



February 19, 2020
(Revised April 13, 2021)
Project No. 109052001

Mr. Ted Drury, MS
Tory R. Walker Engineering
122 Civic Center Drive, Suite 206
Vista, California 92084

Subject: Responses to Cycle Issues
Federal Boulevard Dechannelization and Trail Project
San Diego, California
City of San Diego Project Number 612886

References: City of San Diego, 2021, Cycle Issues, 2 LDR-Geology, Project Number 669559:
dated January 19.

Ninyo & Moore, 2020, Update Geotechnical Evaluation, Federal Boulevard
Dechannelization and Trail Project, San Diego, California, Project No. 109052001:
dated October 16.

Dear Mr. Drury:

This letter has been prepared in response to the City of San Diego Development Cycle Issues dated January 19, 2021 that relate to the geotechnical aspects of the project as addressed in the referenced report (Ninyo & Moore, 2020). The following responses to the current Cycle Issues have been answered based on the information presented in the referenced report (Ninyo & Moore, 2020). Specifically, this letter provides responses, which are referred to as Issues 7, 8, 9, 18, and 19 in the letter (City of San Diego, 2021) presented in Attachment A.

Cycle Issues - Issue Number 7: *The project's geotechnical consultant should provide a conclusion regarding if the proposed development will destabilize or result in settlement of adjacent property of the right of way.*

Response: Based on the results of our geotechnical evaluation and engineering analyses, it is our opinion that the proposed development will not result in destabilization or settlement of the adjacent property of the right of way.

Cycle Issues - Issue Number 8: *The project's geotechnical consultant must provide a professional opinion that the site will be adequately stable following project completion.*

Response: It is our opinion that the site will be stable following project completion. This is based on the results of our global stability analysis of the proposed slope condition indicating adequate factors of safety following project completion (i.e., about 1.5 or higher under the static loading condition and 1.1 or higher under the pseudo-static condition).

Cycle Issues - Issue Number 9: *The project's geotechnical consultant should provide a statement as to whether or not the site is suitable for the intended use.*

Response: Based on the results of our geotechnical evaluation, it is our opinion that the construction of the proposed improvements at the subject site are feasible from a geotechnical standpoint and the site is suitable for the intended use, provided the recommendations from our geotechnical evaluation report (Ninyo & Moore, 2020) are incorporated into the design and construction of the project.

Remaining Review Issues - Issue Number 18: *The project's geotechnical consultant must submit an addendum geotechnical report or update letter that specifically addresses the referenced development plans, previous un-cleared review comments, and the following.*

Response: We will review the development plans once they are finalized. Once reviewed, a separate plan review letter will be prepared.

Remaining Review Issues - Issue Number 19: *The referenced report does not appear to use a saturation depth of 5-feet in the slope stability analysis. Per the City's Guidelines for Geotechnical Reports, if the depth of saturation used in the surficial slope stability analysis is less than 5-feet, the shallower depth must be justified. The project's geotechnical consultant should justify the depth used in their analysis or provide revised slope stability analysis.*

Response: Section 10.1.7 of the referenced report (Ninyo & Moore, 2020) recommends that finished slopes be constructed at inclinations of 2:1 (horizontal to vertical) or flatter. Per the City of San Diego's 2018 Guidelines for Geotechnical Reports, indicates that the surficial slope stability analysis is required for slopes steeper than 2:1.

Note, the slope stability analyses presented in Appendix D of the referenced report (Ninyo & Moore, 2020) for slopes steeper than 2:1 are for the temporary construction slopes, not finished slopes.

Ninyo & Moore appreciates the opportunity to be of continued service on this project.

Respectfully submitted,
NINYO & MOORE



Jeffrey T. Kent, PE, GE
Principal Engineer



CMK/JTK/gg

Attachment: Attachment A – City of San Diego Letter dated January 19, 2021



ATTACHMENT A

City of San Diego Letter dated January 19, 2021

Reviewing Discipline

LDR-Geology

Reviewer Name**Reviewer Phone****Reviewer Email**

Issues			
Issue Num	Issue Text	Cleared	Cleared Date
2	The project site is located in Geologic Hazard Category 32 and 12 as shown on the City's Seismic Safety Study Geologic Hazard Maps and is characterized by a liquefaction potential and a fault buffer zone characterized by potentially active, inactive, or activity unknown faults with a low to moderate risk. (From Cycle 2)	Yes	01/19/2021
3	Submit a geotechnical investigation report that addresses the existing and potential geologic hazards, determines potential impacts of the proposed project, recommends mitigation measures if necessary, and identifies any significant unmitigated geologic impacts to the proposed development. For information regarding geotechnical reports, consider reviewing the City's Guidelines for Geotechnical Reports (https://www.sandiego.gov/sites/default/files/legacy/development-services/pdf/industry/geoguidelines.pdf). (From Cycle 2)	Yes	01/19/2021
4	Please note: All geotechnical documents submitted for digital review must be uploaded independently as they may become record documents. (From Cycle 2)	Yes	01/19/2021
5	The geotechnical investigation report must contain a geologic/geotechnical map that shows the distribution of fill and geologic units, location of exploratory excavations, proposed development, and location of cross-sections. Circumscribe the limits of anticipated remedial grading on the geologic/geotechnical map to delineate the proposed footprint of the project. The proposed Grading Plan could provide a suitable base map. (From Cycle 2)	Yes	01/19/2021
6	The geotechnical investigation report must contain representative geologic/geotechnical cross sections that show the existing and proposed grades, distribution of fill and geologic units, groundwater conditions, proposed retaining walls, and temporary slopes if applicable. The cross-sections should extend beyond the property lines to show any adjacent structures and/or right of ways. (From Cycle 2)	Yes	01/19/2021

7	The project's geotechnical consultant should provide a conclusion	No	
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Issue Num	Issue Text	Cleared	Cleared Date
8	The project's geotechnical consultant must provide a professional opinion that the site will be adequately stable following project completion. (From Cycle 2)	No	
9	The project's geotechnical consultant should provide a statement as to whether or not the site is suitable for the intended use. (From Cycle 2)	No	
10	Please note, geotechnical reports that address geologic hazards must also be signed and sealed (stamped) by a professional geologist. (From Cycle 2)	Yes	01/19/2021
11	The engineer of work should revise note 1 of the Grading and Geotechnical Specifications certification and add a reference to the geotechnical investigation report for the proposed development. (From Cycle 2)	Yes	01/19/2021
12	The engineer of work should revise note 5 of the Grading and Geotechnical Specifications certification to show the geotechnical consultant's information. (From Cycle 2)	No	
13	The engineer of work should revise the Grading and Geotechnical Specification certification and remove the formatting instructions following the asterisk (*) below Note 5. (From Cycle 2)	Yes	01/19/2021
14	To delineate the footprint of the proposed development, the engineer of work should show the "Limits of Grading" on the grading plan. The limits must be clearly labeled "Limits of Grading" and encompass the area of remedial grading if recommended by the project's geotechnical consultant and circumscribe the proposed grading in its entirety. (From Cycle 2)	Yes	01/19/2021
15	Note: These comments are draft and subject to change until presented by the City's assigned Development Project Manager in conjunction with the project Assessment Letter. Staff is unable to process formal, intermediate plan changes and updates outside the full submitted cycle. A formal response to these comments must be made through the resubmittal process in response to the full Assessment Letter. Your DSD Development Project Manager can assist with further questions. (From Cycle 2)	Yes	01/19/2021
16	Update Geotechnical Evaluation, Federal Boulevard Dechannelization and Trail Project, San Diego, California, prepared by Ninyo & Moore, dated October 16, 2020 (their project no. 109052001) Development Plans for: Federal Boulevard Chollas Creek Restoration and Trail Project, prepared by Tory R. Walker Engineering, undated December 15, 2020 (New Issue)	Yes	01/19/2021

17	The previous review comments that have not been cleared remain	No	
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	applicable. (New Issue)		
Issue Num	Issue Text	Cleared	Cleared Date
18	The project's geotechnical consultant must submit an addendum geotechnical report or update letter that specifically addresses the referenced development plans, previous un-cleared review comments, and the following: (New Issue)	No	
19	The referenced report does not appear to use a saturation depth of 5-feet in the slope stability analysis. Per the City's Guidelines for Geotechnical Reports, if the depth of saturation used in the surficial slope stability analysis is less than 5-feet, the shallower depth must be justified. The project's geotechnical consultant should justify the depth used in their analysis or provide revised slope stability analysis. (New Issue)	No	

Update Geotechnical Evaluation

Federal Boulevard Dechannelization and Trail Project

San Diego, California

Tory R. Walker Engineering
122 Civil Center Drive, Suite 206 | Vista, California 92084

October 16, 2020 | Project No. 109052001



Geotechnical | Environmental | Construction Inspection & Testing | Forensic Engineering & Expert Witness

Geophysics | Engineering Geology | Laboratory Testing | Industrial Hygiene | Occupational Safety | Air Quality | GIS

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

Update Geotechnical Evaluation

Federal Boulevard Dechannelization and Trail Project

San Diego, California

Mr. Ted Drury, MS
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October 16, 2020 | Project No. 109052001

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1. INTRODUCTION

In accordance with your request and authorization, we have prepared this geotechnical evaluation for the proposed Federal Boulevard Dechannelization and Trail Project in San Diego, California (Figure 1). Our evaluation was performed in accordance with our proposal dated April 29, 2020. The objectives of this study were to assess the soil conditions at the site, evaluate the engineering properties of the soils encountered, and provide recommendations relative to the geotechnical aspects of the proposed project. This updated report presents the results of our field explorations and laboratory testing, as well as our conclusions regarding the geotechnical conditions at the site and our recommendations for the design and construction of this project.

2. SCOPE OF SERVICES

The scope of services for this study included the following:

- Review of readily available published and in-house geotechnical literature, previous geotechnical reports for the project area, topographic maps, geologic maps, fault maps, and stereoscopic aerial photographs.
- Performance of a field reconnaissance to observe site conditions and to locate and mark the exploratory borings for clearance by Underground Service Alert (USA).
- Acquisition of Right-of-Way (ROW) and Traffic Control permits from the City of San Diego prior to the performance of our field exploration.
- Acquisition of a boring permit from the County of San Diego Department of Environmental Health (DEH) for our subsurface evaluation.
- Performance of a subsurface evaluation consisting of drilling, logging, and sampling of seven exploratory borings. Bulk and in-place soil samples were obtained at selected intervals from within the borings. The collected soil samples were transported to our in-house geotechnical laboratory for analysis.
- Performance of geotechnical laboratory testing on representative samples to evaluate soil characteristics and design parameters.
- Compilation and analysis of the data obtained from our background review, subsurface evaluation, and laboratory testing.
- Preparation of this report presenting our findings, conclusions, and recommendations regarding the geotechnical design and construction aspects of the project.

3. SITE AND PROJECT DESCRIPTION

The project site includes an approximately 1,900-foot long section of the existing east-west trending, channel along the south side of Federal Boulevard from Home Avenue to Interstate 805 (I-805) in San Diego, California (Figures 1, 2A, and 2B). The existing concrete channel is located within Las Chollas Creek. The concrete-lined channel is generally 7 to 10 feet deep, with sidewall inclinations at approximately 2:1 (horizontal to vertical). The channel bottom elevation ranges from approximately 78 to 96 feet above mean sea level (MSL) from the west to east limits of the project, respectively. The northern and southern embankments are covered in vegetation with a chain link fence. The northern embankment is adjacent to Federal Boulevard with elevations ranging from approximately 88 to 107 feet above MSL. The southern embankment is adjacent to the California Department of Transportation (Caltrans) ROW with elevations ranging from approximately 88 to 100 feet above MSL. Along the southern embankment, there is an ascending approximately 2:1 (horizontal to vertical) slope up to State Route (SR) 94.

Based on our review of 60 percent plans prepared by Tory R. Walker Engineering (TRWE, 2018), we understand the project includes the demolition of the existing concrete-lined channel and reconstruction as a soft bottom channel lined with cobbles and rock structures. As part of the reconstruction an approximately 7 to 12-foot high retaining wall is to replace the southern embankment and the northern embankment is to be regraded as a landscaped fill slope at an inclination of 2:1 (horizontal to vertical). The retaining wall may consist of a standard Caltrans type cast-in-place (CIP) concrete retaining wall or a pre-cast concrete block gravity wall system. An additional site improvement is to include a decomposed granite (DG) covered pedestrian trail along the northern embankment of the channel along Federal Boulevard.

As mentioned previously, the Caltrans ROW is at the base of the ascending slope along the southern channel embankment. As part of construction of the retaining wall, temporary grading may extend into the Caltrans ROW.

Our office has previously prepared geotechnical reports for the adjacent developments on the north side of Federal Boulevard that included the City of San Diego Police Department facilities (Ninyo & Moore, 2001 and 2002). These reports (Ninyo & Moore, 2001 and 2002) indicated that the area is generally underlain by artificial fill, alluvium, and materials of the San Diego Formation with large amounts of gravel and cobbles.

