

**SR - 710 Tunnel Technical Study
Steering Committee
Meeting No. 6
Crowell Library
November 18, 2009**



Welcome & Introductions

- **Steering Committee**
- **Metro Staff**
- **Caltrans Staff**
- **Technical Consultants**
- **Community Facilitation Consultants**



Today's Meeting Objectives

- Review findings of the exploration program
- Summarize contents of draft report
- Discuss planned outreach activities



Guiding Principles

- Develop reliable geotechnical information for tunnel options
- Respect Route Neutrality
- Clearly communicate the purpose and scope of the study to solicit public input



Purpose of the Study

Task	Status
Consider all practical routes for the extension of Route 710	✓
Gather information on sub-surface conditions	✓
Provide for public input and involvement	On-going



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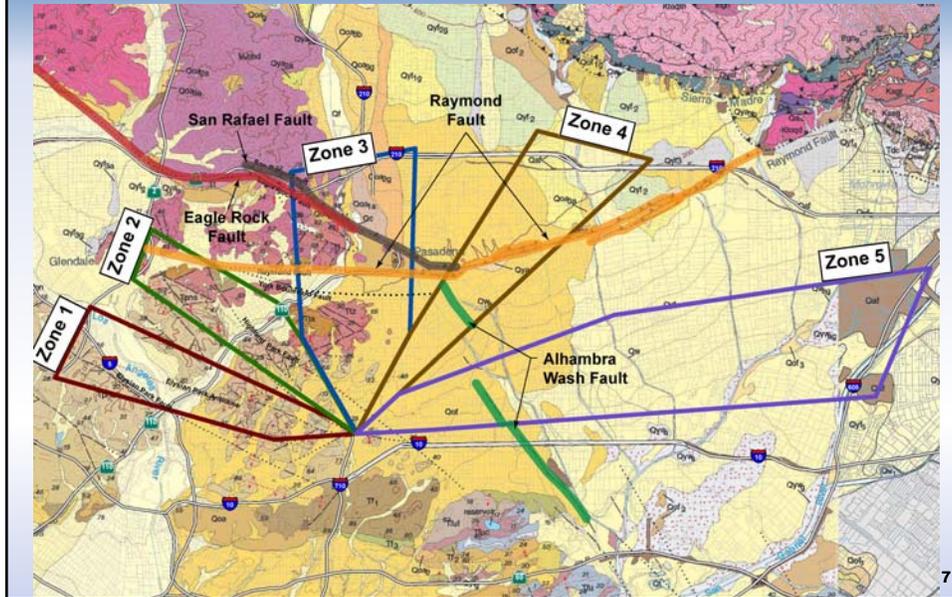
Objective of the Study

- A total of 5 potential zones were investigated
- Collected geotechnical, geological, and hydro-geological information for each zone
- Information to be used for screening purposes



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Study Zones



Scope of Tunnel Study

- Collected and reviewed existing information
- Completed field exploration
 - 25 deep core borings
 - 17 Seismic reflection lines
 - 78 surface wave measurements
- Evaluated collected data
- Prepared draft summary report



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Organization of Report

Volume I – Main Report with Figures and Plates

Volume II – Appendices A and B, Boring Logs, GW monitoring data

Volume III – Appendix C – Geophysical data

Volume IV – Appendices D and E – In situ and laboratory test results

Volume V – Appendix F – Environmental Site Assessment



Data Collection and Review (Section 2)

- San Gabriel and Raymond Basin water wells
- NEIS and Avenue 45 Sewer tunnels
- Metro Gold Line
- Superfund sites
- Faulting and seismicity
- Data base search on contaminated sites
- Oil and gas information
- Geology and groundwater reports
- Caltrans as-built Log of Test Borings



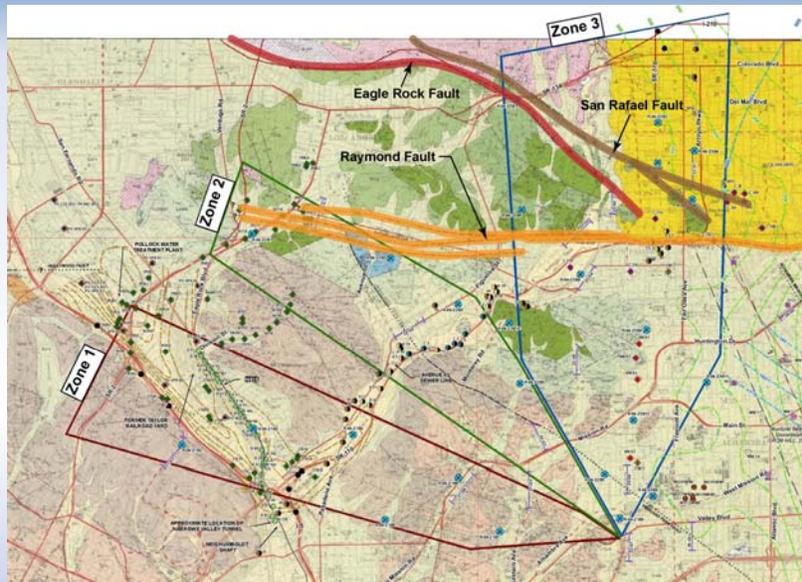
Exploration Summary (Section 3)

Zone	No. of Existing Borings	No. of Borings Completed in Current Study	No. of Seismic Reflection Lines	No. of Surface Wave Lines	Approximate Length of Zone (miles)
1	74	7	4	20	5.0 to 5.5
2	61	5	3	12	5.0 to 5.5
3	40	12	6	24	4.5 to 5.0
4	34	1	2	10	6.0 to 7.5
5	77	0	2	12	9.5 to 11.0



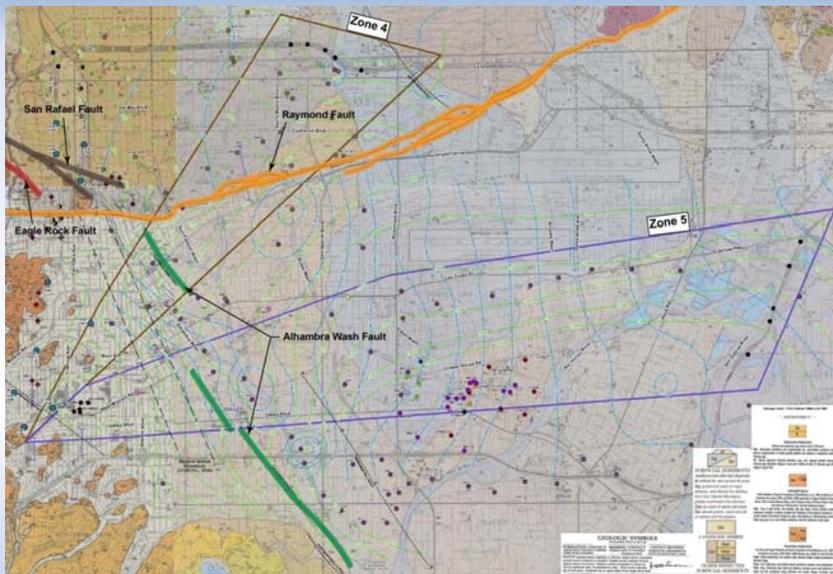
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Summary of Data and Faulting Zones 1, 2, and 3 (Section 4)



