.50	30.529	0.00	0.0	2.00	51.5	0.0423	28.479	0.00	0.0	-2.00	51.0	0.0511	-1.269	-4.94%
58+44.	27.63	28.662	0.00	0.0	2.00	51.5	0.0424	26.612	0.00	0.0	-2.00	51.0	0.0424	-1.867	-4.24%
59+00.	25.78	25.780	0.00	9.0	2.00	0.0	0.0515	24.770	0.00	0.0	-2.00	50.5	0.0329	-2.882	-3.31%
59+45.29	24.71	24.713	0.00	9.0	2.00	0.0	0.0236	23.703	0.00	0.0	-2.00	50.5	0.0236	-1.067	-2.36%
60+00.	23.94	23.936	0.00	9.0	2.00	0.0	0.0142	22.926	0.00	0.0	-2.00	50.5	0.0142	-0.776	-1.42%
60+25.	23.77	23.768	0.00	9.0	2.00	0.0	0.0067	22.758	0.00	0.0	-2.00	50.5	0.0067	-0.168	-0.67%
60+50.	23.72	23.718	0.00	9.0	2.00	0.0	0.0020	22.678	0.00	0.0	-2.00	52.0	0.0032	-0.219	-0.44%
60+75.	23.79	23.785	0.00	9.0	2.00	0.0	0.0050	22.745	0.00	0.0	-2.00	52.0	0.0062	0.067	0.27%
61+00.	23.91	23.910	0.00	9.0	2.00	0.0	0.0050	22.900	0.00	0.0	-2.00	50.5	0.0044	0.192	0.38%
61+50.	24.16	24.160	0.00	9.0	2.00	0.0	0.0050	23.120	0.00	0.0	-2.00	52.0	0.0056	0.250	0.50%
62+00.	24.41	24.410	0.00	9.0	2.00	0.0	0.0050	23.400	0.00	0.0	-2.00	50.5	0.0050	0.250	0.50%
62+30.	24.56	24.560	0.00	9.0	2.00	0.0	0.0050	23.550	0.00	0.0	-2.00	50.5	0.0050	0.150	0.50%
63+00.	24.91	24.910	0.00	9.0	2.00	0.0	0.0050	23.900	0.00	0.0	-2.00	50.5	0.0050	0.500	0.50%
63+15.	24.99	24.985	0.00	9.0	2.00	0.0	0.0050	23.975	0.00	0.0	-2.00	50.5	0.0050	0.425	0.50%
63+60.	25.21	25.210	0.00	9.0	2.00	0.0	0.0050	24.200	0.00	0.0	-2.00	50.5	0.0042	0.800	0.50%
63+99.53	25.41	25.408	0.00	9.0	2.00	0.0	0.0050	24.368	0.00	0.0	-2.00	52.0	0.0688	0.198	0.50%
64+00.	25.41	25.410	0.00	9.0	2.00	0.0	0.0050	24.400	0.00	0.0	-2.00	50.5	0.0050	0.002	0.50%
65+00.	25.91	25.910	0.00	9.0	2.00	0.0	0.0050	24.900	0.00	0.0	-2.00	50.5	0.0050	0.500	0.50%

WRECO

PROJECT

Pavement Calculations

Job:

Profile Grade Line		Left Shoulder						Right Shoulder							
PGL Station (ft)	PGL Elev. (ft)	Lt Shldr Elev (w/o gd) (ft)	Lt Shldr Super. (%)	Lt Shldr Width (ft)	Lt TW Super. (%)	Lt TW Width (ft)	U/S Slope (ft/ft)	Rt Shldr Elev (w/o gd) (ft)	Rt Shldr Super. (%)	Rt Shldr Width (ft)	Rt TW Super. (%)	Rt TW Width (ft)	U/S Slope (ft/ft)	/C Dir- Chg+-	Sx
65+50.	26.16	26.160	0.00	9.0	2.00	0.0	0.0050	25.150	0.00	0.0	-2.00	50.5	0.0050	0.250	0.50%
66+00.	26.41	26.410	0.00	9.0	2.00	0.0	0.0050	25.400	0.00	0.0	-2.00	50.5	0.0050	0.500	0.50%
66+53.14	26.68	26.676	0.00	9.0	2.00	0.0	0.3182	25.666	0.00	0.0	-2.00	50.5	0.3102	0.266	0.50%
66+58.14	28.27	28.267	0.00	9.0	2.00	0.0	0.0114	27.217	0.00	0.0	-2.00	52.5	0.0105	1.591	31.82%
67+00.	27.79	27.789	0.00	9.0	2.00	0.0	0.0114	26.779	0.00	0.0	-2.00	50.5	0.0105	-0.478	-1.14%
67+50.	27.48	27.476	0.00	9.0	2.00	0.0	0.0063	26.466	0.00	0.0	-2.00	50.5	0.0063	-0.313	-0.63%
67+75.	27.43	27.426	0.00	9.0	2.00	0.0	0.0020	26.416	0.00	0.0	-2.00	50.5	0.0020	-0.363	-0.48%
68+00.	27.45	27.445	0.00	9.0	2.00	0.0	0.0033	26.435	0.00	0.0	-2.00	50.5	0.0033	-0.344	-0.34%
68+20.	27.51	27.511	0.00	9.0	2.00	0.0	0.0058	26.501	0.00	0.0	-2.00	50.5	0.0058	0.035	0.05%
68+45.	27.66	27.658	0.00	9.0	2.00	0.0	0.0089	26.648	0.00	0.0	-2.00	50.5	0.0089	0.212	0.47%
68+75.	27.93	27.926	0.00	9.0	2.00	0.0	0.0120	26.916	0.00	0.0	-2.00	50.5	0.0120	0.268	0.89%
69+00.	28.23	28.226	0.00	9.0	2.00	0.0	0.0136	27.216	0.00	0.0	-2.00	50.5	0.0011	0.781	0.78%
69+03.4	28.27	28.273	0.00	9.0	2.00	0.0	0.0178	27.213	0.00	0.0	-2.00	53.0	0.0011	0.046	1.36%
69+75.	29.55	29.551	0.00	9.0	2.00	0.0	0.0233	28.491	0.00	0.0	-2.00	53.0	0.0253	1.278	1.78%
70+00.	30.13	30.133	0.00	9.0	2.00	0.0	0.0274	29.123	0.00	0.0	-2.00	50.5	0.0274	1.860	1.93%
70+49.	31.48	31.477	0.00	9.0	2.00	0.0	0.0303	30.467	0.00	0.0	-2.00	50.5	0.0303	1.345	2.74%
70+50.	31.51	31.508	0.00	9.0	2.00	0.0	0.0331	30.498	0.00	0.0	-2.00	50.5	0.0331	1.375	2.75%
71+00.	33.16	33.164	0.00	9.0	2.00	0.0	0.0415	32.154	0.00	0.0	-2.00	50.5	0.0415	3.031	3.03%
71+99.45	37.29	37.294	0.00	9.0	2.00	0.0	0.0472	36.284	0.00	0.0	-2.00	50.5	0.0472	4.130	4.15%
72+00.	37.32	37.320	0.00	9.0	2.00	0.0	0.0473	36.310	0.00	0.0	-2.00	50.5	0.2040	0.026	4.72%
72+01.34	37.38	37.383	0.00	9.0	1.17	0.0	0.0446	36.583	0.00	0.0	-2.00	40.0	0.0491	0.063	4.73%
73+00.	42.28	41.784	-5.56	9.0	0.00	0.0	0.0445	41.431	-5.56	1.5	-2.00	38.5	0.0500	4.400	4.97%
74+00.	47.28	46.236	-5.56	9.0	-1.50	36.5	0.0482	46.431	-5.56	1.5	-2.00	38.5	0.0500	4.453	5.00%
74+98.83	52.23	50.995	-5.56	9.0	-2.00	36.5	0.0500	51.372	-5.56	1.5	-2.00	38.5	0.0500	4.759	5.00%
75+00.	52.28	51.054	-5.56	9.0	-2.00	36.5	0.0500	51.431	-5.56	1.5	-2.00	38.5	0.0500	0.059	5.00%
76+00.	57.28	56.054	-5.56	9.0	-2.00	36.5	0.0575	56.431	-5.56	1.5	-2.00	38.5	0.0575	5.000	5.00%
77+00.	51.54	50.305	-5.56	9.0	-2.00	36.5	0.0575	50.682	-5.56	1.5	-2.00	38.5	0.0575	-5.749	-5.75%
78+00.	52.09	51.272	-5.56	1.5	-2.00	36.5	0.0029	51.232	-5.56	1.5	-2.00	38.5	0.0017	0.967	0.55%
78+49.	52.17	51.415	-5.56	1.5	-2.00	33.5	0.0002	51.315	-5.56	1.5	-2.00	38.5	0.0002	0.143	0.17%
78+56.25	52.17	51.416	-5.56	1.5	-2.00	33.5	0.0141	51.316	-5.56	1.5	-2.00	38.5	0.0164		
79+00.	52.12	52.035	-5.56	1.5	-2.00		0.0037	52.035	-5.56	1.5	-2.00		0.0037	0.763	0.03%
79+50.	51.94	51.852	-5.56	1.5	-2.00		0.0037	51.852	-5.56	1.5	-2.00		0.0037		
80+00.	51.62	50.785	-5.56	1.5	-2.00	37.5	0.0213	51.053	-5.56	1.5	-2.00	24.1	0.0160	-1.250	-0.50%
80+50.	51.17	50.335	-5.56	1.5	-2.00	37.5	0.0090	50.603	-5.56	1.5	-2.00	24.1	0.0090	-1.517	-0.77%
81+00.	50.74	49.912	-5.56	1.5	-2.00	37.0	0.0085	49.966	-5.56	1.5	-2.00	34.3	0.0127	-0.873	-0.88%
81+67.	50.13	49.309	-5.56	1.5	-2.00	37.0	0.0090	49.363	-5.56	1.5	-2.00	34.3	0.0090	-0.603	-0.90%
81+80.	50.02	49.192	-5.56	1.5	-2.00	37.0	0.0090	49.246	-5.56	1.5	-2.00	34.3	0.0090	-0.117	-0.90%
81+81.	50.01	49.183	-5.56	1.5	-2.00	37.0	0.0090	49.237	-5.56	1.5	-2.00	34.3	0.0090	-0.009	-0.90%
82+00.	50.86	50.038	-5.56	1.5	-2.00	37.0	0.0048	50.060	-5.56	1.5	-2.00	35.9	0.0048	0.127	0.13%
82+75.	50.50	49.675	-5.56	1.5	-2.00	37.0	0.0048	49.697	-5.56	1.5	-2.00	35.9	0.0048	0.366	0.34%
83+00.	50.45	49.630	-5.56	1.5	-2.00	37.0	0.0018	49.320	-5.56	1.5	-2.00	52.5	0.0151	-0.408	-0.41%
83+20.	50.45	49.632	-5.56	1.5	-2.00	36.5	0.0019	49.312	-5.56	1.5	-2.00	52.5	0.0004		
83+75.	50.55	49.738	-5.56	1.5	-2.00	36.5	0.0041	49.418	-5.56	1.5	-2.00	52.5	0.0044		
84+00.	50.66	49.841	-5.56	1.5	-2.00	36.8	0.0067	49.527	-5.56	1.5	-2.00	52.5	0.0067	0.211	0.21%
84+50.	50.99	50.175	-5.56	1.5	-2.00	36.8	0.0098	49.861	-5.56	1.5	-2.00	52.5	0.0098	0.543	0.42%
85+00.	51.48	50.663	-5.56	1.5	-2.00	36.8	0.0122	50.349	-5.56	1.5	-2.00	52.5	0.0100	0.822	0.82%
85+09.	51.59	50.773	-5.56	1.5	-2.00	36.5	0.0139	50.439	-5.56	1.5	-2.00	53.2	0.0138	0.110	1.16%
85+75.	52.50	51.689	-5.56	1.5	-2.00	36.5	0.0167	51.348	-5.56	1.5	-2.00	53.6	0.0164	0.916	1.39%
86+00.	52.92	52.106	-5.56	1.5	-2.00	36.5	0.0190	51.758	-5.56	1.5	-2.00	53.9	0.0190	1.443	1.44%
86+50.	53.87	53.055	-5.56	1.5	-2.00	36.5	0.0221	52.707	-5.56	1.5	-2.00	53.9	0.0219	2.282	1.62%
87+00.	54.97	54.158	-5.56	1.5	-2.00	36.5	0.0253	53.802	-5.56	1.5	-2.00	54.3	0.0252	2.052	2.05%

Appendix H Watershed Maps

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY: RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY: ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

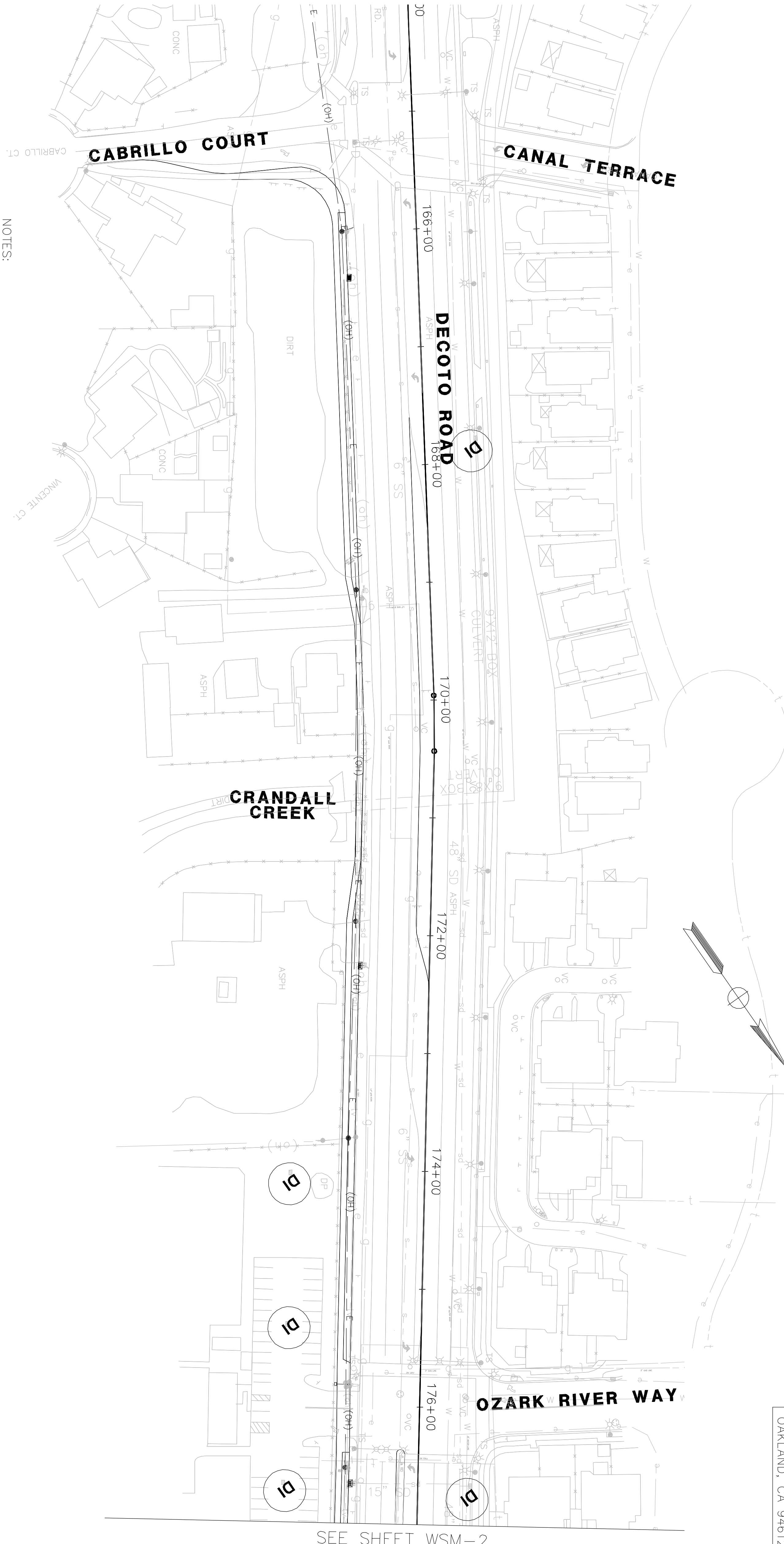
UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

LEGEND

PROPOSED WATERSHEDS

NOTES:

1. THIS PLAN ACCURATE FOR DRAINAGE WORK ONLY.



SEE SHEET WSM-2

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-1

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

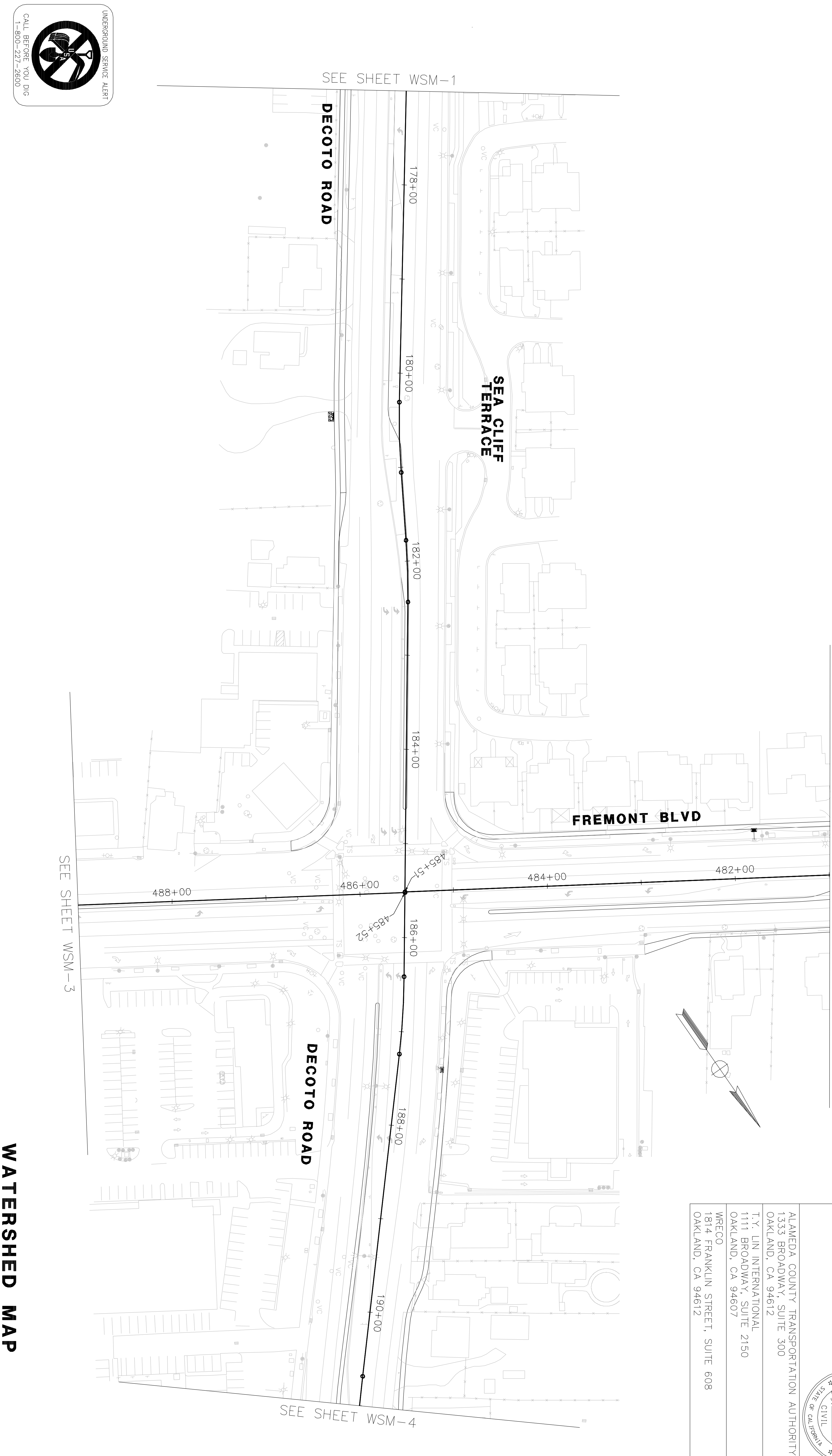
T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM01.dwg   Mar 31, 2009, 6:42pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-2