4. SUBSURFACE EVALUATION

Our subsurface evaluation for this project was performed on July 29 and 30, 2020 and August 6, 2020, and included the drilling, logging, and sampling of seven small-diameter borings (B-1 through B-7) to depths up to approximately 30 feet. Borings B-1, B-3, and B-5 were drilled on the southern embankment using a limited-access drill rig equipped with 6-inch diameter hollow-stem augers. Borings B-2 and B-4 were performed inside the existing concrete-lined channel, and borings B-6 and B-7 were performed on the northern embankment along Federal Boulevard. These borings (B-2, B-4, B-6, and B-7) were manually excavated to depths up to approximately 4 feet. Ninyo & Moore personnel logged the borings in general accordance with the Unified Soil Classification System (USCS) and ASTM International (ASTM) Test Method D 2488 by observing drill cuttings and drive samples. Bulk and in-place soil samples were obtained from the borings at selected intervals. The samples were then transported to our in-house geotechnical laboratory for testing. The approximate locations of the exploratory borings performed for this evaluation and the exploratory borings for the adjacent projects to the north (Ninyo & Moore, 2001 and 2002) are shown on Figure 2. The logs of the recent exploratory borings performed for this evaluation and pertinent previous boring logs (B-1 through B-4; Ninyo & Moore, 2002) for the adjacent project to the north are presented in Appendix A.

5. LABORATORY TESTING

Laboratory testing of representative soil samples included the performance of tests to evaluate in-situ moisture content and dry density, gradation (sieve) analysis, shear strength, expansion index, standard proctor density, soil corrosivity, and R-value. The results of our in-situ moisture content and dry density tests are presented on the exploratory borings in Appendix A. The results of the other laboratory tests and a description of the test methods used are presented in Appendix B.

6. GEOLOGIC AND SUBSURFACE CONDITIONS

The following sections provide information regarding the geologic conditions relative to the project site.

6.1. Regional Geologic Setting

The project area is situated in the coastal foothill section of the Peninsular Ranges Geomorphic Province. This geomorphic province encompasses an area that extends approximately 900 miles from the Transverse Ranges and the Los Angeles Basin south to the southern tip of Baja California (Norris and Webb, 1990; Harden, 2004). The province varies in width from approximately 30 to 100 miles. In general, the province consists of rugged mountains underlain by Jurassic metavolcanic and metasedimentary rocks, and Cretaceous igneous rocks of the southern California batholith.

The Peninsular Ranges Province is traversed by a group of sub-parallel faults and fault zones trending approximately northwest. Several of these faults, shown on Figure 3, are considered active faults (Jennings, 2010). The Elsinore, San Jacinto, and San Andreas faults are active fault systems located northeast of the project area and the Rose Canyon, Coronado Bank, San Diego Trough, and San Clemente faults are active faults located southwest of the project area. The Rose Canyon Fault Zone, the nearest active fault system, has been mapped approximately 3.4 miles southwest of the project site. Major tectonic activity associated with these and other faults within this regional tectonic framework consists primarily of right-lateral, strike-slip movement. Further discussion of faulting relative to the site is provided in the Faulting and Seismicity section of this report.

6.2. Site Geology

The results of our geologic reconnaissance and subsurface evaluation indicate that the site is generally underlain by fill, younger alluvium, and materials of the San Diego Formation (Kennedy and Tan, 2008). Generalized descriptions of the materials encountered during our subsurface exploration are presented below. Additional descriptions of the materials encountered in our exploratory borings are shown on the logs presented in Appendix A. The geology of the site is shown on Figure 4 and geologic cross sections are shown on Figures 5A and 5B.

6.2.1. Encountered Channel Concrete Sections

As noted earlier, borings B-2 and B-4 were performed within the existing concrete-lined channel. Portland cement concrete (PCC) concrete sections were encountered during our subsurface exploration in borings B-2 and B-4 with thicknesses of approximately 9 and 8 inches, respectively. Approximately 3 inches of aggregate base materials was encountered underlying the concrete at boring B-2. No aggregate base materials were encountered in the other borings. Fibrous material and rebar was encountered within the concrete section for borings B-2 and B-4, respectively.

6.2.2. Fill

Fill materials were encountered in each of our borings at the ground surface or underlying the concrete channel sections and extending to depths up to approximately 8 feet. As encountered in our borings, these materials generally consisted of various shades of brown, yellow, and red, moist, medium dense to dense, silty sand, clayey sand, poorly graded sand, and poorly graded gravel. Gravel and cobbles were encountered in the fill materials. Documentation regarding fill placement was not available for our review.

Based on our review of topographic maps and historical aeriels, we anticipate embankment fill was placed during the construction of SR-94 between 1966 and 1980. The as-built plans show a fill slope extending down from SR-94 towards the concrete lined channel (San Diego County, 1971). Based on our review of topographic maps, we anticipate embankment fill to range from approximately 15 to 25 feet.

6.2.3. Younger Alluvium

Holocene and Pleistocene-age younger alluvium was encountered in our recent borings B-1, B-3, and B-5 and our previous boring B-2 (Ninyo & Moore, 2002) underlying the fill materials and extending to depths up to approximately 12 feet. As encountered in our borings, these materials generally consisted of various shades of brown gray, red, and yellow, moist, medium dense to very dense, silty sand, silty gravel, and sandy poorly graded gravel with silt. Scattered gravel and cobble fragments were encountered in the younger alluvium.

6.2.4. San Diego Formation

Materials of the Pleistocene and Pliocene-age San Diego Formation were encountered in borings B-1, B-3, and B-5 underlying the younger alluvium and extending to the total depths explored. As encountered in our borings, these materials generally consisted of various shades of gray, brown, yellow, and white, moist, weakly to moderately cemented, sandstone and silty sandstone.

6.3. Groundwater

Groundwater was not encountered during this our recent evaluation or previous subsurface evaluations nearby. Based on our review of groundwater monitoring well data in the site vicinity (Geotracker, 2020), groundwater has been measured at depths greater than 30 feet below the ground surface. However, due to the project being within an active creek, groundwater may be encountered at shallow depths and would coincide with water flowing in the creek. Fluctuations in the level of groundwater may occur due to variations in ground surface topography, subsurface stratification, rainfall, irrigation practices, groundwater pumping, and other factors which may not have been evident at the time of our field evaluation.

7. GEOLOGIC HAZARDS

In general, hazards associated with faulting and seismic activity include strong ground motion, ground surface rupture, and liquefaction. These considerations and other potential geologic hazards are discussed in the following sections.

7.1. Faulting and Seismicity

Based on our review of the referenced geologic maps and stereoscopic aerial photographs, as well as on our geologic field mapping, the subject site is not underlain by known active or potentially active faults (i.e., faults that exhibit evidence of ground displacement in the last 11,000 years and 2,000,000 years, respectively). However, like the majority of southern California, the site is located in a seismically active area and the potential for strong ground motion is considered significant during the design life of the proposed structures. The nearest known active fault, the Rose Canyon fault is located approximately 3.4 miles west of the site. Additionally, a fault labeled as being “potentially active, inactive, or presumed inactive, or activity unknown” is mapped trending in a roughly north-south direction through the eastern portion of the project site (Figure 6). However, these fault segments are not considered active by the state of California. Additionally, the site is not located within a State of California Earthquake Fault Zone (formerly known as Alquist-Priolo Special Studies Zone) (Hart and Bryant, 2007).

7.1.1. Surface Ground Rupture

Based on our review of the referenced literature and our site reconnaissance, no active faults are known to cross the project site. The active Rose Canyon Fault Zone is located approximately 3.4 miles west of the site. Additionally, a fault labeled as being “potentially active, inactive, or presumed inactive, or activity unknown” is mapped trending in a roughly north-south direction through the eastern portion of the project site. However, this is not considered to be an active fault by the State of California. Therefore, the probability of damage from surface ground rupture is considered to be low. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

7.1.2. Strong Ground Motion

The 2019 California Building Code (CBC) specifies that the Risk-Targeted, Maximum Considered Earthquake (MCE_R) ground motion response accelerations be used to evaluate seismic loads for design of buildings and other structures. The MCE_R ground motion response accelerations are based on the spectral response accelerations for 5 percent damping in the direction of maximum horizontal response and incorporate a target risk for structural collapse

equivalent to 1 percent in 50 years with deterministic limits for near-source effects. The horizontal peak ground acceleration (PGA) that corresponds to the MCE_R for the site was calculated as 0.57g using the Structural Engineers Association of California (SEAOC) and Office of Statewide Health Planning and Development (OSHPD) (SEAOC and OSHPD, 2020) seismic design tool (web-based).

The 2019 CBC specifies that the potential for liquefaction and soil strength loss be evaluated, where applicable, for the Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration with adjustment for site class effects in accordance with the American Society of Civil Engineers (ASCE) 7-16 Standard. The MCE_G peak ground acceleration is based on the geometric mean peak ground acceleration with a 2 percent probability of exceedance in 50 years. The MCE_G peak ground acceleration with adjustment for site class effects (PGA_M) was calculated as 0.64g using the OSHPD (SEAOC and OSHPD, 2020) seismic design tool that yielded a mapped MCE_G peak ground acceleration of 0.53g for the site and a site coefficient (F_{PGA}) of 1.2 for Site Class C.

7.1.3. Liquefaction

Liquefaction is the phenomenon in which loosely deposited granular soils with silt and clay contents of less than approximately 35 percent 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.

As noted in the previous sections, the site is underlain by fill, alluvium, materials of the San Diego Formation. Groundwater was not encountered during our evaluation, however, based on historical information, we anticipate groundwater may be at the present within the channel during the rainy season. Accordingly, we evaluated the liquefaction potential at the project site with the groundwater at the surface elevation of the channel bottom. Liquefaction evaluation was performed using a maximum moment magnitude of 6.9 associated with Rose Canyon fault and MCE_G peak ground acceleration with adjustment for site class effects (PGA_M) of 0.64g as discussed in previous sections. A groundwater depth of 5 feet was used in our analysis based on the anticipated presence of groundwater within the channel.

The liquefaction analysis was performed using the computer program LiquefyPro (CivilTech Software, 2017). The analysis was based on the National Center for Earthquake Engineering Research (NCEER) procedure (Youd, et al., 2001) using Modified Robertson Method (1997). Our analysis indicates that loose to medium dense soils are susceptible to liquefaction up to a depth of approximately 15 feet below the ground surface.

As a result of liquefaction, proposed improvements may be subject to several hazards, including liquefaction-induced settlement. In order to estimate the amount of post-earthquake settlement, the method proposed by Ishihara and Yoshimine (1992) was used for the evaluation of dynamic settlement. The amount of soil settlement during a strong seismic event depends on the thickness of the liquefiable layers and the density and/or consistency of the soils. Post-earthquake total settlements on the order of approximately ¼-inch was calculated for the site using the computer program LiquefyPro (CivilTech Software, 2017). Differential settlements of approximately ¼-inch over a horizontal span of 40 feet should be expected. Our liquefaction analysis results are presented in Appendix C. These dynamic settlements are considered additional to the static settlement discussed in following sections.

7.2. Tsunamis and Seiches

Tsunamis are long wavelength seismic sea waves (long compared to the ocean depth) generated by sudden movements of the ocean bottom during submarine earthquakes, landslides, or volcanic activity. Seiches are similar oscillating waves on inland or enclosed bodies of water. Based on the location and elevation of the site, and the absence of nearby lakes or reservoirs, the potential for a tsunami or seiche to affect the site is not a design consideration.

7.3. Flood Hazards

Based on our review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the majority of the project site is within the 0.2% annual chance flood hazard area and Zone AE: special flood hazard area with base flood elevation and a regulatory floodway. Accordingly, the potential for flooding to impact the site is considered high at the site.

7.4. Landsliding

Per Tan (1995), the site is mapped as “generally susceptible” to landsliding. Based on our review of referenced geologic maps, literature, topographic maps, and stereoscopic aerial photographs, and on our site reconnaissance, no landslides or indications of deep-seated landsliding were noted underlying the project site. As such, the potential for significant large-scale slope instability at the site is not a design consideration.

7.5. City of San Diego Seismic Safety Study

Per the City of San Diego’s seismic safety element (2008) the project site is mapped within hazard categories 32 and 52. Category 32 is defined as “low potential for liquefaction, fluctuating groundwater minor drainages.” Category 52 is defined as “other level mesas, gently sloping to steep terrain, favorable geologic structure, low risk.” Additionally, a potentially active fault segment is mapped trending in a roughly north-south direction in the eastern portion of the project site (Figure 6). However, this fault segment is not considered active by the State of California. The site is not located within a special studies zone for earthquake faults. The portion of the seismic safety element depicting the project site is included as Figure 6.

8. GLOBAL SLOPE STABILITY

The intent of the global stability analysis was to evaluate the potential for deep-seated, rotational failures. A two-dimensional stability analysis program, GEOSTASE (Gregory, 2018), was used to evaluate the 25-foot high, southerly-descending slope. Our geologic cross sections A-A’ and B-B’ (Figures 5A and 5B) were used in our analysis of this slope. Based on the modal magnitude of 6.9 and distance of 5.4 km, and MCE_G peak ground acceleration with adjustment for site class effects (PGA_M) of 0.64g, a horizontal acceleration coefficient of 0.24g was used to evaluate the pseudo-static stability during the relatively dry conditions. We also evaluated the temporary backcut during the retaining wall construction to evaluate the temporary conditions during construction.

