APPENDIX F – PRELIMINARY GEOTECHNICAL REPORT

Preliminary Geotechnical Report

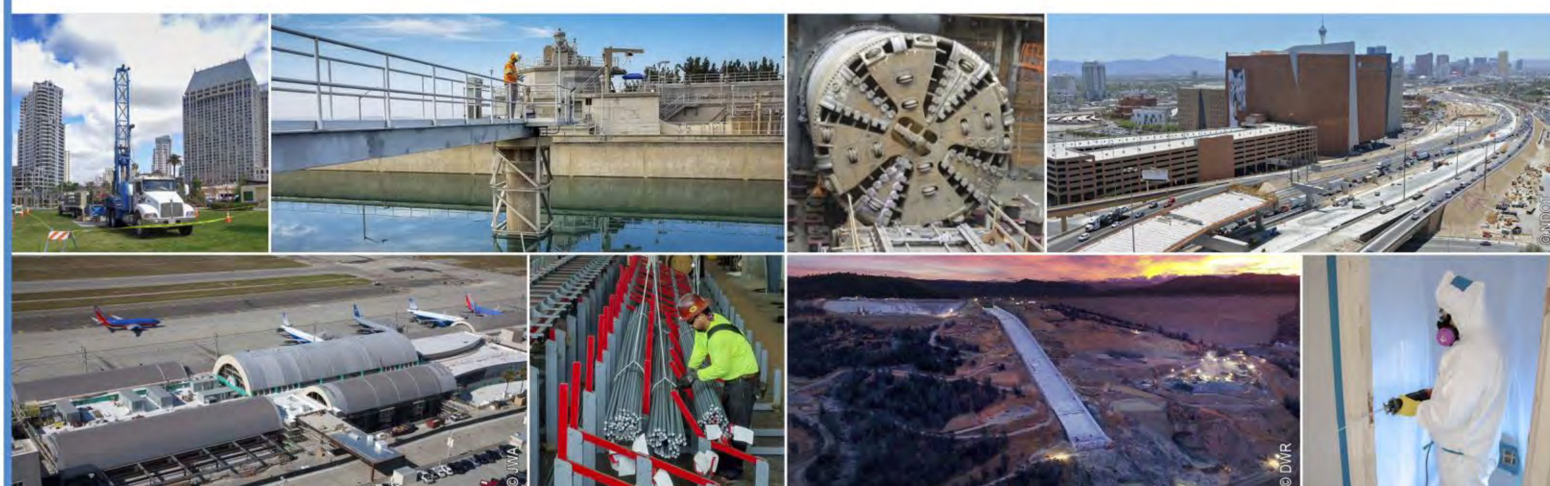
Cherry Channel Drainage Project

Beaumont, California

Chambers Group, Inc.

3151 Airway Avenue, Suite F-208 | Costa Mesa, California 92626

September 23, 2024 | Project No. 212774002



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Preliminary Geotechnical Report
Cherry Channel Drainage Project
Beaumont, California

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1 INTRODUCTION

In accordance with your request and authorization, Ninyo & Moore has prepared this preliminary geotechnical report for the Cherry Channel Drainage Project located adjacent to Cherry Avenue between Cougar Way and Oak Valley Parkway in Beaumont, California (Figure 1). Ninyo & Moore understands that the geo-mat lining on the existing Channel is in poor condition and the City of Beaumont is proposing to line the Channel with concrete. The purpose of this report is to summarize our preliminary findings, conclusions, and opinions regarding the site geotechnical conditions to aid in the planning of the project.

2 SCOPE OF SERVICES

The scope of our geotechnical services included the following:

- Project coordination and planning.
- Review of readily available background materials, including published geologic maps and literature, geologic and seismic data, groundwater data, in-house information, and aerial photographs.
- Geotechnical reconnaissance to document the existing surficial conditions at the project site.
- Assessment of the general geologic conditions and seismic hazards affecting the site, and evaluation of their potential impacts on the proposed project. Evaluation of geologic impacts includes groundwater, flood hazards, compressible and collapsible soils, and expansive soils. Evaluation of seismic impacts includes potential surface fault rupture, ground shaking, liquefaction, lateral spreading, and tsunamis and seiches.
- Preparation of this preliminary report presenting general information regarding the geologic and soils conditions at the subject site and our preliminary opinions regarding geotechnical constraints affecting the project.

