


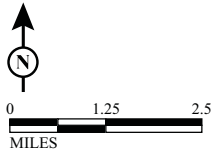
LEGEND
 SR 710 North Study Area

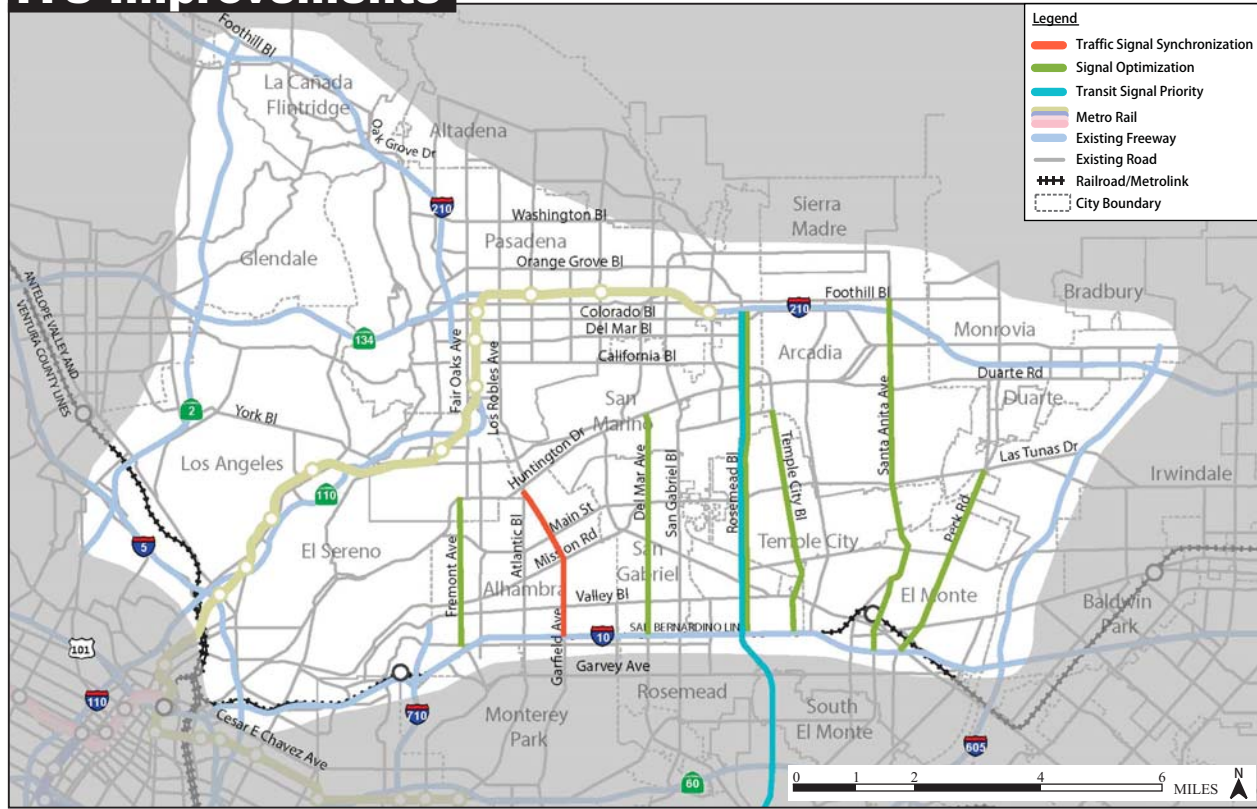
FIGURE 1-1



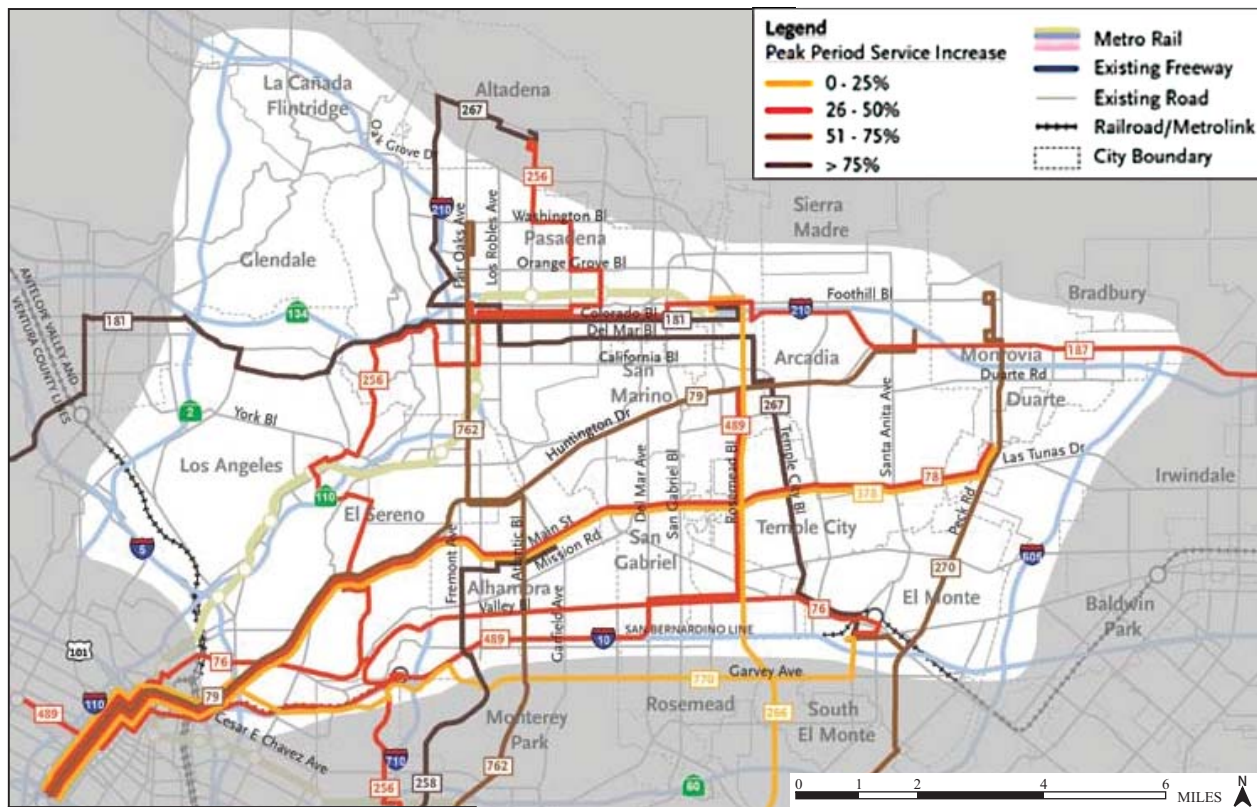
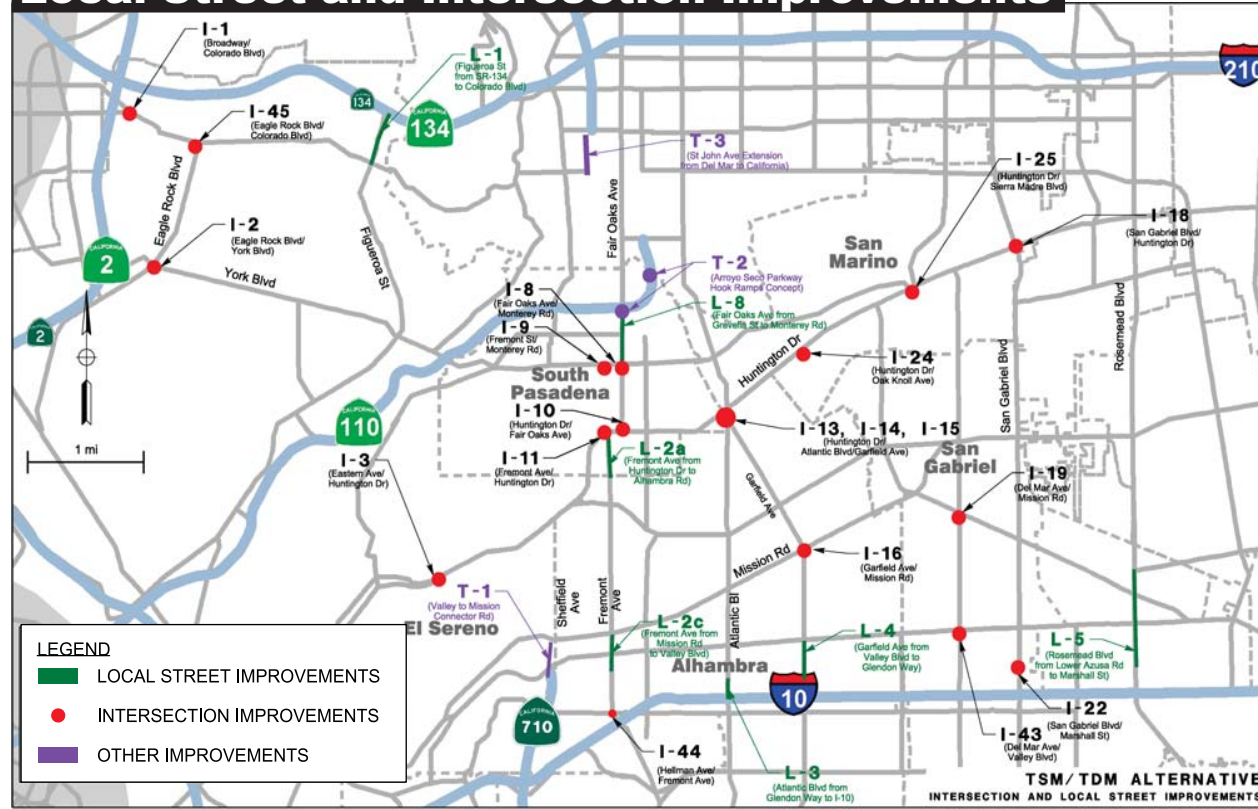
SOURCE: ESRI (2008); LSA (2013)
 I:\CHM1105\GVP&N\Project Location.cdr (10/27/14)

SR 710 North Study
 Project Location
 07-LA-710 (SR 710)
 EA 187900
 EFIS 0700000191

ITS Improvements



Local Street and Intersection Improvements



Transit Refinement



Active Transportation

FIGURE I-3

SR 710 North Study
TSM/TDM Alternative
07-LA-710 (SR 710)
EA 187900
EFIS 0700000191