The fill material was assigned unit weight and shear strength parameters based on in-place wet densities and direct shear tests performed on representative samples collected during our geotechnical exploration. The unit weight and shear strength parameters for the younger alluvium and San Diego Formation was selected based on our experience with formations of similar characteristics at nearby sites. The unit weight and shear strength parameters for the new compacted fill was selected based on the Caltrans standards for structural backfill. Ultimate shear strength values were used in our analysis of the static, pseudo-static, and temporary loading conditions. The relevant parameters used in our slope stability analysis are presented in Table 1.

Table 1 – Global Slope Stability Design Parameters

Materials	Static, Psuedo Static, and Temporary Conditions		
	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degree)
Existing Fill	110	190 ¹	28 ¹
Younger Alluvium	110	0	32
San Diego Formation	115	250 ²	31
New Compacted Fill	120	0	34
Concrete (3,600 psi)	150	259,200	0

Notes:

¹Existing fill and SR-94 embankment fill parameters are based on a shear test performed on a remolded sample to 90% of its standard protector value.

²Due to sample disturbance, a cohesion value of 250 psf was used for the San Diego Formation.

pcf = pounds per cubic foot

psf = pounds per square foot

pci = pounds per square inch

The results of our global slope stability analysis of the proposed slope improvements and temporary slope conditions indicate adequate factors of safety (i.e., about 1.5 or higher under the static loading condition, 1.1 or higher under the pseudo-static loading condition, 1.25 or higher under temporary conditions). The results of our global stability analyses are presented in Appendix D.

9. CONCLUSIONS

Based on our geotechnical evaluation, it is our opinion that construction of the proposed improvements at the subject site is feasible from a geotechnical standpoint, provided the following recommendations are incorporated into the design and construction of the project.

- The areas of the proposed improvements are underlain by fill, younger alluvium, and materials of the San Diego Formation.
- Onsite materials are generally considered suitable for reuse onsite as general engineered fill and slope fill, provided they are processed to meet the recommendations provided herein. However, onsite materials are not suitable for use as Caltrans structure backfill. Import material will be required for Caltrans structure backfill.
- Excavations during site grading should be generally feasible with earthmoving equipment in good working order. Onsite excavations that extend into materials of the younger alluvium and San Diego Formation may encounter difficulties due to the presence of gravel, cobbles, concretions, and/or strongly cemented zones.
- Onsite excavations (including utility trenches) are anticipated to generate oversize material and additional processing and handling of these materials, including screening and/or rock picking, should be anticipated prior to reuse.
- Due to the generally cohesionless, granular nature of the fill and alluvium, caving should be anticipated.

- Groundwater was not encountered during our recent or previous nearby subsurface exploration. However, due to the project being within an active creek, groundwater may be encountered at shallow depths and would coincide with water flowing in the creek. The depth to groundwater varies due to seasonal precipitation, subsurface conditions, irrigation, groundwater pumping, and other factors. Seepage and fluctuations in the groundwater levels at the site should be anticipated.
- Additionally, due to the project being within an active creek, groundwater may be encountered at shallow depths and would coincide with water flowing in the creek, drying back or aerating soils to near optimum moisture content prior to reuse should be anticipated.
- The subject site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zone). However, the closest known major active fault is the Rose Canyon Fault, which is located approximately 3.4 miles west of the project. Additionally, a fault labeled as being “potentially active, inactive, or presumed inactive, or activity unknown” is mapped trending in a roughly north-south direction through the eastern portion of the project site.
- Based on the laboratory testing presented in Appendix B, the onsite materials possess a very low potential for expansion.
- Based on the results of our soil corrosivity tests and Caltrans amended (2019) AASHTO (2017) corrosion criteria, the onsite soils would not be classified as corrosive.
- Based on the results of our slope stability analysis, construction activities would not destabilize the ascending slope and SR-94 south of the proposed improvements.

10. RECOMMENDATIONS

Based on our understanding of the project, the following recommendations are provided for the design and construction of the proposed improvements. The proposed site improvements should be constructed in accordance with the requirements of the applicable governing agencies.

10.1. Earthwork

In general, earthwork should be performed in accordance with the recommendations presented in this report. Ninyo & Moore should be contacted for questions regarding the recommendations or guidelines presented herein.

10.1.1. Site Preparation

Site preparation should begin with the removal of flatwork, vegetation, utility lines, asphalt, concrete, and other deleterious debris from areas to be graded. Obstructions that extend below the finished grade (such as tree stumps) should be removed to such a depth that organic material is generally not present and the resulting holes filled with compacted soil. Clearing and grubbing should extend to the outside of the proposed excavation and fill areas. The debris

and unsuitable material generated during clearing and grubbing should be removed from areas to be graded and disposed of at a legal dumpsite away from the project area.

10.1.2. Temporary Excavations and Shoring

For temporary excavations, we recommend that the following Occupational Safety and Health Administration (OSHA) soil classifications be used:

<i>Younger Alluvium</i>	<i>Type C</i>
<i>Fill, San Diego Formation</i>	<i>Type B</i>

Upon making the excavations, the soil classifications and excavation performance should be evaluated in the field by the geotechnical consultant in accordance with the OSHA regulations. Temporary excavations should be constructed in accordance with OSHA recommendations. For trench or other excavations, OSHA requirements regarding personnel safety should be met using appropriate shoring (including trench boxes) or by laying back the slopes to no steeper than 1.5:1 (horizontal to vertical) in younger alluvium and 1:1 (horizontal to vertical) in materials of the San Diego Formation and fill material based on our laboratory testing. Temporary excavations that encounter seepage may be shored or stabilized by placing sandbags or gravel along the base of the seepage zone. Excavations encountering seepage should be evaluated on a case-by-case basis. Onsite safety of personnel is the responsibility of the contractor.

In areas with limited space for construction (where temporary excavations may not be laid back at the recommended slope inclination or temporary slot cuts cannot be performed), a shoring system may be utilized to stabilize the excavation sidewalls during construction. Shoring systems should be constructed through the fill and into very old paralic deposits. The shoring system should be designed using the magnitude and distribution of lateral earth pressures presented on Figure 7 for braced shoring systems and Figure 8 for cantilevered shoring systems. The recommended design earth pressures are based on the assumptions that (a) the shoring system is constructed without raising the ground surface elevation behind the shoring, (b) that there are no surcharge loads, such as soil stockpiles, construction materials, or vehicular traffic, and (c) that no loads act above a 1:1 plane extending up and back from the base of the shoring system. For shoring subjected to the above-mentioned surcharge loads, the contractor should include the effect of these loads on lateral earth pressures acting on the shoring wall.

Settlement of the ground surface may occur behind the shoring wall during excavation. The amount of settlement depends on the type of shoring system, the quality of contractor's workmanship, and soil conditions. Settlement may cause distress to adjacent structures, if present. To reduce the potential for distress to adjacent structures, we recommend that the shoring system be designed to limit the ground settlement behind the shoring to ½ inch or less. Possible causes of settlement that should be addressed include vibration during installation of the sheet piling, excavation for construction, construction vibrations, dewatering, and removal of the support system. We recommend that the potential settlement distress be evaluated carefully by the contractor prior to construction.

The contractor should retain a qualified and experienced engineer to design the shoring system. The shoring parameters presented in this report are for preliminary design purposes and the contractor should evaluate the adequacy of these parameters and make appropriate modifications for their design. We recommend that the contractor take appropriate measures to protect workers. OSHA requirements pertaining to worker safety should be observed. We further recommend that the construction methods provided herein be carefully evaluated by a qualified specialty contractor prior to commencement of the construction.

10.1.3. Construction Dewatering

As noted previously, due to the project being within an active creek, groundwater may be encountered at shallow depths and would coincide with water flowing in the creek. However, significant fluctuations in the groundwater level can occur as a result of variations in seasonal precipitation, irrigation, and other factors. Consequently, dewatering may be warranted within excavations performed at the site. Considerations for construction dewatering (if groundwater is encountered) should include anticipated drawdown, volume of pumping, potential for settlement, and groundwater discharge. Disposal of groundwater should be performed in accordance with guidelines of the Regional Water Quality Control Board.

10.1.4. Excavation Characteristics

Based on our exploratory borings and review of geologic background materials, we anticipate that excavation of the artificial fill, younger alluvium, and materials of the San Diego Formation present on site may generally be accomplished with heavy-duty grading equipment in good operating condition. Excavations extending into the San Diego Formation may encounter very difficult excavation conditions and the contractor should be prepared to utilize heavy ripping and/or use of a rock wheel/saw. Onsite excavations (including utility trenches) are anticipated to

generate oversize material and additional processing and additional processing and handling of these materials, including screening and/or rock picking, should be anticipated.

10.1.5. Materials for Fill

Materials for general engineered fill and slope fill may be obtained from onsite excavations or import material. Fill soils should possess an organic content of less than approximately 3 percent by volume (or 1 percent by weight). In general, fill material should not contain rocks or lumps over approximately 3 inches in diameter, and not more than approximately 30 percent larger than $\frac{3}{4}$ inch. However, onsite materials are not suitable for use as Caltrans structure backfill. Import material will be required for Caltrans structure backfill.

Imported fill material, if needed, should generally be granular soils with a very low to low expansion potential (i.e., an EI of 50 or less). Import fill material should also be non-corrosive in accordance with the Caltrans amended (2019) AASHTO (2017) corrosion criteria. Non-corrosive soils are soils that possess an electrical resistivity more than 1,100 ohm-centimeter (ohm-cm), a chloride content less than 500 parts per million (ppm), less than 0.15 percent sulfates, and a pH greater than 5.5. Materials for use as fill should be evaluated by Ninyo & Moore's representative prior to filling or importing.

Additionally, concrete materials generated from the demolition of the existing improvements may be crushed and reused within the fill materials, provided they are free of rebar and painted surfaces. These materials are considered suitable, provided they are processed and mixed with onsite soils to meet the gradation recommendations provided above. In areas of landscaping, the landscape architect should be consulted regarding the use of recycled concrete materials within the fill.

10.1.6. Compacted Fill

Prior to placement of compacted fill, the contractor should request an evaluation of the exposed ground surface by Ninyo & Moore. Unless otherwise recommended, the exposed ground surface should then be scarified to a depth of approximately 8 inches and watered or dried, as needed, to achieve moisture contents generally at or slightly above the optimum moisture content. The scarified materials should then be compacted to a relative compaction of 90 percent as evaluated in accordance with ASTM D 1557. The evaluation of compaction by the geotechnical consultant should not be considered to preclude any requirements for observation or approval by governing agencies. It is the contractor's responsibility to notify

this office and the appropriate governing agency when project areas are ready for observation and to provide reasonable time for that review.

Fill materials should be moisture conditioned to generally at or slightly above the laboratory optimum moisture content prior to placement and should be generally consistent within the soil mass. The optimum moisture content will vary with material type and other factors.

Prior to placement of additional compacted fill material following a delay in the grading operations, the exposed surface of previously compacted fill should be prepared to receive fill. Preparation may include scarification, moisture conditioning, and recompaction.

Compacted fill should be placed in horizontal lifts of approximately 8 inches in loose thickness. Prior to compaction, each lift should be watered or dried as needed to achieve a moisture content generally at or slightly above the laboratory optimum, mixed, and then compacted by mechanical methods, to a relative compaction of 90 percent as evaluated by ASTM D 1557. Successive lifts should be treated in a like manner until the desired finished grades are achieved.

10.1.7. Slopes

We anticipate that new cut and fill slopes will be constructed for the project. Unless otherwise recommended by our offices and approved by the regulating agencies, permanent cut and fill slopes should not be steeper than 2:1 (horizontal to vertical). Buildings, structures, and improvements should be set back from the top of slopes in accordance with the 2019 CBC. We recommend buildings and structures be set back 20 feet or more from the top of slopes.

Compaction of the face of fill slopes should be performed by backrolling at intervals of 4 feet or less in vertical slope height, or as dictated by the capability of the available equipment, whichever is less. Fill slopes should be overbuilt and cut back to finish grades. The placement, moisture conditioning, and compaction of fill slope materials should be done in accordance with the recommendations presented herein.

Site runoff should not be permitted to flow over the tops of slopes. Positive drainage should be established away from the top of slopes. This may be accomplished by utilizing brow ditches placed at the top of slopes to divert surface runoff away from the slope face where drainage devices are not otherwise available.

The onsite soils are susceptible to erosion. The project plans and specifications should contain design features and construction requirements to mitigate erosion of soils or contain a maintenance program to redress erosion features as they develop on a periodic basis.

10.1.8. Pipe Bedding and Modulus of Soil Reaction (E')

It is our recommendation that new pipelines (pipes), where constructed in open excavations, be supported on 6 or more inches of granular bedding material. Granular pipe bedding should be provided to distribute vertical loads around the pipe. Bedding material and compaction requirements should be in accordance with this report. Pipe bedding typically consists of graded aggregate with a coefficient of uniformity of three or more.

The modulus of soil reaction (E') is used to characterize the stiffness of soil backfill placed at the sides of buried flexible pipes for the purpose of evaluating deflection caused by the weight of the backfill over the pipe (Hartley and Duncan, 1987). A soil reaction modulus of 1,400 pounds per square inch (psi) may be used for an excavation depth of up to approximately 5 feet when backfilled with granular soil compacted to a relative compaction of 90 percent as evaluated by the ASTM D 1557.