3 SITE DESCRIPTION

The proposed Cherry Channel Drainage Project is located along the eastern side of Cherry Avenue between Cougar Way and Oak Valley Parkway in Beaumont, California (Figure 2). The project area is approximately 2,500 feet long and is bounded by Cherry Avenue to the west, Cougar Way to the north, Oak Valley Parkway to the south, and asphalt concrete paved pedestrian walkway, single-family residential developments, and a community center to the east. A utility easement with high-voltage transformers crosses near the center of the Channel alignment. The existing Cherry Channel is a trapezoidal unlined earthen drainage Channel approximately 38 to 60 feet in width and 8 to 12 feet in depth. The Channel walls have a slope gradient of approximately 2:1 (horizontal to vertical) (Exp., 2024). The Channel is lined with a geo-mat along the side slopes and Channel bottom. Based on our site observations, the existing geo-mat is in poor condition with exposed, missing, or torn sections. The Channel contains localized areas of riprap and sparse to high vegetation along its slopes and Channel bottom. In addition, the Channel slopes have been eroded from urban run-off and contain holes from burrowing animals. Rover Lane crosses over the Channel approximately 400 feet north of Oak Valley Parkway and the entrance to the Albert A. Chatigny Senior Community Recreation Center's overflow parking lot crosses over the Channel approximately 800 feet north of Oak Valley Parkway. Additional existing improvements along the Channel include concrete drain outlets along the Channel, irrigation systems adjacent to and on the Channel slopes, and landscaping adjacent to the Channel.

4 PROJECT UNDERSTANDING

Based on discussions with the Chambers Group, Inc., and review of the Request for Proposal prepared by the City of Beaumont (City of Beaumont, 2024), Ninyo & Moore understands that the City plans to concrete-line the existing unlined earthen Cherry Channel from approximately Cougar Way to Oak Valley Parkway. The Channel's alignment and grade will be maintained as well as all existing junction structures for the Channel.

4.1 Previous Geotechnical Study

As a part of our current evaluation, a technical memorandum prepared by Converse Consultants, was reviewed dated April 25, 2022, providing a limited geotechnical evaluation of the Cherry Channel (Converse, 2022). Converse performed a site reconnaissance to evaluate the Channel conditions visually and provided recommendations for Channel rehabilitation.

Based on Converse's site reconnaissance, Converse indicated that the geo-mat lining and the soil beneath the lining were in good condition between Oak Valley Parkway and Rover Lane, in moderate condition between Rover Lane and a driveway approximately 400 feet north, and in poor condition between the driveway and Cougar Way to the north. Converse probed the sides and the bottom of the Channel at various locations and collected bulk samples for expansion index testing. Probe depths ranged from about 0.1 to 1.5 feet on the Channel slopes and about 0.2 to 3 feet in the Channel bottom.

Converse concluded that the Channel area is generally underlain by up to approximately 2 feet of compressible soils within the Channel slopes and up to approximately 3 feet of potentially compressible soils along the Channel bottom. Converse recommended that compressible soils at the site be removed and replaced with compacted fill soils prior to construction of the concrete lining.

4.2 Historical Aerial Photographs

As a part of our evaluation, we reviewed historical aerial photographs publicly available from the Historical Aerials online aerial photo library (Historic Aerials, 2024). The historical aerial photograph dates reviewed ranged from 1966 to 2022. The 1966 photo shows the site as an undeveloped dry wash with adjacent areas being undeveloped or used for agriculture. Between 1966 and 2005, the site appears to have remained relatively unchanged. A portion of the Cherry Channel appears to have been constructed by 2009, between Oak Valley Parkway and just north of Rover Lane. The site appears to be relatively unchanged from 2009 to 2014. The remaining portion of the Cherry Channel appears to be constructed between 2014 and 2016. The site appears to have remained in its current configuration since 2016.

5 GEOLOGIC CONDITIONS

5.1 Regional Geologic Setting

The project site is located within the Transverse Ranges Geomorphic Province of southern California. The Transverse Ranges encompasses an approximately 40- to 60-mile-wide area (north to south) that extends approximately 320 miles (west to east) from Point Arguello and San Miguel Island to the Eagle and Pinto Mountains of the Mojave Desert (Norris and Webb, 1990). The Province generally consists of a region of east- to west-trending mountain ranges considered atypical to the predominant northwest to southeast structural fabric of California. The atypical trend of the Province is the result of a restraining bend (“the Big Bend”) on the San Andreas Fault that has rotated and compressed the region to its current configuration. The compression has resulted in folding and reverse/thrust faulting with similar east to west trends, and regional uplift. (Norris & Webb, 1990).