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Summary of Data and Faulting, Zones 4 and 5 (Section 4)

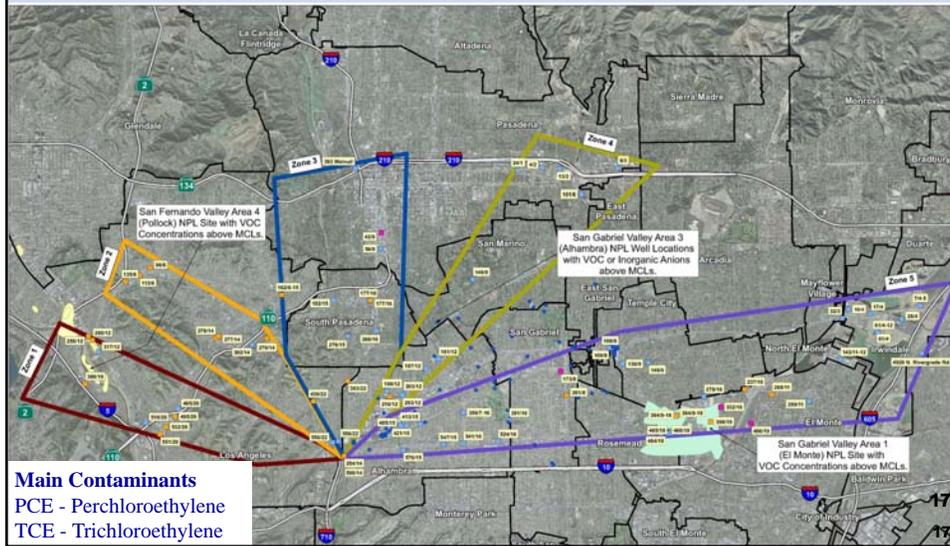


Groundwater Conditions (Section 5)

- Located within 5 groundwater basins
- Several groundwater production wells and monitoring wells exist within the 5 zones
- Tunnel will not affect the surface water features
- No springs are known to occur in the upland areas



Limits of Potential Groundwater Contamination

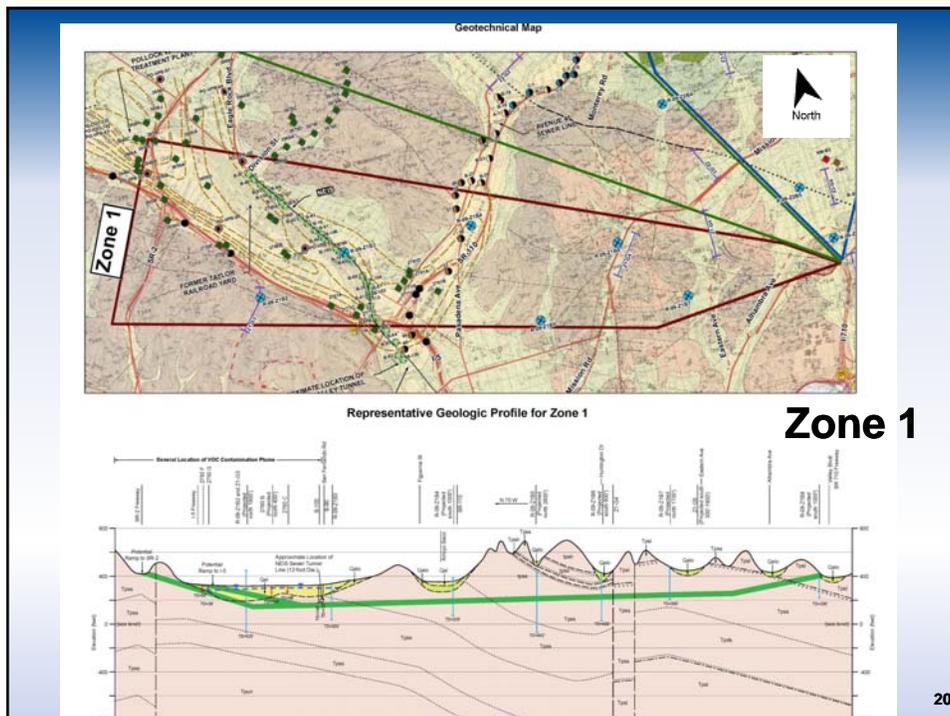


Status of Contaminated Groundwater Sites Per EPA

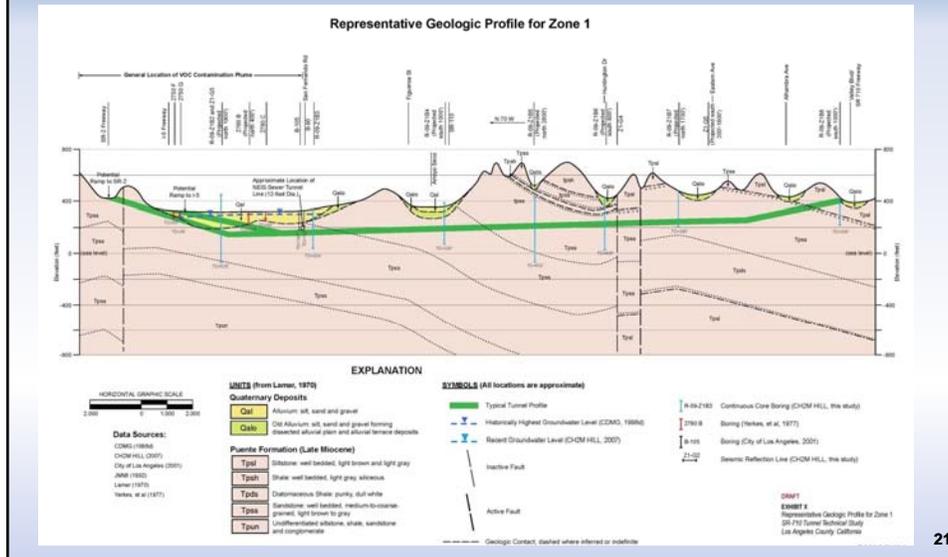
- **Zone 1**
 - Containment in place
 - Groundwater treatment began in 1998
- **Zone 4**
 - Currently evaluating extent of contamination
 - Record of Decision to be completed in next few years
 - Remedial and containment plans to be developed after Record of Decision
- **Zone 5**
 - Plan for containment is being evaluated, Installation of containment planned to begin in next few years
 - Cleaning up of the SUPERFUND site to be determined later



Subsurface Conditions (Sections 7 through 11)