10.1.9. Pipe Zone Backfill

The pipe zone backfill should be placed on top of the pipe bedding material and extend to 1 foot or more above the top of the pipe in accordance with the recent edition of the Standard Specifications for Public Works Construction ("Greenbook"). Pipe zone backfill should have a Sand Equivalent (SE) of 30 or more and be placed around the sides and top of the pipe. Silts and clays should not be used as pipe zone backfill. Special care should be taken not to allow voids beneath and around the pipe. Compaction of the pipe zone backfill should proceed up both sides of the pipe.

It has been our experience that the voids within a crushed rock material are sufficiently large to allow fines to migrate into the voids, thereby creating the potential for sinkholes and depressions to develop at the ground surface. If open-graded gravel is utilized as pipe zone backfill, this material should be separated from the adjacent trench sidewalls and overlying trench backfill with a geosynthetic filter fabric.

10.1.10. Utility Trench Zone Backfill

Based on our subsurface evaluation, the onsite earth materials should be generally suitable for reuse as trench zone backfill provided they are free of organic material, clay lumps, debris, and rocks more than approximately 3 inches in diameter. Trench zone backfill should be moisture-conditioned to generally at or slightly above the laboratory optimum. Trench zone backfill should be compacted to a relative compaction of 90 percent as evaluated by ASTM D 1557, except for the upper 12 inches of the backfill beneath vehicular pavements that should be compacted to a relative compaction of 95 percent as evaluated by ASTM D 1557. Lift thickness for backfill will depend on the type of compaction equipment utilized, but fill should generally be placed in lifts not exceeding 8 inches in loose thickness. Special care should be exercised to avoid damaging the pipe during compaction of the backfill.

10.1.11. Thrust Blocks

Thrust restraint for buried pipelines may be achieved by transferring the thrust force to the soil outside the pipe through a thrust block. Thrust blocks may be designed using the magnitude and distribution of passive lateral earth pressures presented on Figure 9. Thrust blocks should be backfilled with granular backfill material and compacted following the recommendations presented in this report.

10.2. Seismic Design Considerations

Design of the proposed improvements should be performed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 2 presents the seismic design parameters for the site in accordance with the CBC (2019) guidelines and adjusted MCE_R spectral response acceleration parameters (SEAOC and OSHPD, 2020).

Seismic Design Factors	Value
Site Class	C
Site Coefficient, F_a	1.2
Site Coefficient, F_v	1.5
Mapped Spectral Acceleration at 0.2-second Period, S_s	1.19g
Mapped Spectral Acceleration at 1.0-second Period, S_1	0.405g
Spectral Acceleration at 0.2-second Period Adjusted for Site Class, S_{MS}	1.428g
Spectral Acceleration at 1.0-second Period Adjusted for Site Class, S_{M1}	0.608g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	0.952g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.405g

10.3. Site Retaining Wall Foundations

Site retaining walls that are not connected to the building may be supported on continuous footings bearing on compacted fill. The subgrade soils should be scarified to a depth of 12 inches, moisture conditioned to generally at or slightly above the laboratory optimum moisture content, and compacted to a relative compaction of 90 percent as evaluated by ASTM D 1557. The continuous footing should have a width of 24 inches or more and the bottom of the foundation should be embedded a depth of 24 inches or more. The foundations should be reinforced in accordance with the recommendations of the project structural engineer. An allowable bearing capacity of 3,000 pounds per square feet (psf) may be used for the design of site retaining wall foundations. An allowable bearing capacity of 1,500 psf may be used for the design of site retaining wall foundations under submerged conditions. The allowable bearing capacity may be increased by one-third when considering loads of short duration, such as wind or seismic forces.

For the design of a site yielding retaining wall that is not restrained against movement by rigid corners or structural connections, lateral pressures are presented on Figure 10. Site restrained walls (non-yielding) may be designed for lateral pressures presented on Figure 11. These pressures assume Caltrans structure backfill materials are used and free draining conditions. Measures should be taken to reduce the potential for build-up of moisture behind the retaining walls. A drain should be provided behind the retaining wall as shown on Figure 12. The drain should be connected to an appropriate outlet.

10.3.1. Lateral Resistance

For resistance of footings to lateral loads bearing on compacted fill, we recommend an allowable passive pressure of 300 psf per foot of depth be used with a value of up to 3,000 psf. We recommend a submerged passive pressure of 140 psf per foot of depth be used with a value up to 1,400 psf. These values assume that the ground is horizontal for a distance of 10 feet, or three multiplied by the height generating the passive pressure, whichever is more. We recommend that the upper 1 foot of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance.

For frictional resistance to lateral loads, we recommend a coefficient of friction of 0.35 be used between soil and concrete. These values may be increased by one-third when considering loads of short duration such as wind or seismic forces.

10.3.2. Static Settlement

We estimate that the proposed structures, designed and constructed as recommended herein, and founded in compacted fill will undergo total settlement on the order of 1 inch. Differential settlement on the order of ½ inch over a horizontal span of 40 feet should be expected.

10.4. Preliminary Flexible Pavement Design

Although not currently included in the 60 percent plans (TRWE, 2018), we are providing recommendations for the construction of new flexible pavements for the project. Our laboratory testing of a near surface soil sample along the alignment indicated an R-value of 39. This R-value, along with an estimated design Traffic Index (TI) of 5 have been the basis of our preliminary flexible pavement design. Actual pavement recommendations should be based on R-value tests performed on bulk samples of the soils that are exposed at the finished subgrade elevations along the alignments during grading operations.

We have provided recommendations for several options of structural flexible pavement sections. These options include pavement sections in accordance with the City of San Diego (2018a) Standard Drawings for Schedule “J” Pavement using asphalt concrete (AC) underlain by cement treated base (CTB) materials, and sections in accordance with the Caltrans (2020) Highway Design Manual using AC underlain by Caltrans Class 2 AB or Greenbook crushed aggregate base (CAB) materials. The preliminary recommended flexible pavement sections are presented in Table 3 below.

Traffic Index	AC Over CTB		AC Over CAB or AB	
	AC Thickness (inches)	CTB Thickness (inches)	AC Thickness (inches)	CAB or AB Thickness (inches)
5.0	3.0	5.0	3.0	5.0

Notes:

- AC = Asphalt Concrete
- AB = Caltrans Class 2 Aggregate Base Materials
- CAB = Greenbook Crushed Aggregate Base Materials
- CTB = Cement Treated Base Materials.

As indicated, these values assume TI value of 5 for site pavements. If traffic loads are different from those assumed, the pavement design should be re-evaluated. In addition, we recommend that the upper 12 inches of the subgrade soils, AB, CAB, and CTB materials be compacted to a relative compaction of 95 percent relative density as evaluated by the current version of ASTM D 1557. Preparation of CTB, including such processes as micro cracking, should be performed in accordance with City of San Diego standards (2018a).

10.5. Preliminary Rigid Pavement Design

Although not currently included in the 60 percent plans (TRWE, 2018), we are providing recommendations for the construction of new rigid pavements for the project. Our laboratory testing of a near surface soil samples along the alignment indicated an R-value 39. This R-value, along with an estimated design TI of 5 have been the basis of our preliminary rigid pavement design. Actual pavement recommendations should be based on R-value tests performed on bulk samples of the soils that are exposed at the finished subgrade elevations along the alignments during grading operations.

We have provided recommendations for several options of structural flexible pavement sections. These options include pavement sections in accordance with the City of San Diego (2018a) Standard Drawings for Schedule “J” Pavement using PCC underlain CTB materials, and sections in accordance with the Caltrans (2020) Highway Design Manual using PCC underlain by AB or CAB materials. The preliminary recommended rigid pavement sections is presented in Table 4.

Table 4 – Preliminary Rigid Pavement Recommendations (R-Value 30.0 to 39.9)

Traffic Index	PCC Over CTB		PCC Over CAB or AB	
	PCC Thickness (inches)	CTB Thickness (inches)	PCC Thickness (inches)	CAB or AB Thickness (inches)
5.0	6.5	--	6.0	4.0

Notes:

AB = Caltrans Class 2 Aggregate Base Materials
 CAB = Greenbook Crushed Aggregate Base Materials
 CTB = Cement Treated Base Materials
 PCC = Portland Cement Concrete

As indicated, these values assume TI values of 5 for site pavements. If traffic loads are different from those assumed, the pavement design should be re-evaluated. In addition, we recommend that the upper 12 inches of the subgrade soils, AB, CAB, and CTB materials be compacted to a relative compaction of 95 percent relative density as evaluated by the current version of ASTM D 1557. Preparation of CTB, including such processes as micro cracking, should be performed in accordance with City of San Diego standards (2018a).

10.6. Exterior Concrete Flatwork

Exterior concrete flatwork (sidewalks) should be 4 inches in thickness and should be constructed in accordance with City of San Diego Standard Drawings SDG-155 and SDG-156 (2016). This assumes that the sidewalks are underlain by materials that possess a very low to low EI (i.e., an EI of 50 or less). To reduce the potential manifestation of distress to exterior concrete flatwork due to movement of the underlying soil, we recommend that such flatwork be installed with crack-control

joints at appropriate spacing as designed by the project engineer. The subgrade soils should be scarified to a depth of 8 inches, moisture conditioned to generally at or slightly above the laboratory optimum moisture content, and compacted to a relative compaction of 90 percent as evaluated by ASTM D 1557. Positive drainage should be established and maintained adjacent to flatwork.

As described earlier, we anticipate that the project alignment will encounter subgrade soils that possess a very low to low for expansion. Per the 2018 City of San Diego “Whitebook” Specifications, if expansive subgrade soils are encountered, the expansive soil subgrade is to be removed and replaced with a non-expansive material having an expansion index of less than 20 (ASTM D4829). The depth of subgrade removal should be based on the expansion index of the subgrade soil in accordance with the following table:

Table 5 – Recommended Depths of Removal	
Expansive Index of Native Subgrade Soil	Depth of Subgrade to be Removed and Replaced (inches)
0 - 50	None
51 - 90	18
91 – 130	24
Above 130	36

Reference:
City of San Diego “Whitebook” Specifications, 2018.

The removal, if needed based on EI of the exposed subgrade soils, should extend beyond the edge of the sidewalk for a horizontal distance equivalent to the depth of removal.

10.7. Corrosivity

Laboratory testing was performed on a representative sample of the near-surface soil to evaluate soil pH, electrical resistivity, water-soluble chloride content, and water-soluble sulfate content. The soil pH and electrical resistivity tests were performed in general accordance with California Test Method (CT) 643. The chloride content test was performed in general accordance with CT 422. Sulfate testing was performed in general accordance with CT 417.

The soil pH was measured to be from 7 to 9.6 and the electrical resistivity was measured to be approximately 1,200 to 3,300 ohm-centimeters (ohm-cm). The chloride content of the samples was measured to be approximately 50 to 100 ppm. The sulfate content of the tested samples was noted to be from 0.003 to 0.014 (i.e. 30 to 140 ppm). Based on a comparison with the California Department of Transportation amended (Caltrans, 2019) AASHTO (2017) corrosion criteria, the soils at the project site are classified as non-corrosive, which is defined as having earth materials with less than

500 ppm chlorides, less than 0.15 percent sulfates (i.e., 1,500 ppm), a pH more than 5.5, and an electrical resistivity more than 1,100 ohm-cm.

10.8. Concrete

Concrete in contact with soil or water that contains high concentrations of water-soluble sulfates that can be subject to premature chemical and/or physical deterioration. As noted, the soil sample tested in this evaluation indicated water-soluble sulfate contents of 0.003 to 0.014 percent by weight (i.e., 30 to 140 ppm). Based on the American Concrete Institute (ACI) 318 criteria, the site soils would correspond to exposure class S0. For this exposure class, ACI 318 recommends that normal weight concrete in contact with soil possess a compressive strength of 2,500 psi or more. Furthermore, due to the potential for variability of site soils, we also recommend that normal weight concrete in contact with soil use Type II, II/V, or V cement.

10.9. Drainage

Proper surface drainage is imperative for satisfactory site performance. Positive drainage should be provided and maintained to direct surface water away from the new sidewalk and retaining wall improvements. Positive drainage is defined as a slope of 2 percent or more over a distance of 5 feet away from the foundations and tops of slopes. Runoff should then be directed by the use of swales or pipes into a collective drainage system. Surface waters should not be allowed to pond adjacent to footings or pavements.

11. PRE-CONSTRUCTION CONFERENCE

We recommend that a pre-construction meeting be held prior to commencement of grading. The owner or his representative, the agency representatives, the architect, the civil engineer, Ninyo & Moore, and the contractor should attend to discuss the plans, the project, and the proposed construction schedule.

12. PLAN REVIEW AND CONSTRUCTION OBSERVATION

The conclusions and recommendations presented in this report are based on analysis of observed conditions in widely spaced exploratory borings. If conditions are found to vary from those described in this report, Ninyo & Moore should be notified, and additional recommendations will be provided upon request. Ninyo & Moore should review the final project drawings and specifications prior to the commencement of construction. Ninyo & Moore should perform the needed observation and testing services during construction operations.