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER
XX-XX-XX

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

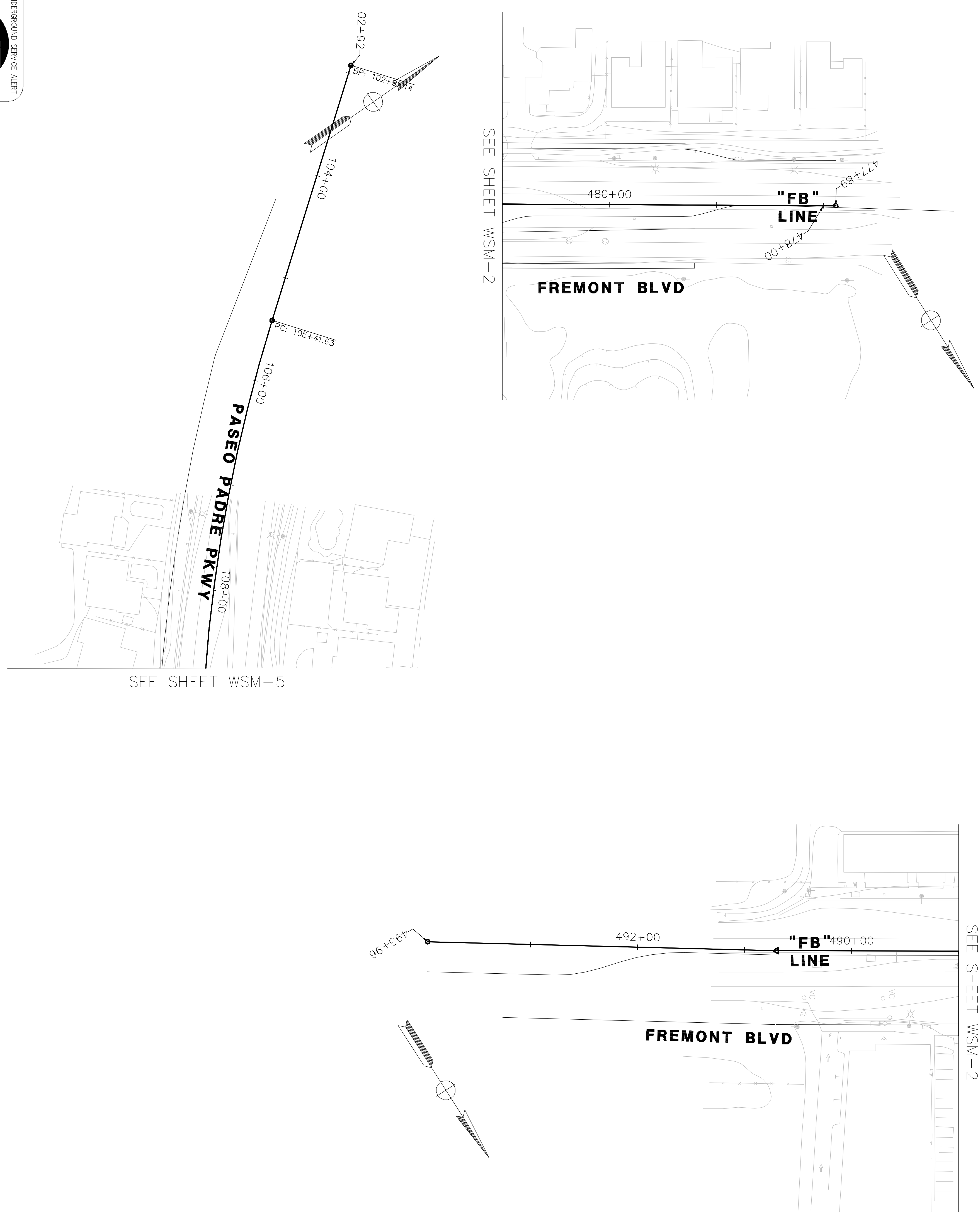
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM02.dwg Mar 31, 2009, 6:43pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-3

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER XX-XX-XX

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

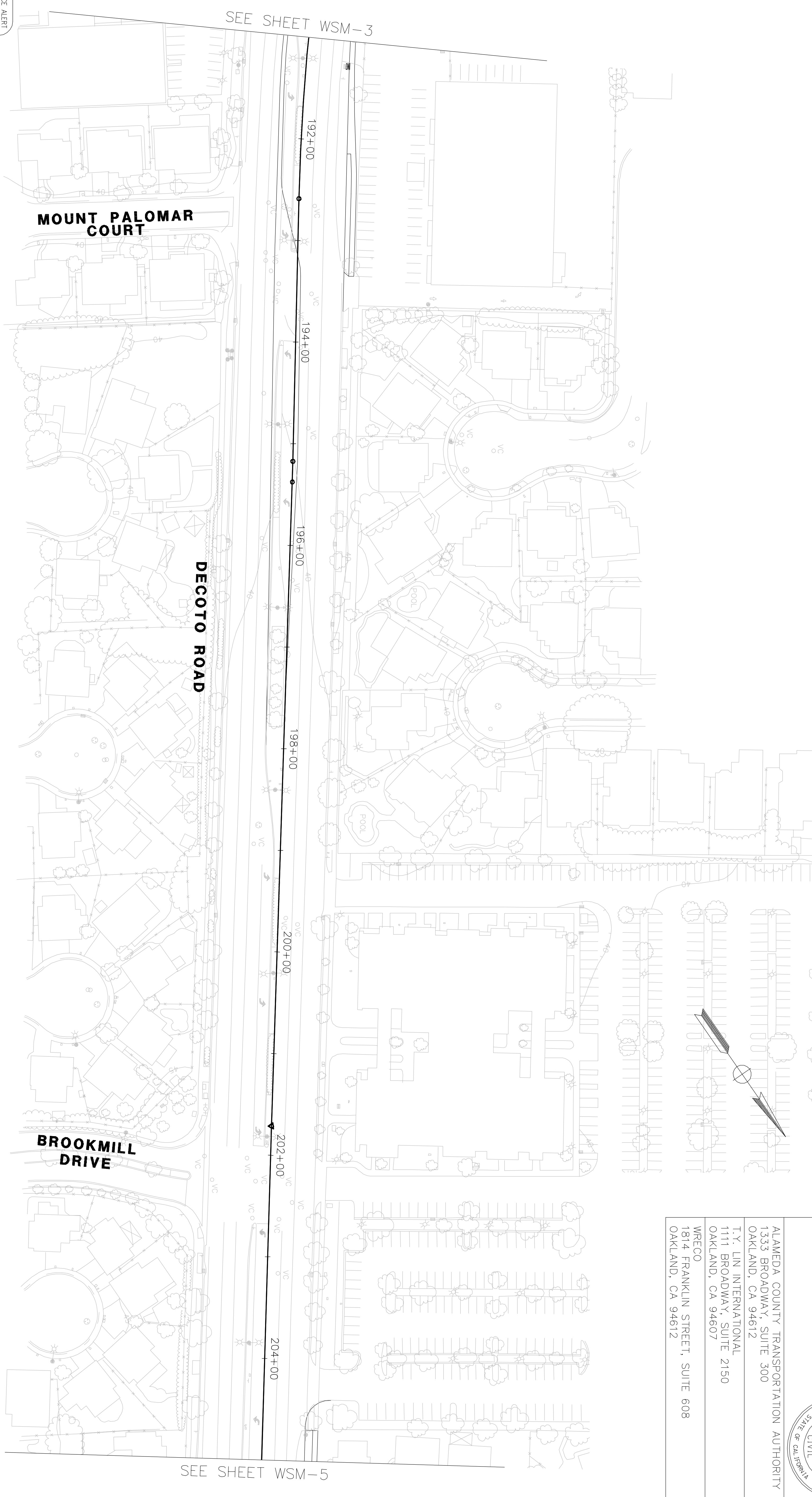
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM03.dwg Mar 31, 2009, 6:45pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES
0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

EA 000000

WATERSHED MAP

SCALE 1"=50'

WSM-4

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

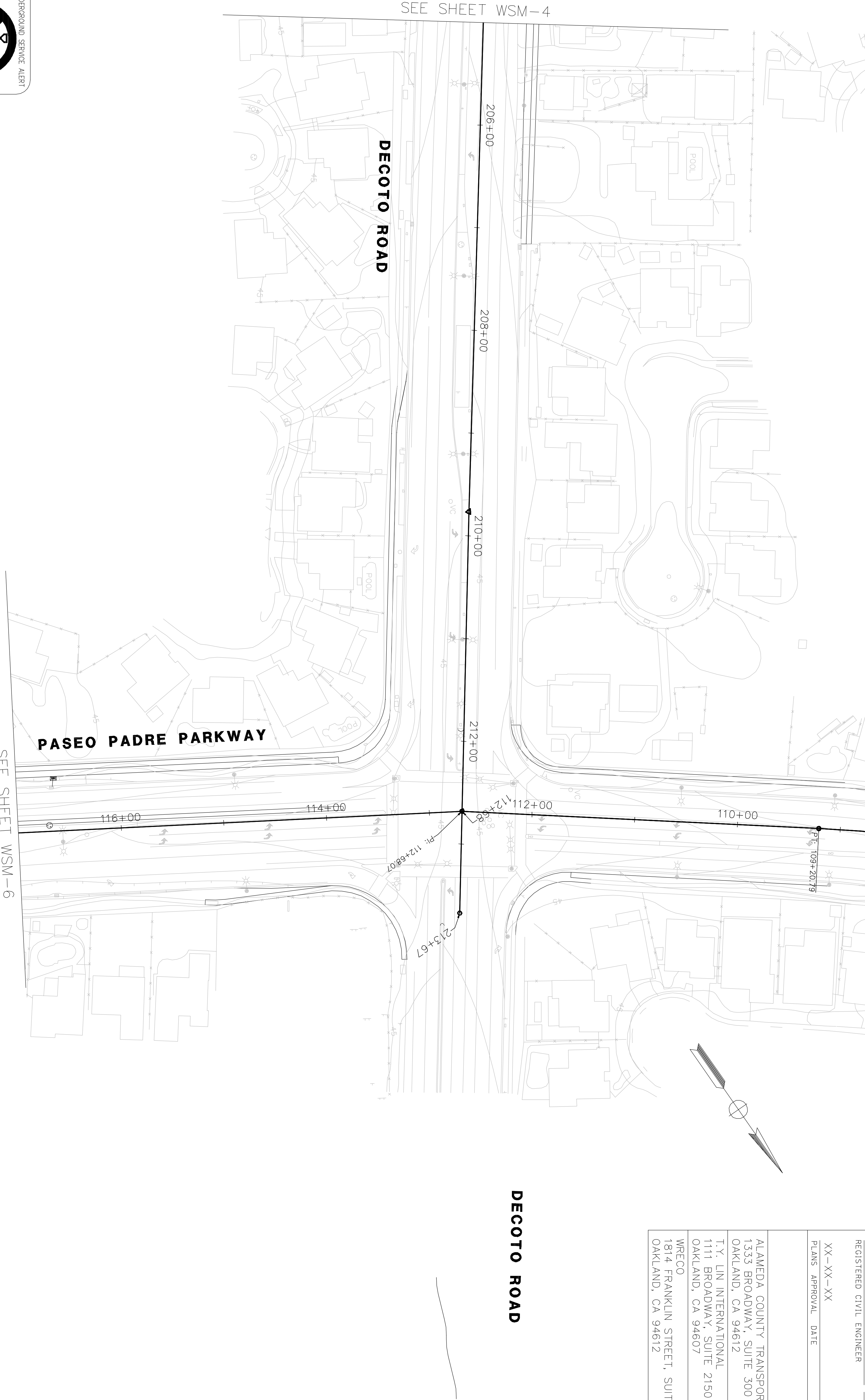
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM04.dwg Mar 31, 2009, 6:45pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



WATERSHED MAP

SCALE 1"=50'

WSM-5

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER
XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

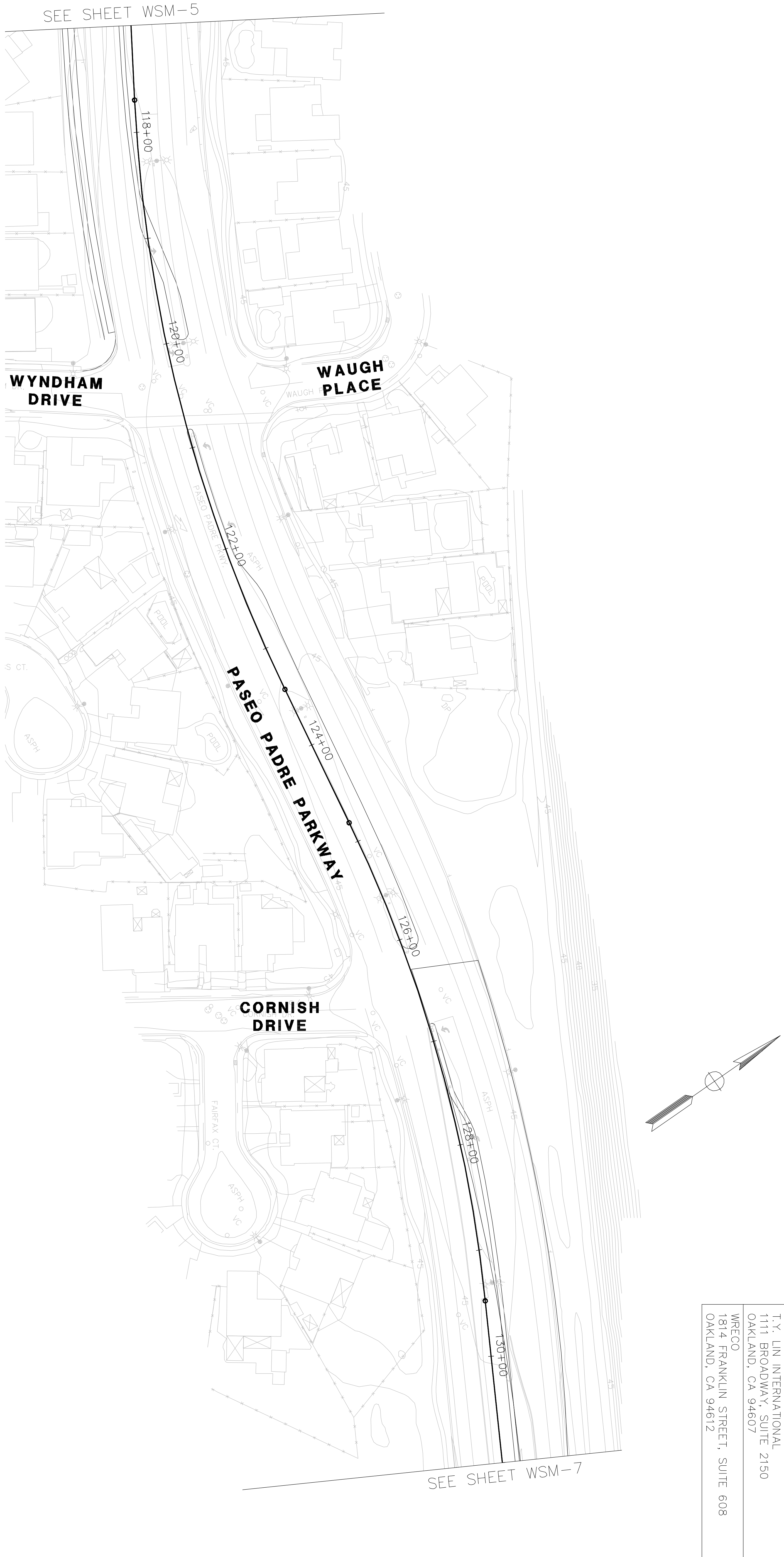
EA 000000

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM05.dwg Mar 31, 2009, 6:46pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-6

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

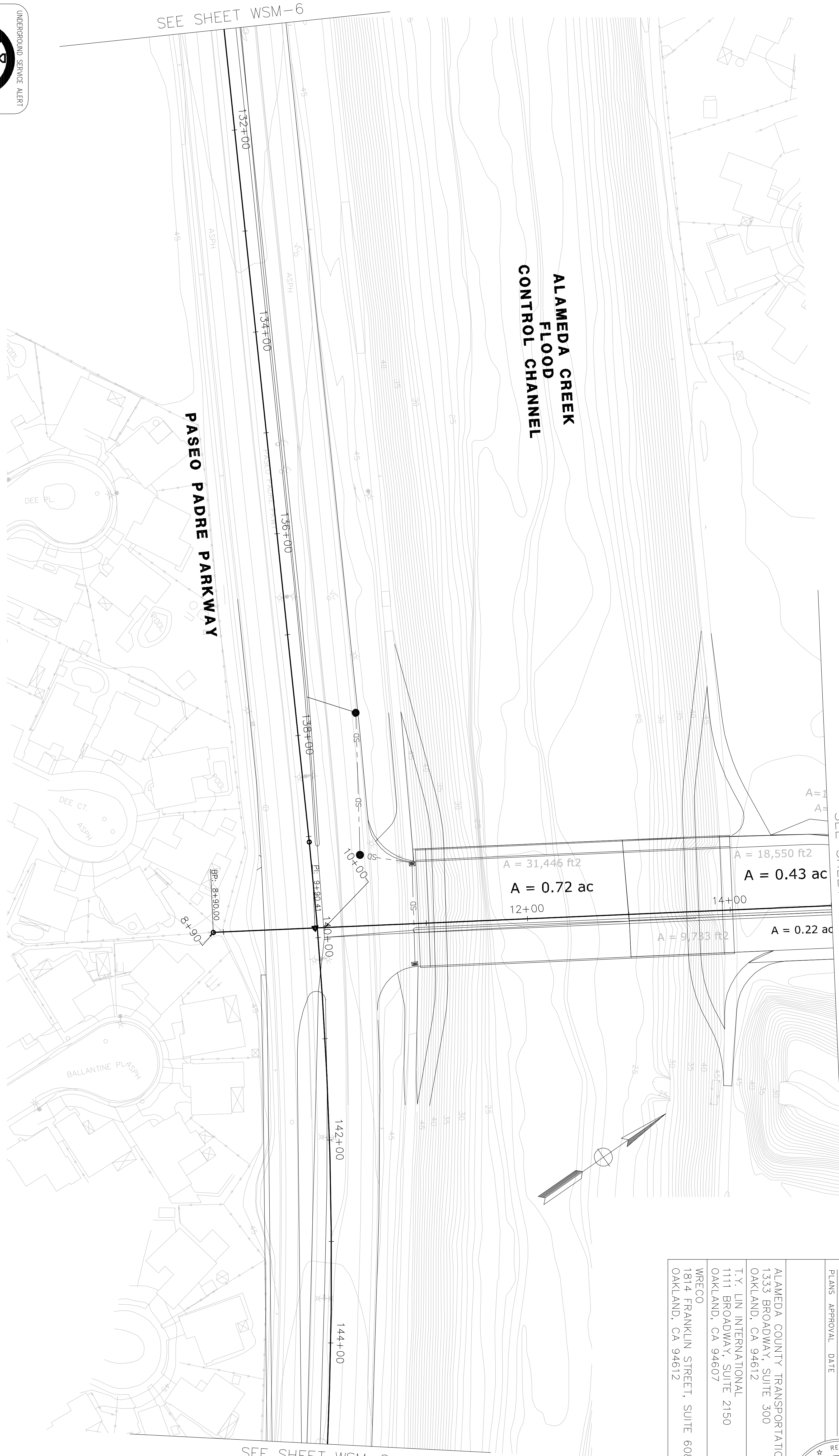
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM06.dwg Mar 31, 2009, 6:47pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-7

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM07.dwg Mar 31, 2009, 6:40pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-8