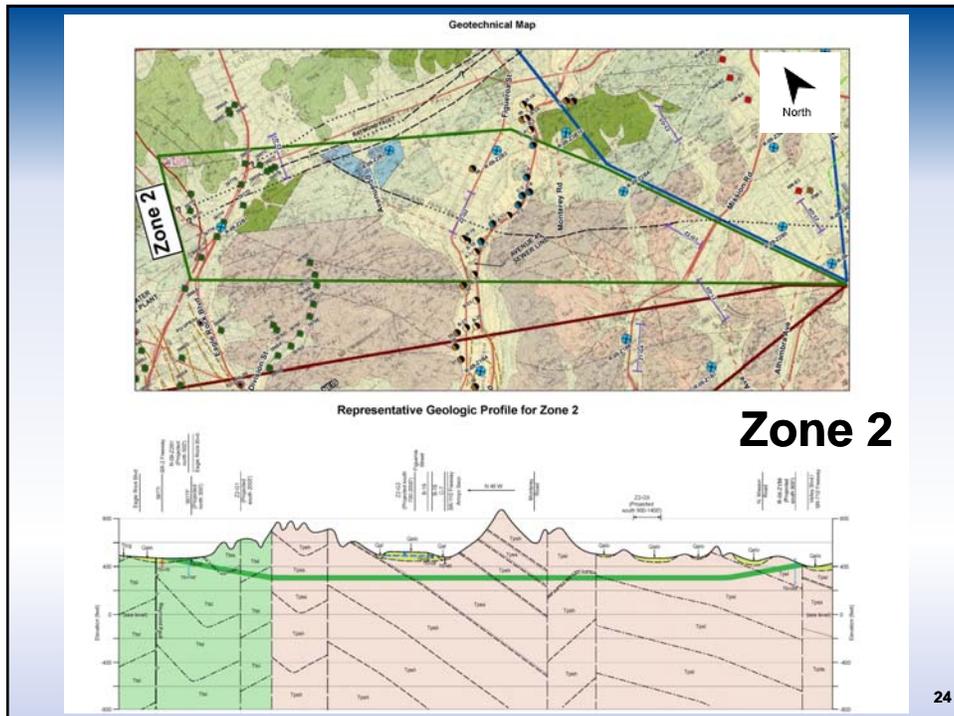
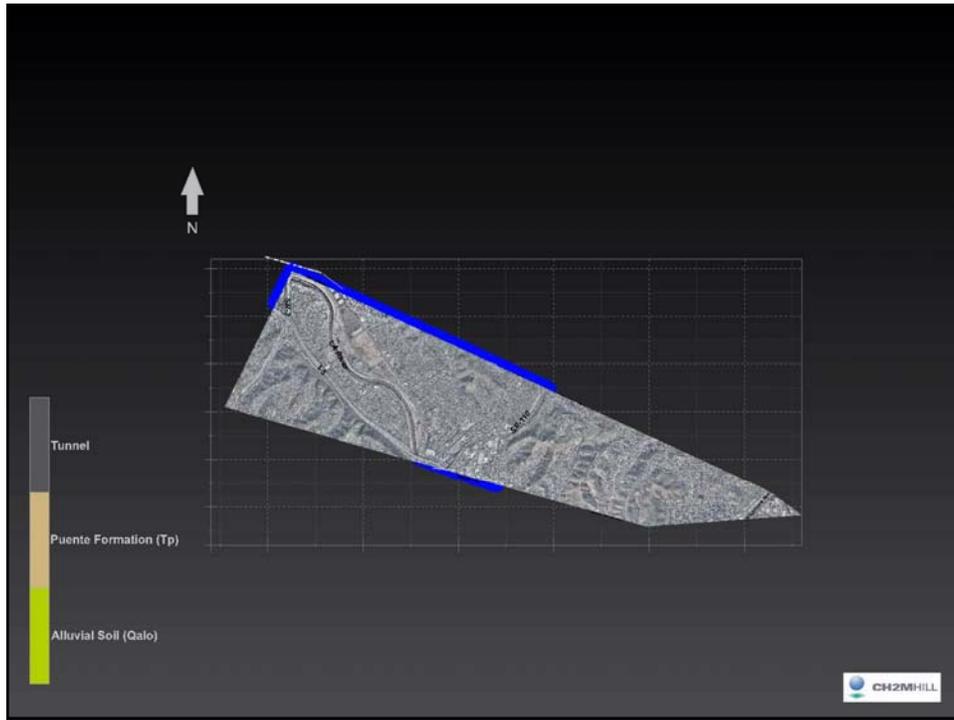
Representative Geologic Cross Section for Zone 1



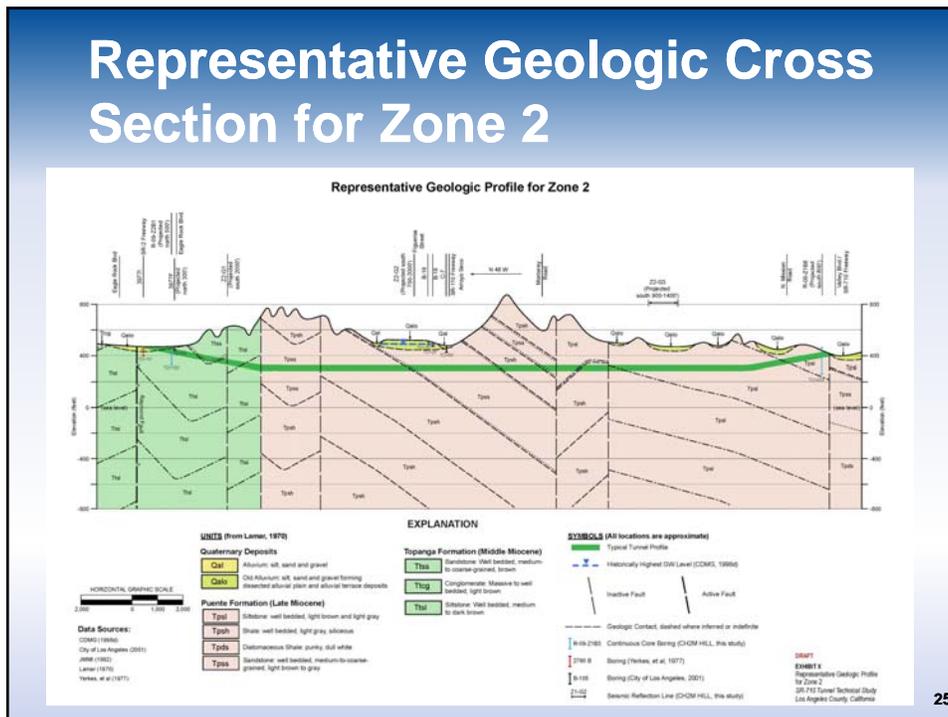
Zone 1 (to SR-2 at I-5) – Section 7

- Uniform geologic conditions consisting mainly of Puente Formation
 - Weak sandstone with thin siltstone interbeds
- Alluvium has potential for high groundwater inflows
- Several inactive faults within the Zone
- Potential gassy conditions
- Superfund site located in the northwest portion
- Groundwater is approximately 20 to 50 feet below surface