The recommendations provided in this report are based on the assumption that Ninyo & Moore will provide geotechnical observation and testing services during construction. In the event that it is decided not to utilize the services of Ninyo & Moore during construction, we request that the selected consultant provide the client with a letter (with a copy to Ninyo & Moore) indicating that they fully understand Ninyo & Moore's recommendations, and that they are in full agreement with the design parameters and recommendations contained in this report. Construction of proposed improvements should be performed by qualified subcontractors utilizing appropriate techniques and construction materials.

13. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified, and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government

action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

14. REFERENCES

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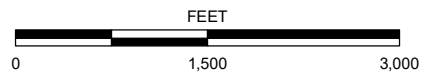
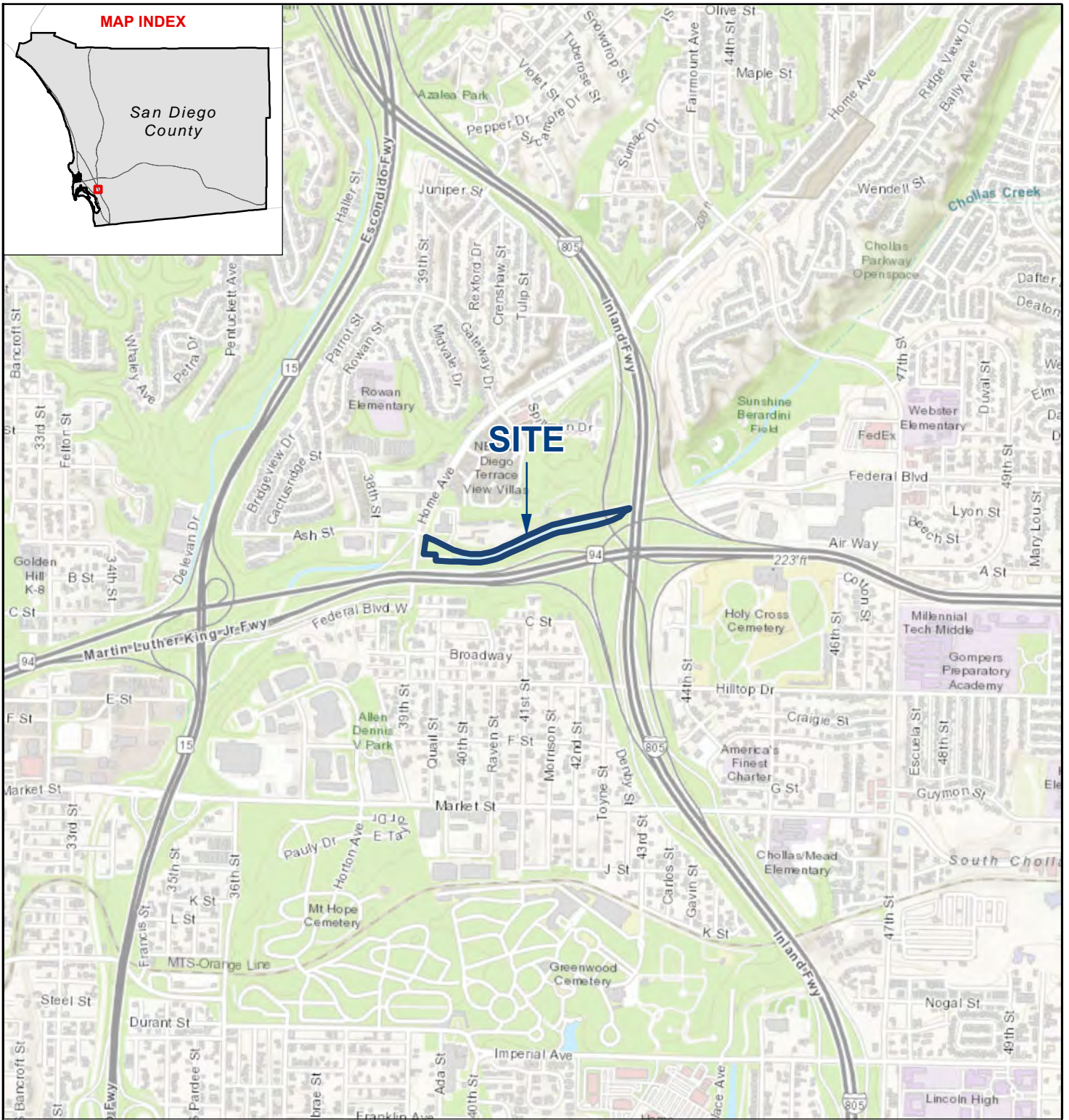
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FIGURES

MAP INDEX



NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: ESRI WORLD TOPO, 2020

FIGURE 1

SITE LOCATION

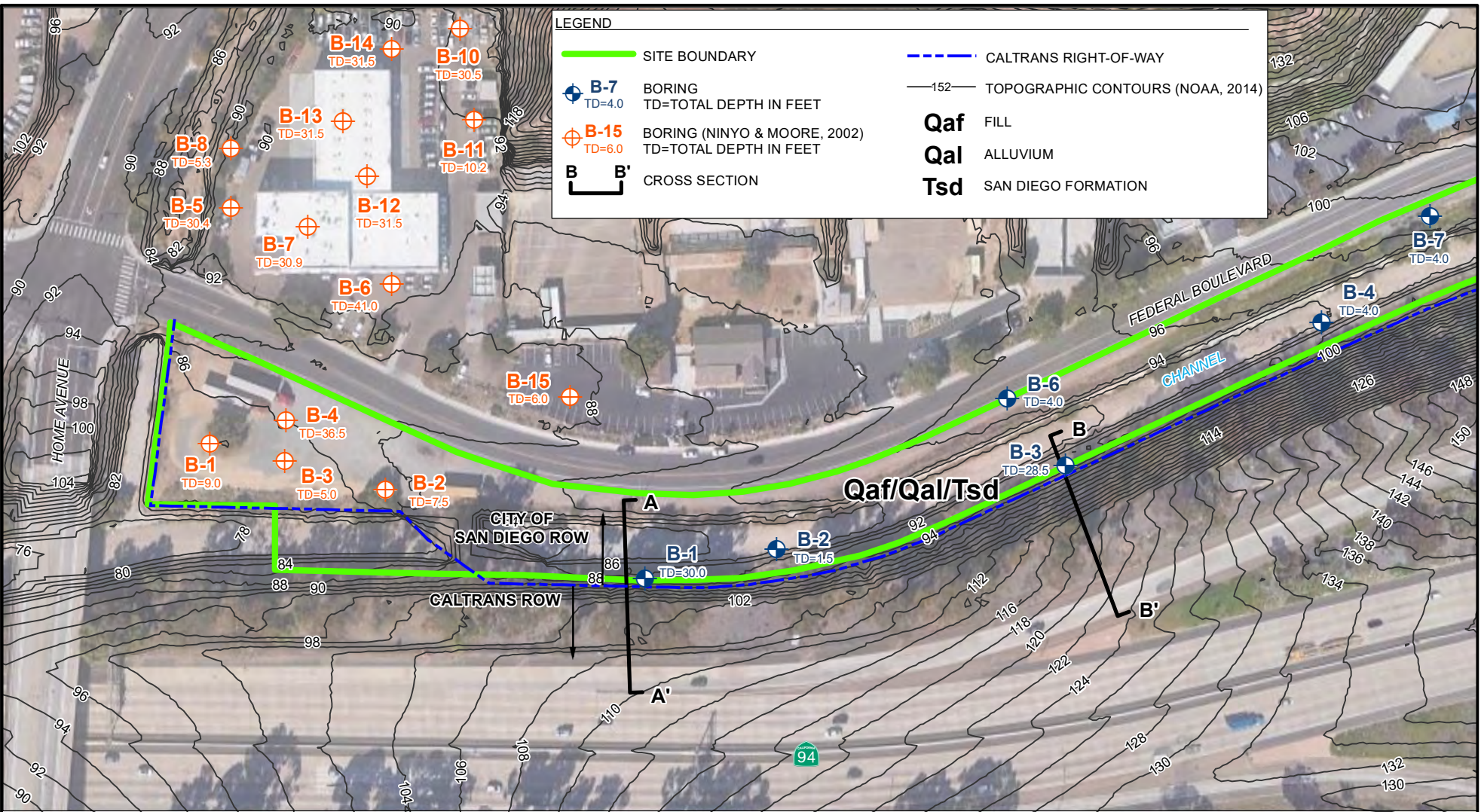
FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA



1_109052001_SL.mxd 10/1/2020 AOB

LEGEND

- SITE BOUNDARY
- - - CALTRANS RIGHT-OF-WAY
- 152— TOPOGRAPHIC CONTOURS (NOAA, 2014)
- ⊕ **B-7** BORING
TD=TOTAL DEPTH IN FEET
TD=4.0
- ⊕ **B-15** BORING (NINYO & MOORE, 2002)
TD=TOTAL DEPTH IN FEET
TD=6.0
- ┌ **B** └
└ **B'** ┌ CROSS SECTION
- Qaf** FILL
- Qal** ALLUVIUM
- Tsd** SAN DIEGO FORMATION



2A_109052001_GM2.mxd 10/1/2020 AOB

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2020.

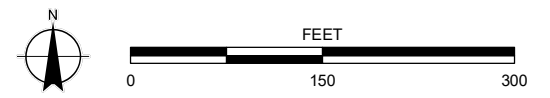


FIGURE 2A



LEGEND

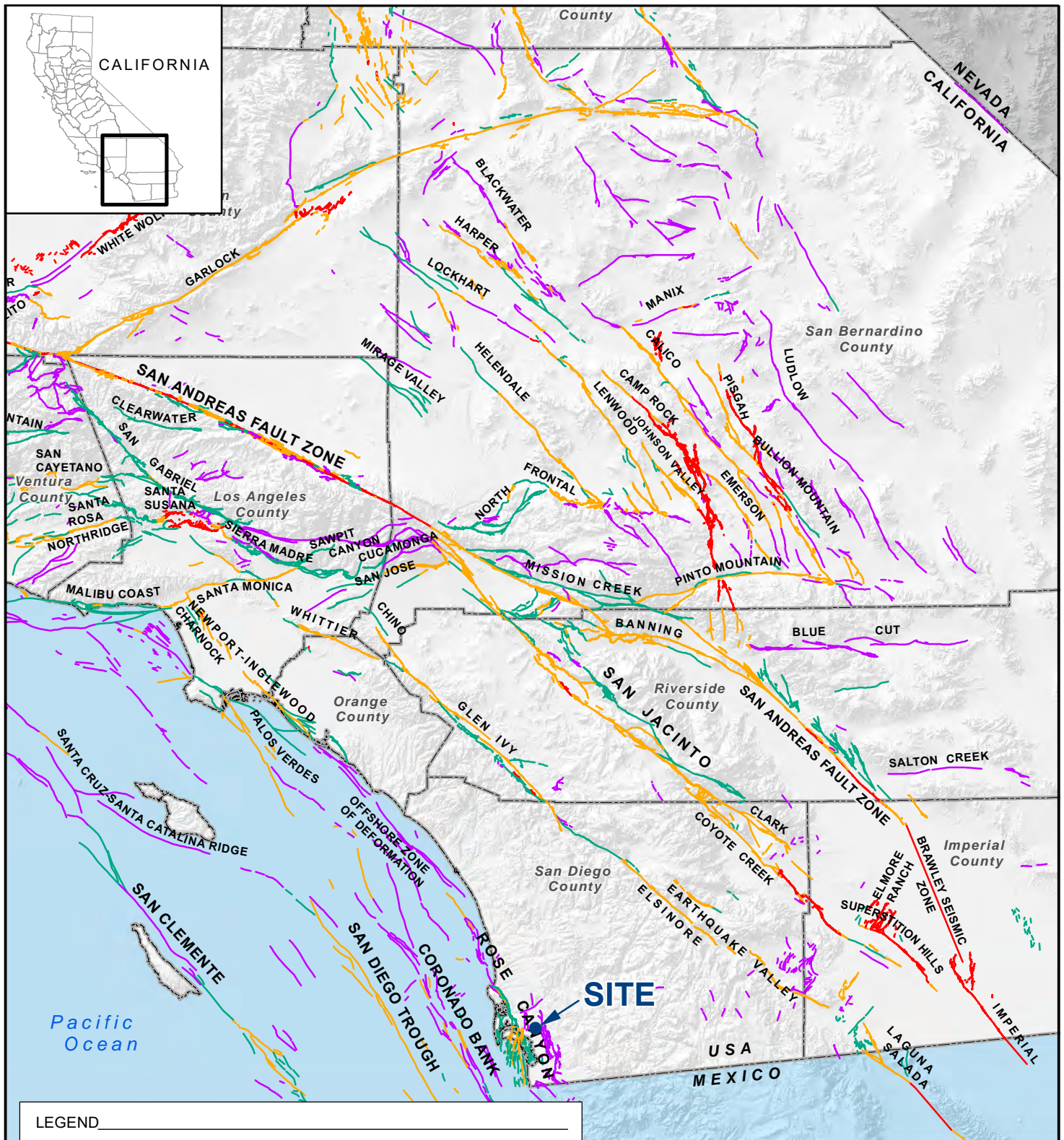
- █ SITE BOUNDARY
- ⊕ **B-7** BORING
TD=TOTAL DEPTH IN FEET
TD=4.0
- ⊕ **B-4** BORING (NINYO & MOORE, 2001)
TD=TOTAL DEPTH IN FEET
TD=22.0
- CALTRANS RIGHT-OF-WAY
- 152— TOPOGRAPHIC CONTOURS (NOAA, 2014)
- Qaf** FILL
- Qal** ALLUVIUM
- Tsd** SAN DIEGO FORMATION



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NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2020.