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

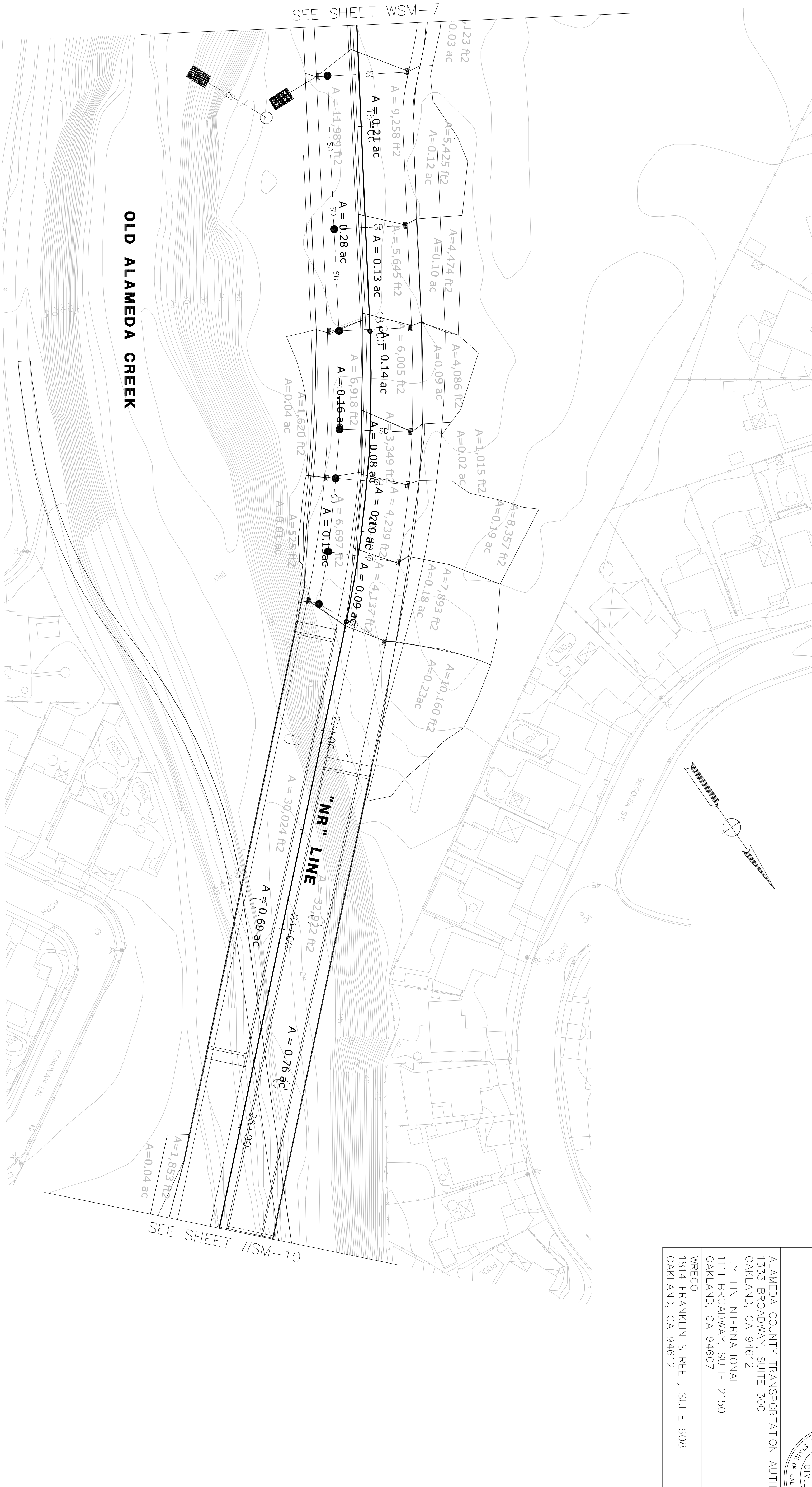
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM08.dwg Mar 31, 2009, 6:48pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY: RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY: ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES
0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-9

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

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EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY: RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY: ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
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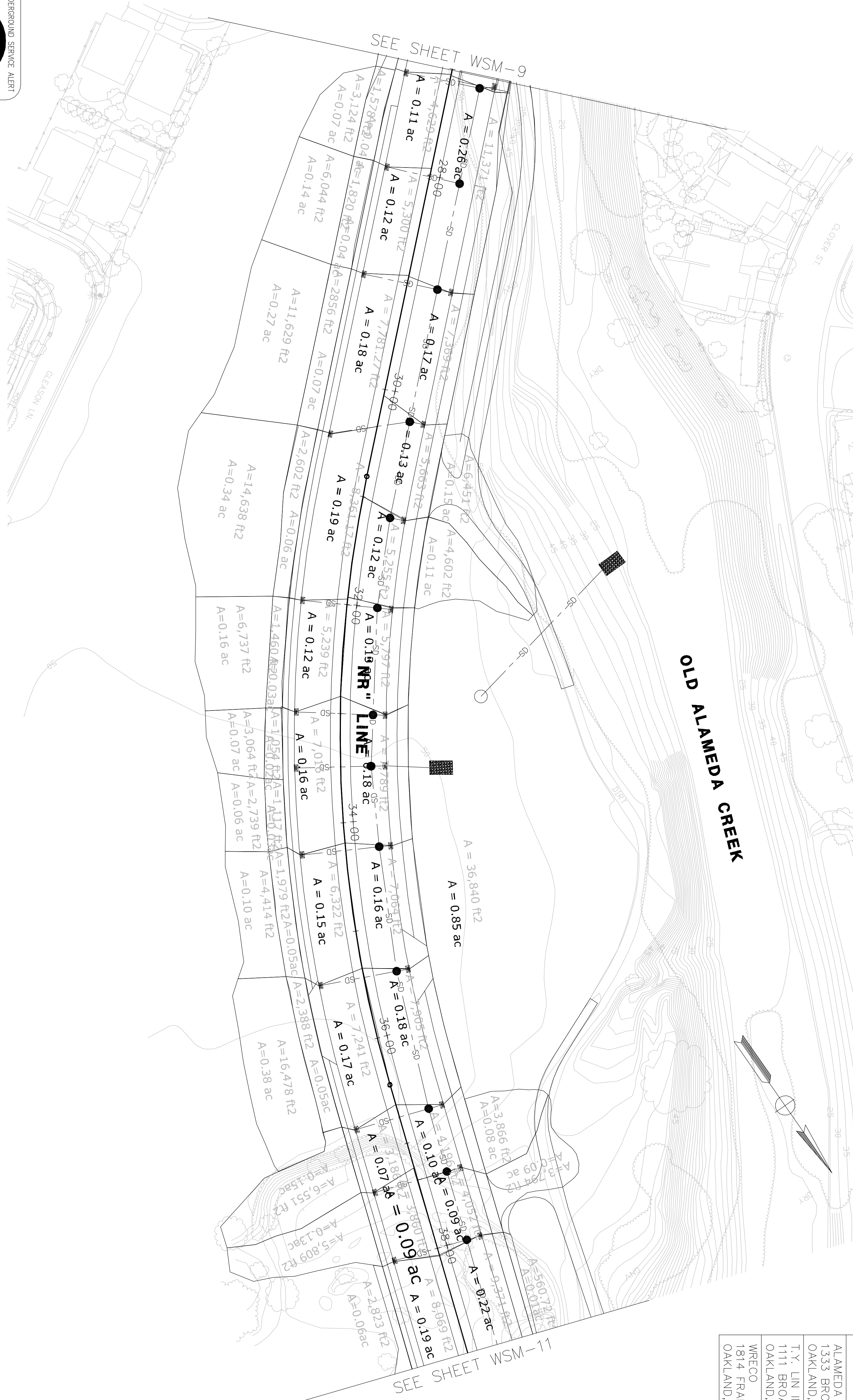
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

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DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-10

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

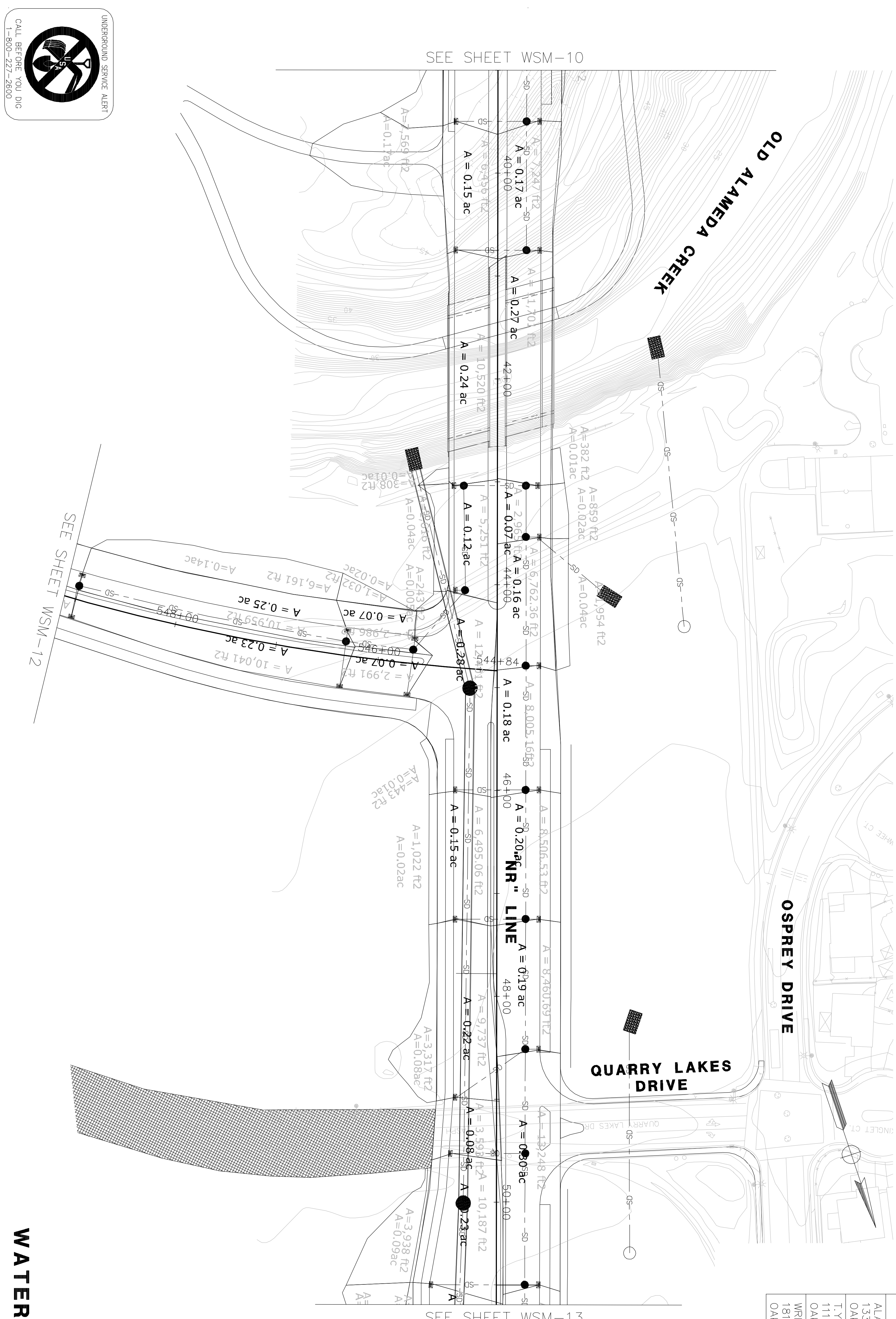
ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00 Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM10.dwg Mar 31, 2009, 6:50pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-11

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

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OAKLAND, CA 94607

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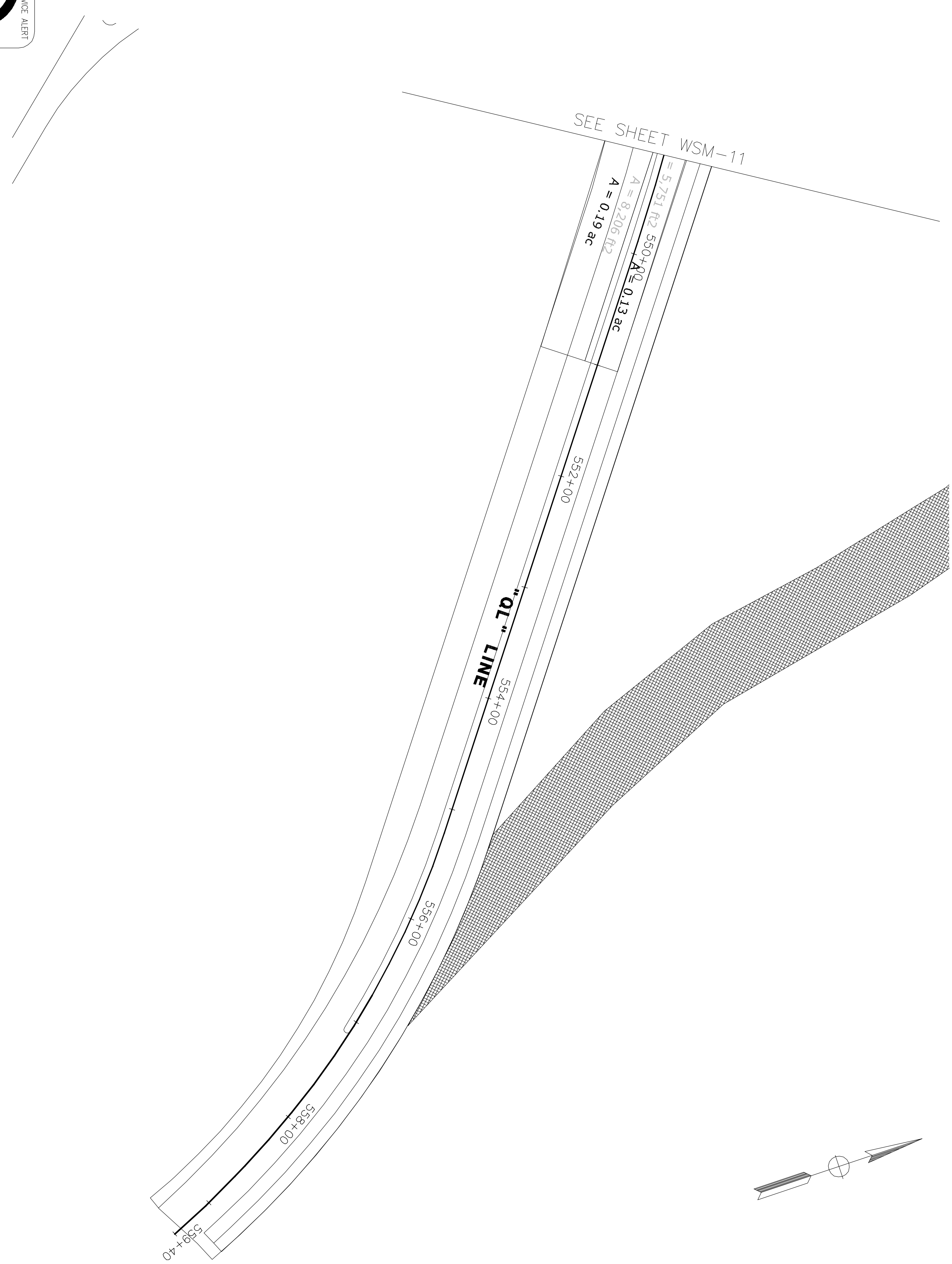
LAST REVISION 00-00-00 | Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM11.dwg | Mar 31, 2009, 6:51pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-12

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER XX-XX-XX

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

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OAKLAND, CA 94607

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1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

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00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM12.dwg Mar 31, 2009, 6:52pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
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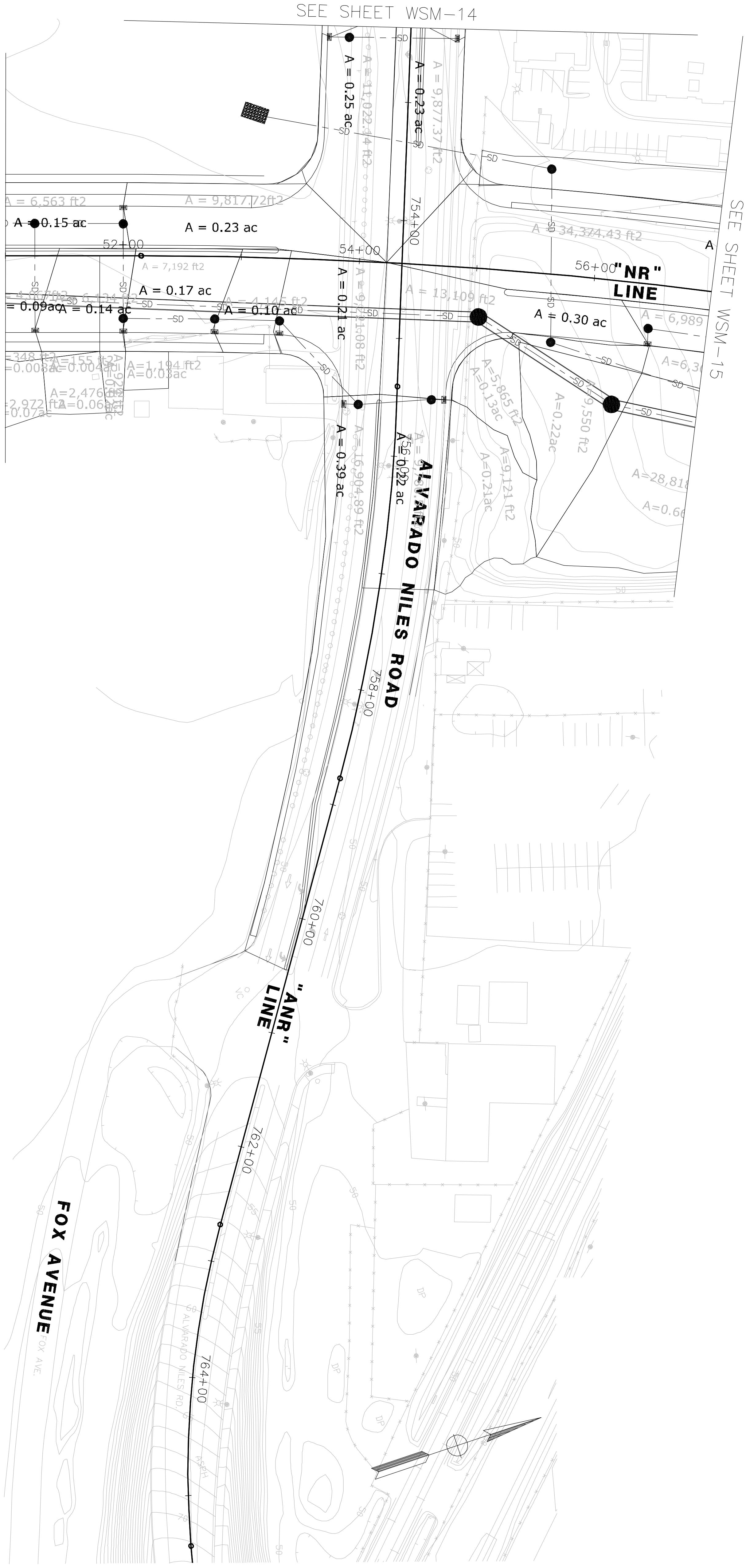

RELATIVE BORDER SCALE IS IN INCHES
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USERNAME => $USER
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WATERSHED MAP

SCALE 1"=50'

WSM-13

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER
XX-XX-XX
XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM13.dwg Mar 31, 2009, 6:53pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