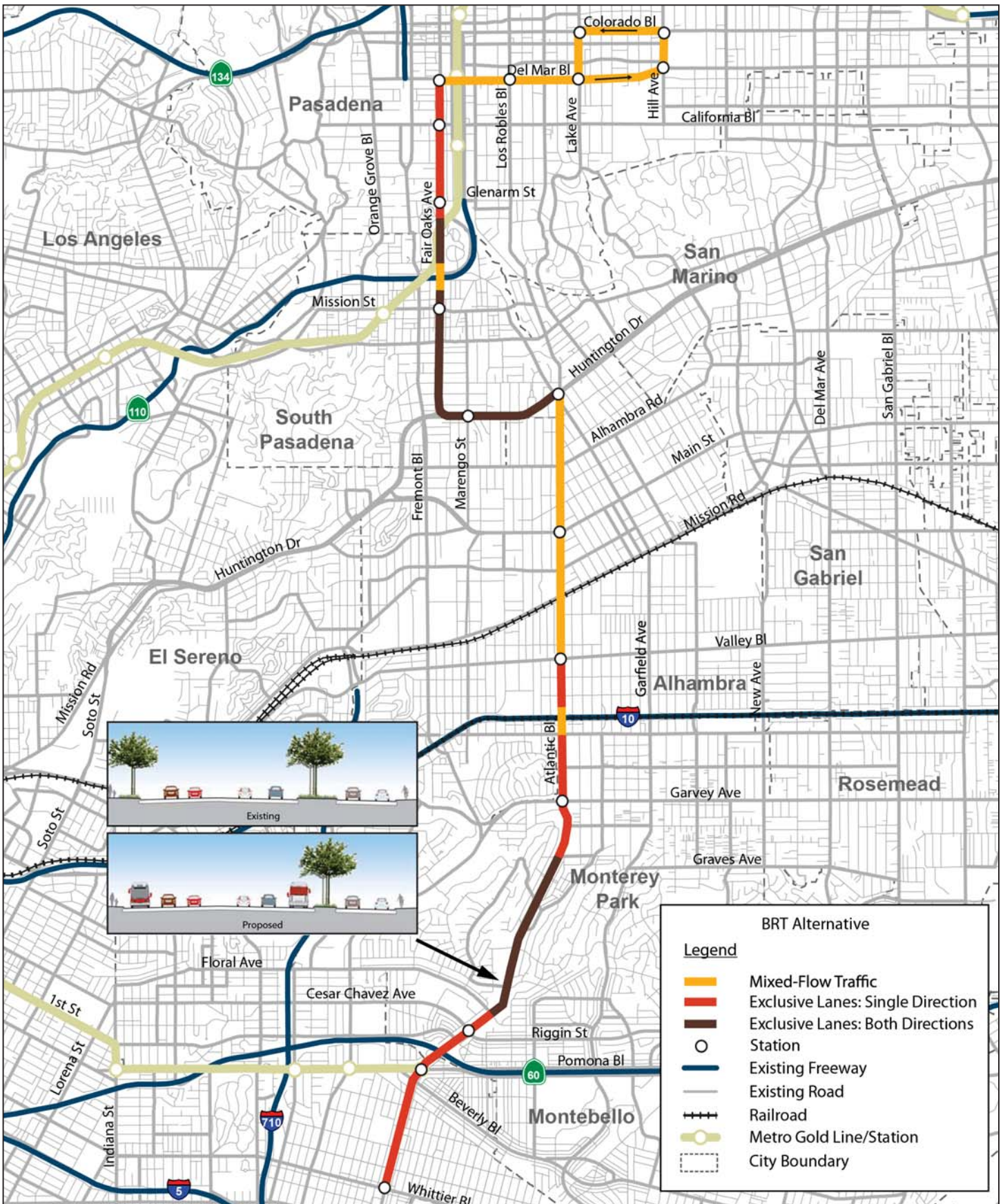


FIGURE 1-4



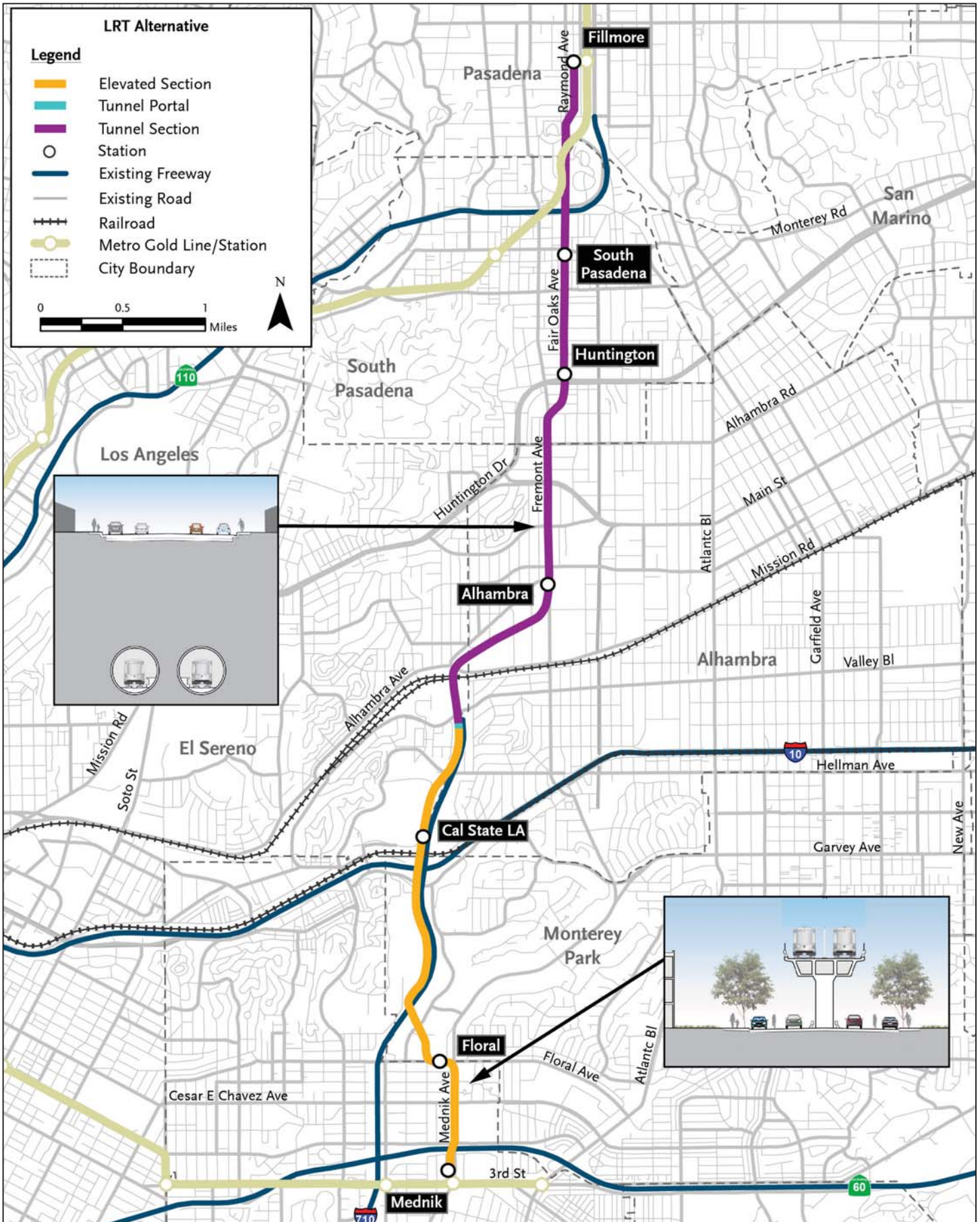
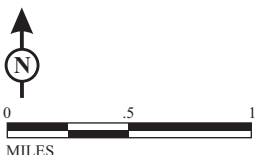


FIGURE 1-5



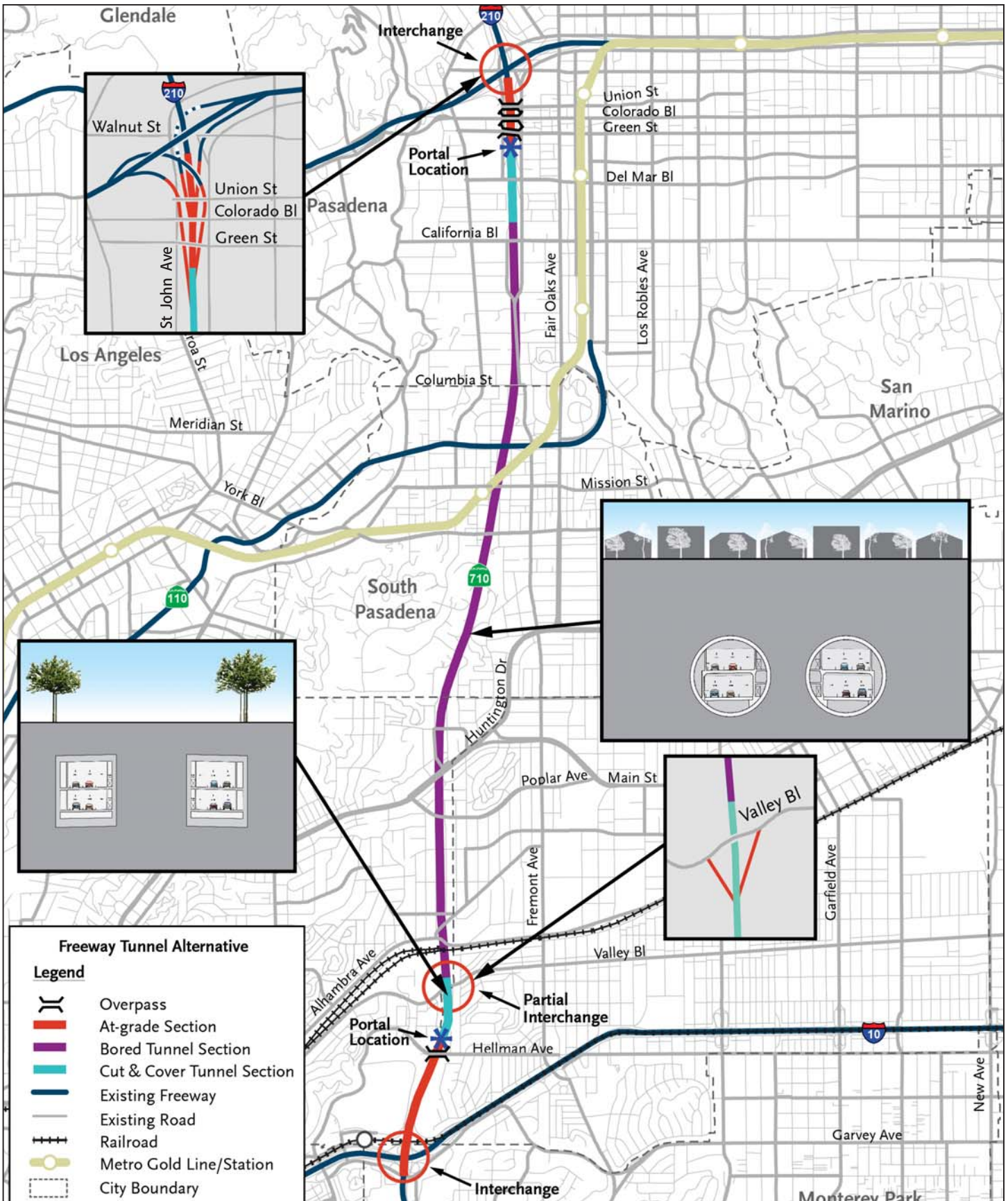
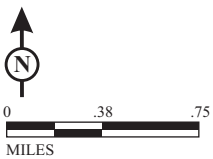


FIGURE 1-6



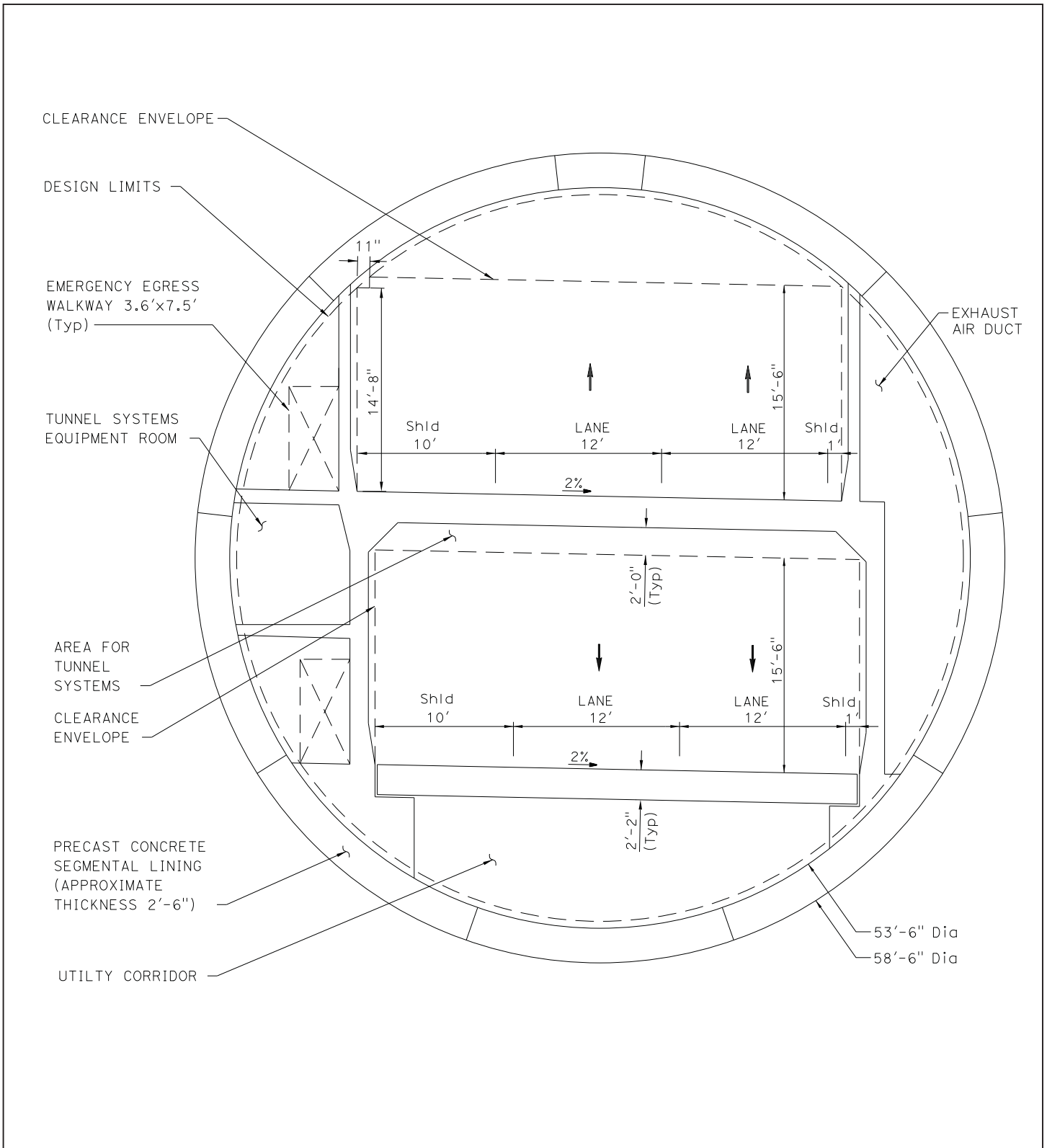
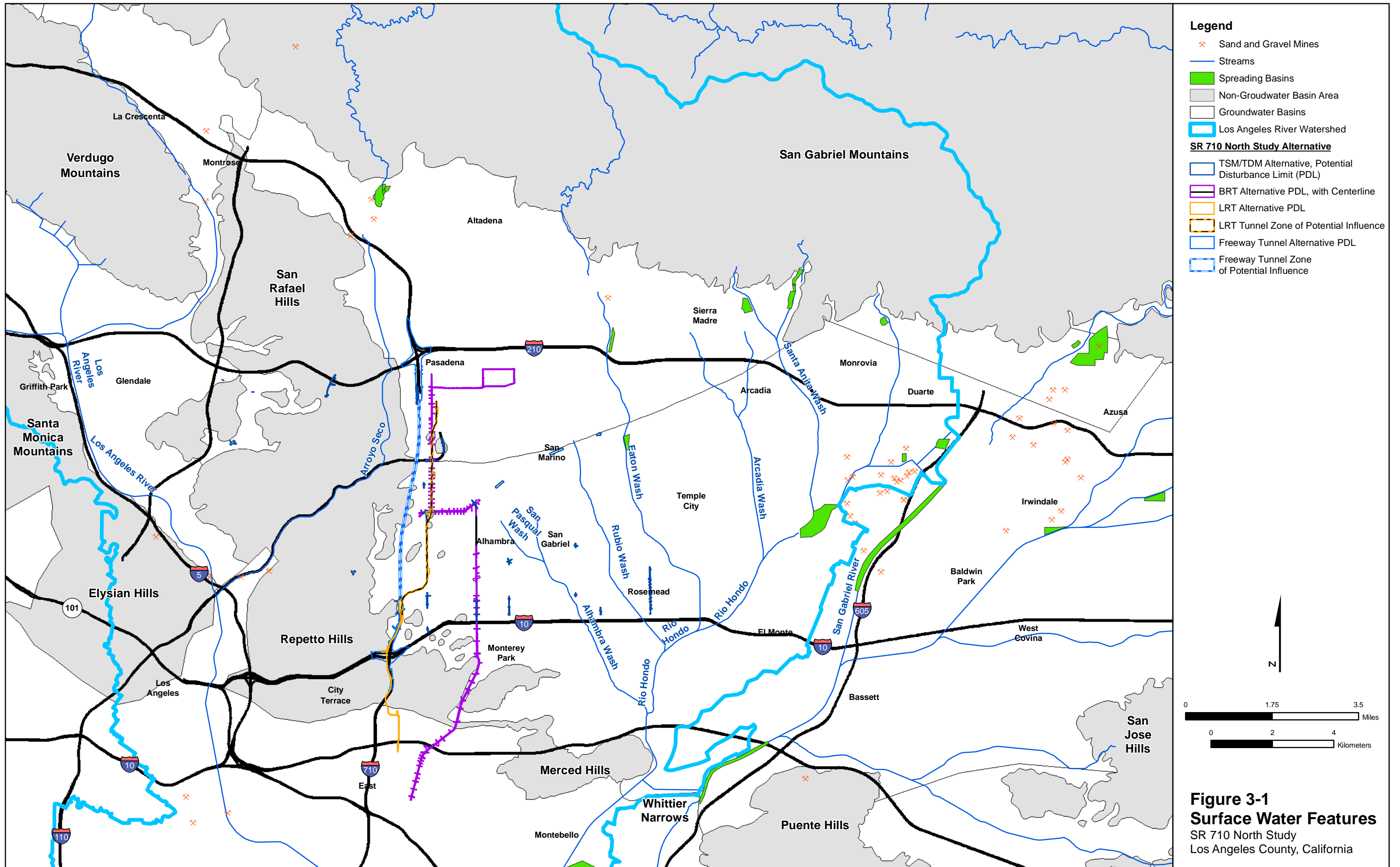


FIGURE 1-7

SR 710 North Study
 Freeway Tunnel Alternative
 Single Bore Cross Section
 07-LA-710 (SR 710)
 EA 187900
 EFIS 0700000191