FIGURE 2B

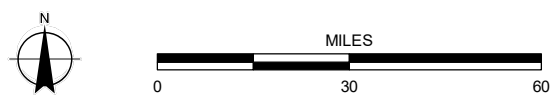


LEGEND

CALIFORNIA FAULT ACTIVITY

HISTORICALLY ACTIVE	QUATERNARY (POTENTIALLY ACTIVE)
HOLOCENE ACTIVE	STATE/COUNTY BOUNDARY
LATE QUATERNARY (POTENTIALLY ACTIVE)	

SOURCE: U.S. GEOLOGICAL SURVEY AND CALIFORNIA GEOLOGICAL SURVEY, 2006. QUATERNARY FAULT AND FOLD DATABASE FOR THE UNITED STATES.



NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

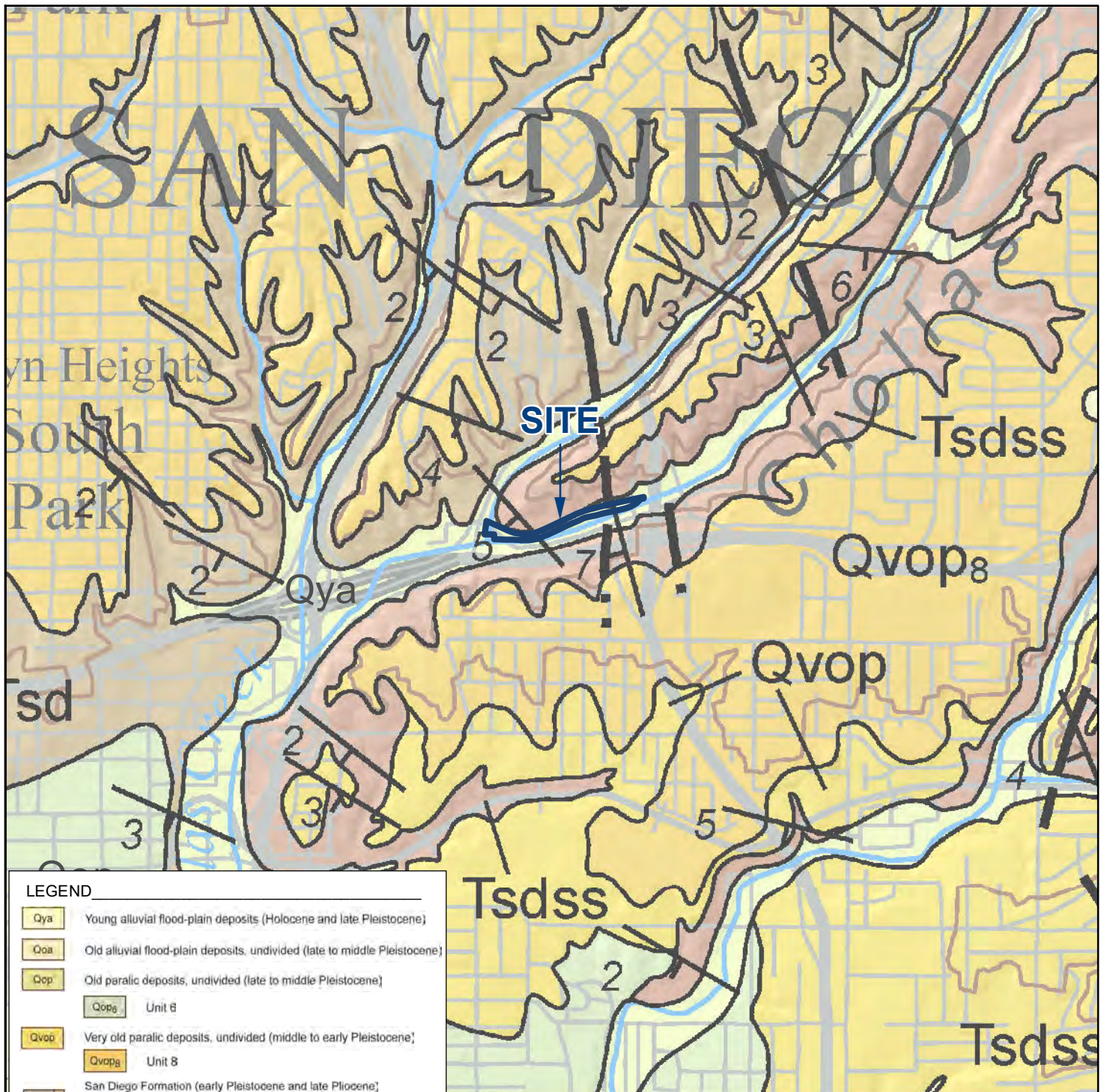
FIGURE 3

FAULT LOCATIONS

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA



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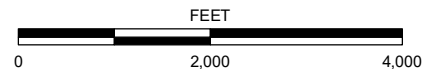


LEGEND

- Qya Young alluvial flood-plain deposits (Holocene and late Pleistocene)
- Qoa Old alluvial flood-plain deposits, undivided (late to middle Pleistocene)
- Qcp Old paralic deposits, undivided (late to middle Pleistocene)
- Qopg Unit 6
- Qvop Very old paralic deposits, undivided (middle to early Pleistocene)
- Qvopg Unit 8
- San Diego Formation (early Pleistocene and late Pliocene)
 Tsd - undivided
 Tsdcg - transitional marine and nonmarine pebble and cobble conglomerate
 Tsdss - marine sandstone
- Tmv Mission Valley Formation (middle Eocene)
- Tst Stadium Conglomerate (middle Eocene)

70 0 70
 Fault - Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown
 Strike and dip of beds in block Arrow and number indicate dip of fault plane.

REFERENCE: KENNEDY, M.P., TAN, S.S., 2008, GEOLOGIC MAP OF THE SAN DIEGO 30 X 60-MINUTE QUADRANGLE, CALIFORNIA

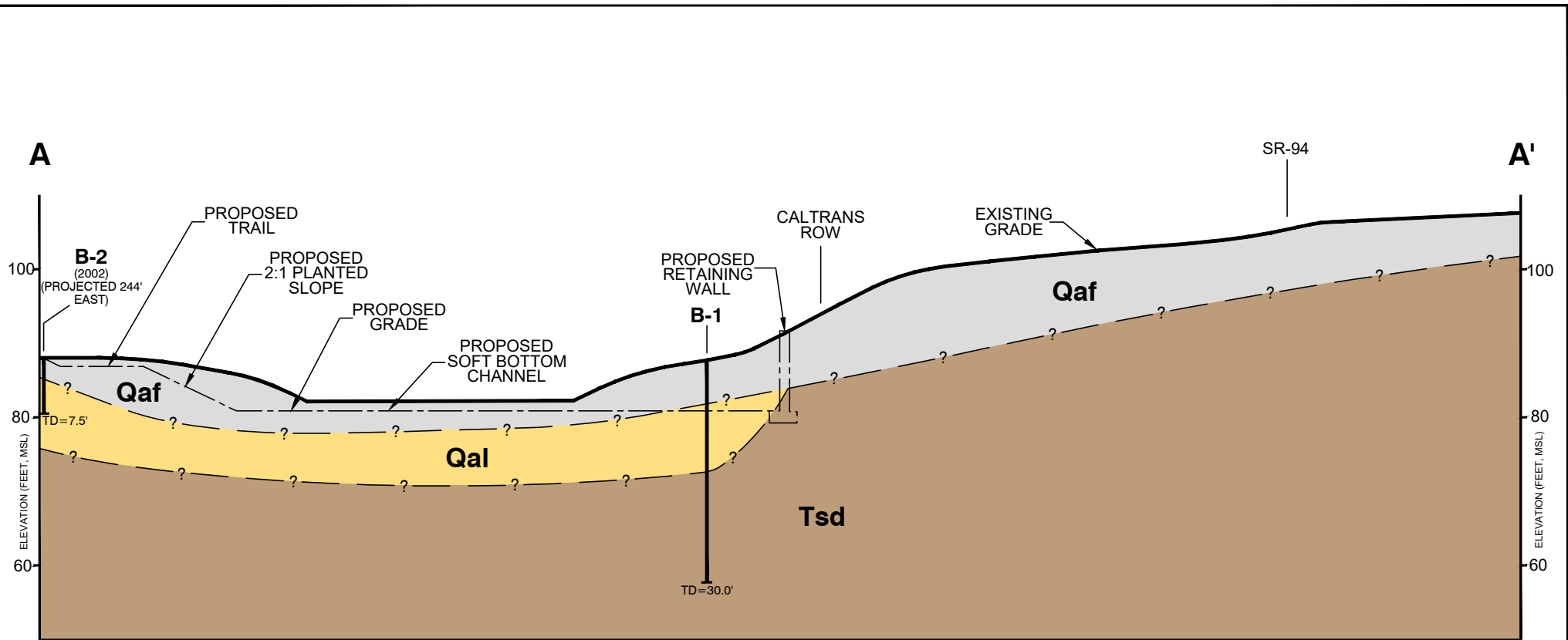


NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

FIGURE 4

GEOLOGY

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
 SAN DIEGO, CALIFORNIA



LEGEND		
B-1 ↓ TD=30.0'	BORING TD=TOTAL DEPTH IN FEET	Qaf FILL
B-2 ↓ TD=7.5'	BORING (NINYO & MOORE, 2002) TD=TOTAL DEPTH IN FEET	Qal ALLUVIUM
		Tsd SAN DIEGO FORMATION, UNDIVIDED
		— ? — GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

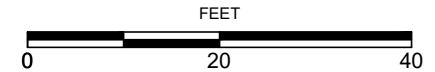
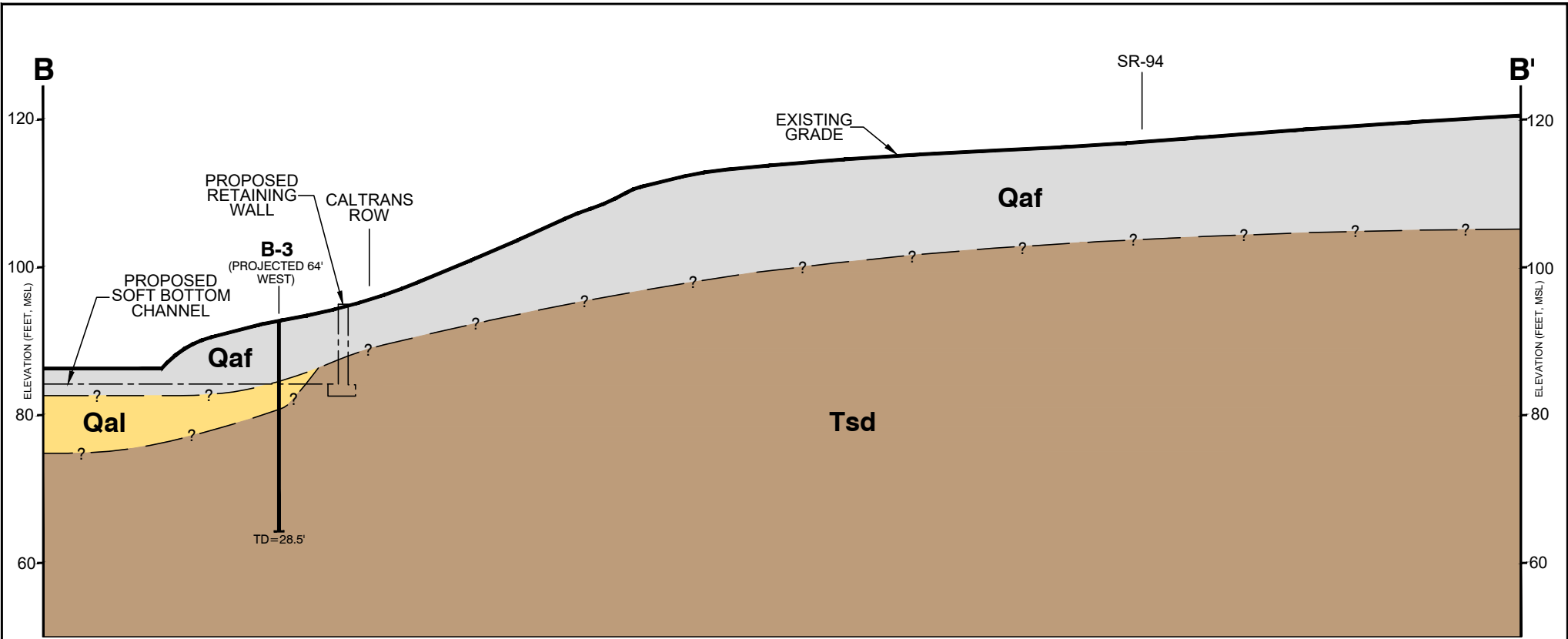