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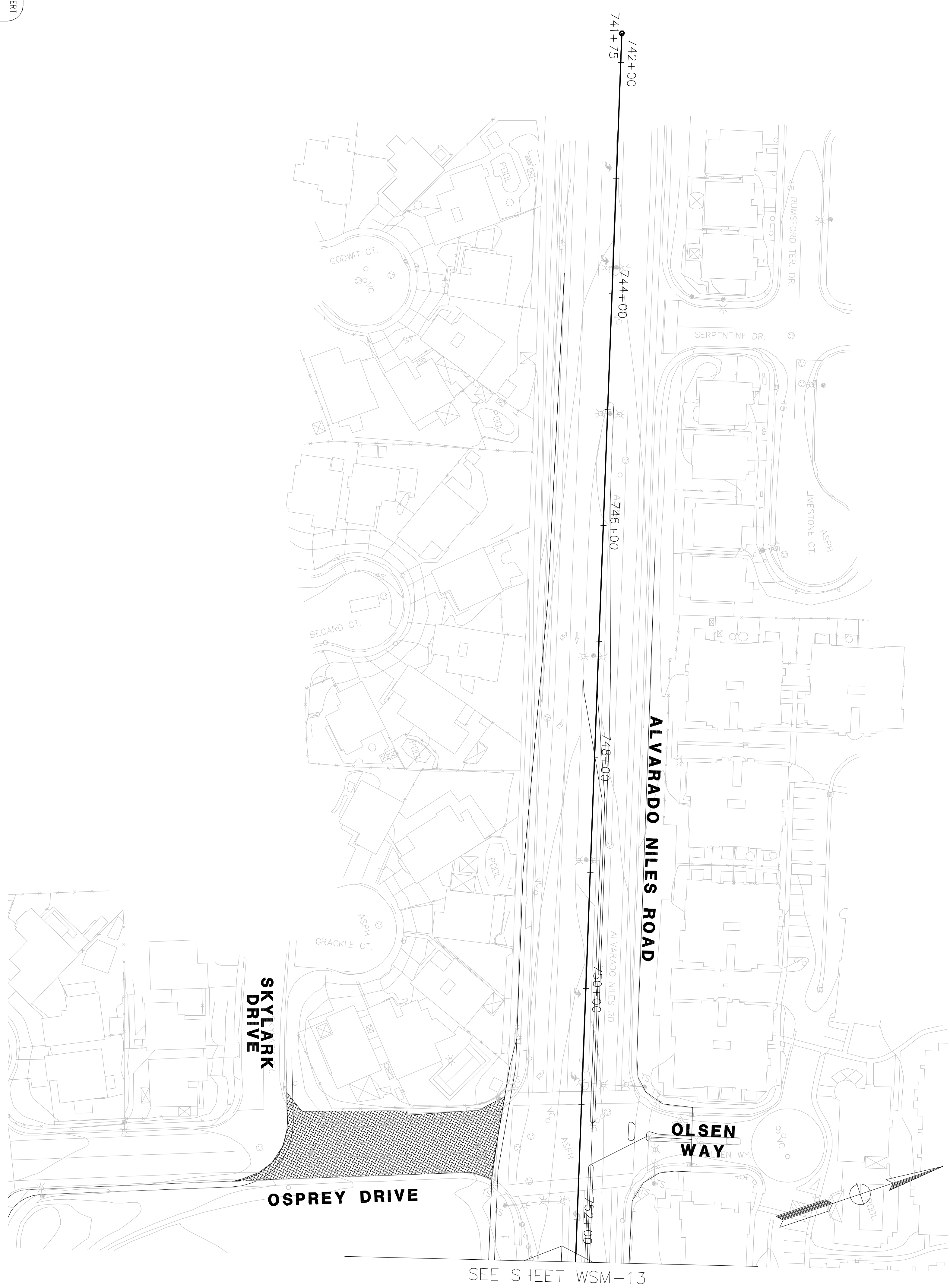
1-800-227-2600



SEE SHEET WSM-13

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-14

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER XX-XX-XX

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

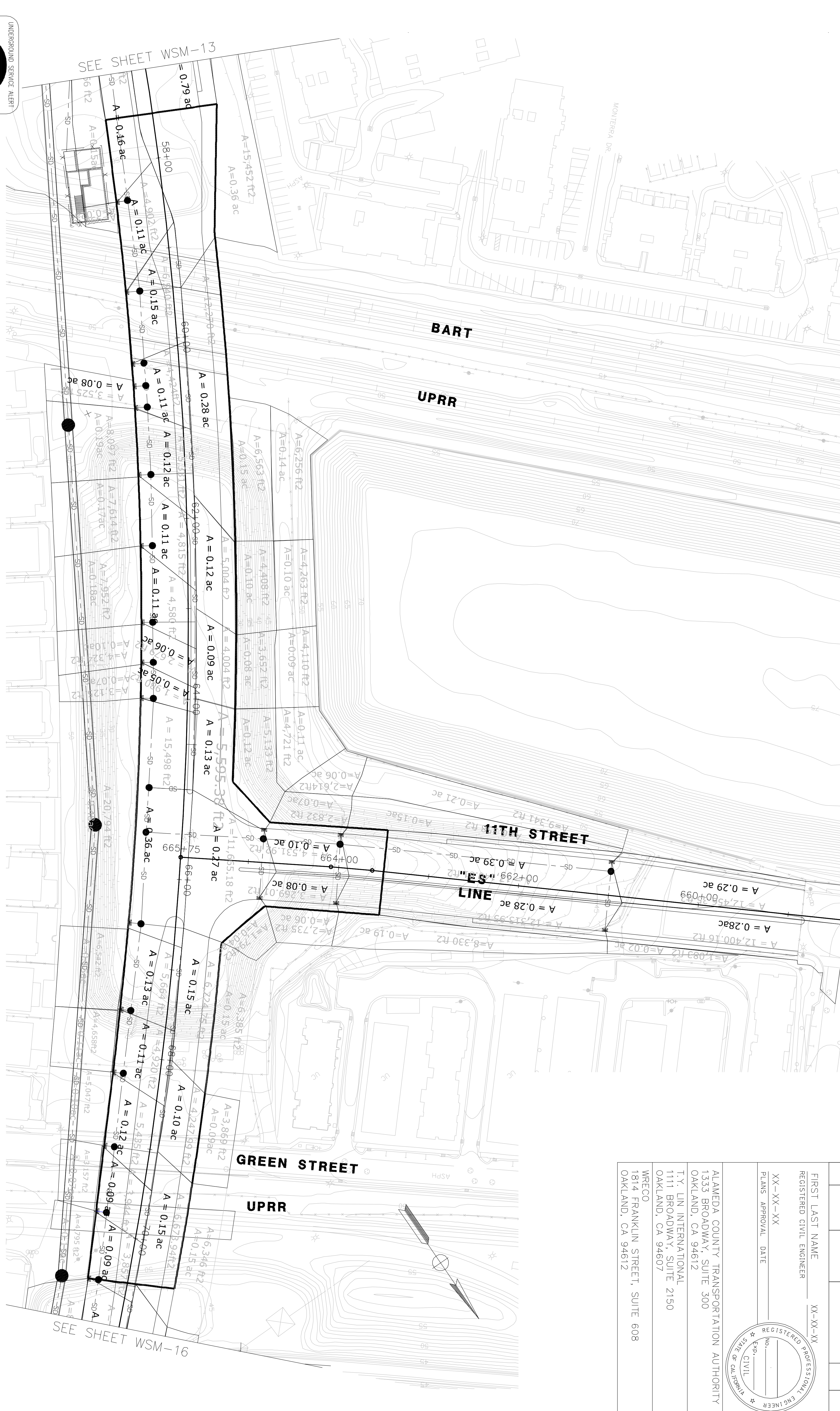
T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM14.dwg Mar 31, 2009, 6:54pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX



WATERSHED MAP

SCALE 1"=50'

WSM-15

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM15.dwg Mar 31, 2009, 6:55pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
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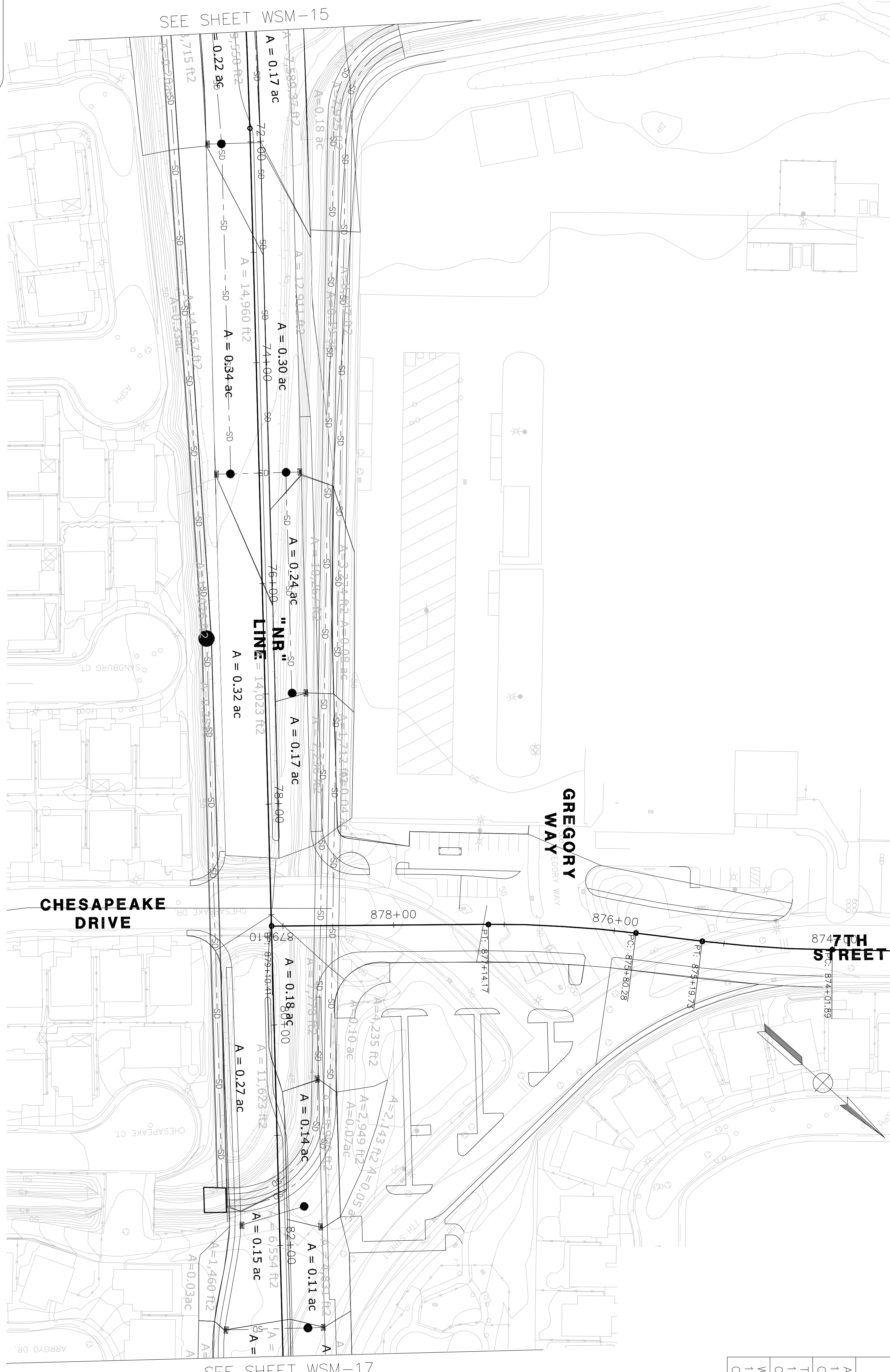

RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-16

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM16.dwg Mar 31, 2009, 6:56pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
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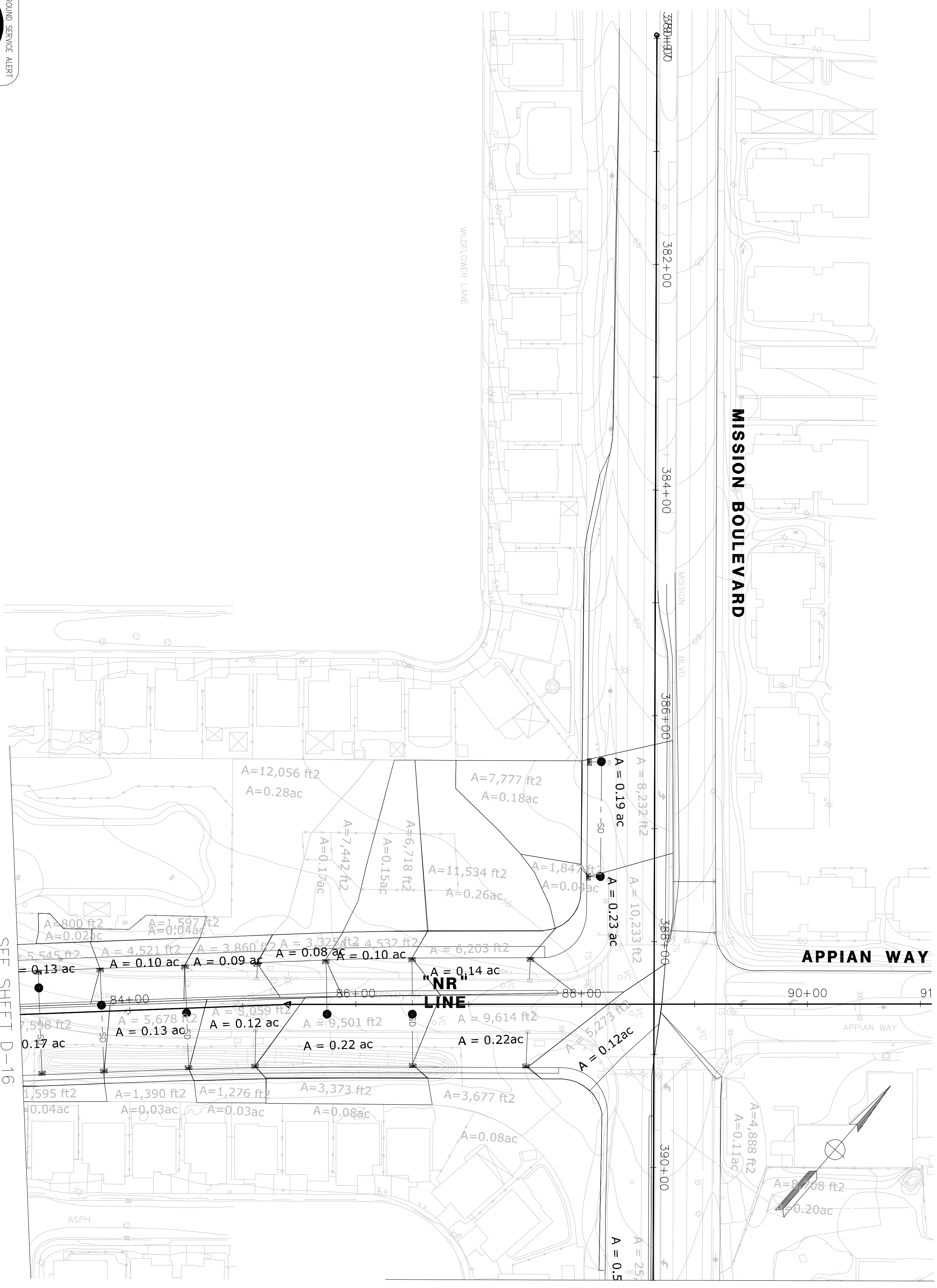
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-17

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER XX-XX-XX

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

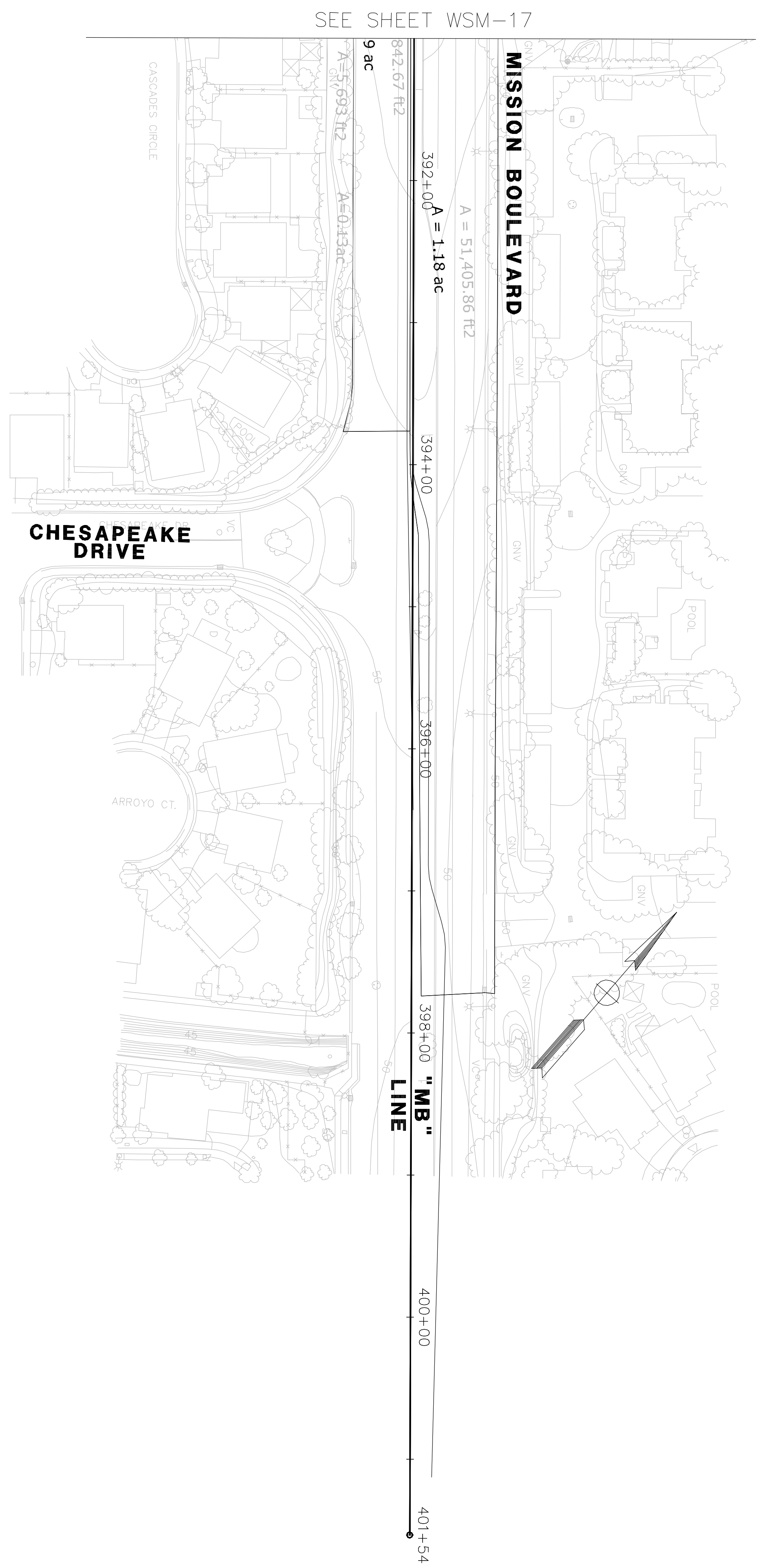
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM17.dwg Mar 31, 2009, 6:57pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY: RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY: ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

WATERSHED MAP

SCALE 1"=50'

WSM-18

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\WSM\wsm-2004\WSM18.dwg Mar 31, 2009, 6:58pm

Appendix I Drainage Plans

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

LEGEND

- PROPOSED STORM DRAIN INLET
- PROPOSED STORM DRAIN MANHOLE
- EXISTING STORM DRAIN INLET
- —SD— PROPOSED STORM DRAIN PIPE
- —sd— EXISTING STORM DRAIN PIPE
- —s— EXISTING SANITARY SEWER SYSTEM
- —SD— PROPOSED DRAINAGE OUTFALL
- TREE WELLS
- ADJUST SSMH TO GRADE

ABBREVIATIONS

JB	JUNCTION BOX
HW	HEADWALL
Mod MH	MODIFIED MANHOLE
RCP	RIENFORCED CONCRETE PIPE
DI	DRAINAGE INLET
RSP	ROCK SLOPE PROTECTION
STR	STRUCTURE