Representative Geologic Cross Section for Zone 2

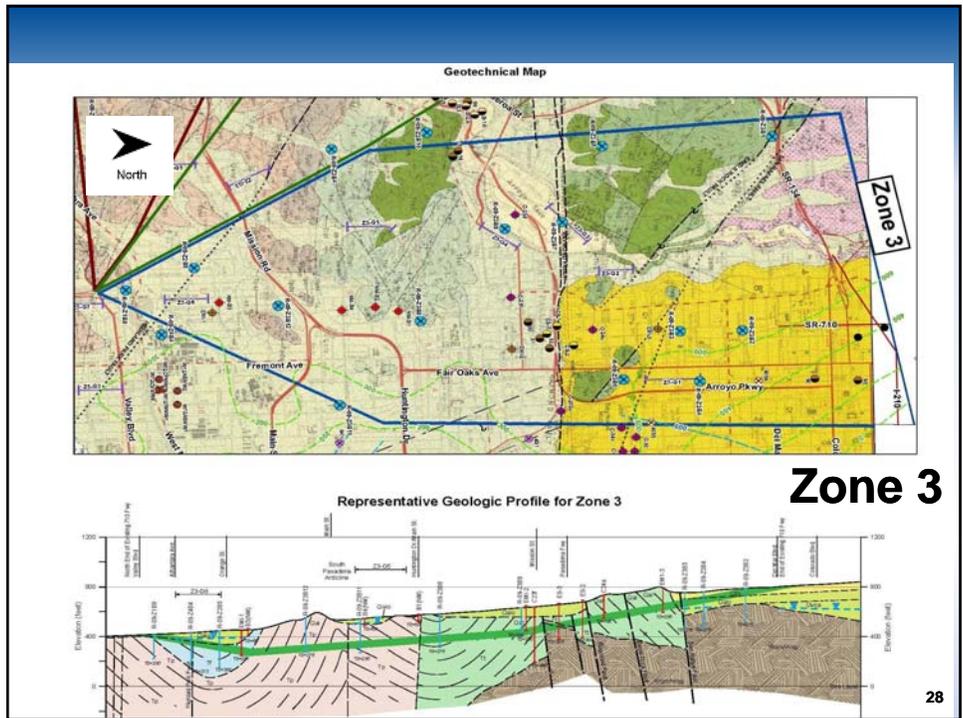
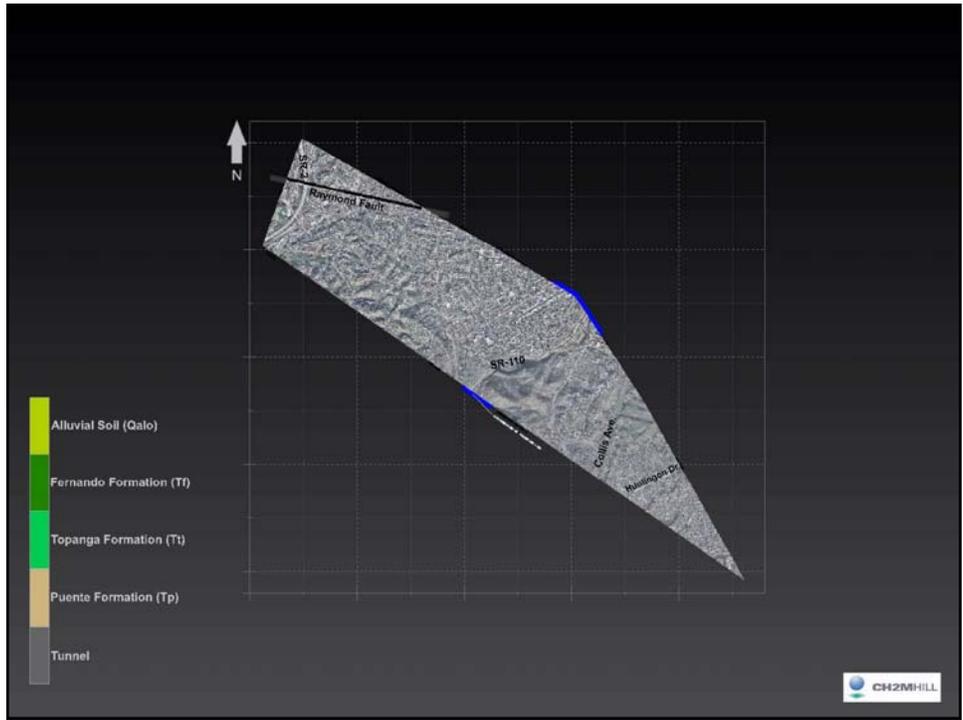


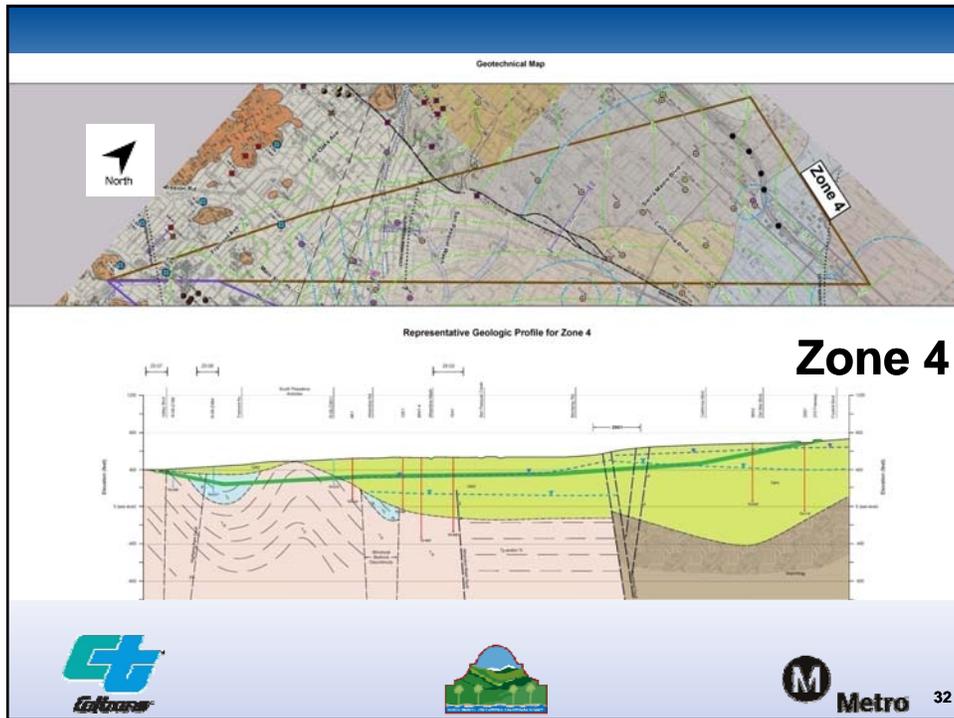
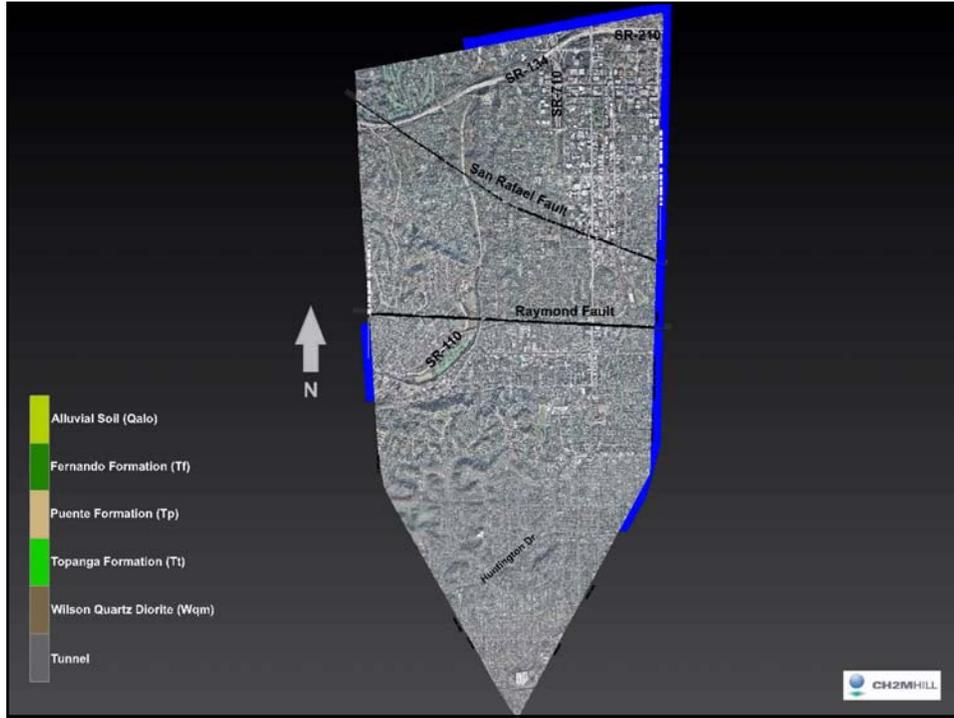
Zone 2 (to SR-2) – Section 8