5.2 Project Area Geology

Based on our review, the site is mapped as being underlain by Holocene to late Pleistocene-age alluvial fan deposits consisting of sand and gravel of plutonic and gneissic detritus derived from the San Bernardino Mountains to the north (Dibblee, 2003) as shown on Figure 3.

5.3 Groundwater

Approximately six inches of standing water was observed within sections of the Channel bottom. Converse (2022) also observed up to approximately six inches of standing water along the Channel bottom during their site reconnaissance. Based on our review of available information on the California Department of Water Resources (DWR) Water Library, groundwater measured within an observation well located approximately 0.98 miles east of the project area was reported to be approximately 563 feet below the ground surface in January 2005 (DWR, 2024). Fluctuations in groundwater levels will occur due to variations in precipitation, ground surface topography, subsurface stratification, irrigation, groundwater pumping, and other factors that may not have been evident at the time of our site reconnaissance. However, based on the location of the site, groundwater is not expected to pose as a constraint during construction.

6 FAULTING AND SEISMIC HAZARDS

The project site is not located within a State of California Earthquake Fault Zone (formerly known as Alquist-Priolo Special Studies Zone, [Hart & Bryant, 2018]). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed improvements. The approximate locations of major faults in the site vicinity and their geographic relationship to the site are shown on Figure 4.

In general, seismic hazards evaluated at the subject site include ground surface rupture, ground motion, liquefaction, dynamic settlement, lateral spreading, and tsunamis and seiches. These potential hazards are discussed in the following sections.

6.1 Surface Fault Rupture

Surface fault rupture is the offset or rupturing of the ground surface by relative displacement across a fault during an earthquake. Based on our review of the referenced published data, the project site is not transected by known active faults. Therefore, the potential for surface rupture is relatively low. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

6.2 Seismic Ground Shaking

Earthquake events from one of the regional active or potentially active faults near the site could result in strong ground shaking which could affect the project area. The level of ground shaking at a given location depends on many factors, including the size and type of earthquake, distance from the earthquake, and subsurface geologic conditions. The type of construction also affects how particular structures and improvements perform during ground shaking.

Considering the proximity of the site to active faults capable of producing a maximum moment magnitude of 6.0 or more, the project site has a high potential for experiencing strong ground motion. The 2022 California Building Code (CBC) specifies that the potential for liquefaction and soil strength loss be evaluated, where applicable, for the mapped maximum considered earthquake geometric mean (MCE_G) peak ground acceleration (PGA_M) with adjustment for site class effects in accordance with the American Society of Civil Engineers (ASCE) 7-16 Standard. The MCE_G PGA is based on the geometric mean PGA with a 2 percent probability of exceedance in 50 years. The PGA_M was calculated as 1.07g using the 2024 Applied Technology Council (ATC) hazard tool (web-based).

This potential level of ground shaking could have high impacts on site improvements without appropriate design mitigation, and should be considered during the detailed design phase of the project. Mitigation of the potential impacts of seismic ground shaking can be achieved through project structural design. Structural elements of planned improvements can be designed to resist or accommodate appropriate site-specific ground motions and to conform to the current seismic design standards. Appropriate structural design and mitigation techniques would reduce the impacts related to seismic ground shaking to low levels.

6.3 Liquefaction and Seismically Induced Settlement

Liquefaction is the phenomenon in which loosely deposited granular soils and non-plastic silts located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure, and causes the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking. The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of slabs due to sand boiling, and/or buckling of deep foundations due to liquefaction-induced ground settlement.

Based on the Beaumont General Plan, the Channel site is located in an area mapped as having very low susceptibility to liquefaction (City of Beaumont, 2020). Our review of the regional geologic maps indicates that the site is predominantly underlain by relatively young alluvial materials; however, due to the significant recorded depth of groundwater near the site, liquefaction is not a design concern for this project.