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

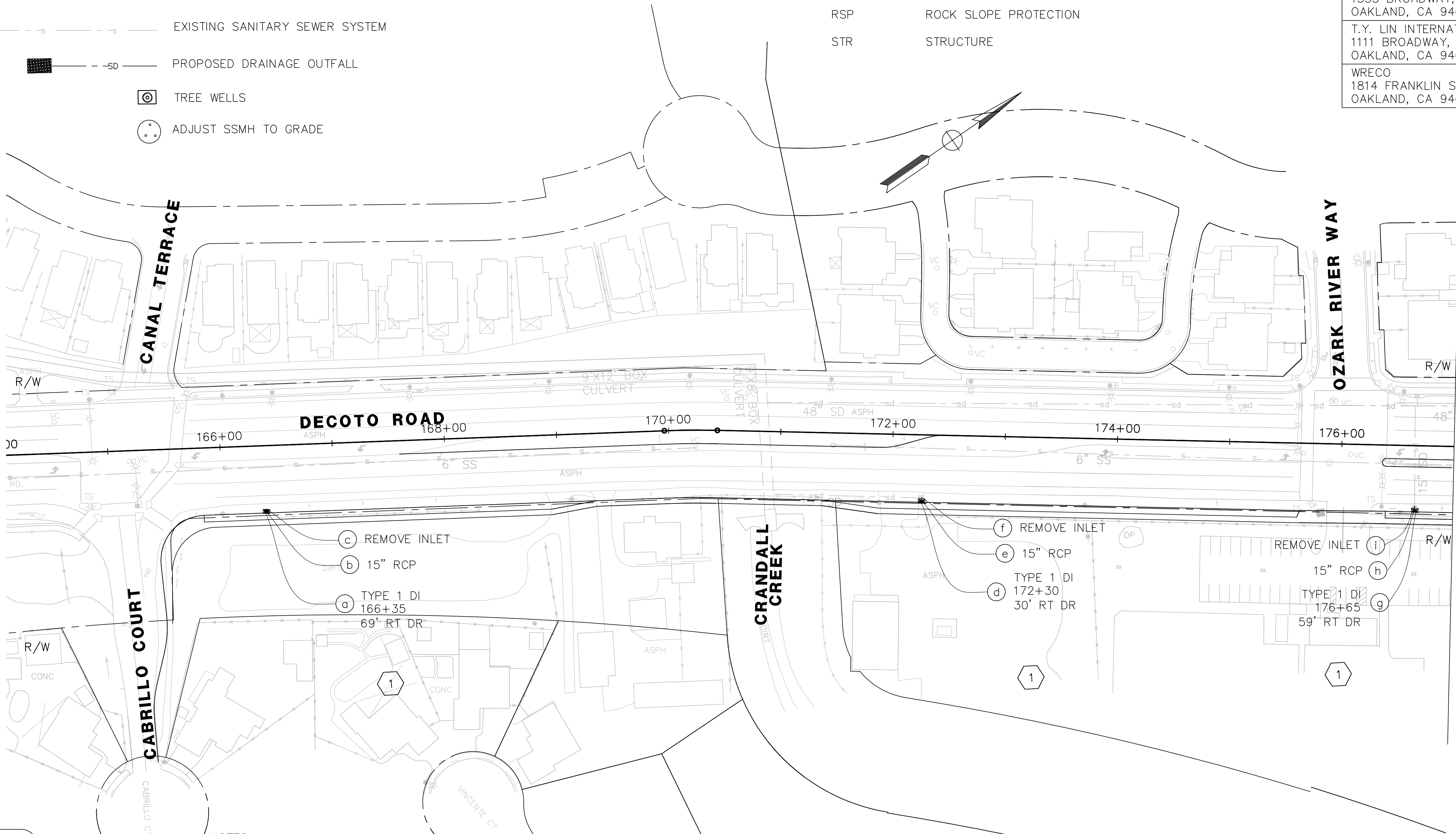
XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612



SEE SHEET DSS-2

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CALL BEFORE YOU DIG
1-800-227-2600

NOTES:

1. THIS PLAN ACCURATE FOR DRAINAGE WORK ONLY.
2. ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-1

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

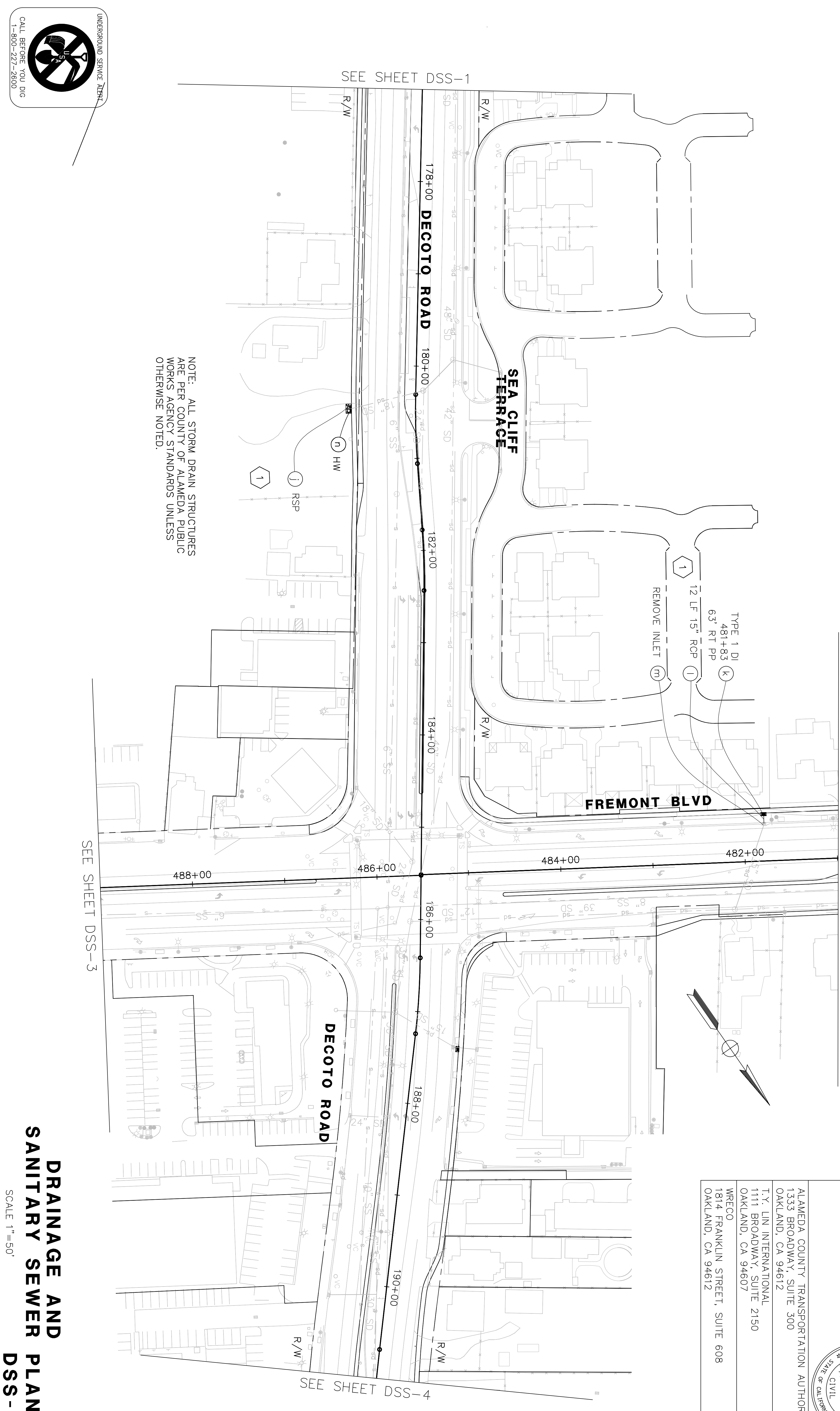
USERNAME => $USER
DGN FILE => $REQUEST

CU 00000 EA 000000

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-1.dwg Mar 24, 2009, 2:59pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN
DSS-2

SCALE 1"=50'

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

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OAKLAND, CA 94607

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LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-2.dwg Mar 24, 2009, 3:01pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
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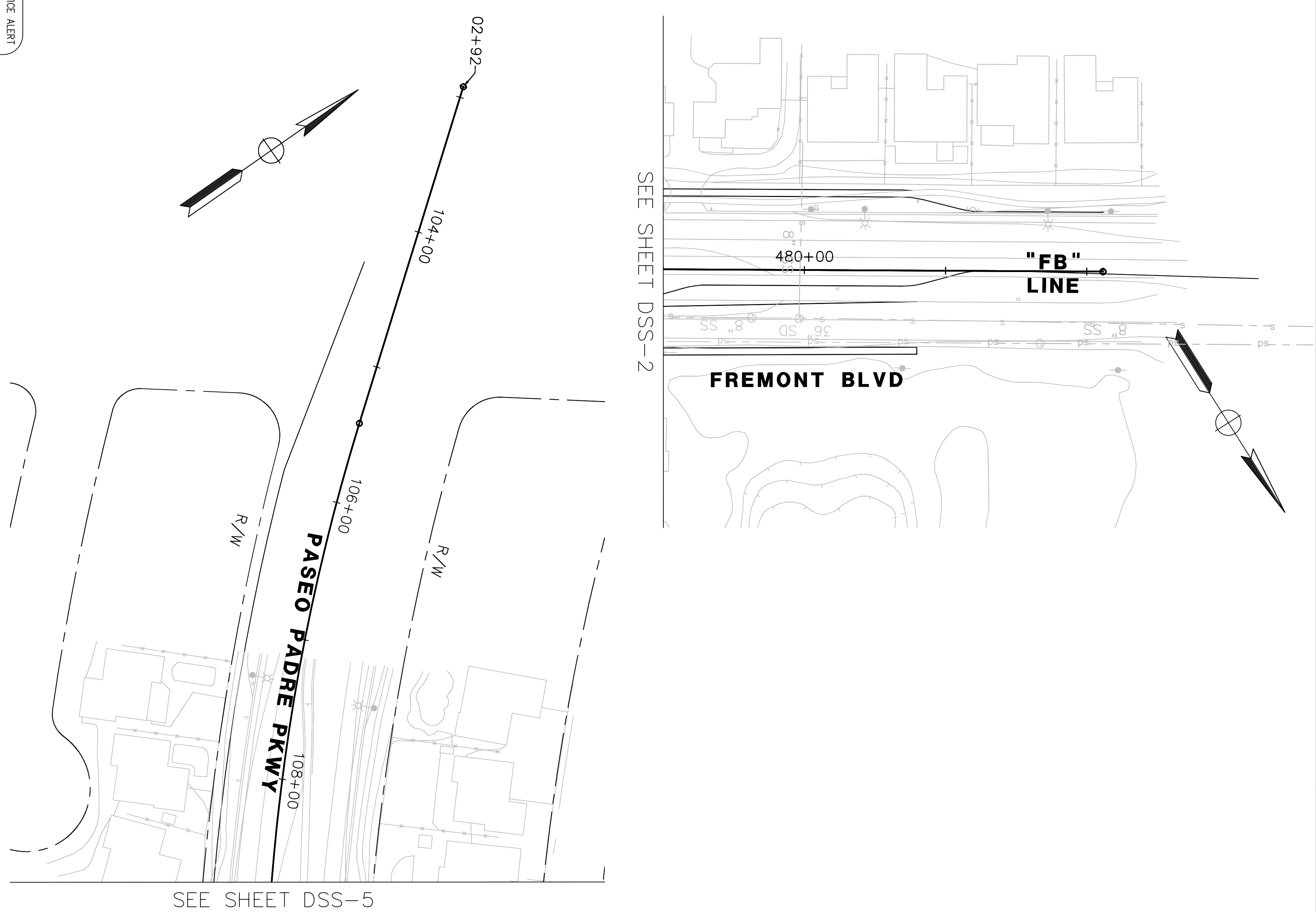
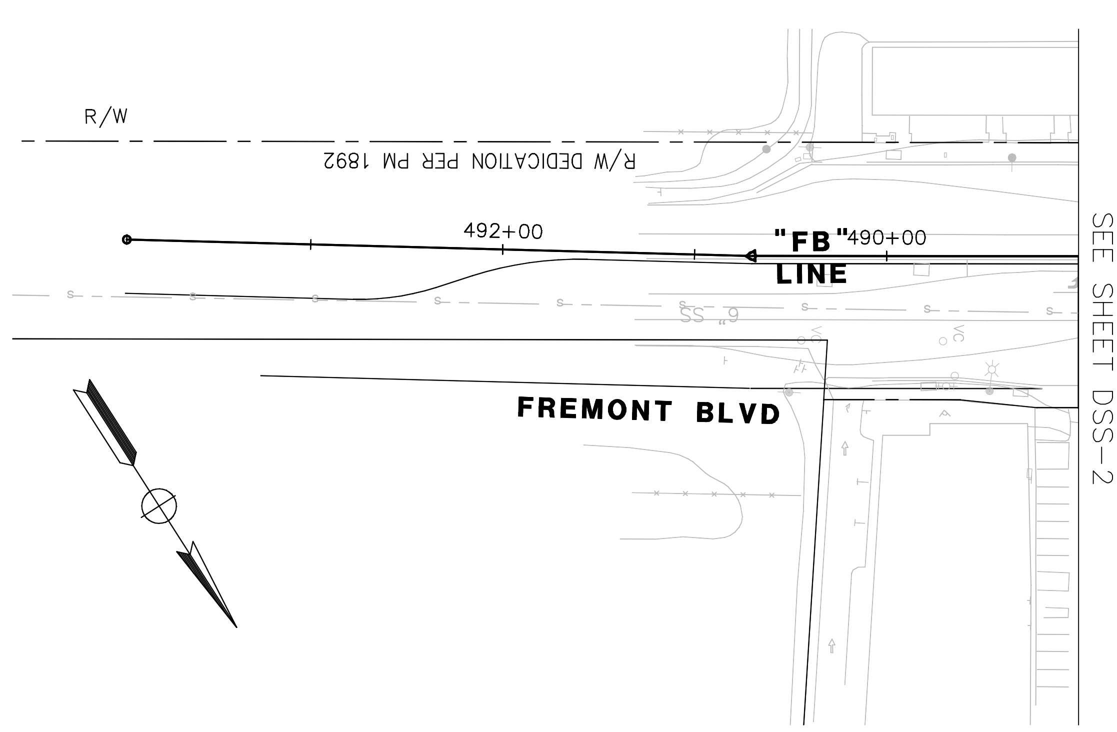
1-800-227-2600





RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-3

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

CU 00000

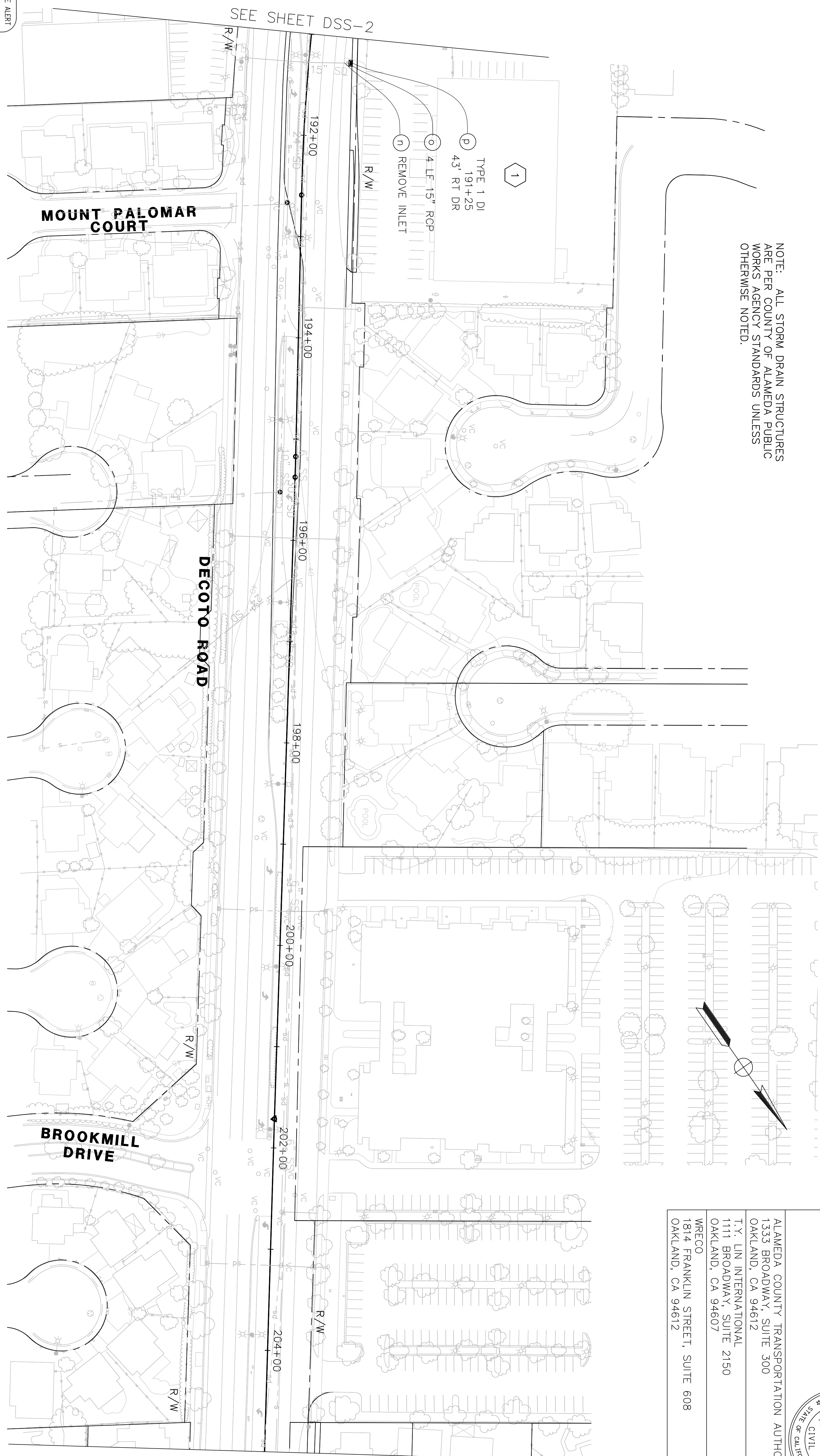
EA 000000

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-3.dwg Mar 24, 2009, 3:03pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-4

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

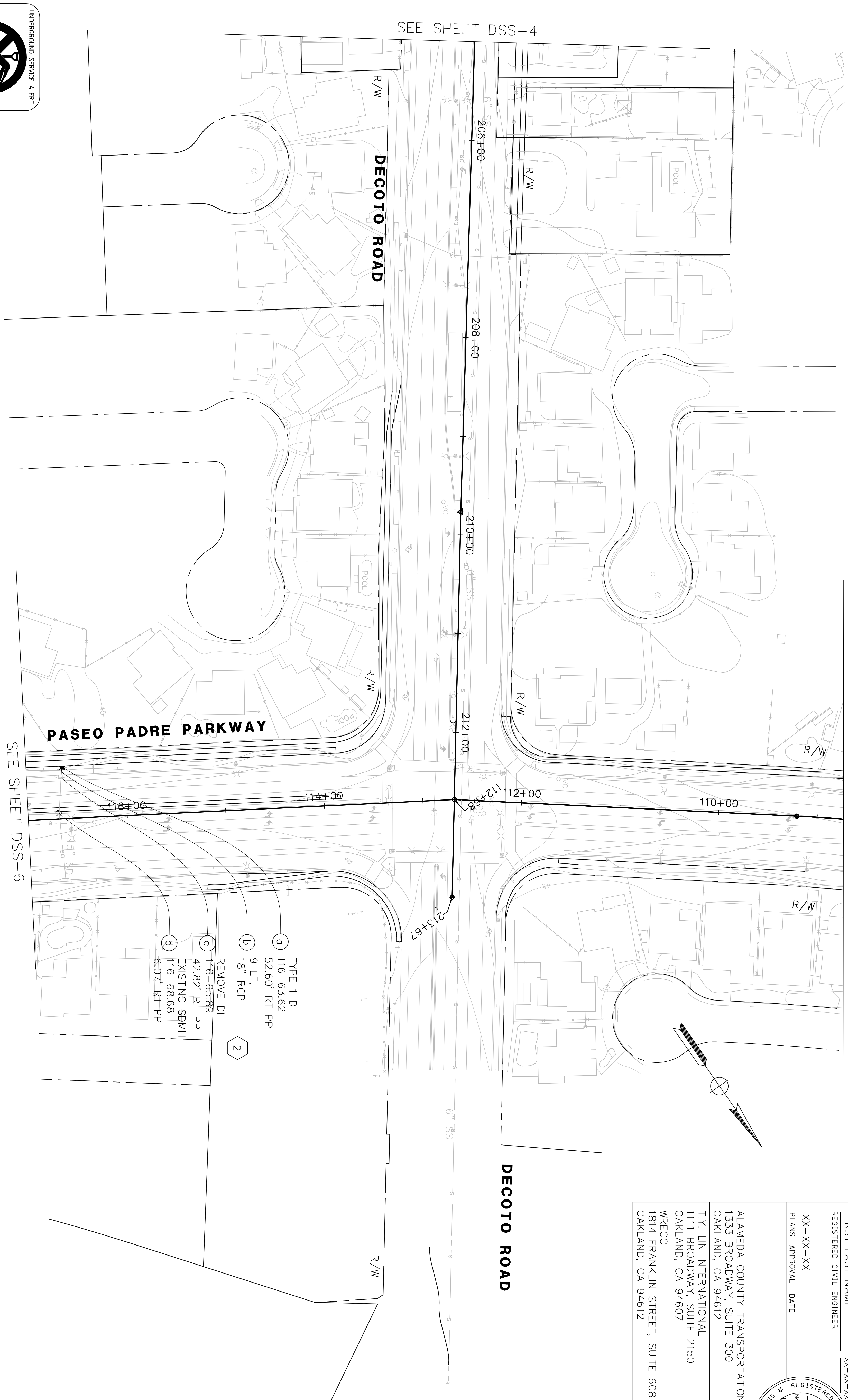
LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-4.dwg Mar 24, 2009, 3:04pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY: RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY: ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-5