- Legend**
- ✕ Sand and Gravel Mines
 - Streams
 - Spreading Basins
 - Non-Groundwater Basin Area
 - Groundwater Basins
 - ▭ Los Angeles River Watershed
- SR 710 North Study Alternative**
- ▭ TSM/TDM Alternative, Potential Disturbance Limit (PDL)
 - ▭ BRT Alternative PDL, with Centerline
 - ▭ LRT Alternative PDL
 - ▭ LRT Tunnel Zone of Potential Influence
 - ▭ Freeway Tunnel Alternative PDL
 - ▭ Freeway Tunnel Zone of Potential Influence

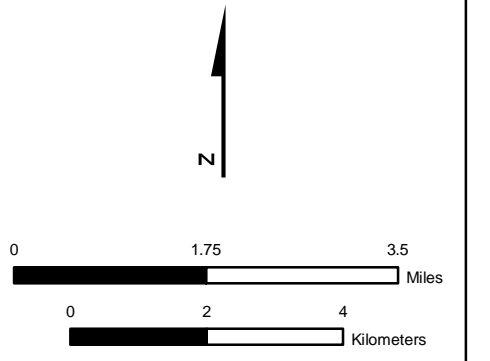
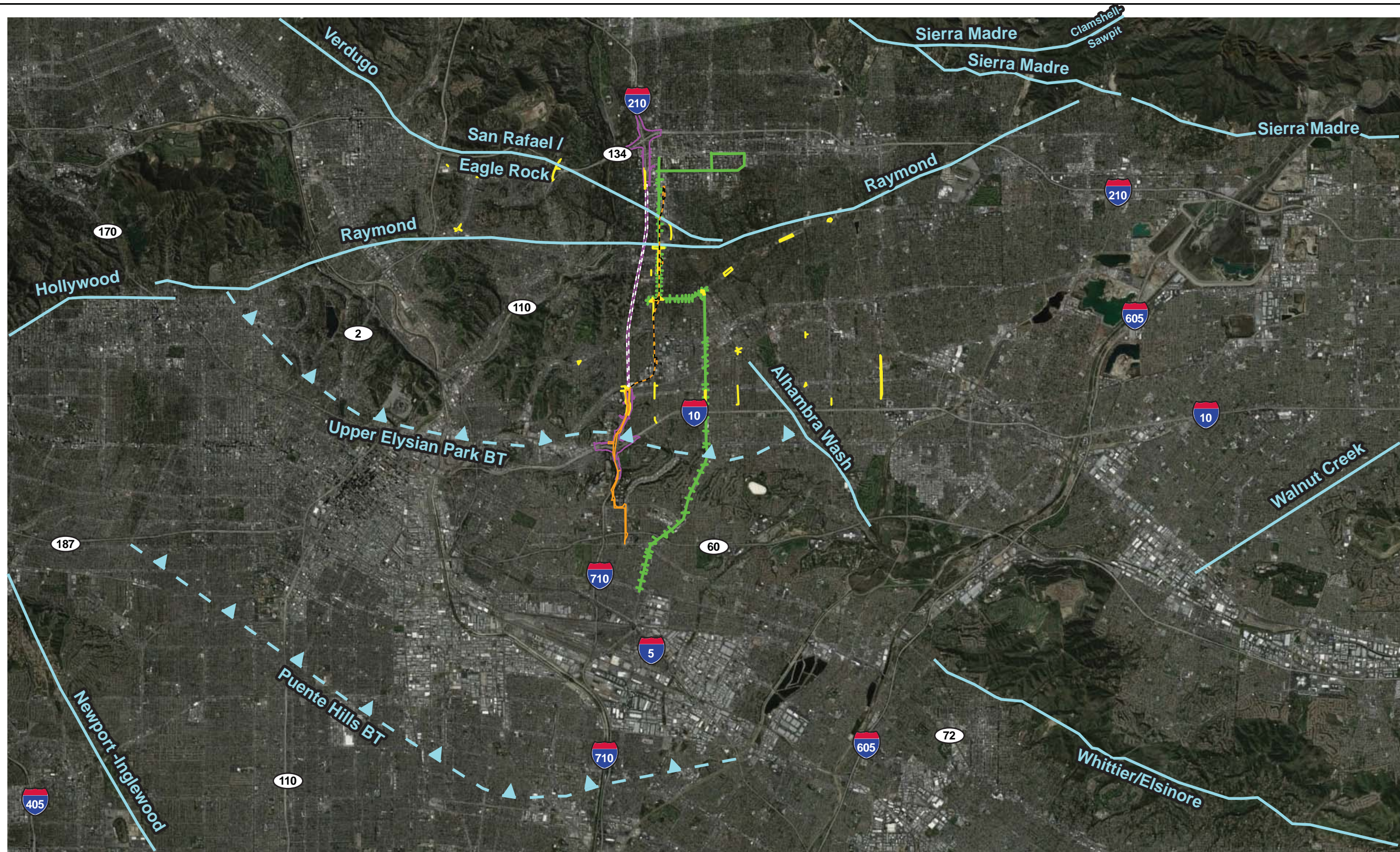


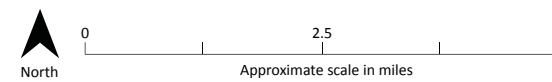
Figure 3-1
Surface Water Features
 SR 710 North Study
 Los Angeles County, California



Aerial image © Google Earth, 2013. Annotation by CH2M HILL, 2013.

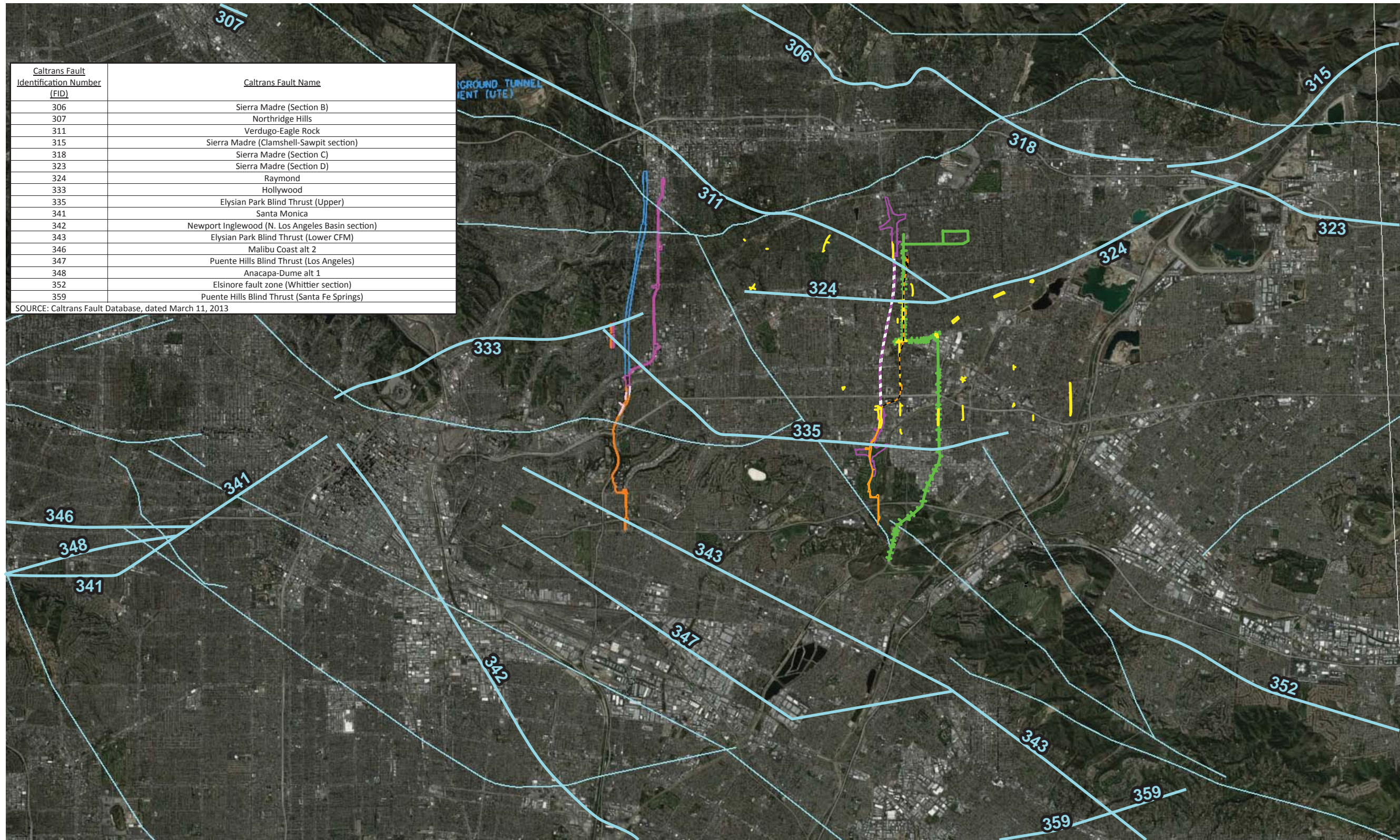
LEGEND

- ▲ Approximate Fault Location with Name (BT = Blind Thrust, Subsurface Fault, Barbs on Upper Block)
- TSM/TDM Alternative, Potential Disturbance Limit (PDL)
- BRT Alternative PDL, with Centerline
- LRT Alternative PDL
- LRT Tunnel Zone of Potential Influence
- Freeway Tunnel Alternative PDL
- Freeway Tunnel Zone of Potential Influence



**FIGURE 4-1
FAULT LOCATION MAP
SR 710 North Study,
Los Angeles County, California**

Fault Data from: Plesch et al, 2007 and USGS, 2010; with modifications based on this study.



Caltrans Fault Identification Number (FID)	Caltrans Fault Name
306	Sierra Madre (Section B)
307	Northridge Hills
311	Verdugo-Eagle Rock
315	Sierra Madre (Clamshell-Sawpit section)
318	Sierra Madre (Section C)
323	Sierra Madre (Section D)
324	Raymond
333	Hollywood
335	Elysian Park Blind Thrust (Upper)
341	Santa Monica
342	Newport Inglewood (N. Los Angeles Basin section)
343	Elysian Park Blind Thrust (Lower CFM)
346	Malibu Coast alt 2
347	Puente Hills Blind Thrust (Los Angeles)
348	Anacapa-Dume alt 1
352	Elsinore fault zone (Whittier section)
359	Puente Hills Blind Thrust (Santa Fe Springs)

SOURCE: Caltrans Fault Database, dated March 11, 2013

Aerial image © Google Earth, 2013. Annotation by CH2M HILL, 2013.

LEGEND

- Approximate Fault Location with Caltrans FID (see table above)
- TSM/TDM Alternative, Potential Disturbance Limit (PDL)
- BRT Alternative PDL, with Centerline
- LRT Alternative PDL
- LRT Tunnel Zone of Potential Influence
- Freeway Tunnel Alternative PDL
- Freeway Tunnel Zone of Potential Influence

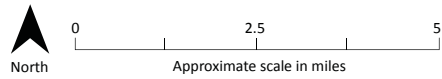


FIGURE 4-2
REGIONAL FAULT MAP
 SR 710 North Study,
 Los Angeles County, California

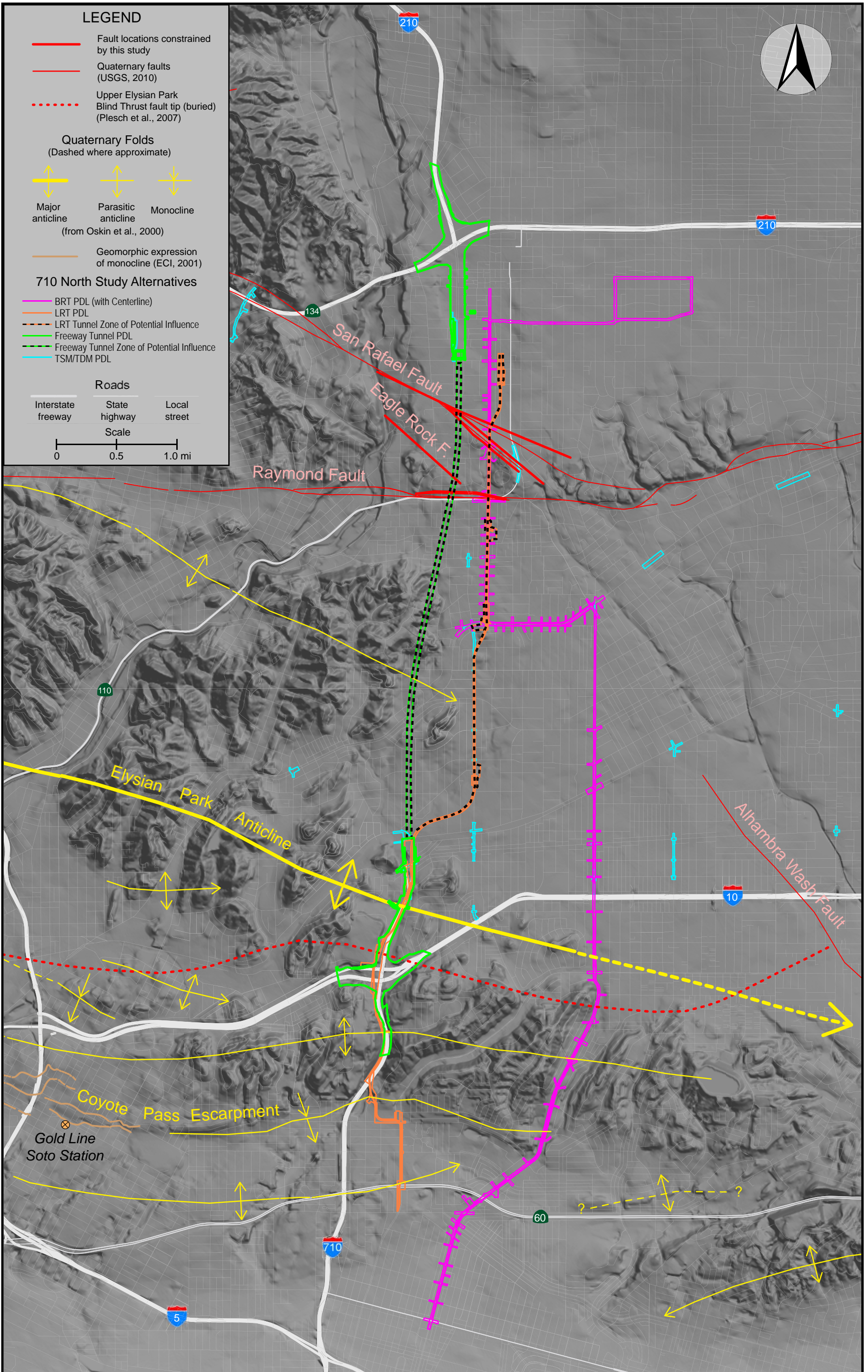


FIGURE 4-3
**ELYSIAN PARK BLIND THRUST FAULT
 AND FOLD MAP**
 SR 710 North Study,
 Los Angeles County, California
CH2MHILL.