FIGURE 5A



LEGEND

B-3 ↓ TD=28.5'	BORING TD=TOTAL DEPTH IN FEET	— ? —	GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN
Qaf	FILL		
Qal	ALLUVIUM		
Tsd	SAN DIEGO FORMATION, UNDIVIDED		

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

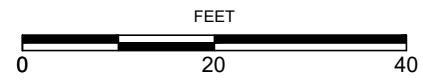
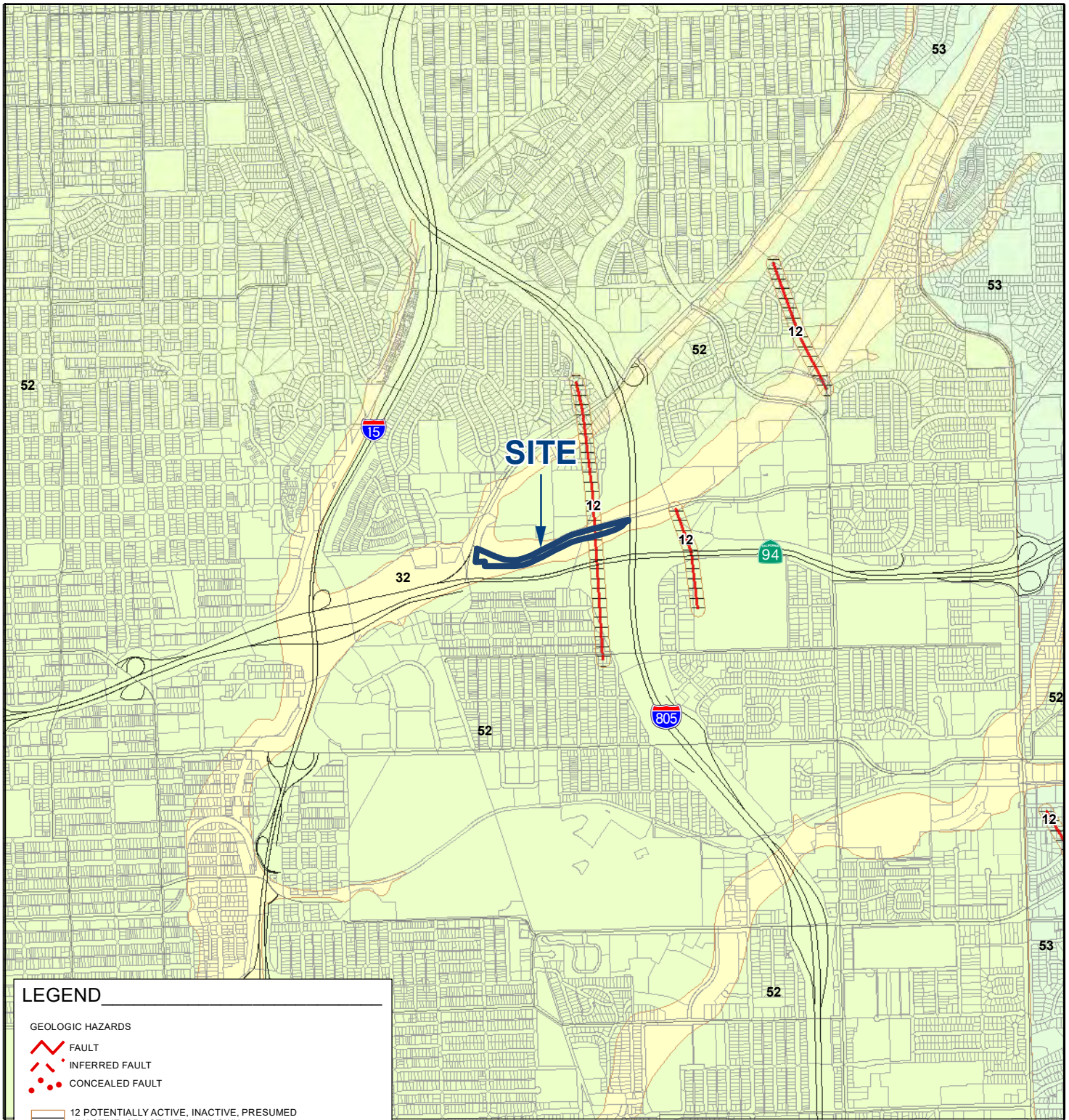


FIGURE 5B



GEOLOGIC CROSS SECTION B-B'
 FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
 SAN DIEGO, CALIFORNIA
 109052001 | 10/20



LEGEND

GEOLOGIC HAZARDS

- FAULT
- INFERRED FAULT
- CONCEALED FAULT

12 POTENTIALLY ACTIVE, INACTIVE, PRESUMED INACTIVE, OR ACTIVITY UNKNOWN

LIQUEFACTION

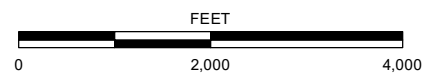
32 LOW POTENTIAL -- FLUCTUATING GROUNDWATER MINOR DRAINAGES

OTHER TERRAIN

- 52 OTHER LEVEL AREAS, GENTLY SLOPING TO STEEP TERRAIN, FAVORABLE GEOLOGIC STRUCTURE, LOW RISK
- 53 LEVEL OR SLOPING TERRAIN, UNFAVORABLE GEOLOGIC STRUCTURE, LOW TO MODERATE RISK

SOURCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY GEOLOGIC HAZARDS AND FAULTS, SANGIS, 2008

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

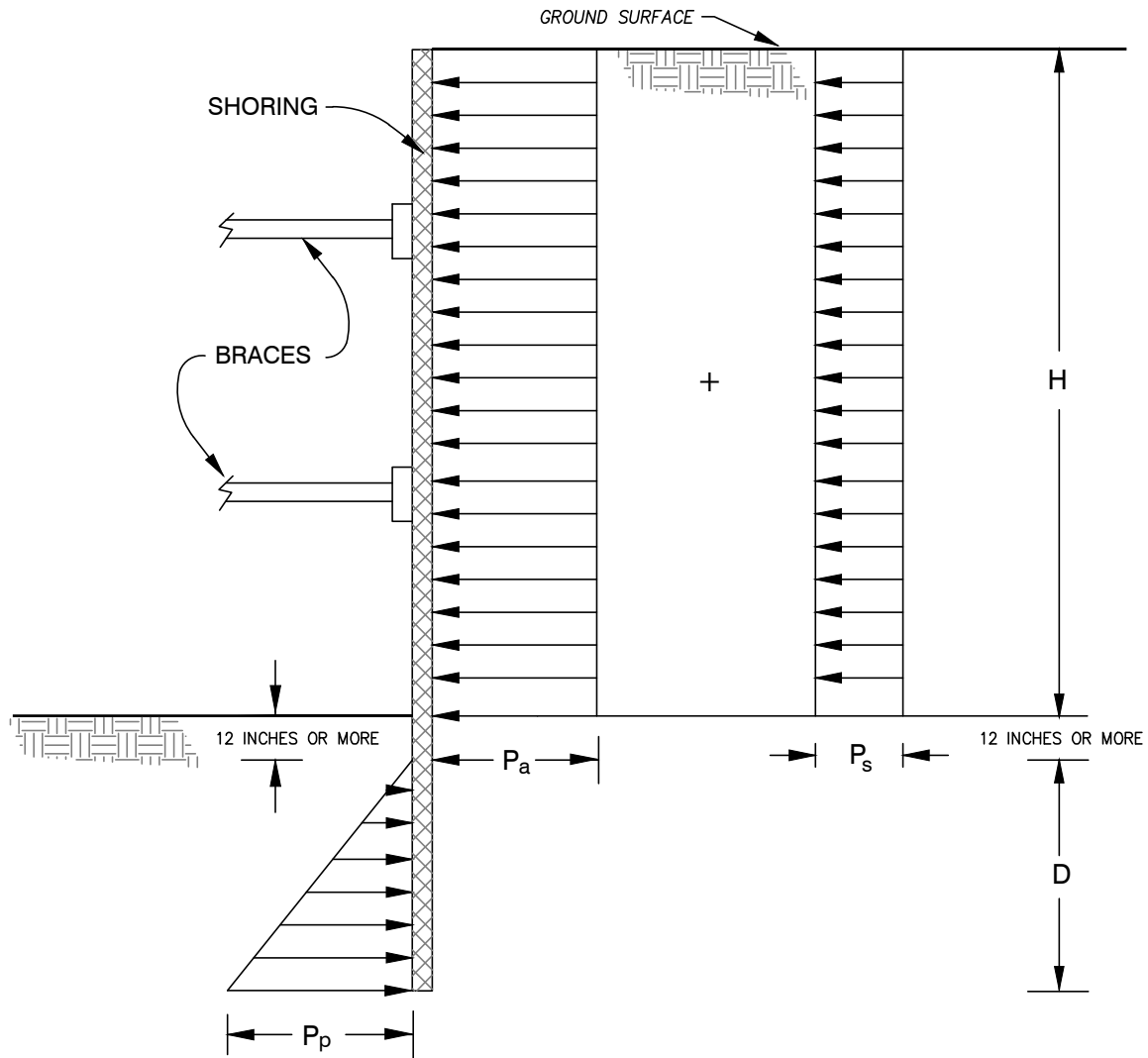


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FIGURE 6

GEOLOGIC HAZARDS

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA



NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
 $P_a = 28 H$ psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
 $P_s = 120$ psf
3. PASSIVE LATERAL EARTH PRESSURE, P_p
 $P_p = 300 D$ psf
 SUBMERGED PASSIVE PRESSURE
 $P_p = 185 D$ psf
4. ASSUMES GROUNDWATER IS NOT PRESENT
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H AND D ARE IN FEET