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

CU 00000

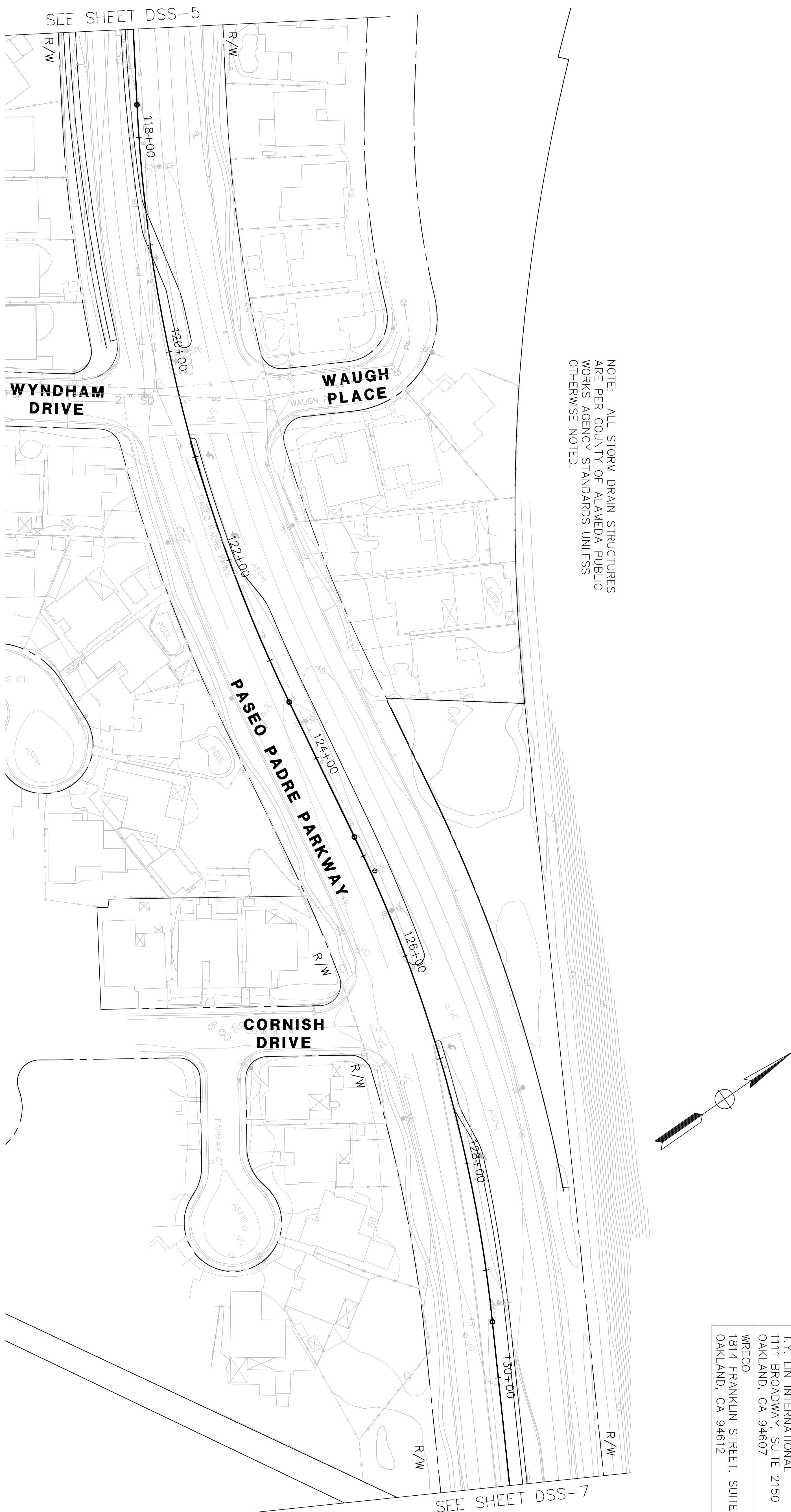
EA 000000

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-5.dwg Mar 24, 2009, 3:05pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-6

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

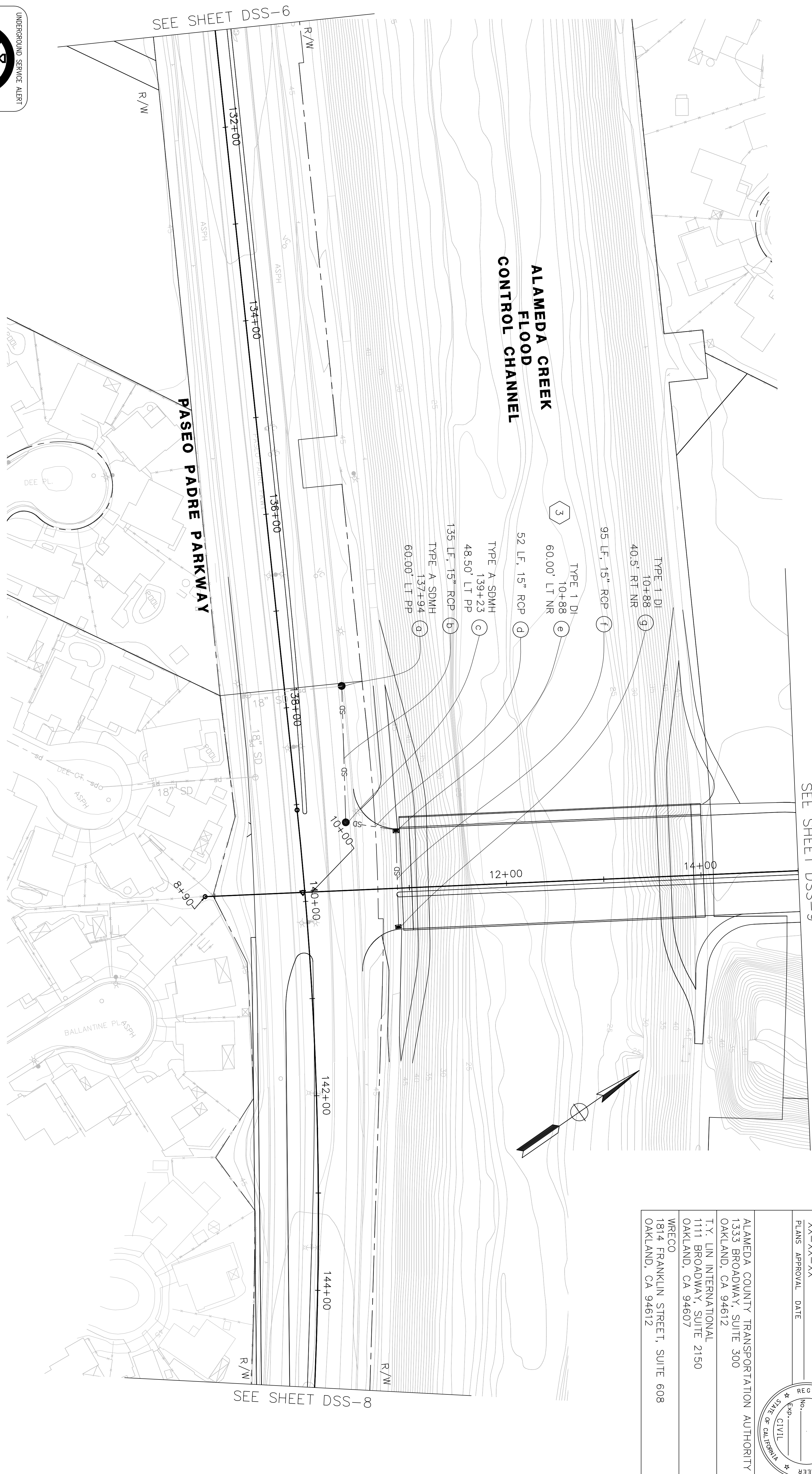
LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-6.dwg Mar 24, 2009, 3:06pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/DESIGNED BY: RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY: ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.



FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER
XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-7

RELATIVE BORDER SCALE IS IN INCHES
0 1 2 3

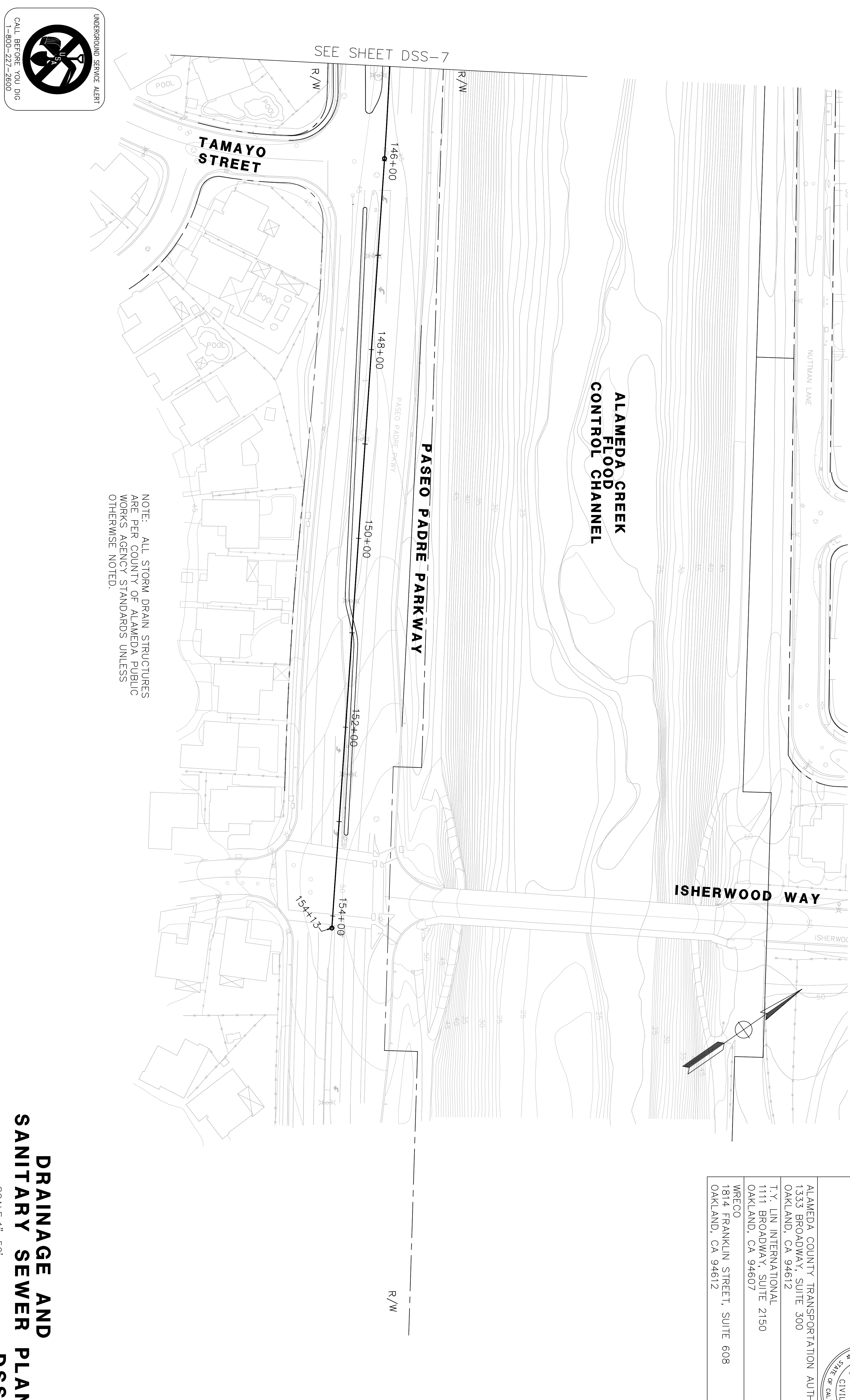
USERNAME => $USER
DGN FILE => $REQUEST

CU 00000
EA 000000

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-7.dwg Mar 24, 2009, 3:07pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX



NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.

RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

EA 000000

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-8

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

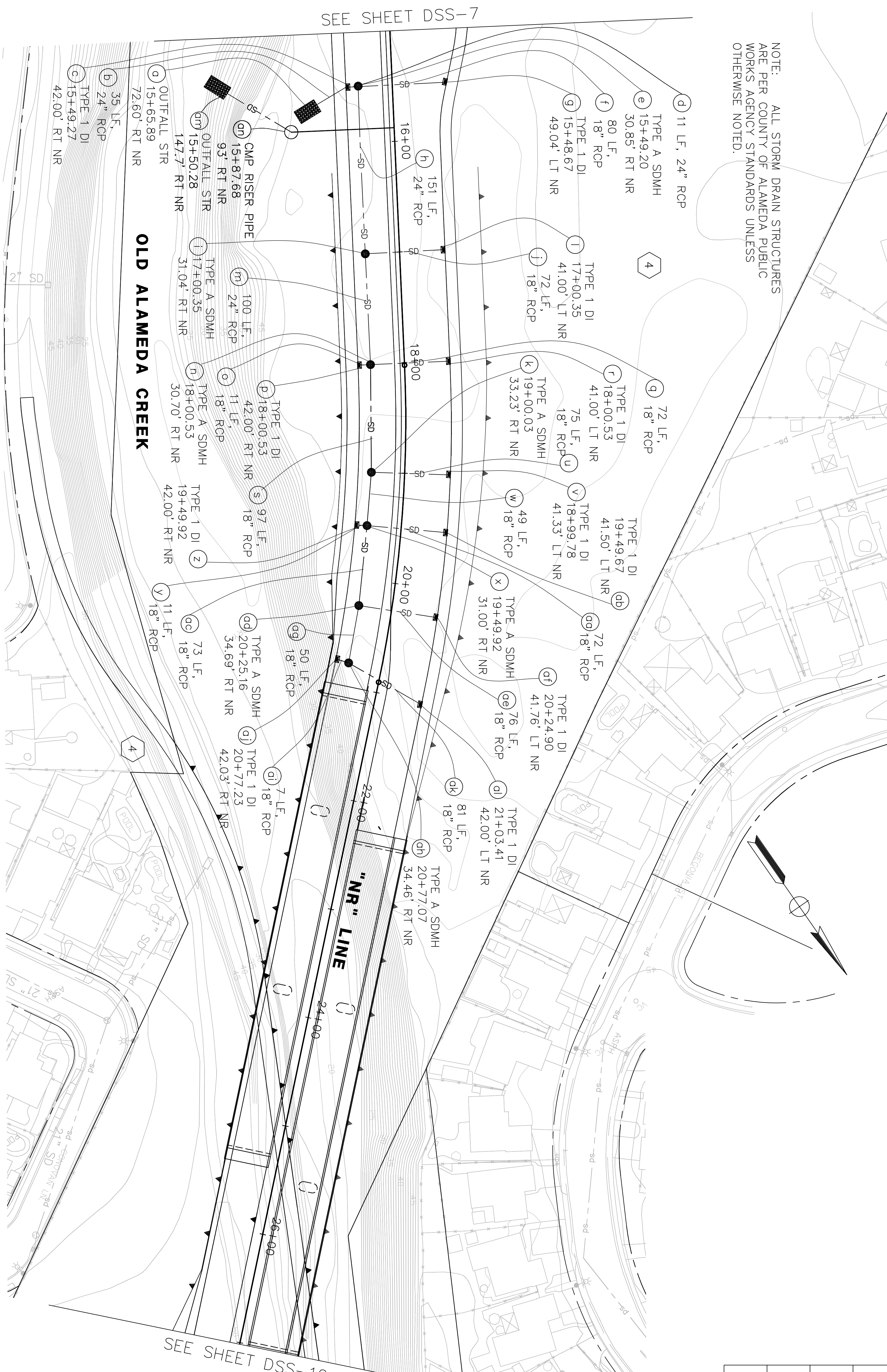
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-8.dwg Mar 24, 2009, 3:08pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES
0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-9

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. ____
Exp. ____
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

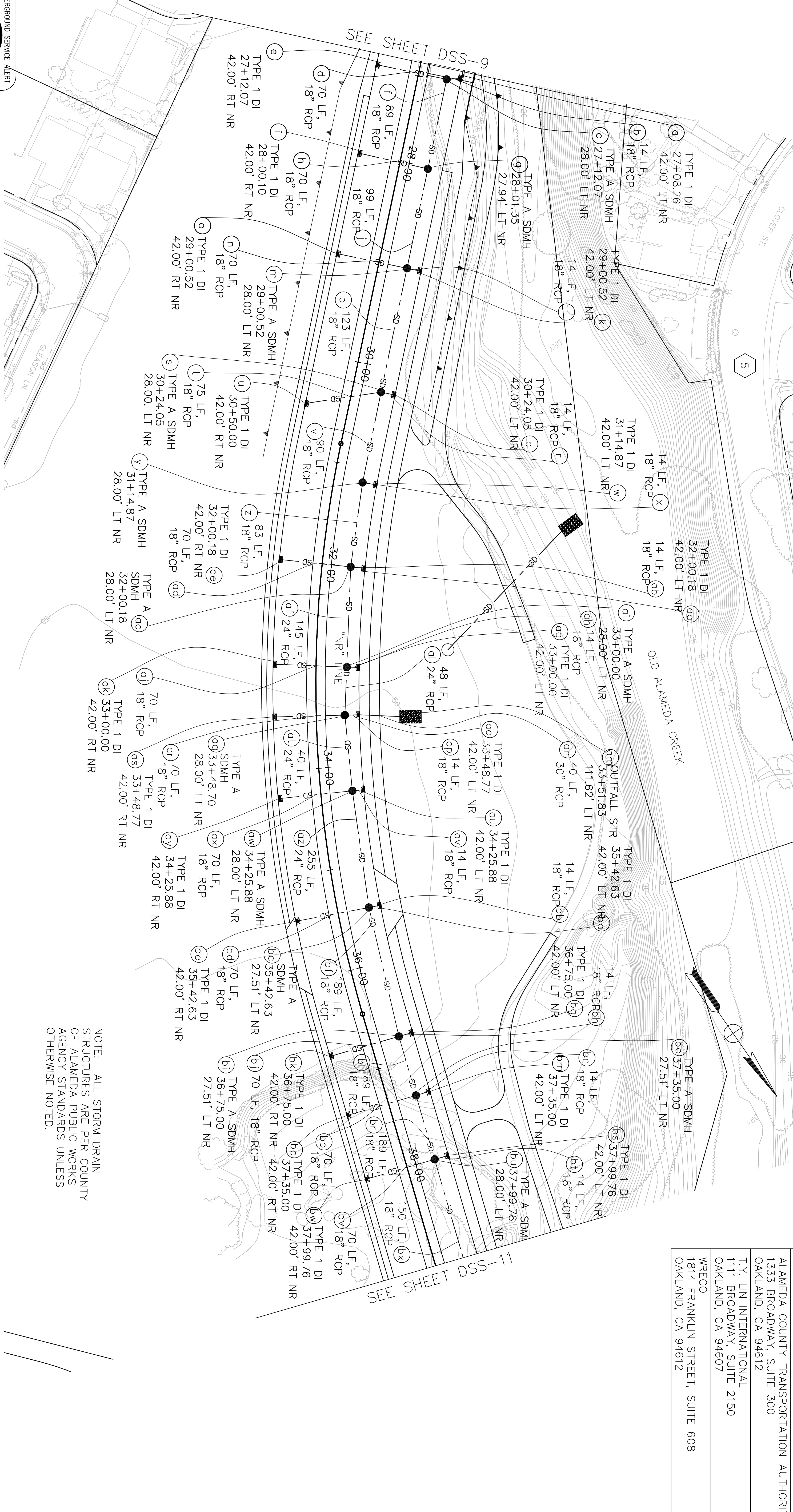
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-9.dwg Mar 24, 2009, 3:09pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-10