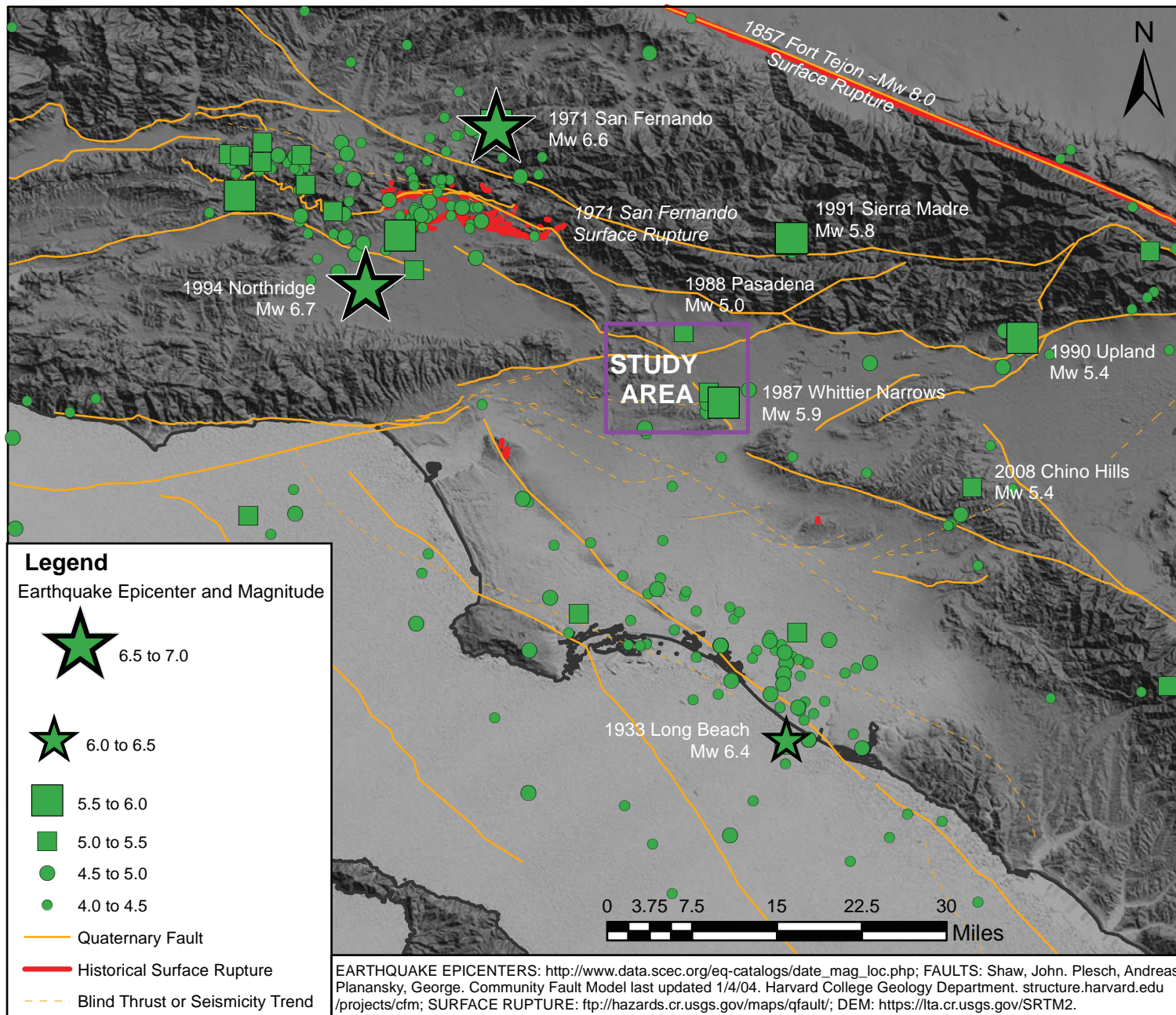
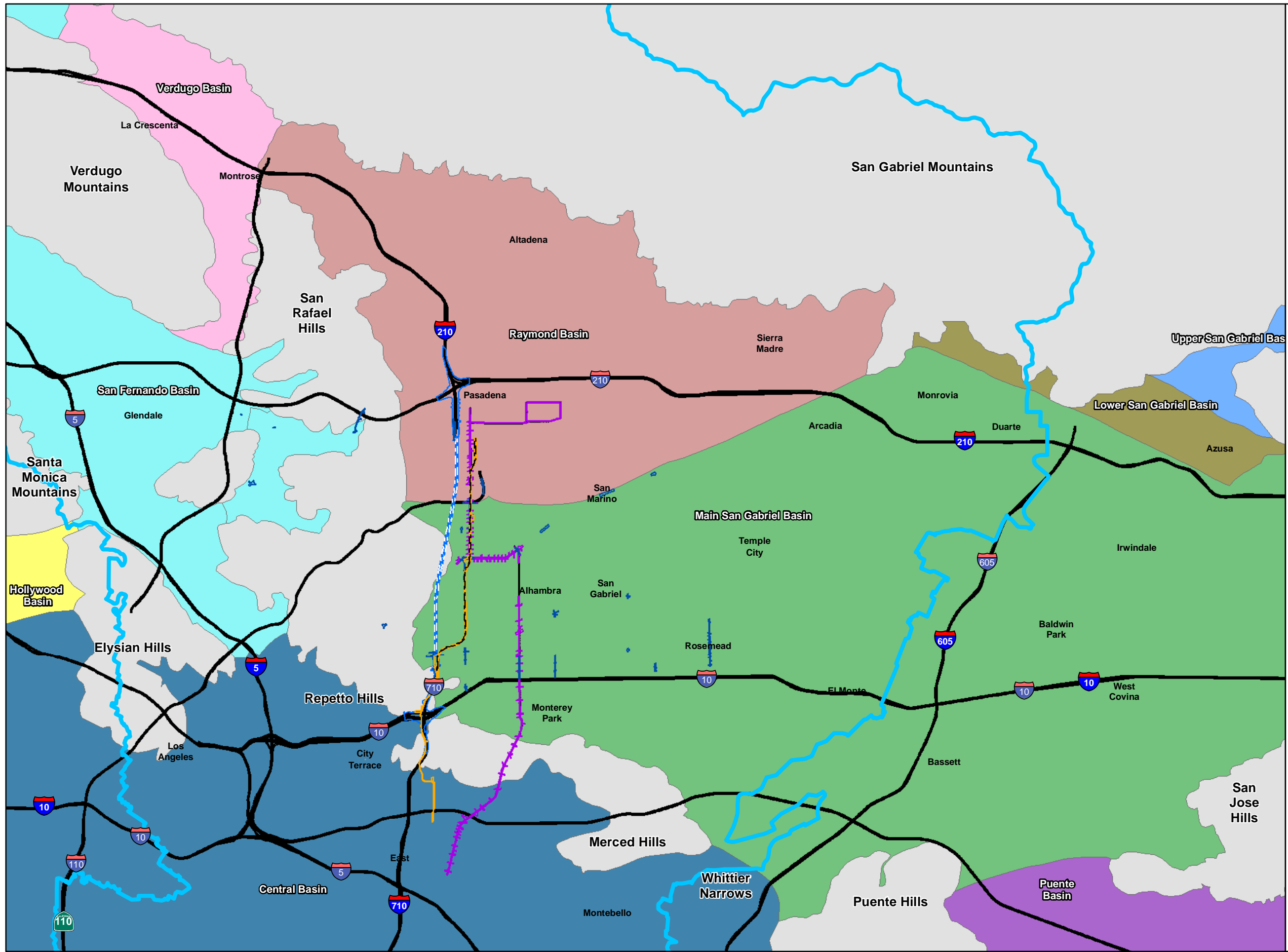


FIGURE 4-4
HISTORICAL SEISMICITY MAP
SR 710 North Study
Los Angeles County, California



Legend

SR 710 North Study Alternative

- TSM/TDM Alternative, Potential Disturbance Limit (PDL)
- BRT Alternative PDL, with Centerline
- LRT Alternative PDL
- LRT Tunnel Zone of Potential Influence
- Freeway Tunnel Alternative PDL
- Freeway Tunnel Zone of Potential Influence

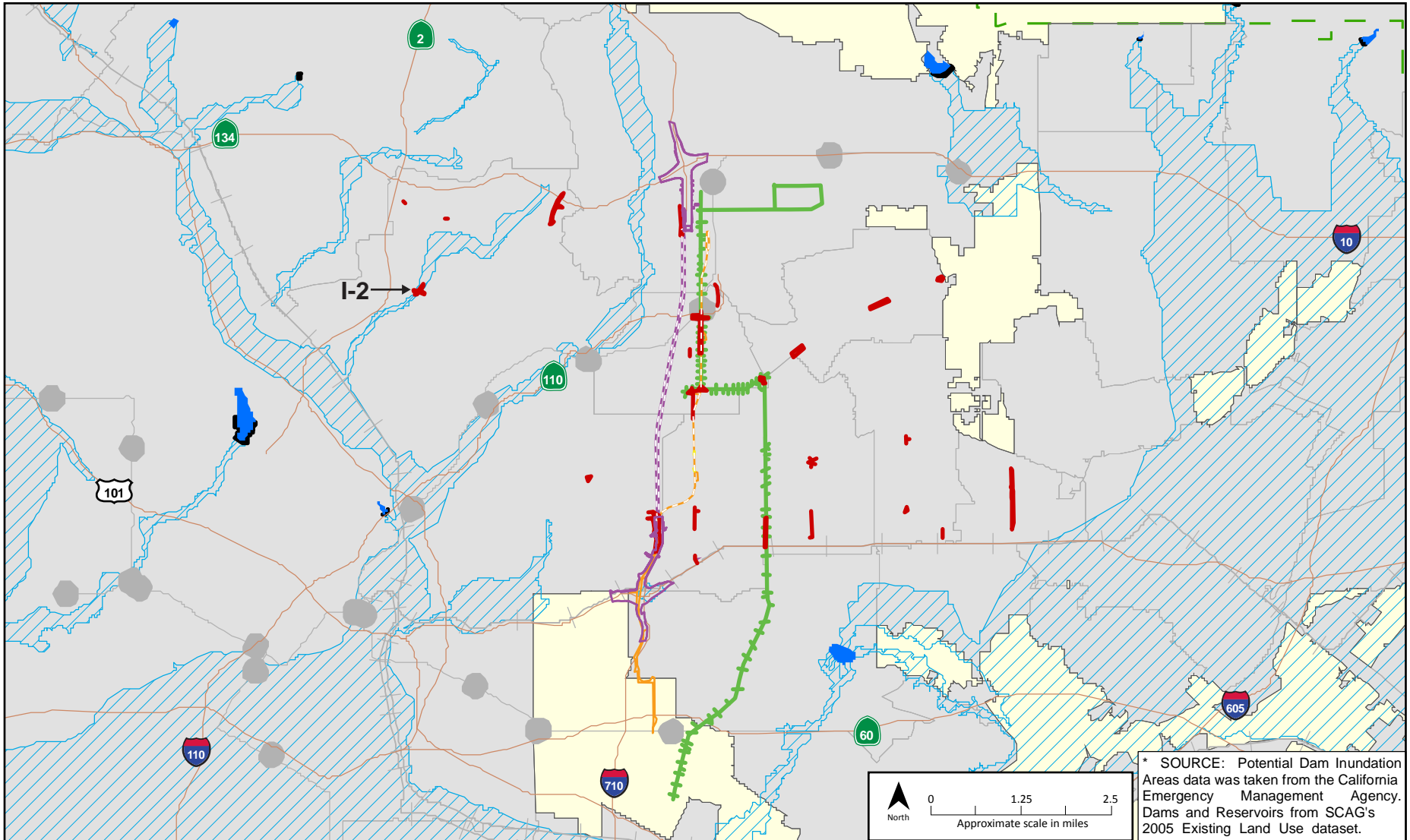
Ground Water Basins

- Los Angeles River Watershed Boundary
- Verdugo Basin
- Upper San Gabriel Basin
- San Fernando Basin
- Raymond Basin
- Puente Basin
- Main San Gabriel Basin
- Lower San Gabriel Basin
- Hollywood Basin
- Central Basin
- Bedrock Upland Area (Non-Water Bearing)

Source:
Los Angeles County Department of Public Works,
Water Resources Division

0 1.75 3.5 Miles
0 2 4 Kilometers

Figure 5-1
Groundwater Basins
SR 710 North Study
Los Angeles County, California



* SOURCE: Potential Dam Inundation Areas data was taken from the California Emergency Management Agency. Dams and Reservoirs from SCAG's 2005 Existing Land Use dataset.