6.4 Lateral Spreading

Lateral spread of the ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Lateral spread has generally been observed to take place in the direction of a free-face (i.e., retaining wall, slope, creek) but has also been observed to a lesser extent on ground surfaces with very gentle slopes. For sites located in proximity to a free face, the amount of lateral ground displacement is strongly correlated with the distance of the site from the free-face. Other factors such as earthquake magnitude, distance from the earthquake epicenter, thickness of the liquefiable layers, and the fines content and particle sizes of the liquefiable layers also affect the amount of lateral ground displacement.

The site is comprised of an unlined drainage Channel with an estimated depth of approximately 8 to 12 feet and slope inclination of approximately 2:1 (horizontal to vertical). However, due to the negligible probability of liquefaction as discussed above, lateral spreading is not a design concern for this project.

6.5 Tsunamis and Seiches

Tsunamis are long wavelength seismic sea waves (long compared to ocean depth) generated by the sudden movements of the ocean floor during submarine earthquakes, landslides, or volcanic activity. Seiches are waves generated in a large enclosed body of water. The project site is not mapped in an area considered susceptible to tsunami or seiche inundation.

7 MISCELLANEOUS HAZARDS

7.1 Flood Hazards

Based on our review of flood insurance rate maps for the project area (Federal Emergency Management Agency [FEMA], 2008), the project site is located in a 100-year Flood Hazard Zone, A, and contains flood discharge. Zone A includes areas to be protected from a 100-year flood by the Federal Flood Protection System under construction at the time of publication of the FEMA map.

7.2 Expansive Soils

Expansive soils include clay minerals that are characterized by their ability to undergo significant volume change (shrink or swell) due to variations in moisture content. Sandy soils are generally not expansive. Changes in soil moisture content can result from rainfall, irrigation, pipeline leakage, surface drainage, perched groundwater, drought, or other factors. Volumetric change in expansive soil may cause excessive cracking and heaving of relatively light-weight structures with shallow foundations, concrete slabs-on-grade, or pavements supported on these materials.

Detailed assessment of the potential for expansive soils should be evaluated during the design phase of the project through subsurface exploration and laboratory testing. Converse (2022) collected two bulk samples during their 2022 site reconnaissance and tested for expansion index. Their test results indicate that the site soils are generally non-expansive.

7.3 Compressible and Collapsible Soils

Compressible soils are generally comprised of soils that undergo time-dependent consolidation when exposed to new loading, such as fill or foundation loads. Soil collapse is a phenomenon where the soils undergo a significant decrease in volume upon increase in moisture content, with or without an increase in external loads. Undocumented fill soils are potentially compressible and not considered suitable for the support of foundations or compacted fill. Structures and other improvements may be subject to excessive settlement-related distress when compressible soils or collapsible soils are present. All undocumented fill soils should be removed and replaced as engineered fill at the project site. Based on the data presented in Converse's technical memorandum (Converse, 2022), the Channel slopes and Channel bottom are underlain by up to about 2 and 3 feet of potentially compressible soils, respectively.

8 PRELIMINARY CONCLUSIONS AND GEOTECHNICAL CONSIDERATIONS

A detailed geotechnical evaluation including subsurface exploration should be performed during the design phase of the project to develop site-specific information and appropriate geotechnical recommendations for the design and construction of the proposed concrete-lined Channel and other proposed new site improvements. The primary geotechnical considerations for the proposed improvements include the presence of undocumented fill and compressible soil at the site and stability of the Channel slopes.

Our preliminary findings and opinions pertaining to the geotechnical aspects of the proposed Cherry Channel Drainage Project are presented below.

- Based on our review of regional geologic maps, the site is predominantly underlain by Holocene to late Pleistocene-age alluvial fan deposits consisting of sand and gravel of plutonic and gneissic detritus derived from the San Bernardino Mountains to the north (Dibblee, 2003).

- Approximately six inches of standing water was observed in the Channel during our site reconnaissance. Standing water was also observed in some portions of the Channel during Converse's evaluation in 2022. Wet and/or saturated soils should be anticipated during construction.

- The site is not located within an Earthquake Fault Zone with the potential for fault rupture as defined by the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 2018).

- The site is located in an area mapped as having very low susceptibility to liquefaction (City of Beaumont, 2020).
- Liquefaction-induced lateral spreading is not a design concern for the site.
- Tsunamis and seiches are also not design concerns for this site.
- Based on Converse's field observations, the Channel slopes and Channel bottom are underlain by up to about 2 and 3 feet of potentially compressible soils, respectively. The site soils are generally expected to be non-expansive.
- Prior to construction of the proposed improvements, undocumented fill soils will need to be removed and replaced with compacted fill.
- Based on our site observation, the Cherry Channel slope has an approximately 2:1 (horizontal to vertical) gradient. Stability of the Channel slopes should be evaluated during the design phase of this project.