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME — XX-XX-XX
REGISTERED CIVIL ENGINEER
XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

CU 00000

EA 000000

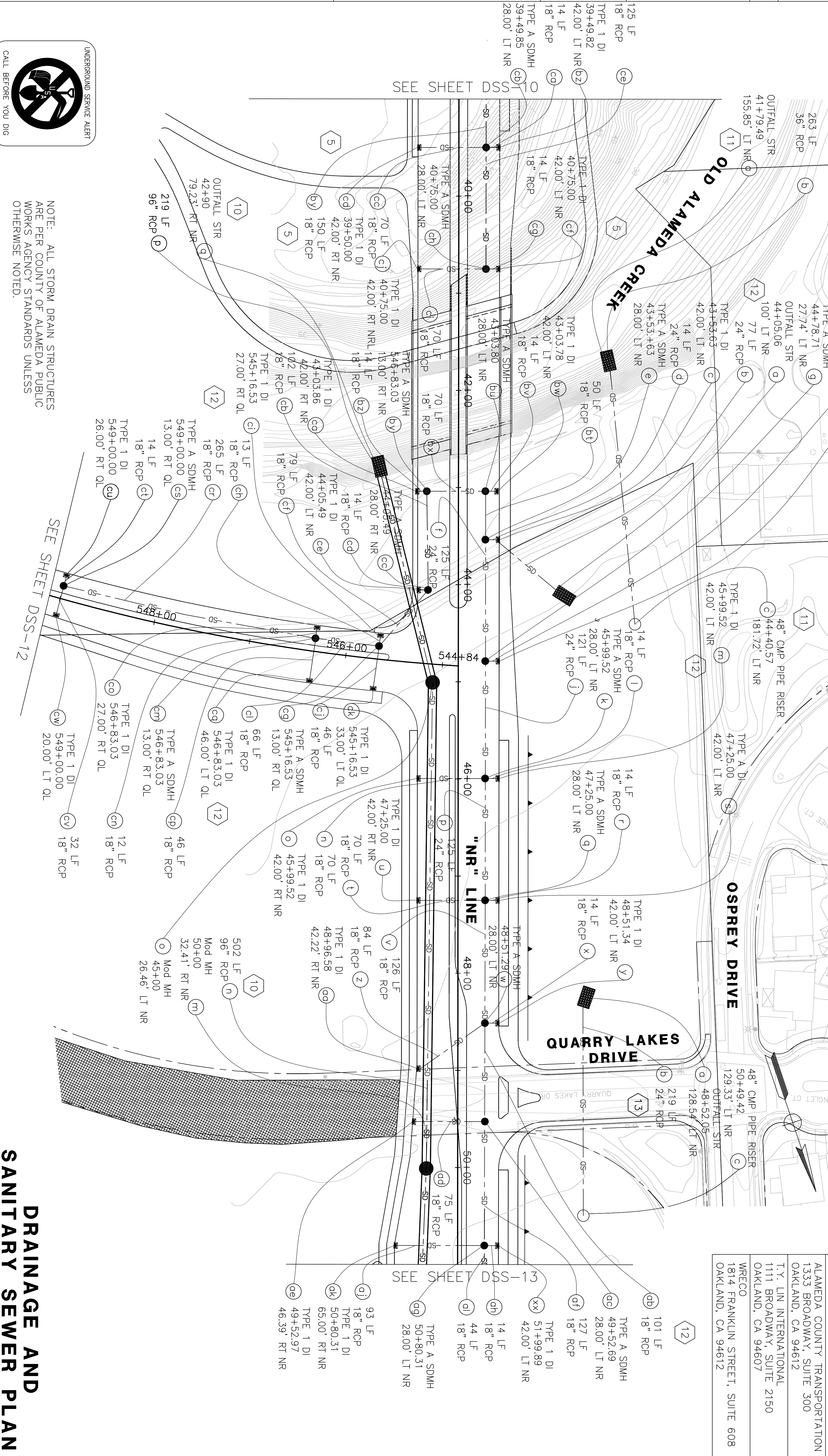
LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-10.dwg Mar 24, 2009, 3:10pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/ DESIGNED BY: RIPEN KAUR	CHECKED BY: ANALETTE OCHOA	DATE: XX-XX	REVISED BY: XXX XXX XXX XXX	DATE REVISED: XX-XX XX-XX XX-XX XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.



DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-11

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000
EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

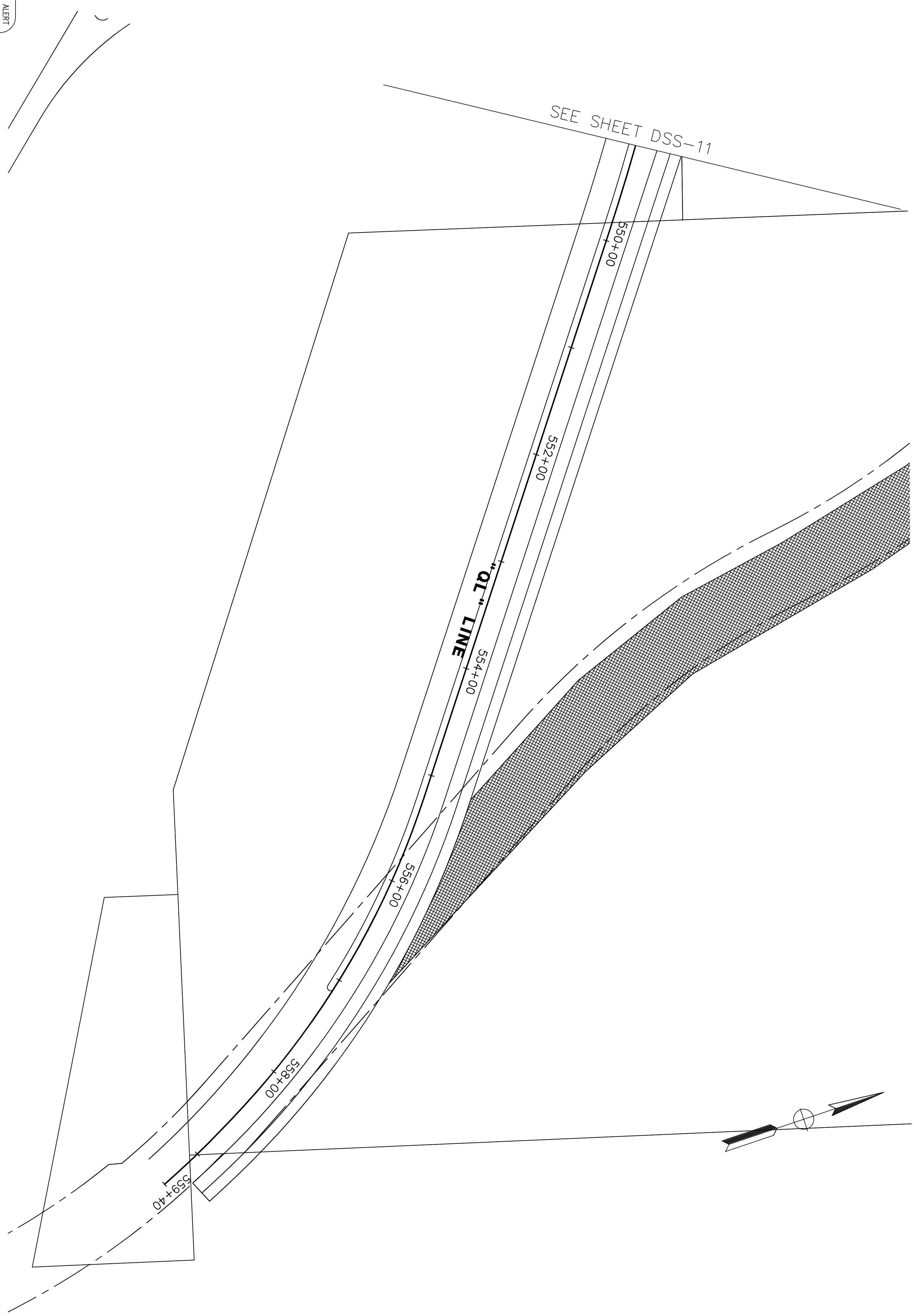
WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-11.dwg Mar 24, 2009, 3:11pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

EA 000000

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-12

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER
XX-XX-XX

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

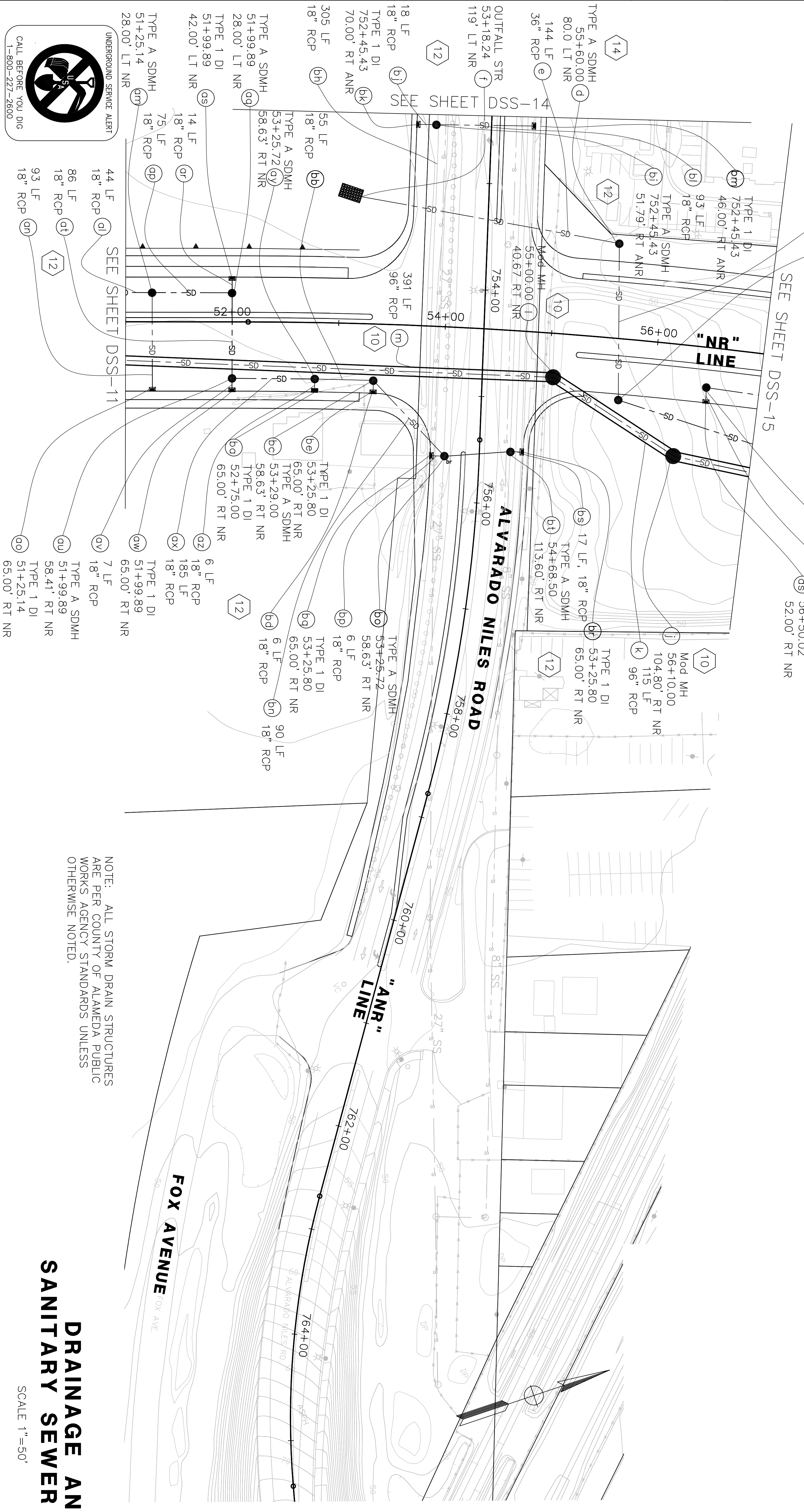
T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-12.dwg Mar 24, 2009, 3:12pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER: HAN-BIN LIANG	CALCULATED/DESIGNED BY: RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
		CHECKED BY: ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX



NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-13

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME
REGISTERED CIVIL ENGINEER XX-XX-XX

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

EA 000000

LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-13.dwg Mar 24, 2009, 3:13pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

SEE SHEET DSS-13

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-14

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

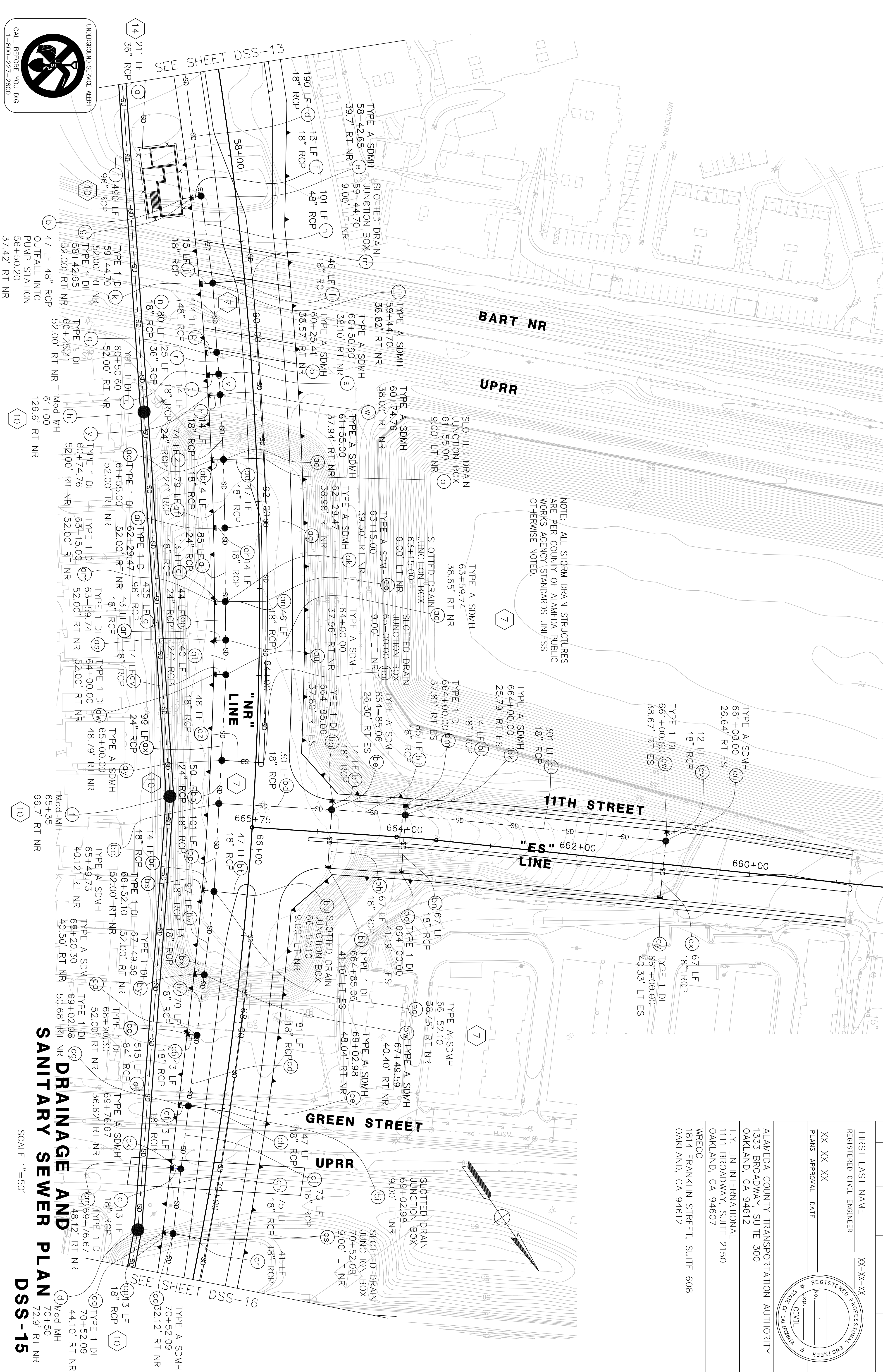
T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-14.dwg Mar 24, 2009, 3:15pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX



DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-15

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

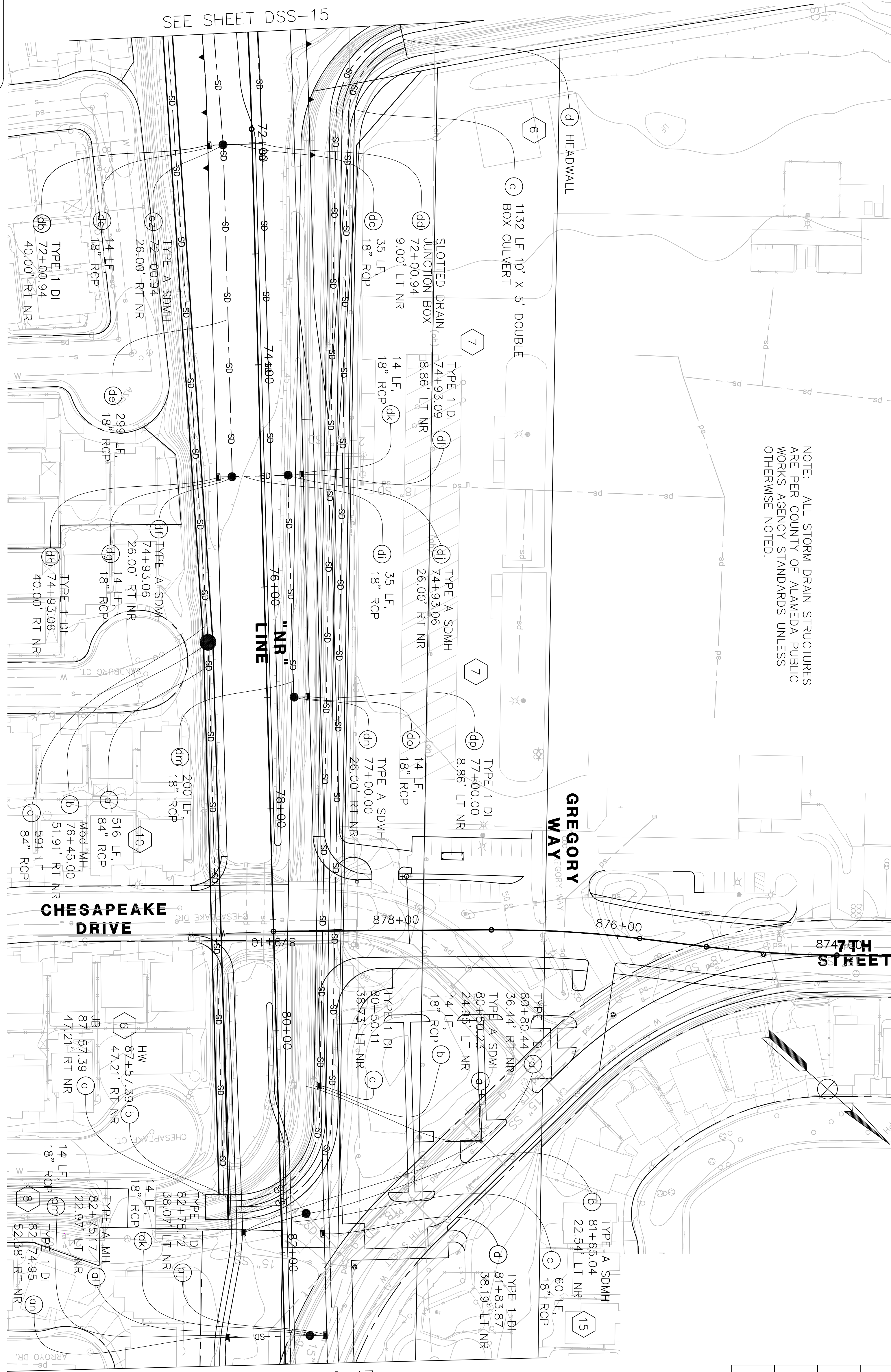
EA 000000

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-15.dwg Mar 24, 2009, 3:29pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 00000