- **Topanga, Puente and Fernando Formations:**
 - Topanga Formation (siltstone, sandstone)
 - Puente Formation (sandstone, siltstone, shale)
 - Fernando Formation (sandstone, conglomerate)
- **Shallow alluvium at northwest end**
- **Variable geologic structures**
- **Several inactive faults within the zone**
- **Raymond fault crosses near northwest end**
- **Groundwater locally up to 20 ft below surface**

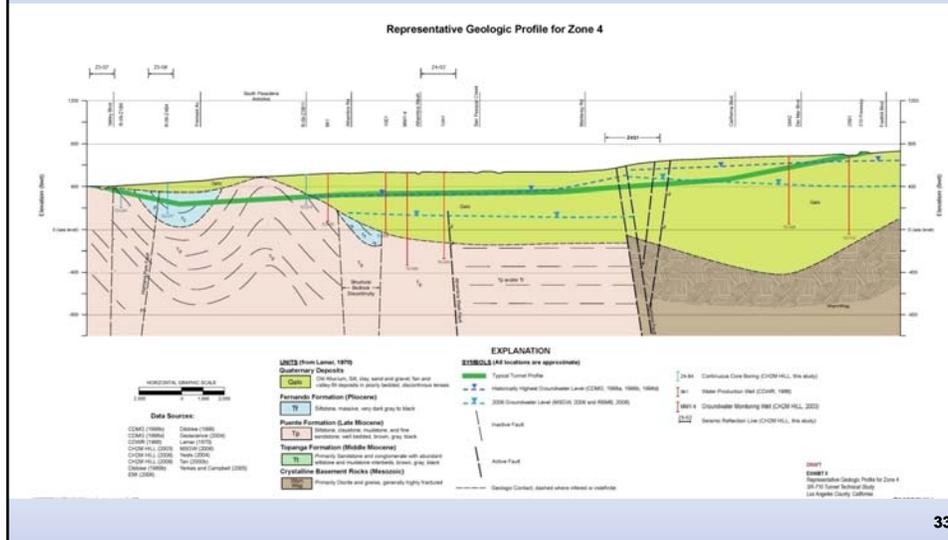


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Representative Geologic Cross Section for Zone 4



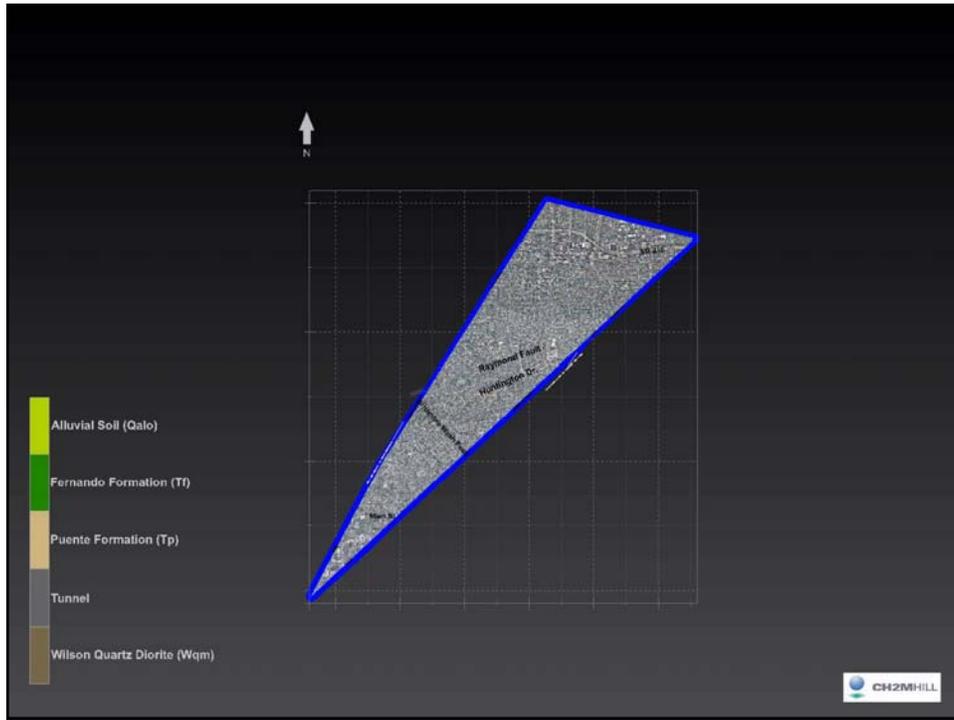
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Zone 4 (to I-210) – Section 10

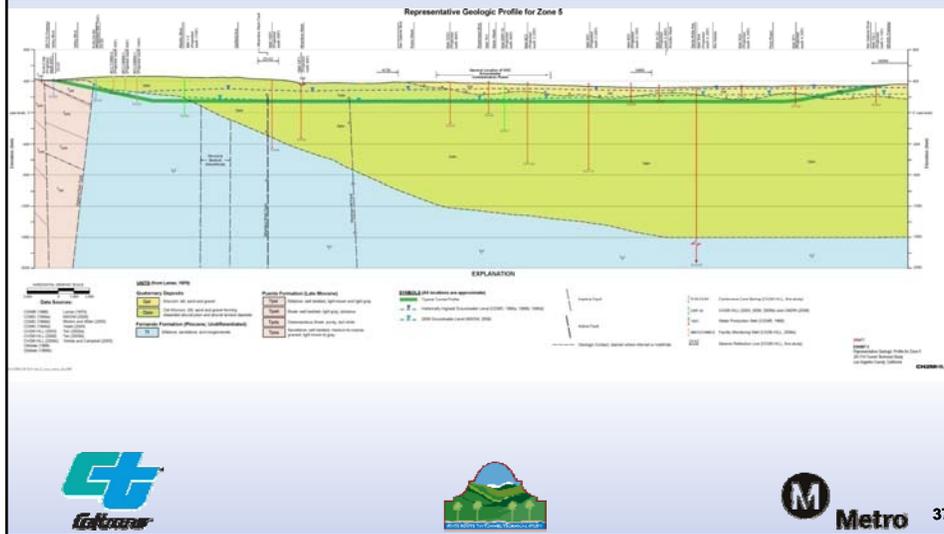
- Mostly alluvium with some Fernando and Puente Formation rock near south end
 - Alluvium may contain cobbles and boulders
 - Fernando Formation: mudstone
 - Puente Formation: sandstone, siltstone, and mudstone
- Raymond and Alhambra Wash Faults are considered active and act as a groundwater barrier
- Potential for high groundwater inflows in alluvium
- Potential for caving soils
- Groundwater levels not uniform across the zone
- Superfund site located in the central portion