9 RECOMMENDATIONS FOR FUTURE WORK

Additional geotechnical engineering studies for the proposed new improvements should be performed during the design phase of the project. When preliminary design plans are prepared, those should be forwarded to this office for review so that the locations of the exploratory borings can be evaluated. Detailed geotechnical design and construction recommendations for the project will be provided in our geotechnical evaluation report.

10 LIMITATIONS

The purpose of this study was to evaluate geotechnical conditions and potential geologic and seismic hazards at the site by reviewing readily available geotechnical data, to present preliminary geotechnical opinions and recommendations that can be utilized in the preparation of a scope of work for subsurface exploration for the design phase of the project. This report is intended for preliminary planning purposes only. A detailed geotechnical evaluation, including subsurface exploration should be performed prior to detailed design and construction of new structures.

The geotechnical analyses presented in this report have been conducted in accordance with current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, implied or expressed, is made regarding the preliminary conclusions, recommendations, and professional opinions expressed in this report. The preliminary conclusions and recommendations are based on a review of readily available geotechnical literature, geologic and seismic data, and an analysis of the observed conditions. Variations may exist and conditions not observed or described in this report may be encountered.

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FIGURES

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: USGS, 2018.

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FIGURE 1

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SITE LOCATION

CHERRY CHANNEL DRAINAGE PROJECT
BEAUMONT, CALIFORNIA

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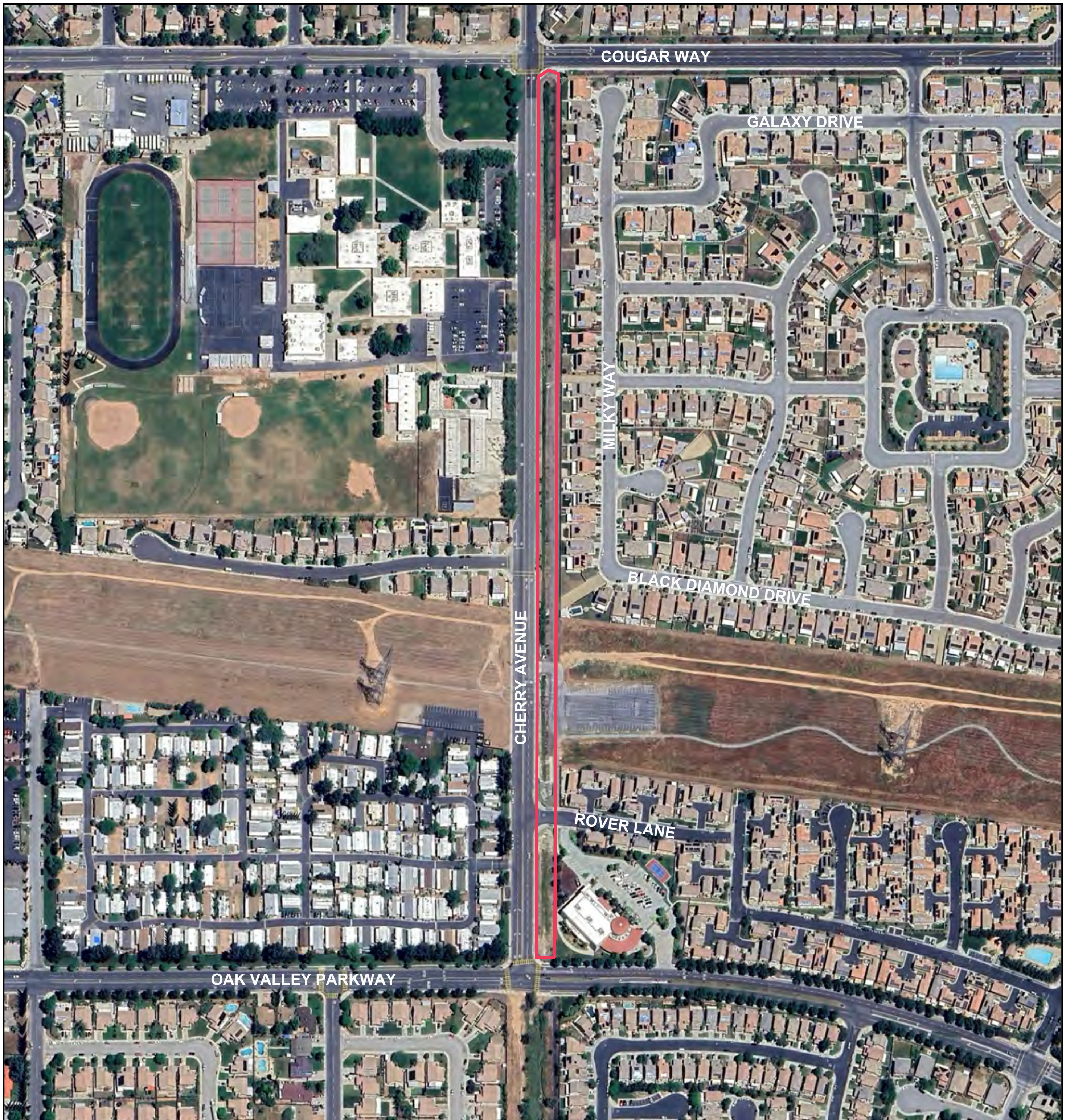