EA 000000

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-16

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

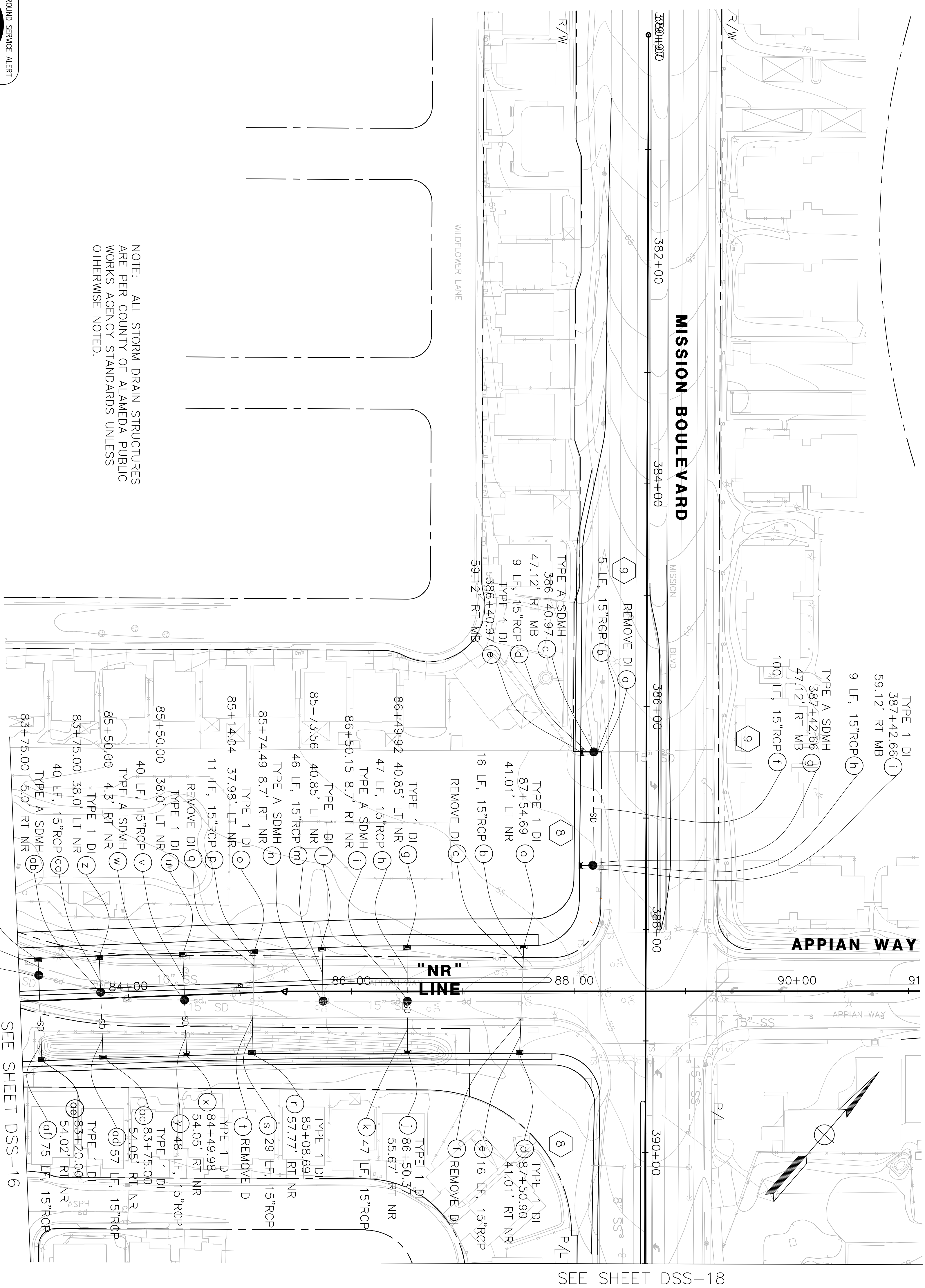
LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-16.dwg Mar 24, 2009, 3:16pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-17

CU 00000

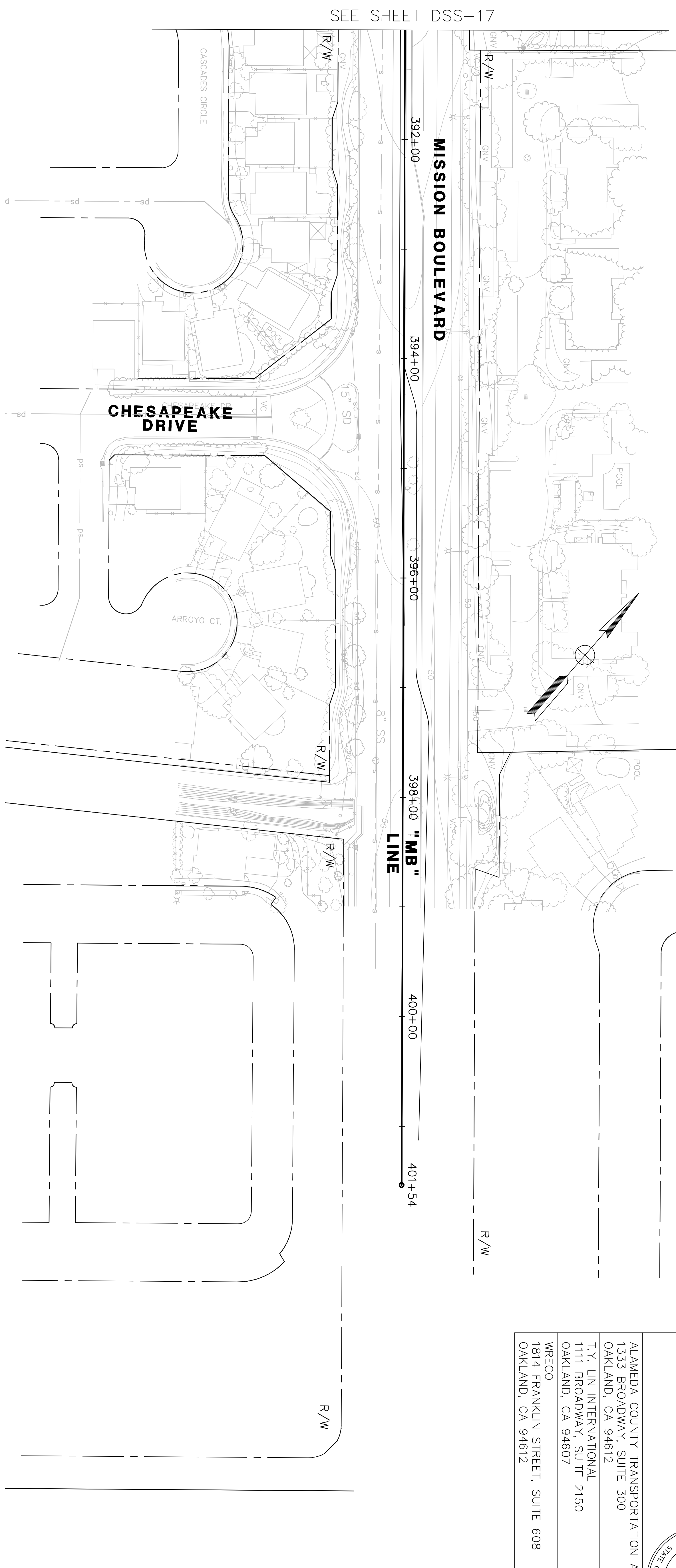
EA 000000

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-17.dwg Mar 24, 2009, 3:17pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600



RELATIVE BORDER SCALE IS IN INCHES

USERNAME => $USER
DGN FILE => $REQUEST

DRAINAGE AND SANITARY SEWER PLAN

SCALE 1"=50'

DSS-18

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No. Exp. CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

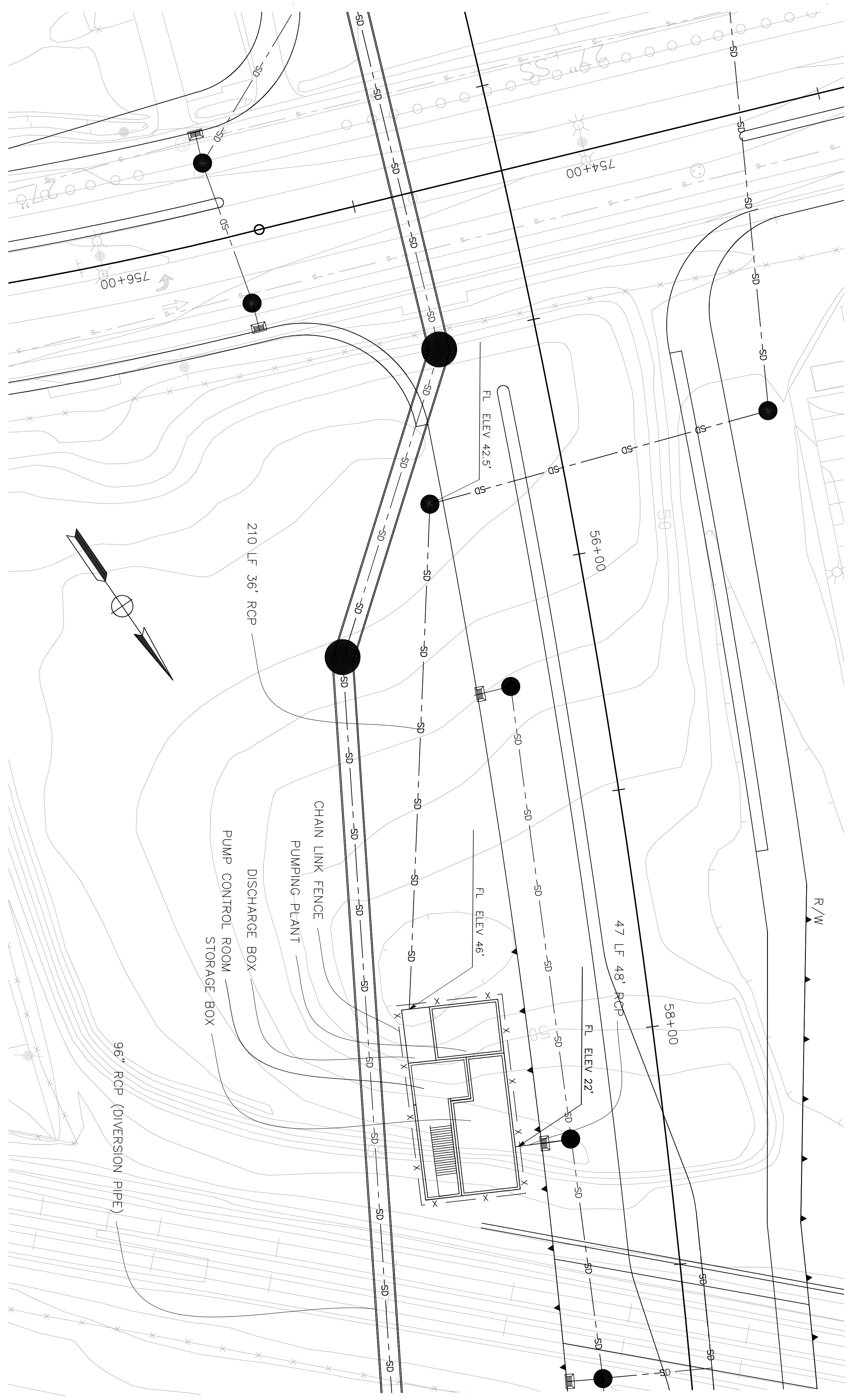
LAST REVISION 00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-18.dwg Mar 24, 2009, 3:18pm

EAST-WEST CONNECTOR PROJECT (MB 226)	PROJECT ENGINEER	CALCULATED/ DESIGNED BY	RIPEN KAUR	DATE	REVISED BY	XXX	XXX	XXX	XXX
	HAN-BIN LIANG	CHECKED BY	ANALETTE OCHOA	XX-XX	DATE REVISED	XX-XX	XX-XX	XX-XX	XX-XX

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
1-800-227-2600

NOTE: ALL STORM DRAIN STRUCTURES ARE PER COUNTY OF ALAMEDA PUBLIC WORKS AGENCY STANDARDS UNLESS OTHERWISE NOTED.



RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => $USER
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PUMPING PLANT PLAN

SCALE 1"=25'

DSS-19

CU 00000

EA 000000

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

FIRST LAST NAME XX-XX-XX
REGISTERED CIVIL ENGINEER

XX-XX-XX
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

ALAMEDA COUNTY TRANSPORTATION AUTHORITY
1333 BROADWAY, SUITE 300
OAKLAND, CA 94612

T.Y. LIN INTERNATIONAL
1111 BROADWAY, SUITE 2150
OAKLAND, CA 94607

WRECO
1814 FRANKLIN STREET, SUITE 608
OAKLAND, CA 94612

LAST REVISION
00-00-00

Drawing: G:\Projects\Y2007\P0727 East West Connector\Dwg\Drainage\pl\D-19.dwg Mar 24, 2009, 3:19pm

Appendix J Drainage Cost Estimate

Preliminary Drainage Cost Estimates

Project: East-West Connector
Prepared by : WRECO
Prepared for : TY Lin

Item No.	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
1	Remove Existing Storm Drain Inlet	EA	13	$1,000.00	$13,000
2	Remove Storm Drain Pipe	LF	6	$30.00	$180
3	New Storm Drain Inlet	EA	123	$5,000.00	$615,000
4	36 inch Corrugated Metal Pipe Inlet	LF	16	$400.00	$6,400
5	Adjust Storm Drain Manhole to Grade	EA	1	$500.00	$500
6	New Storm Drain Manhole	EA	85	$5,000.00	$425,000
7	New Storm Drain Manholes (Bifurcation Pipe)	EA	6	$12,000.00	$72,000
8	New Storm Drain Manholes (Bifurcation Pipe) (Depth < 15 ft)	EA	2	$10,000.00	$20,000
9	Slotted Drain Junction Box	EA	11	$5,000.00	$55,000
10	Class II Concrete (Box Culvert)	CY	1,791	$1,500.00	$2,686,500
11	Class II Concrete (Headwall)	CY	7	$2,000.00	$14,000
12	Bar Reinforcing Steel	LB	418,840	$2.00	$837,680
13	18 inch Slotted Pipe	LF	1,470	$150.00	$220,500
14	15 inch Storm Drain Pipe	LF	664	$100.00	$66,400
15	18 inch Storm Drain Pipe	LF	9,057	$120.00	$1,086,840
16	24 inch Storm Drain Pipe	LF	1,323	$127.00	$168,021
17	36 inch Storm Drain Pipe	LF	866	$240.00	$207,840
18	84 inch Storm Drain Pipe	LF	1,107	$1,500.00	$1,660,500
19	96 inch Rienforced Concrete Pipe	LF	2,750	$1,700.00	$4,675,000
20	Head Wall (for 18" Pipe)	EA	1	$1,500.00	$1,500
21	Rock Slope Protection (1/4 T)	CF	4,785	$10.00	$47,850
22	Rock Slope Protection Fabric	SF	3,633	$3.50	$12,716
23	Roadway Excavation	CY	39,600	$80.00	$3,168,000
24	Erosion Control (Hydroseeding)	SY	23,600	$3.00	$70,800
25	Tree Well	EA	24	$20,000.00	$480,000
26	Pump Station Setup	LS	1	$1,000,000.00	$1,000,000
27	Minor Concrete (Backfill)	CY	189	$250.00	$47,259
28	Minor Concrete (Minor Structure)	CY	67	$1,500.00	$100,500
		DRAINAGE TOTAL			$17,758,986

Segment-wise Drainage Quantities Distribution: **East-West Connector**

Item No.	Item Description	Unit of Measure	Estimated Quantity Segment 1	Cost Segment 1	Estimated Quantity Segment 2	Cost Segment 2	Estimated Quantity Segment 3	Cost Segment 3	Estimated Quantity Segment 4	Cost Segment 4	Estimated Quantity Segment 5	Cost Segment 5
1	Remove Existing Storm Drain Inlet	EA	5	$5,000	1	$1,000	2	$2,000			5	$5,000
2	Remove Storm Drain Pipe	LF					6	$180				
3	New Storm Drain Inlet	EA	5	$25,000	1	$5,000	2	$10,000	64	$320,000	51	$255,000
4	36 inch Corrugated Metal Pipe Inlet	LF							16	$6,400		
5	Adjust Storm Drain Manhole to Grade	EA					1	$500				
6	New Storm Drain Manhole	EA					2	$10,000	42	$210,000	41	$205,000
7	New Storm Drain Manholes (Bifurcation Pipe)	EA							2	$24,000	4	$48,000
8	New Storm Drain Manholes (Bifurcation Pipe) (Depth < 15 ft)	EA									2	$20,000
9	Slotted Drain Junction Box	EA									11	$55,000
10	Class II Concrete (Box Culvert)	CY									1791	$2,686,500
11	Class II Concrete (Headwall)	CY									7	$14,000
12	Bar Reinforcing Steel	LB									418840	$837,680
13	18 inch Slotted Pipe	LF									1470	$220,500
14	15 inch Storm Drain Pipe	LF	46	$4,600	4	$400	9	$900			605	$60,500
15	18 inch Storm Drain Pipe	LF					170	$20,400	5044	$605,280	3843	$461,160
16	24 inch Storm Drain Pipe	LF							1323	$168,021		
17	36 inch Storm Drain Pipe	LF							263	$63,120	603	$144,720
18	84 inch Storm Drain Pipe	LF									1107	$1,660,500
19	96 inch Rienforced Concrete Pipe	LF							1220	$2,074,000	1530	$2,601,000
20	Head Wall (for 18" Pipe)	EA	1	$1,500								
21	Rock Slope Protection (1/4 T)	CF	60	$600					4200	$42,000	525	$5,250
22	Rock Slope Protection Fabric	SF	60	$210					3176	$11,116	397	$1,390
23	Roadway Excavation	CY							39600	$3,168,000		
24	Erosion Control (Hydroseeding)	SY							23600	$70,800		
25	Tree Well	EA			10	$200,000	6	$120,000			8	$160,000
26	Pump Station Setup	LS									1	$1,000,000
27	Minor Concrete (Backfill)	CY	10	$2,588	1	$225	42	$10,409			136	$34,037
28	Minor Concrete (Minor Structure)	CY									67	$100,500
	TOTAL COST (Segment wise)			$39,498		$206,625		$174,389		$6,762,737		$10,575,737
	TOTAL DRAINAGE COST	**$17,758,986**										

*Contingency and Mobilization not included

: 1) Quantities and Cost estimates are based on conceptual design