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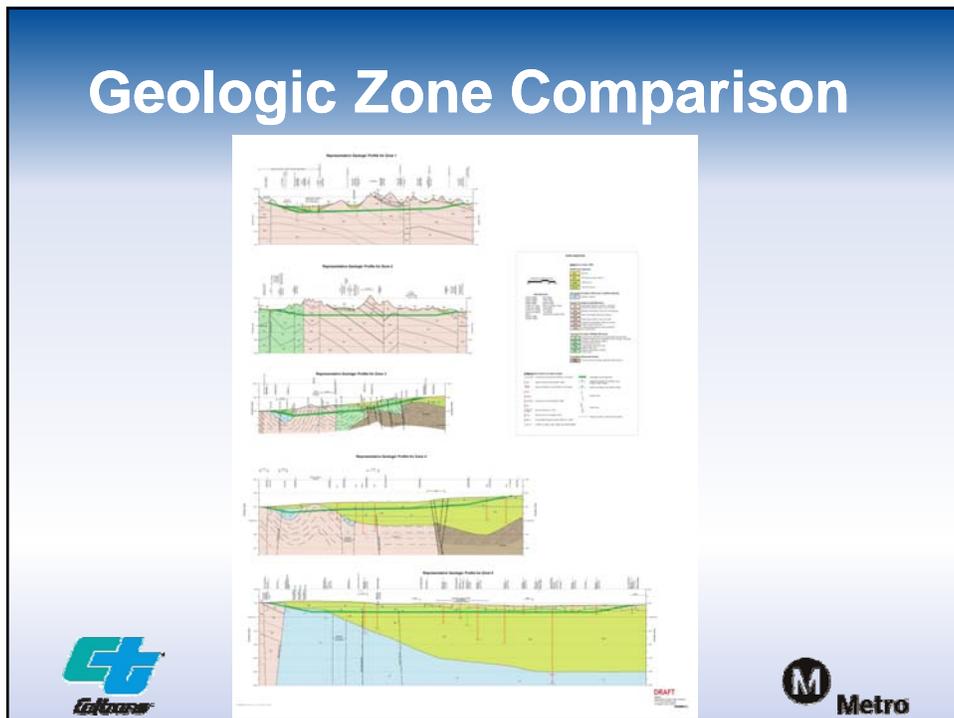
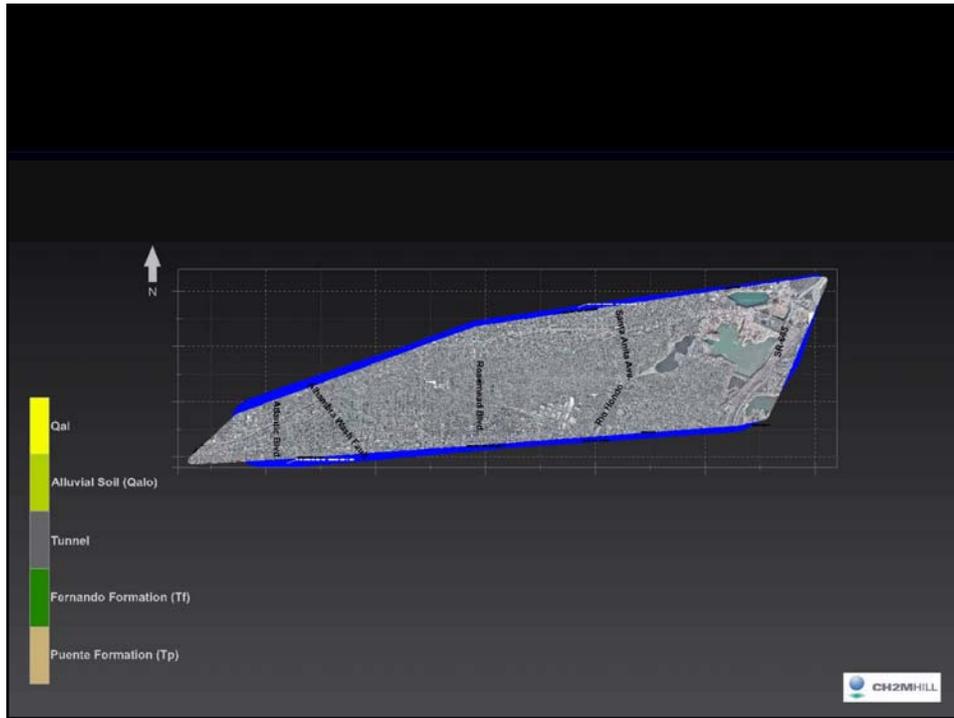
Representative Geologic Cross Section for Zone 5



Zone 5 (to I-605) – Section 11

- **Mostly alluvium with some Fernando and Puente Formation rock near south end**
 - Alluvium may contain cobbles and boulders
 - Fernando Formation: mudstone
 - Puente Formation: sandstone, siltstone, and mudstone
- **Alhambra Wash Fault is considered active**
- **Potential for high groundwater inflows in alluvium**
- **Groundwater levels not uniform across the zone**
- **Superfund site located in the south central portion**
- **Perennial Rio Hondo and San Gabriel Rivers and recharge lakes at eastern portion**





Summary of Findings (Section 13)

Zone	Predominant Geologic Formation(s)	Number of Geologic Formations	Percent of Zone in each Formation	Number of Reported / Mapped Faults	Number of Active Faults Crossing Zone	Potential for Gassy Conditions ^a	Percent of Zone Under Superfund Site
1	Puente Alluvium	2	80 to 90 10 to 20	5	0	H	5 to 10
2	Puente Topanga Fernando Alluvium	4	70 to 80 10 to 15 5 to 10 5 to 10	7	1 (NW Portal)	H	0
3	Topanga Alluvium Puente Fernando Diorite	5	30 to 40 10 to 20 20 to 30 5 to 10 10 to 20	7	3 ^b	M	0
4	Alluvium Fernando Puente	3	70 to 80 10 to 15 10 to 15	5	2	L	5 to 15
5	Alluvium Fernando Puente	3	75 to 85 10 to 15 5 to 10	3	1	L	5 to 30

^aH-High, M-Moderate, L-Low
^bIncludes potentially active faults

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Key Geotechnical Factors for Tunneling

- Type of material (soil or rock)
- Uniformity of geology
- Rock/soil strength
- Stability of the ground
- Groundwater conditions
- Faults, especially active faults
- Potential for gas (methane, hydrogen sulfide)
- Contaminated soil, rock, or groundwater



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Geotechnical Feasibility of Tunneling

- Feasible in all 5 zones
- Each zone presents unique challenges
- Technology exists to address challenges
- Has been done successfully in Los Angeles, California, and around the world



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Ground Stability

- Loss of ground leads to surface settlement
- Groundwater magnifies issues
- Alluvium (soil deposits)
- Extensive in Zones 4 and 5, some in Zone 3, limited in Zones 1 and 2