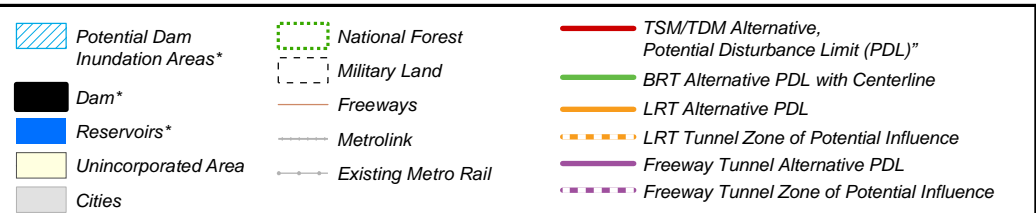
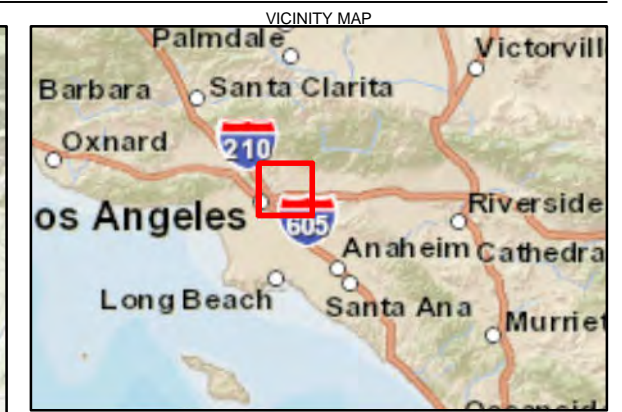
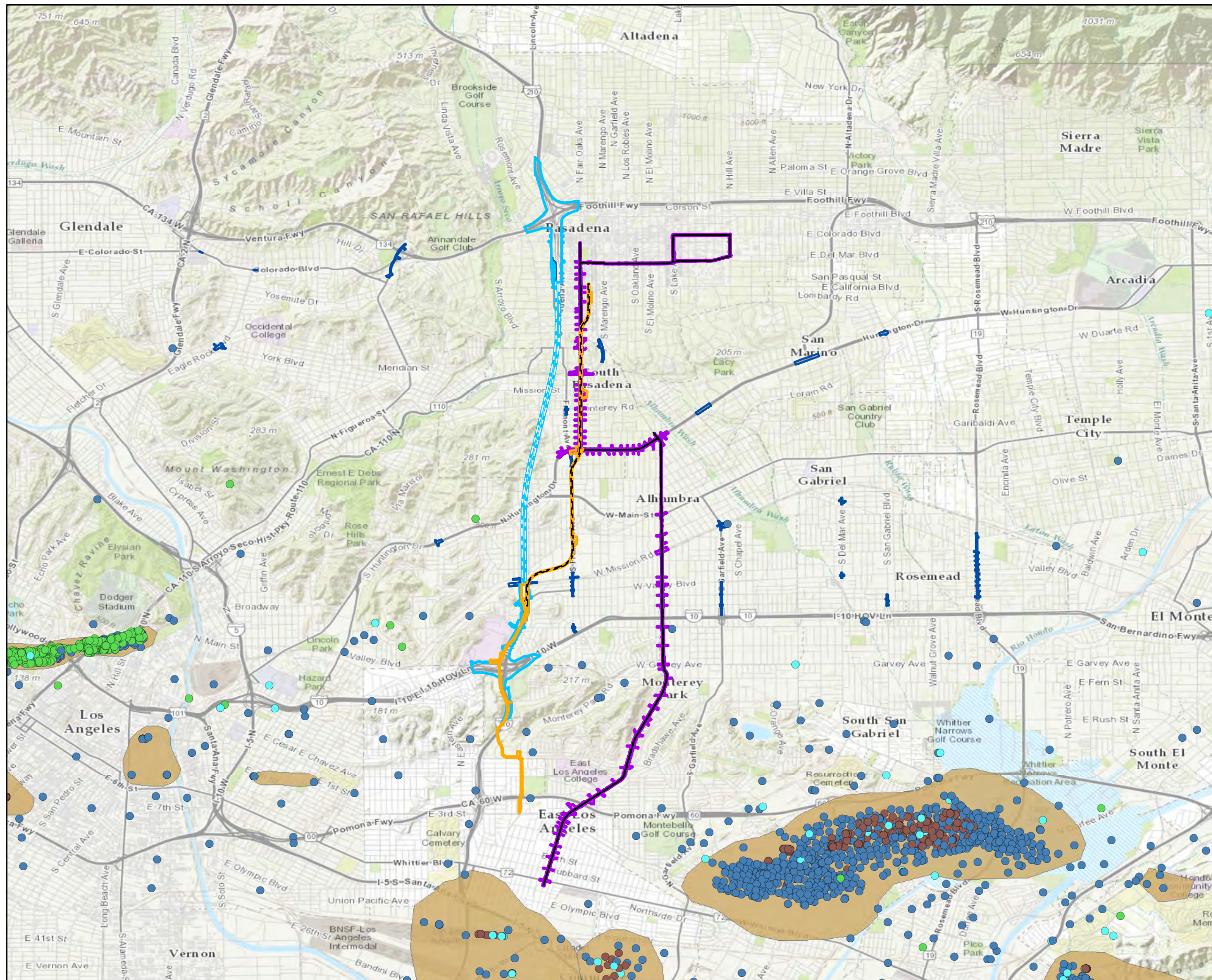


FIGURE 5-2
DAM INUNDATION MAP
 SR 710 North Study,
 Los Angeles County, California





LEGEND

Well Status

- Active
- Buried
- Idle
- New
- Plugged
- Oil Fields

SR 710 North Study Alternative

- ▭ TSM/TDM Alternative, Potential Disturbance Limit (PDL)
- ▭ BRT Alternative PDL, with Centerline
- ▭ LRT Alternative PDL
- ▭ LRT Tunnel Zone of Potential Influence
- ▭ Freeway Tunnel Alternative PDL
- ▭ Freeway Tunnel Zone of Potential Influence

Sources:

- 1) Department of Oil, Gas, and Geothermal Resources, 2005, Oil and Gas Field Database. Available at http://ftp.consrv.ca.gov/pub/oil/Data_Catalog/Oil_and_Gas/Oil_fields/. Accessed September 17, 2013.
- 2) Department of Oil, Gas, and Geothermal Resources, 2012, Well Database. Available at <http://conservation.ca.gov/dog/maps/Pages/GISMapping2.aspx>. Accessed September 17, 2013.

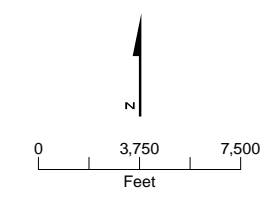
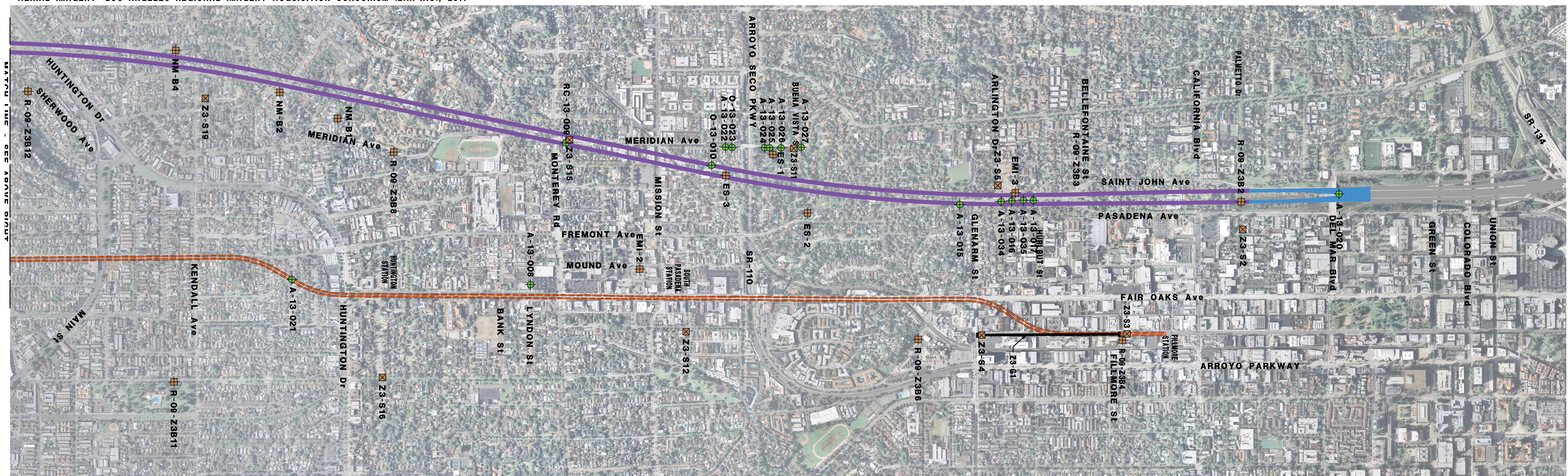


FIGURE 6-1
Oil and Gas Well Location Map
 SR 710 North Study
 Los Angeles, California



AERIAL IMAGERY: LOS ANGELES REGIONAL IMAGERY ACQUISITION CONSORTIUM (LAR-IAC), 2011



LEGEND:

- █ FREEWAY TUNNEL ALTERNATIVE, CUT & COVER TUNNEL
- █ FREEWAY TUNNEL ALTERNATIVE, BORED TUNNEL
- █ FREEWAY TUNNEL ALTERNATIVE, SURFACE
- █ LRT ALTERNATIVE, ELEVATED
- █ LRT ALTERNATIVE, TUNNEL
- A, R, RC, or O-13-001 CURRENT BORINGS (CH2M HILL and ECI, 2013)
- Z3-G6 SEISMIC REFLECTION LINE (CH2M HILL, 2010)
- Z3-S22 MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW), (CH2M HILL, 2010)
- R-09-Z1B8 PREVIOUS BORINGS (CH2M HILL, 2010)
- NM-B4; EMI-3; ES-2 PREVIOUS BORINGS (Ninvo and Moore, 1999; Earth Mechanics Inc., 2006; Caltrans, 1974)

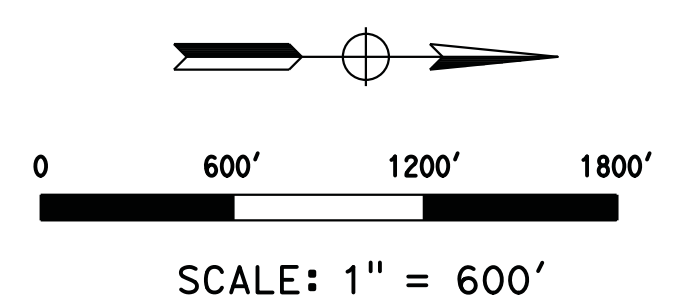
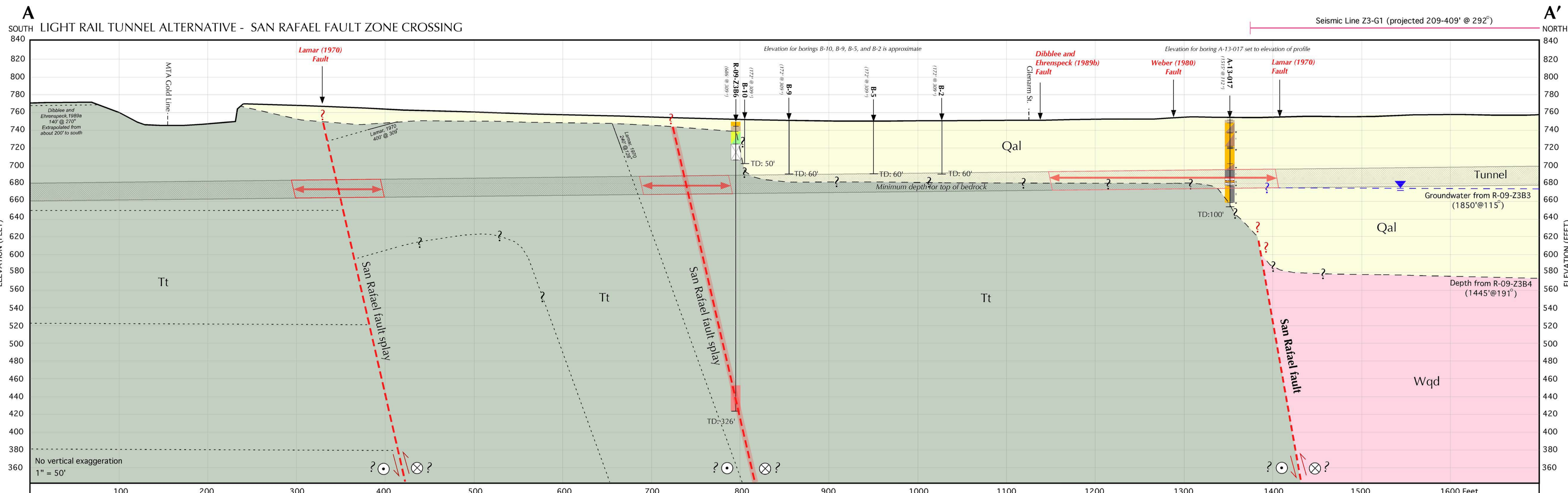
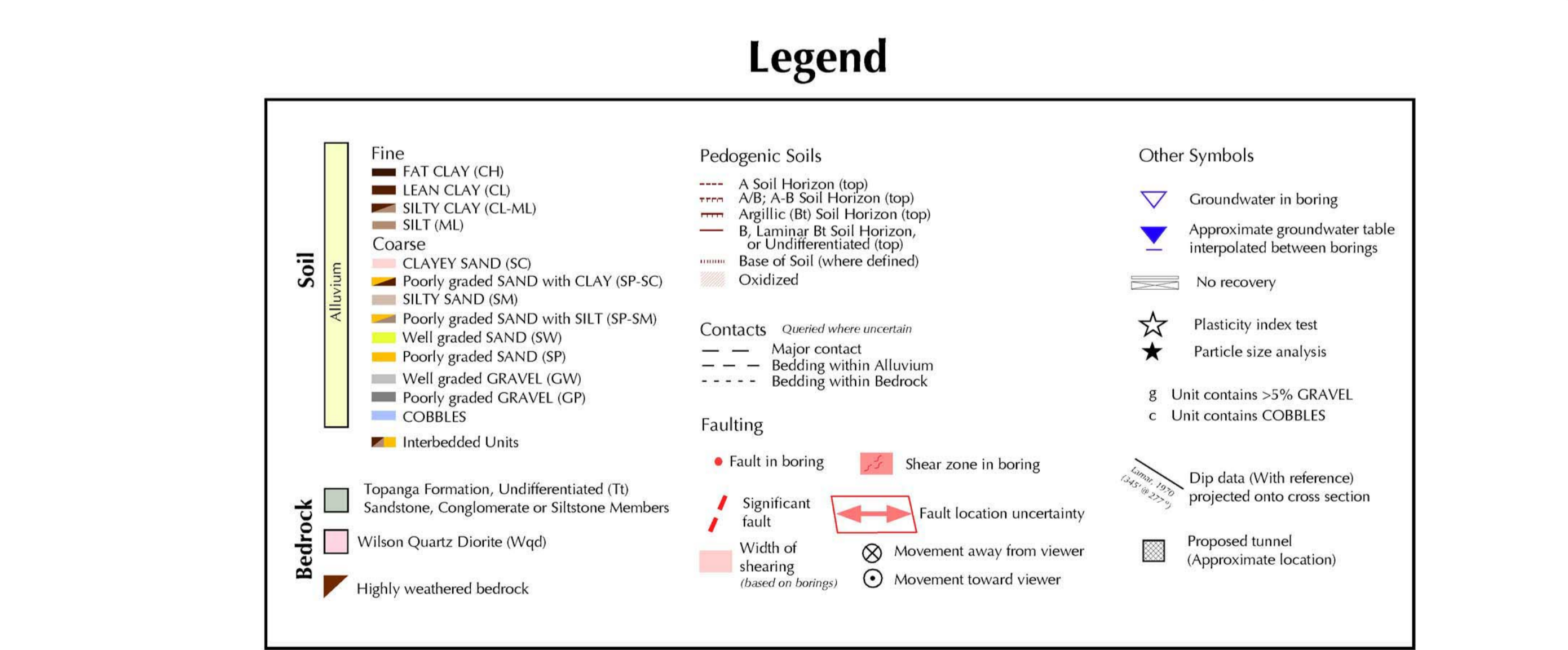