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SITE BOUNDARY

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: GOOGLE EARTH, 2024.

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FIGURE 2

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SITE AERIAL

CHERRY CHANNEL DRAINAGE PROJECT
BEAUMONT, CALIFORNIA

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FIGURE 3

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REGIONAL GEOLOGY

CHERRY CHANNEL DRAINAGE PROJECT
BEAUMONT, CALIFORNIA

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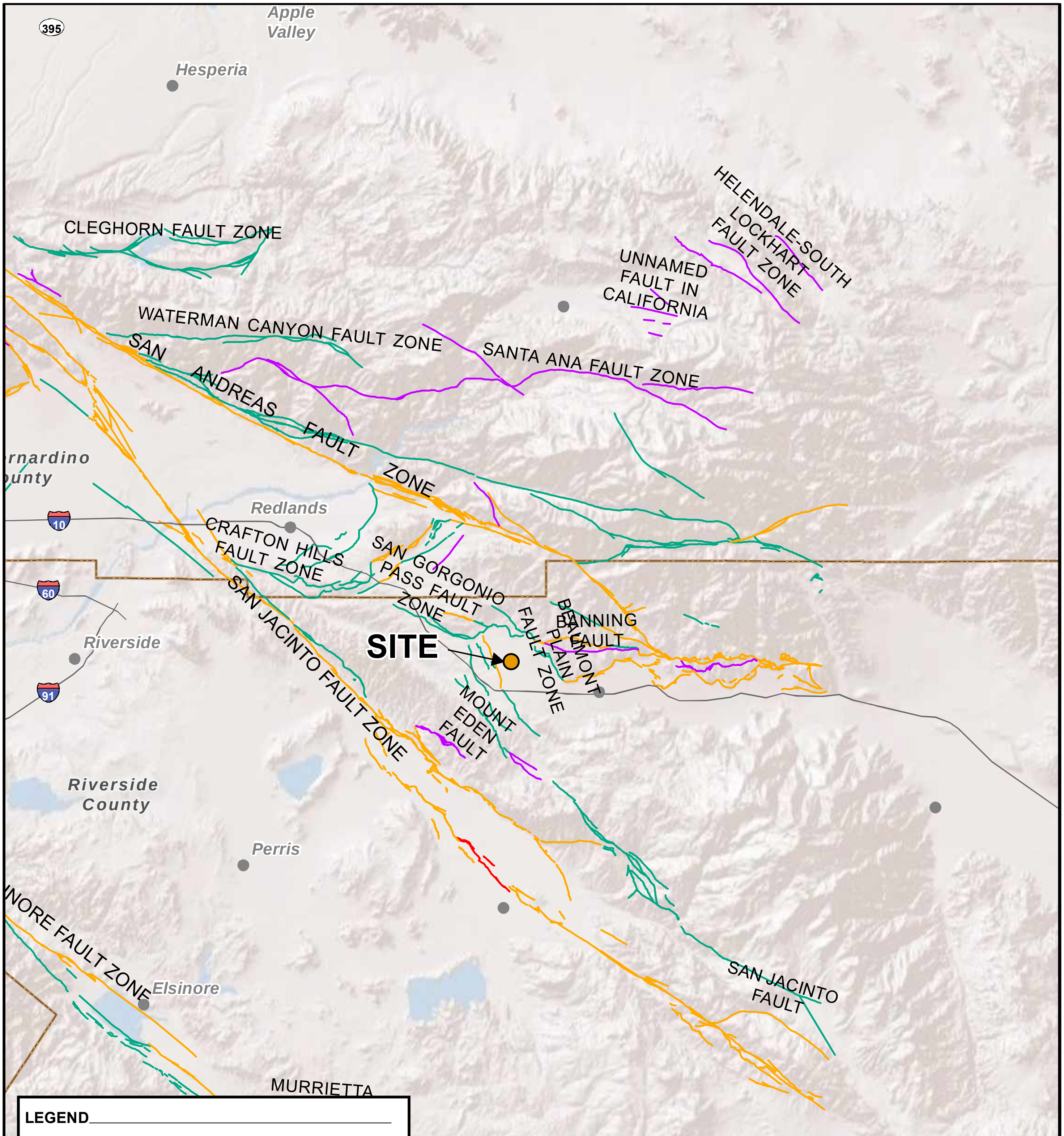