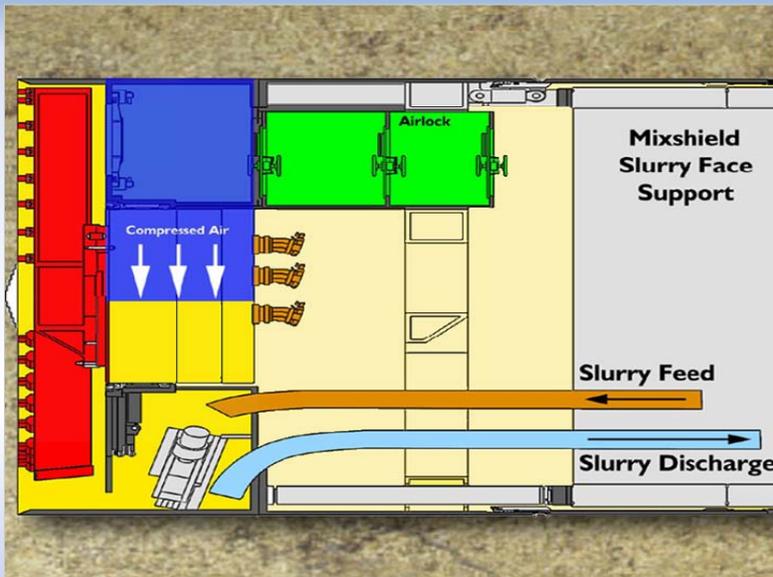


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Special Pressurized Face Tunneling Machines



Slurry TBM



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Watertight Segmental Lining



- Designed to resist ground loads, hydrostatic pressures
- Gaskets provide watertight seal
- Significant structural capacity



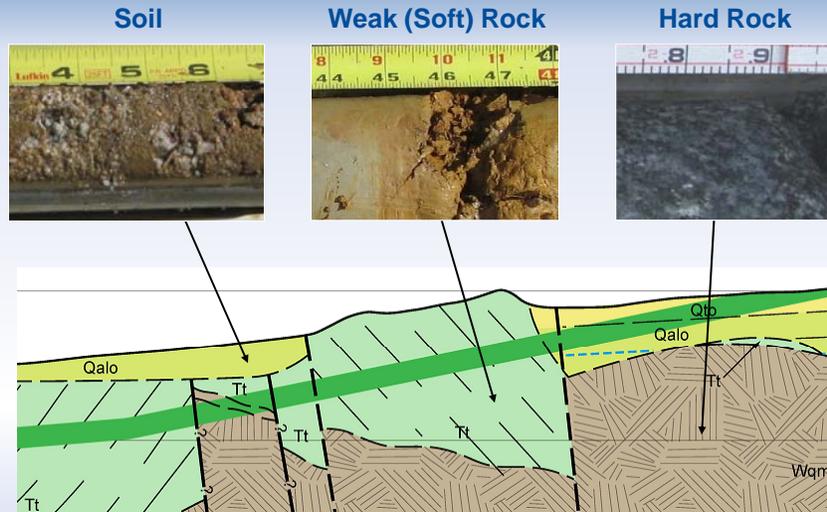
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Arrowhead Tunnels



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Uniformity of Geologic Units



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TBM with Rock/Soil Cutterhead

- **Riverside Badlands Tunnel**
- **Single TBM for 8-mile tunnel**
- **Weak sedimentary rock; hard rock (gneiss); and alluvium**



Natural Gas



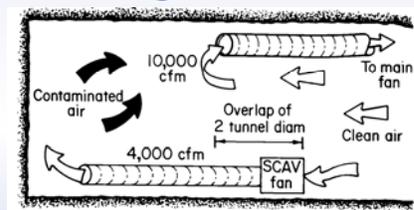
- **Puente Formation – Zones 1 and 2**
- **Proper safety precautions necessary**
- **Regulated by Cal/OSHA**



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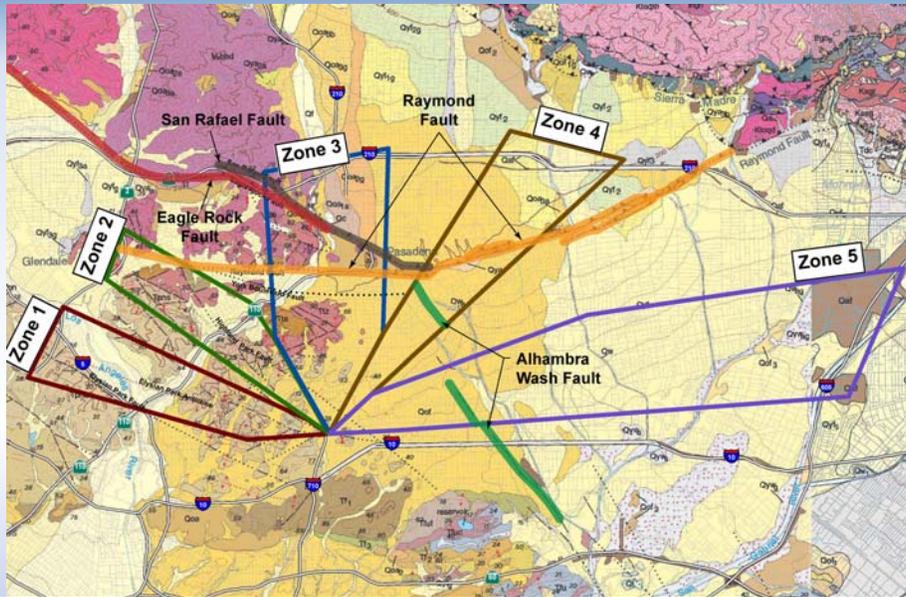
Special Provisions to Deal with Gassy Conditions

- **Ventilation is critical**
- **Designed to prevent “dead spots”**
- **Spark-free electrical equipment**
- **Continuous gas monitoring**
- **Safety training**

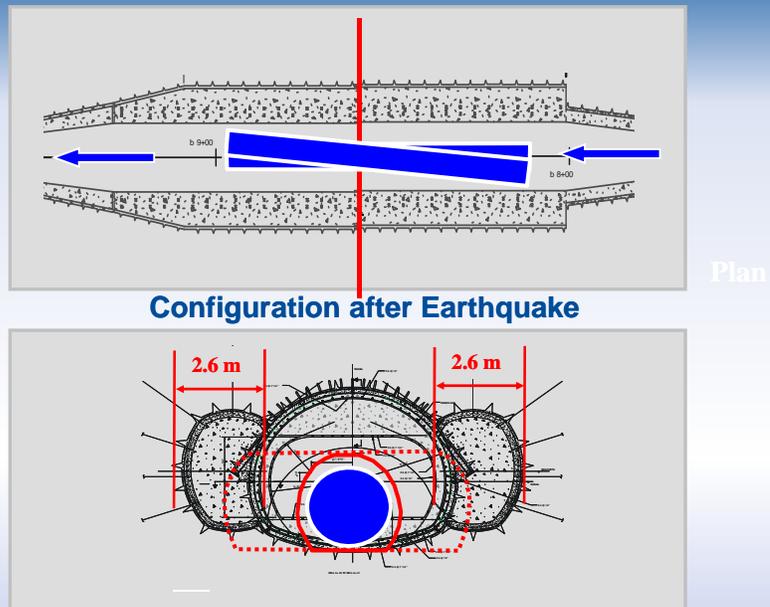


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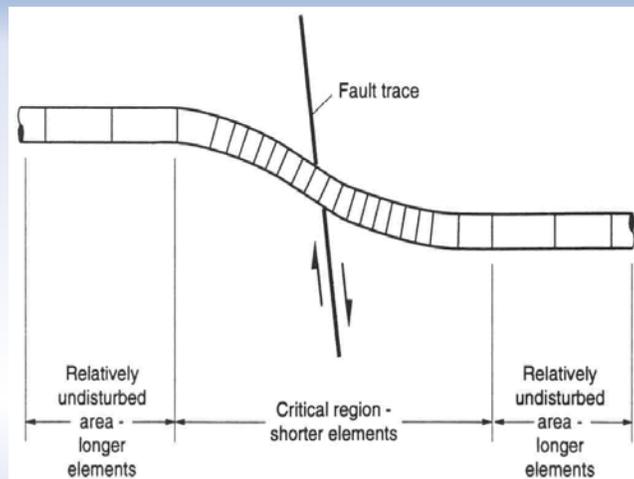
Active Faults in Zones 2, 3, 4, and 5