PLATE 1
BORING LOCATION MAP
SR 710 North Study
Los Angeles County, California

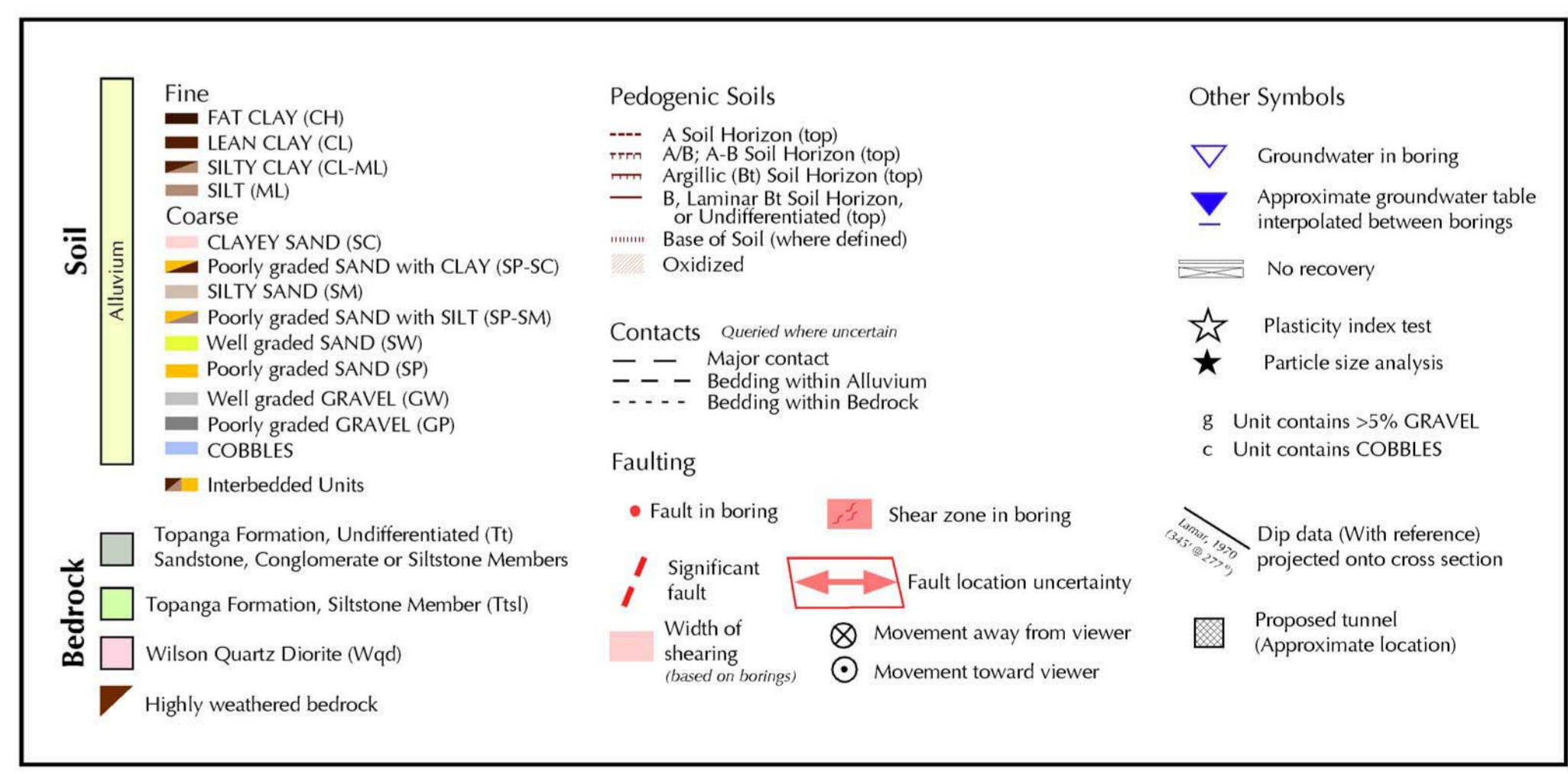
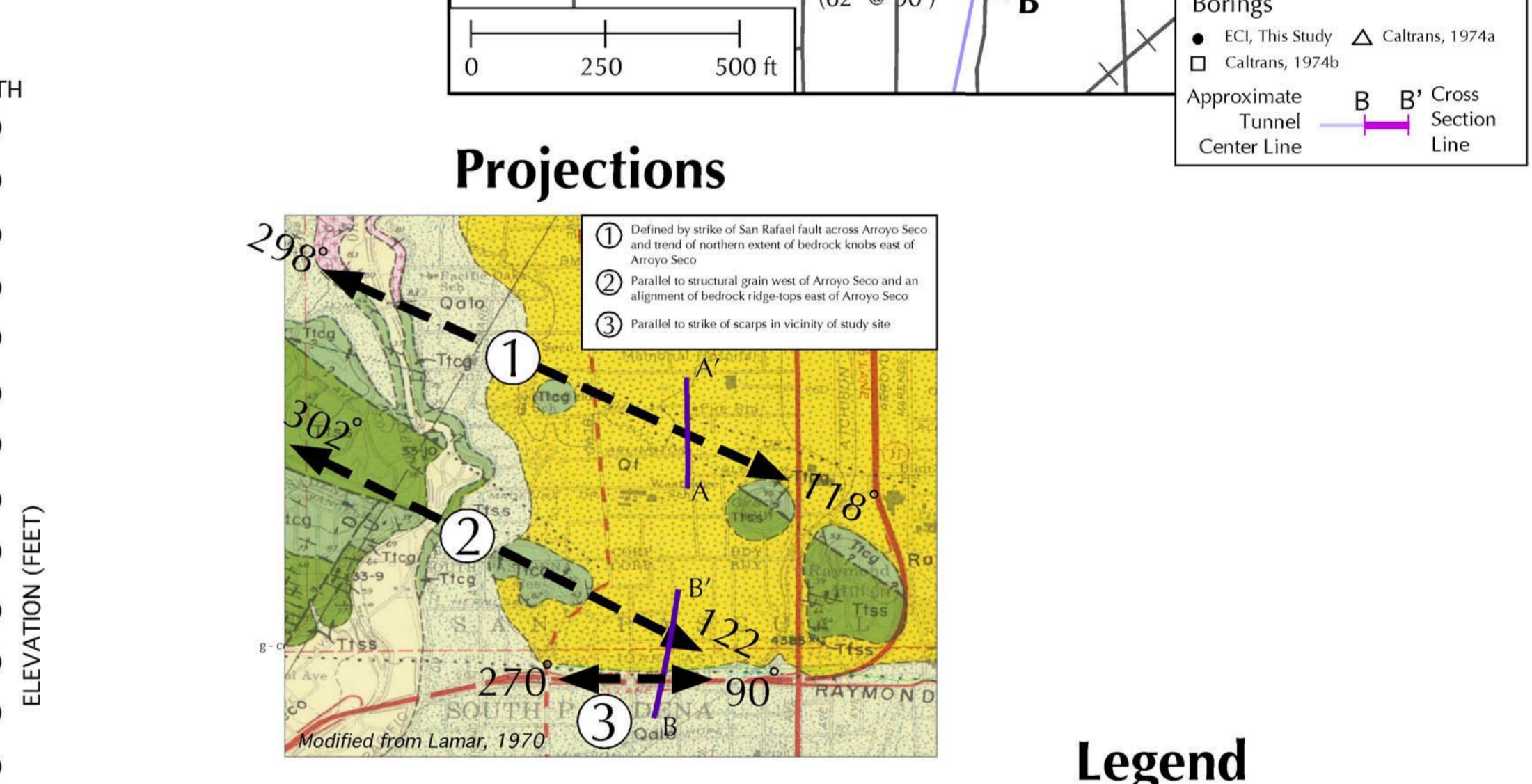
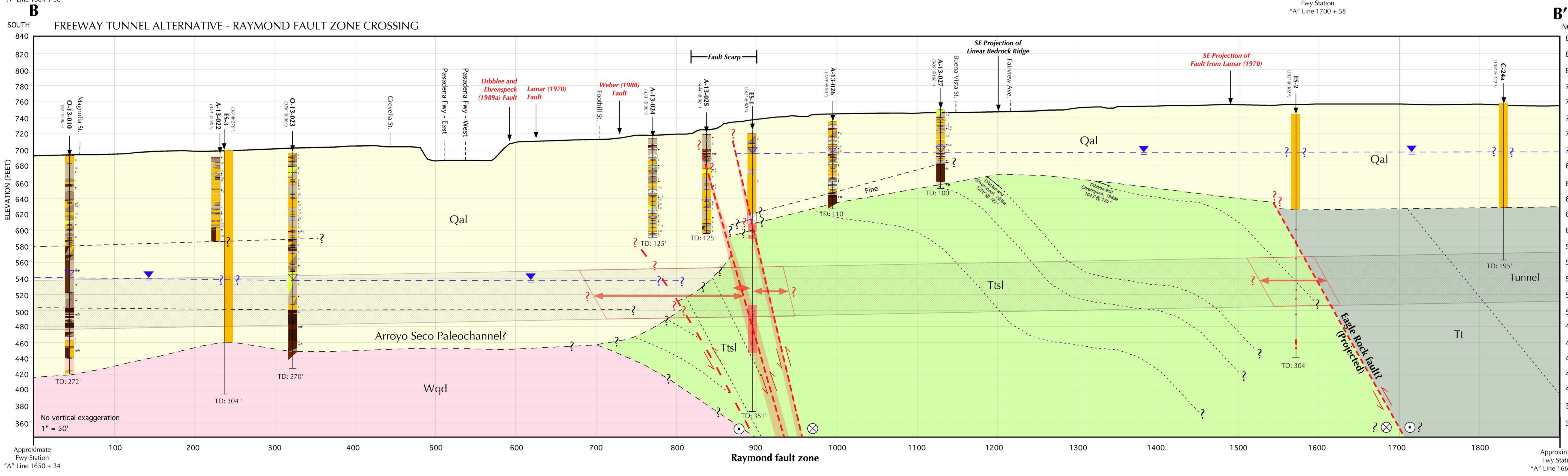
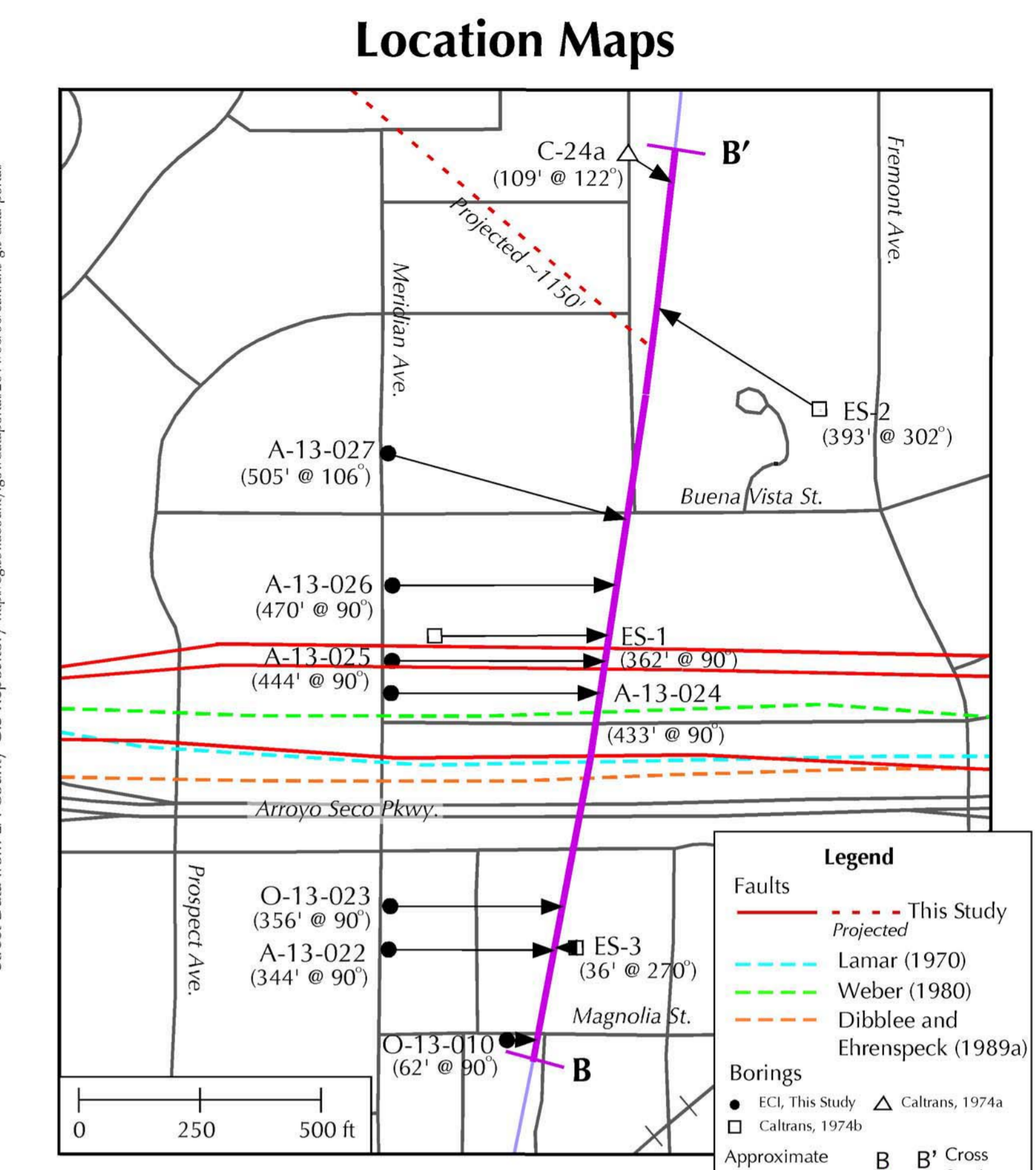
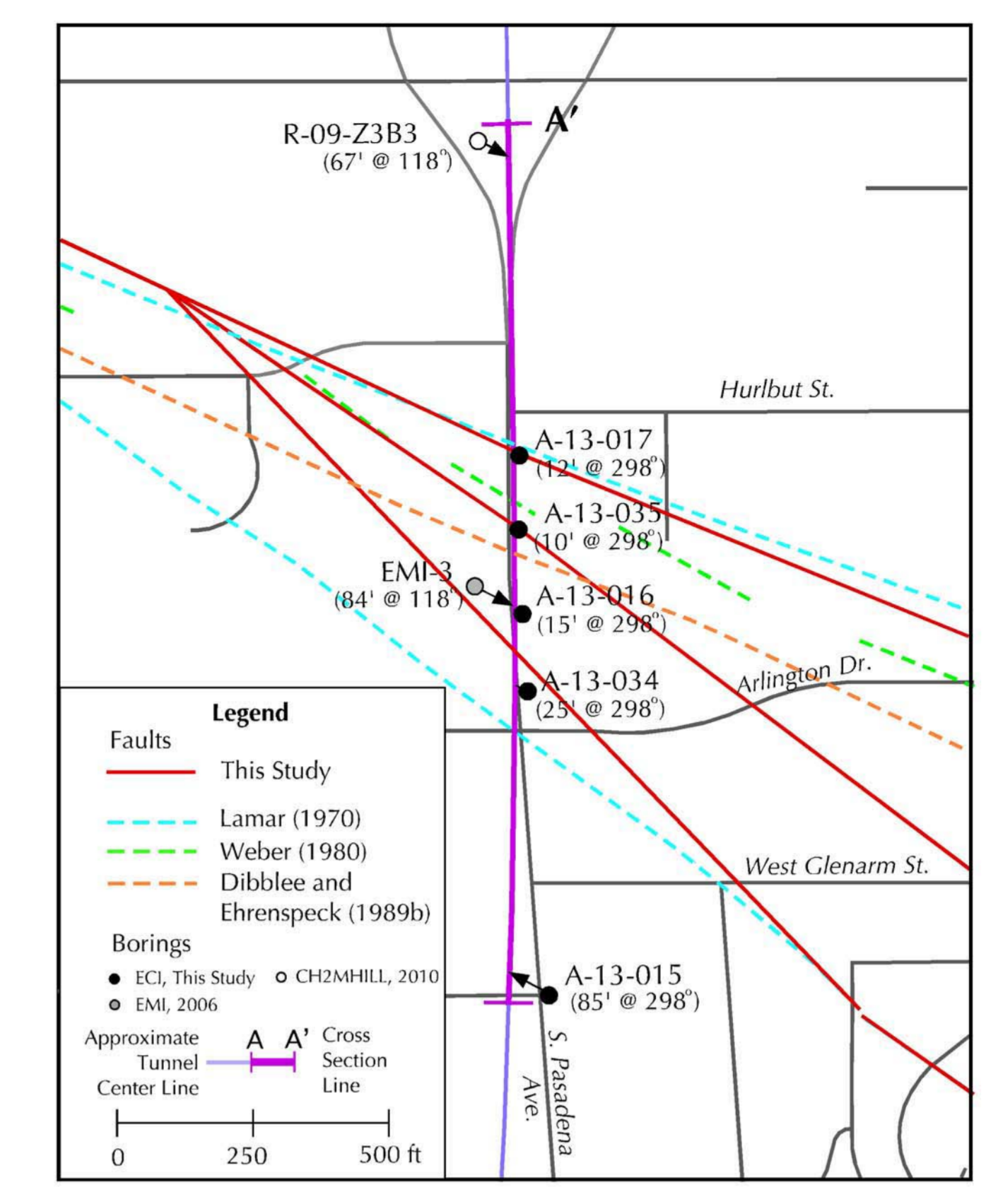
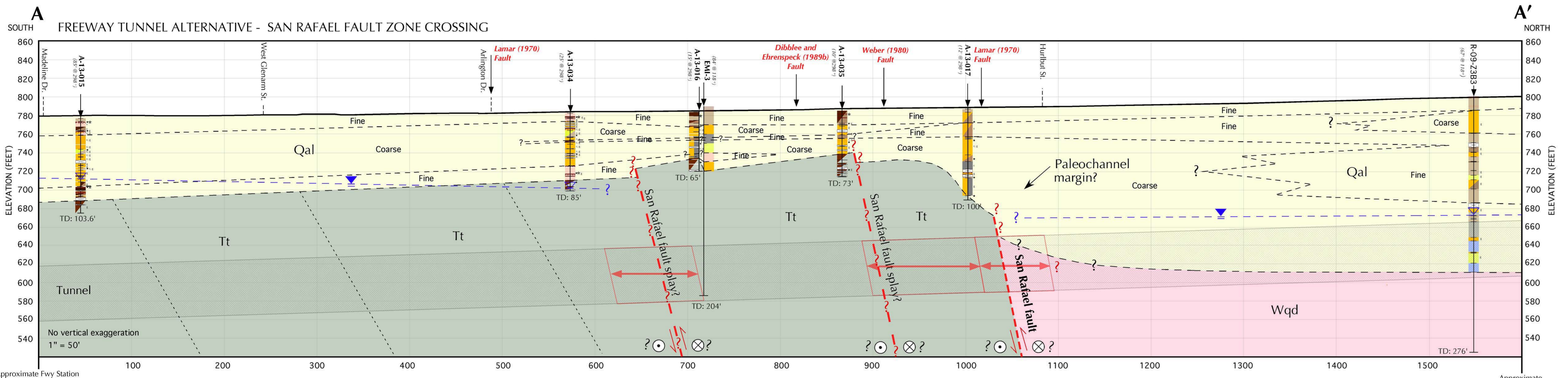