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- QUATERNARY (POTENTIALLY ACTIVE)
- STATE/COUNTY BOUNDARY

SOURCES: QUATERNARY FAULTS DATABASE - U.S. GEOLOGICAL SURVEY AND CALIFORNIA GEOLOGICAL SURVEY, QUATERNARY FAULT AND FOLD DATABASE FOR THE UNITED STATES, ACCESSED AUGUST 07, 2024, AT: https://www.usgs.gov/programs/earthquake-hazards/faults, ESRI, 2023.

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NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

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FIGURE 4

FAULT LOCATIONS

CHERRY CHANNEL DRAINAGE PROJECT
BEAUMONT, CALIFORNIA

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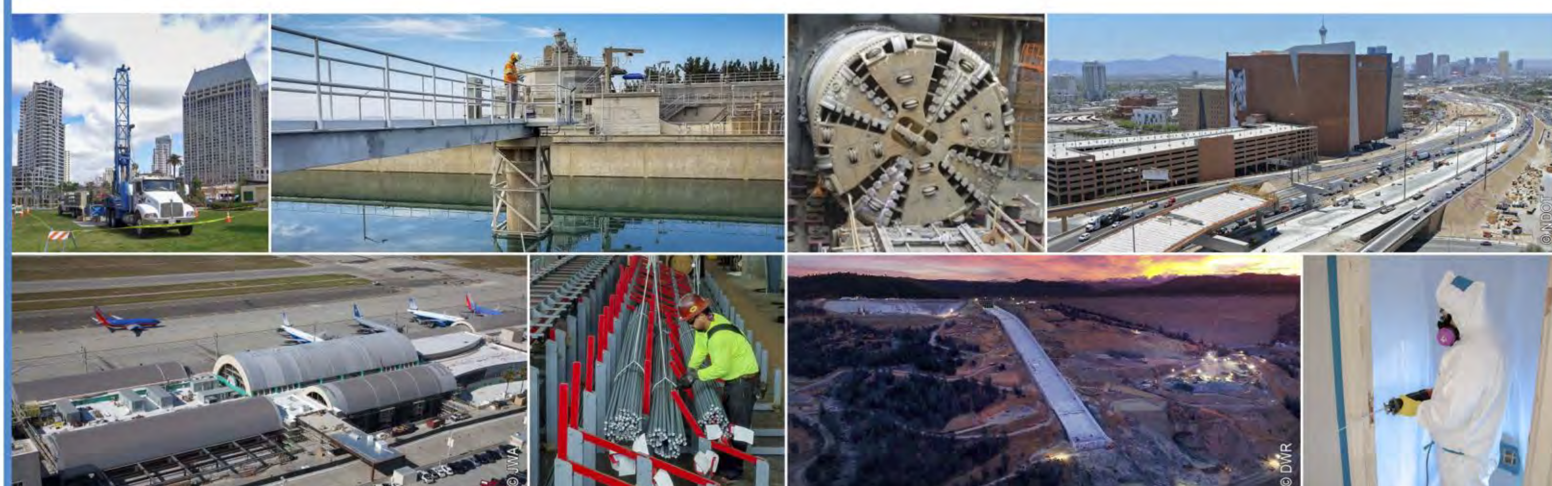

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