Oversized Vault Section



Fault Crossing with Segmental Tunnel



Contaminated Soil and Groundwater

- Potential safety hazard
- Cannot allow plume to migrate
- Must dispose of properly
- Disposal costs can be significant
- Zones 1, 4, and 5



Geotechnical Challenges

Zone	Significant Ground Stability	Non-Uniform Conditions	High Gas Potential	Active Faults	Soil and GW Contamination
1			X		X
2			X	X	
3		X		X	
4	X	X		X	X
5	X	X		X	X

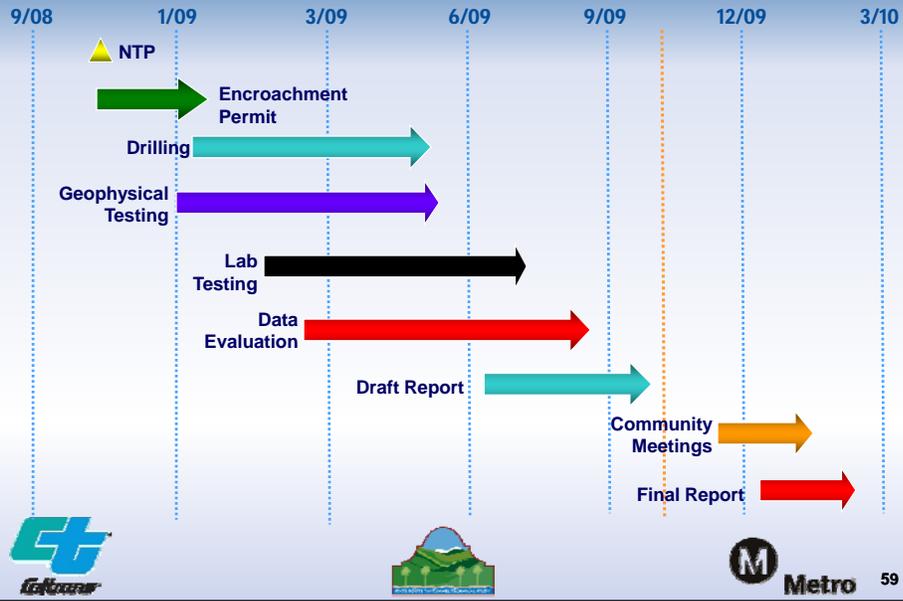


Summary

- Geotechnically feasible to tunnel in all zones
- Each zone has some challenges
- Technology exists to address these challenges



Tunnel Study - Schedule



Questions and Answers



TAC Comments and Questions

- Project team met the expectation of TAC
- Geotechnical Report is easy to understand by a layperson
- What is the risk associated with fault displacement?
- Is the tunnel safe during an earthquake?
- Why more field testing conducted within Zone 3 compared to other zones?
- Why ventilation and emergency access shafts are not considered in this study?

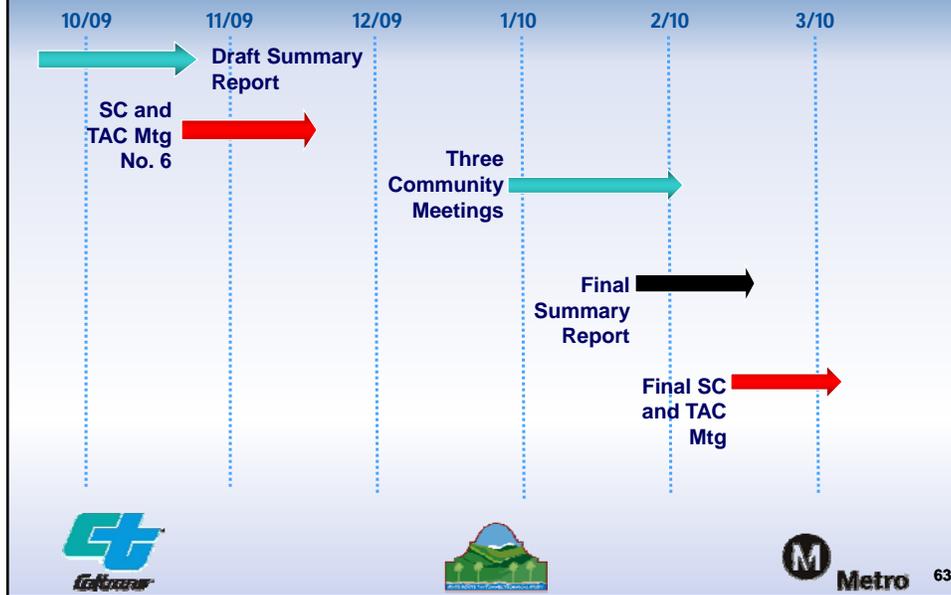


TAC Comments and Questions

- Why not consider other factors related to tunnel construction in the feasibility study?
- Can you separate the geotechnical tunnel consideration for constructability, long term performance, and/or both?
- What is the purpose of the three community meetings if the comments are due by November 30?
- Can you determine the cost of the tunnel project?
- What will Caltrans/Metro do in the next phase?



Outreach Milestones



Upcoming Community Meetings - 2010

- **La Canada Flintridge, Glendale, Northeast LA**
 Location: Wilson Middle School - 1221 Monterey Road
 Glendale, CA
 Date: January 20, 2010
- **Pasadena, South Pasadena and San Marino**
 Location: San Marino Center - 1800 Huntington Blvd.
 San Marino, CA
 Date: January 26, 2010
- **El Sereno, Monterey Park, Alhambra**
 Location: Los Angeles Christian Presbyterian Church - 2241 N.
 Eastern Ave., Los Angeles, CA
 Date: February 2, 2010



Geotechnical Report DVD Public Library Locations:

South Pasadena Public Library 1100 Oxley Street	Glendale Public Library 222 E. Harvard Street	La Canada Flintridge Library 4545 North Oakwood Avenue
Alhambra Civic Center and Library 101 S. First Street	Monterey Park Bruggemeyer Library 318 S. Ramona Avenue	Crowell Library 1890 Huntington Drive
Pasadena Public Library 285 E. Walnut Street	El Sereno Branch Library 5226 S. Huntington Dr.	Arroyo Seco Regional Library 6145 N. Figueroa Street
Cypress Park Branch Library 1150 Cypress Avenue	Lincoln Heights Branch Library 2530 Workman Street	

www.710tunnelstudy.info



Next Steps

- Continued feedback on Draft Report
- Comments due by November 30, 2009
- Final Summary Report – Feb/Mar 2010
- Presentation to TAC/SC – Feb/Mar 2010



See You Next Meeting!