Location Maps

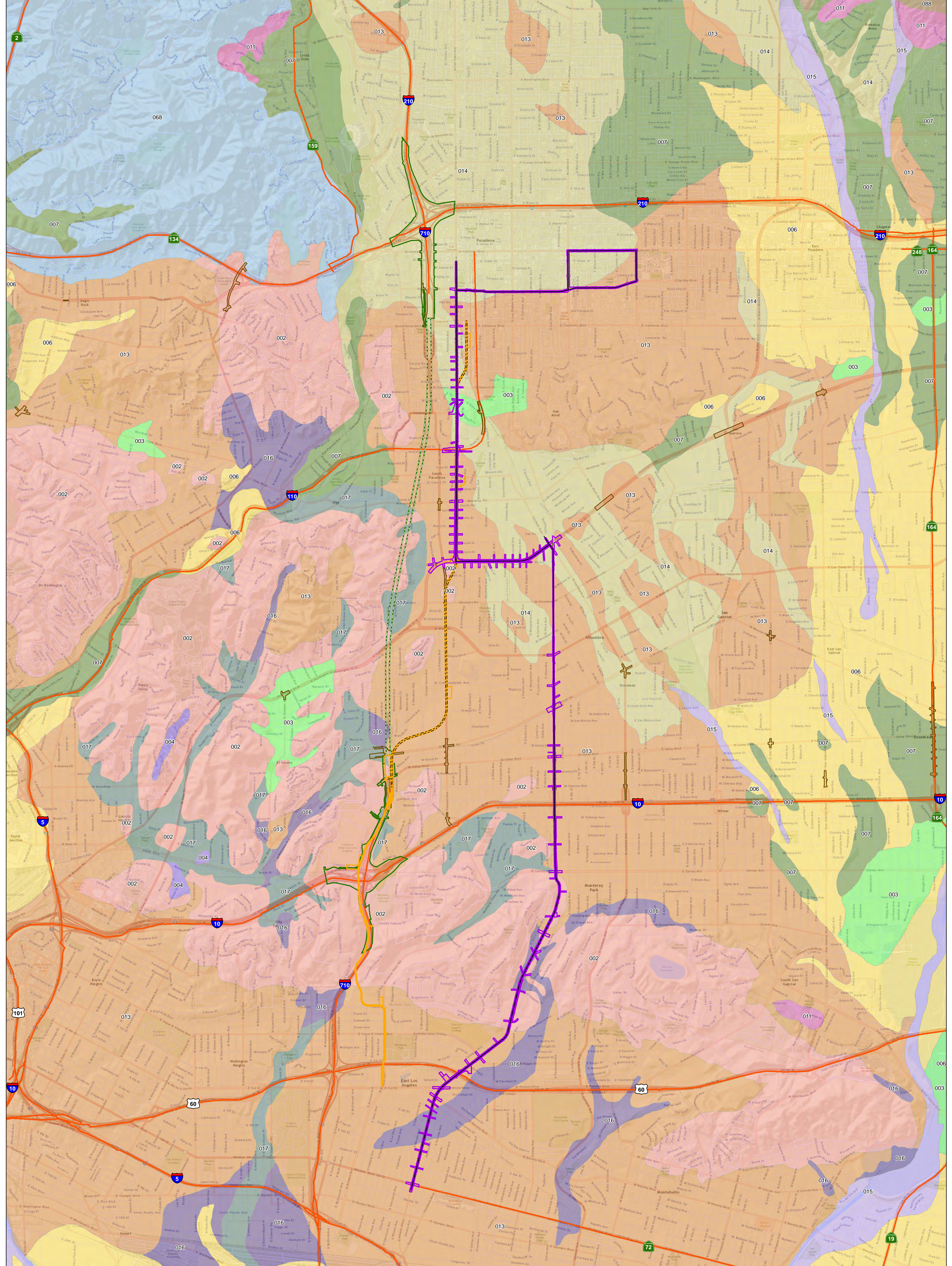
B LIGHT RAIL TUNNEL ALTERNATIVE - RAYMOND FAULT ZONE CROSSING



SR 710 North Study Light Rail Transit Alternative Geologic Cross Sections Across the San Rafael and Raymond Fault Zones



SR 710 North Study, Freeway Tunnel Alternative, Geological Cross Sections Across the San Rafael, Eagle Rock and Raymond Fault Zones



- Legend**
- SR 710 North Study Alternative**
- TSM/TDM Alternative, Potential Disturbance Limit (PDL)
 - BRT Alternative PDL, with Centerline
 - LRT Alternative PDL
 - LRT Tunnel Zone of Potential Influence
 - Freeway Tunnel Alternative PDL
 - Freeway Tunnel Zone of Potential Influence
- Soils**
- 002 - ALTAMONT CLAY LOAM
 - 003 - CHINO SILT LOAM
 - 004 - DIABLO CLAY LOAM
 - 006 - HANFORD FINE SANDY LOAM
 - 007 - HANFORD GRAVELLY SANDY LOAM
 - 011 - PLACENTIA LOAM
 - 013 - RAMONA LOAM
 - 014 - RAMONA SANDY LOAM
 - 015 - TUJUNGA FINE SANDY LOAM
 - 016 - YOLO LOAM
 - 017 - YOLO CLAY LOAM

- 004 - DIABLO CLAY LOAM
- 006 - HANFORD FINE SANDY LOAM
- 007 - HANFORD GRAVELLY SANDY LOAM
- 011 - PLACENTIA LOAM
- 013 - RAMONA LOAM
- 014 - RAMONA SANDY LOAM
- 015 - TUJUNGA FINE SANDY LOAM
- 016 - YOLO LOAM
- 017 - YOLO CLAY LOAM

References:
 1 - Road base map streamed from ESRI (September, 2014)
 2 - Los Angeles County Department of Public Works, 2006. Hydrology Manual, January.
 3 - Los Angeles Department of Public Works, 2013. Hydrology Map, A GIS viewer application to view the data for the hydrology manual. <http://ladpw.org/wrd/hydrologygis/>. Accessed on September 18.

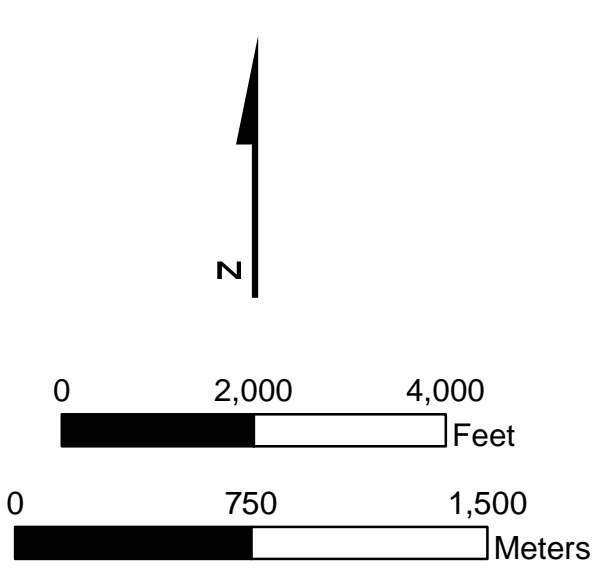
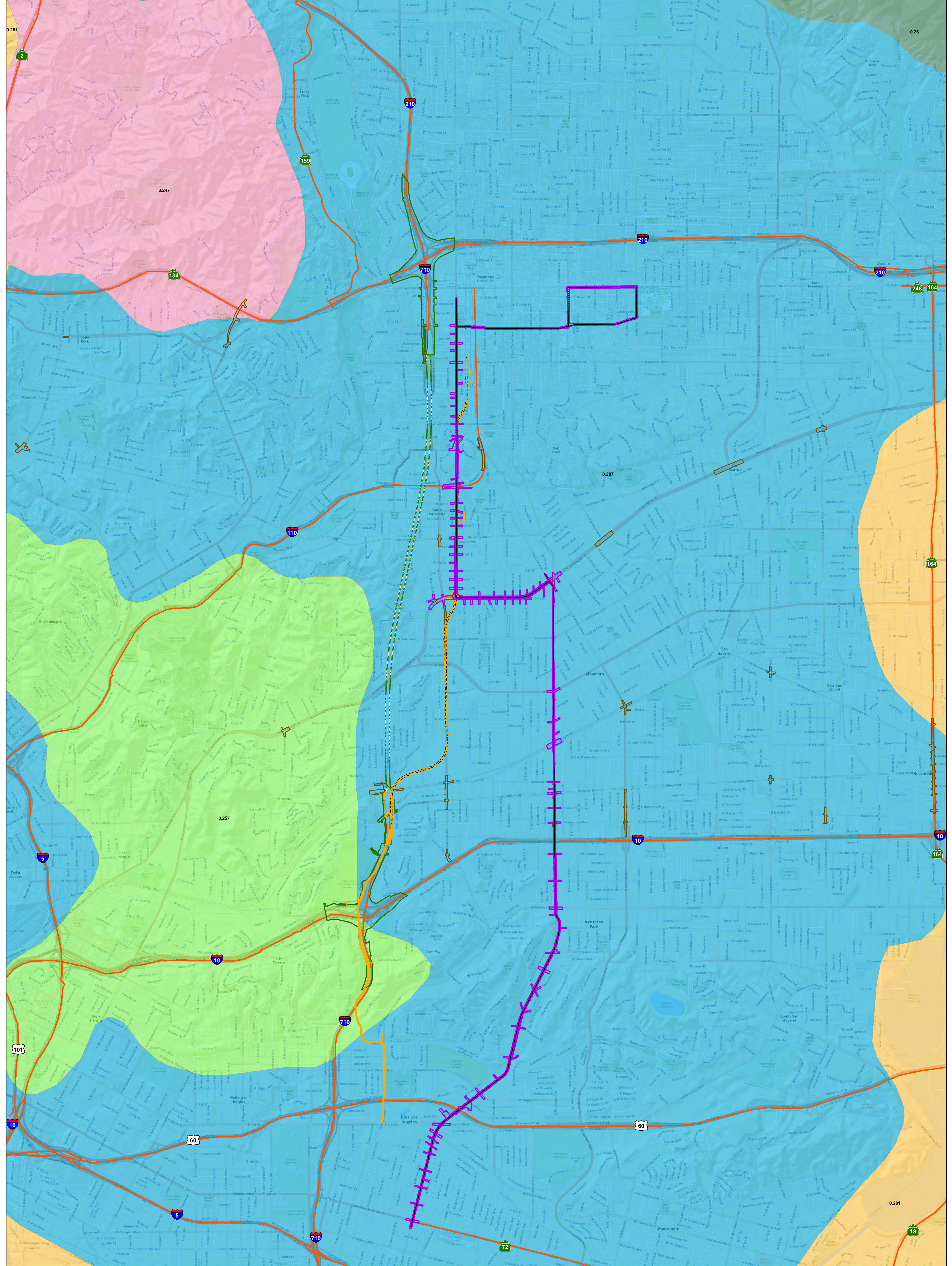


Plate 5
Surficial Soils Map
 SR 710 North Study
 Los Angeles County, California





Legend

SR 710 North Study Alternative

- TSM/TDM Alternative, Potential Disturbance Limit (PDL)
- BRT Alternative PDL, with Centerline
- LRT Alternative PDL
- LRT Tunnel Zone of Potential Influence
- Freeway Tunnel Alternative PDL
- Freeway Tunnel Zone of Potential Influence

K-Factor

- 0.247
- 0.257
- 0.26
- 0.281
- 0.287

Soil Susceptibility to Erosion

Low
Moderate
High

K-Factor

0.05 to 0.20
0.20 to 0.40
>0.40

References:

- 1 - NRCS-USA State Office of Michigan, 2013. Revised Universal Soil Loss Equation (RUSLE) Technical Guide. Available at <http://www.lwr.msu.edu/rusle/kfactor.htm>. Accessed September 19, 2013
- 2 - STATSGO - U.S. Department of Agriculture, 1994. Available at <http://water.usgs.gov/lookup/getspatial?mud>. Accessed September 19, 2013
- 3 - Road base map streamed from ESRI (September, 2014)

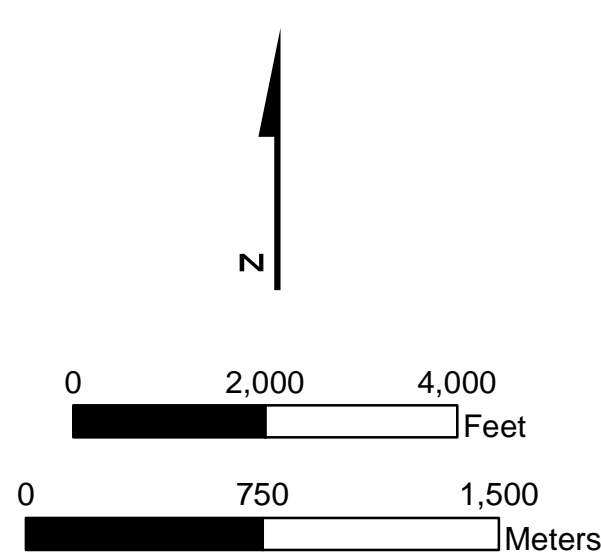
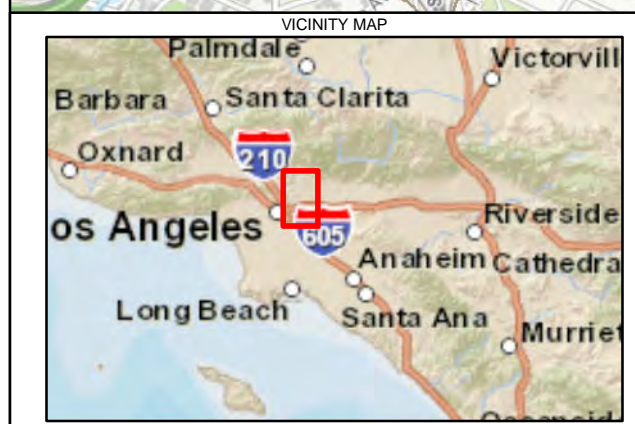
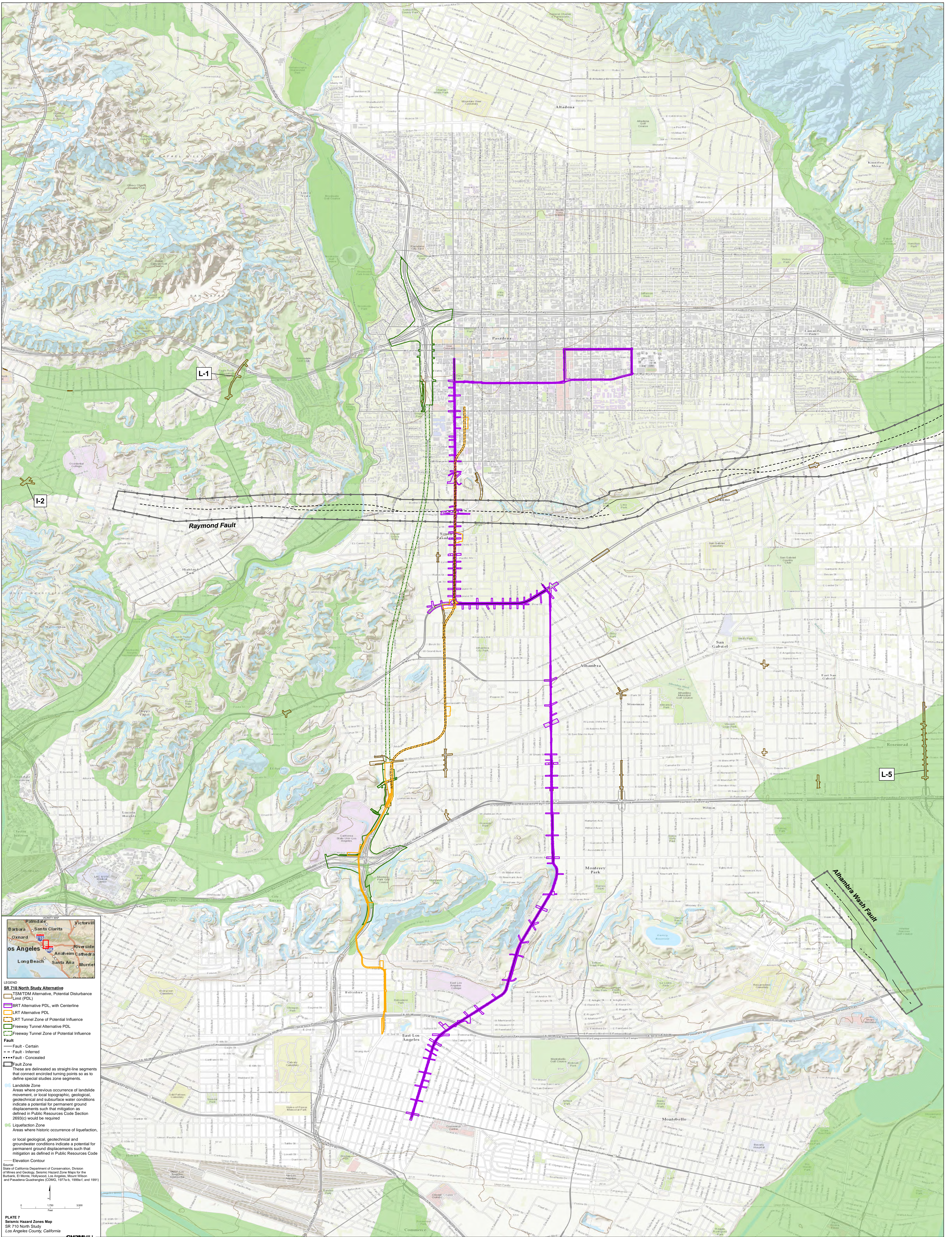


Plate 6
Soil Erodibility Map
SR 710 North Study
Los Angeles County, California



LEGEND

SR 710 North Study Alternative

- TSM/TDM Alternative, Potential Disturbance Limit (PDL)
- BRT Alternative PDL with Centerline
- LRT Alternative PDL
- LRT Tunnel Zone of Potential Influence
- Freeway Tunnel Alternative PDL
- Freeway Tunnel Zone of Potential Influence

Fault

- Fault - Certain
- Fault - Inferred
- Fault - Concealed

Fault Zone

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Landslide Zone

Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Liquefaction Zone

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Elevation Contour

Source: State of California Department of Conservation, Division of Mines and Geology; Seismic Hazard Zone Maps for the Burbank, El Monte, Hollywood, Los Angeles, Mount Wilson and Pasadena Quadrangles (CDMG, 1977a,b, 1998a, and 1999)

Scale: 0 1,750 3,500 Feet

PLATE 7
Seismic Hazard Zones Map
SR 710 North Study
Los Angeles County, California

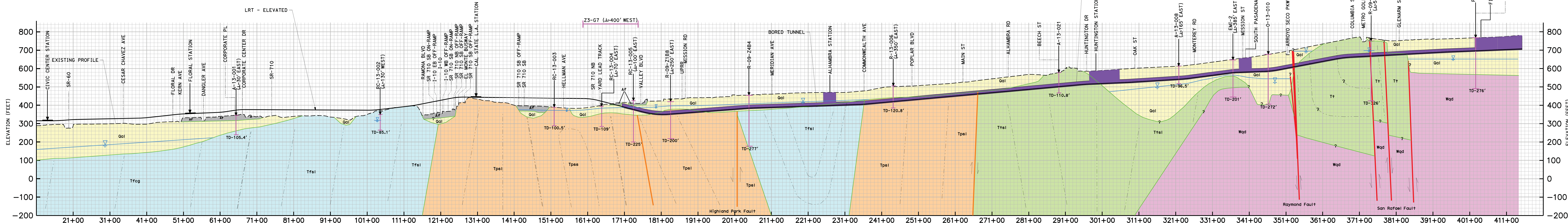
CH2MHILL

VE=5X
H:1"=1000'; V:1"=200'



- Notes: 1) Existing profile based on topographic survey by Warner Engineering and Surveying Inc. for the SR 710 North Study. - Mapping datums are NAD 1983 and NAVD 1988
- 2) The geology interpreted on this cross section is approximated, based on the geologic sources referenced in the text of this report and a limited number of widely spaced borings. Significant, additional detailed geologic investigation will be required to adequately characterize the geologic conditions along the alignment.
- 3) The alignment shown on the cross section, and associated stationing is based on the SR 710 North Study Advanced Conceptual Engineering Plans prepared for the Light Rail Transit Alternative by AECOM, dated February, 2014.

Geologic Cross Section SR 710 North Study - Light Rail Transit Alternative



LEGEND

- UNITS**
- Af ARTIFICIAL FILL
 - Qal ALLUVIAL SOIL
 - Tfsg FERNANDO FORMATION, CONGLOMERATE MEMBER
 - Tfsi FERNANDO FORMATION, SILTSTONE MEMBER
 - Tpsl PUENTE FORMATION, SILTSTONE MEMBER
 - Tps PUENTE FORMATION, SANDSTONE MEMBER
 - Tt TOPANGA FORMATION, UNDIFFERENTIATED
 - Tts TOPANGA FORMATION, SANDSTONE MEMBER
 - Ttcg TOPANGA FORMATION, CONGLOMERATE MEMBER
 - Ttsi TOPANGA FORMATION, SILTSTONE MEMBER
 - Wqd WILSON QUARTZ DIORITE

- SYMBOLS**
- GEOLGIC CONTACT
 - INACTIVE FAULT
 - ACTIVE OR POTENTIALLY ACTIVE FAULT
 - - - INTRAFORMATIONAL CONTACT
 - - - GENERALIZED BEDDING
 - ▽ ESTIMATED TOP OF GROUNDWATER TABLE
 - Z3-G7 SEISMIC LINE (CH2M HILL, 2010), WITH PROJECTION
 - ⊕ GEOTECHNICAL BORING WITH TOTAL DEPTH AND PROJECTION:
A, R, RC, O-13-001 - CH2M HILL, THIS STUDY
R-09-2188 - CH2M HILL, 2010
NM-B3 - NINYO AND MOORE, 1999
EMI-3 - EARTH MECHANICS INC, 2006
ES-2 - CALTRANS, 1974

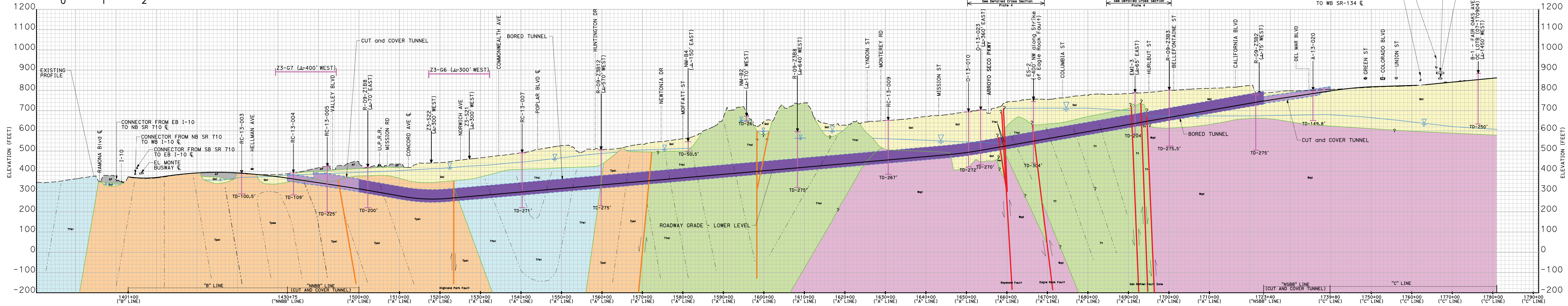
PLATE 8
LRT ALTERNATIVE GEOLOGIC CROSS SECTION
SR 710 North Study
Los Angeles County, California

VE=5X
H:1"=1000'; V:1"=200'

Geologic Cross Section SR 710 North Study - Freeway Tunnel Alternative

LEGEND

- UNITS**
- Af ARTIFICIAL FILL
 - Qal ALLUVIAL SOIL
 - Tfcg FERNANDO FORMATION, CONGLOMERATE MEMBER
 - Tfsl FERNANDO FORMATION, SILTSTONE MEMBER
 - Tpsl PUENTE FORMATION, SILTSTONE MEMBER
 - Tpss PUENTE FORMATION, SANDSTONE MEMBER
 - Tt TOPANGA FORMATION, UNDIFFERENTIATED
 - Ttss TOPANGA FORMATION, SANDSTONE MEMBER
 - Ttfcg TOPANGA FORMATION, CONGLOMERATE MEMBER
 - Ttfsi TOPANGA FORMATION, SILTSTONE MEMBER
 - Wqd WILSON QUARTZ DIORITE
- SYMBOLS**
- ALL LOCATIONS ARE APPROXIMATE. QUERIES INDICATE UNCERTAINTY.
- GEOLOGIC CONTACT
 - INACTIVE FAULT
 - ACTIVE OR POTENTIALLY ACTIVE FAULT
 - - - INTRAFORMATIONAL CONTACT
 - - - GENERALIZED BEDDING
 - ▽ ESTIMATED TOP OF GROUNDWATER TABLE
 - Z3-G7 SEISMIC LINE (CH2M HILL, 2010), WITH PROJECTION
- GEOTECHNICAL BORHOLE WITH TOTAL DEPTH AND PROJECTION:**
- A, R, RC, O-13-001 - CH2M HILL, THIS STUDY
 - R-09-2188 - CH2M HILL, 2010
 - NM-B3 - NINYO AND MOORE, 1999
 - EMI-3 - EARTH MECHANICS INC, 2006
 - ES-2 - CALTRANS, 1974



Notes: 1) Existing profile based on topographic survey by Warner Engineering and Surveying Inc. for the SR 710 North Study. - Mapping datums are NAD 1983 and NAVD 1988
 2) The geology interpreted on this cross section is approximated, based on the geologic sources referenced in the text - of this report and a limited number of widely spaced borings. Significant, additional detailed geologic investigation will be required to adequately characterize the geologic conditions along the alignment.
 3) The alignment shown on the cross section, and associated stationing is based on the SR 710 North Study Project - Report prepared for the Freeway Tunnel Alternative Preliminary Project Plans by CH2M HILL, dated February 2014.