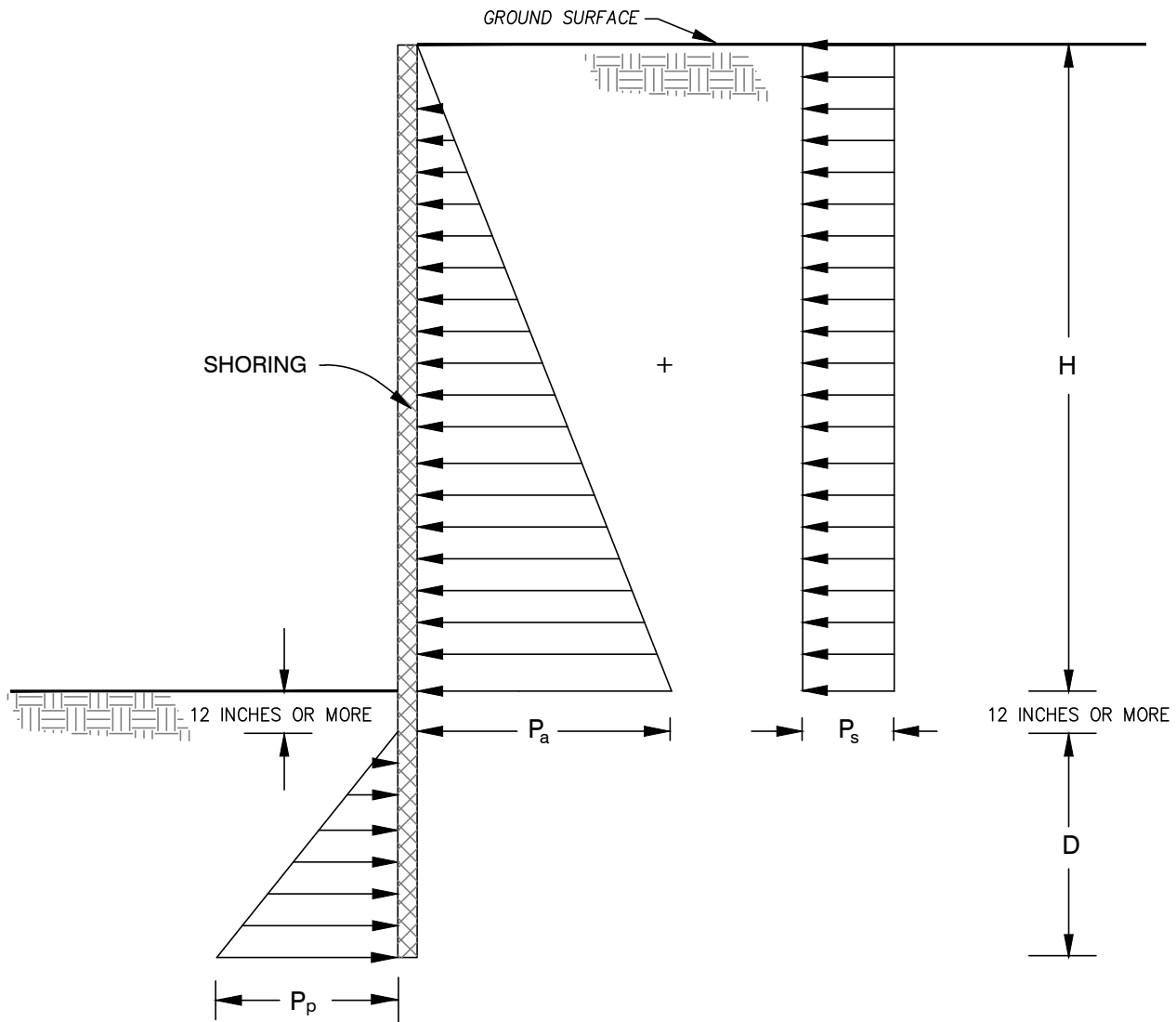
NOT TO SCALE

FIGURE 7

LATERAL EARTH PRESSURES FOR BRACED EXCAVATION

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
 SAN DIEGO, CALIFORNIA

109052001 DETAIL FIGURES.DWG AOB

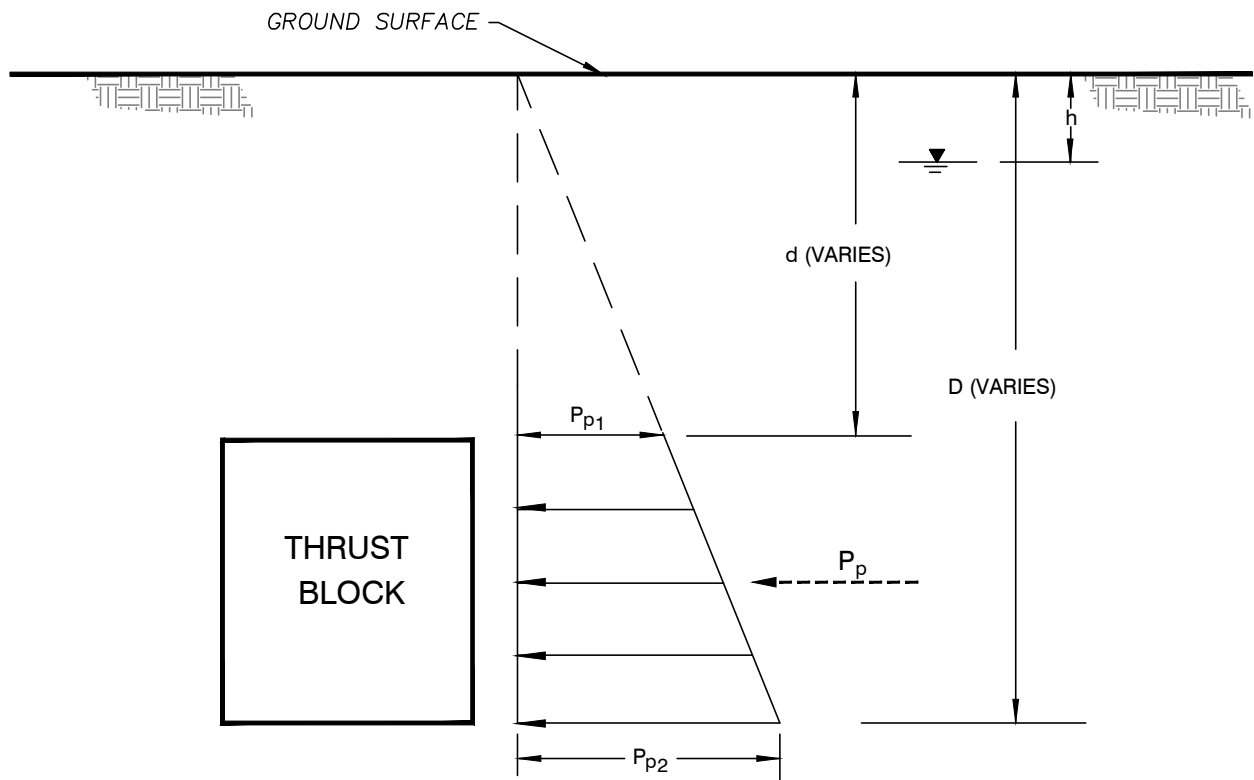


NOTES:

1. ACTIVE LATERAL EARTH PRESSURE, P_a
 $P_a = 43 H$ psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
 $P_s = 120$ psf
3. PASSIVE LATERAL EARTH PRESSURE, P_p
 $P_p = 300 D$ psf
SUBMERGED PASSIVE PRESSURE
 $P_p = 185 D$ psf
4. ASSUMES GROUNDWATER IS NOT PRESENT
5. H AND D ARE IN FEET

NOT TO SCALE


FIGURE 8



NOTES:

1. GROUNDWATER BELOW BLOCK

$$P_p = 175 (D^2 - d^2) \text{ lb/ft}$$
2. GROUNDWATER ABOVE BLOCK

$$P_p = 1.5 (D - d) [124.8h + 58 (D + d)] \text{ lb/ft}$$
3. ASSUMES BACKFILL IS GRANULAR MATERIAL
4. ASSUMES THRUST BLOCK IS ADJACENT TO COMPETENT MATERIAL
5. D, d AND h ARE IN FEET
6.  GROUNDWATER TABLE

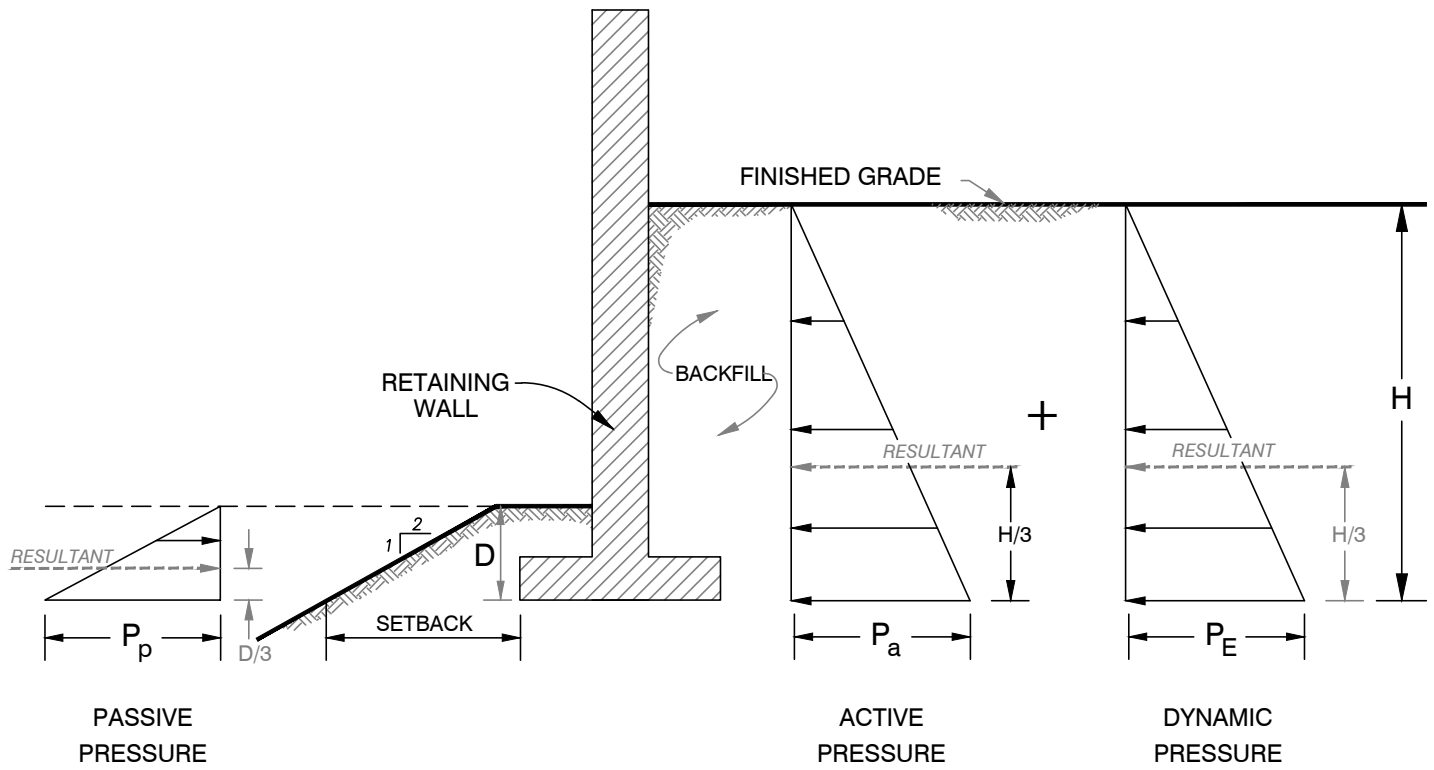
NOT TO SCALE

FIGURE 9

THRUST BLOCK LATERAL EARTH PRESSURE DIAGRAM

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
 SAN DIEGO, CALIFORNIA

109052001.DETAIL FIGURES.DWG AOB



NOTES:

1. ASSUMES NO HYDROSTATIC PRESSURE BUILD-UP BEHIND THE RETAINING WALL
2. CALTRANS STRUCTURE BACKFILL MATERIALS SHOULD BE USED FOR RETAINING WALL BACKFILL
3. DRAINS AS RECOMMENDED IN THE RETAINING WALL DRAINAGE DETAIL SHOULD BE INSTALLED BEHIND THE RETAINING WALL
4. DYNAMIC LATERAL EARTH PRESSURE IS BASED ON A MAPPED DESIGN PEAK GROUND ACCELERATION OF 0.64g
5. P_E IS CALCULATED IN ACCORDANCE WITH THE RECOMMENDATIONS OF MONONOBE AND MATSUO (1929), AND ATIK AND SITAR (2010)
6. SURCHARGE PRESSURES CAUSED BY VEHICLES OR NEARBY STRUCTURES ARE NOT INCLUDED
7. H AND D ARE IN FEET
8. SETBACK SHOULD BE IN ACCORDANCE WITH THE CBC (2019)

RECOMMENDED GEOTECHNICAL DESIGN PARAMETERS

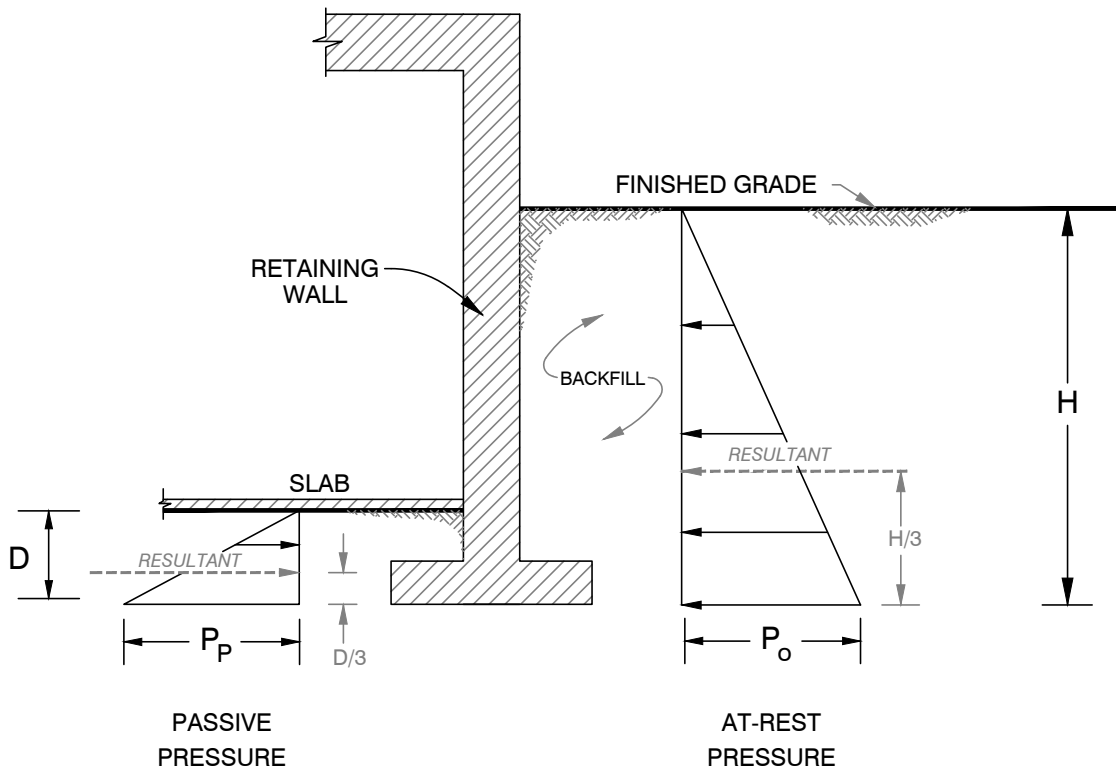
Lateral Earth Pressure	Equivalent Fluid Pressure (lb/ft ² /ft) ⁽¹⁾	
P_a	Level Backfill with Granular Soils ⁽²⁾	2H:1V Sloping Backfill with Granular Soils ⁽²⁾
	35H	50H
P_E	27H	
P_p	Level Ground (Submerged)	2H:1V Descending Ground
	300D (140D)	130D

NOT TO SCALE

FIGURE 10

LATERAL EARTH PRESSURES FOR YIELDING RETAINING WALLS

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA



NOTES:

1. ASSUMES NO HYDROSTATIC PRESSURE BUILD-UP BEHIND THE RETAINING WALL
2. CALTRANS STRUCTURE BACKFILL MATERIALS SHOULD BE USED FOR RETAINING WALL BACKFILL
3. DRAINS AS RECOMMENDED IN THE RETAINING WALL DRAINAGE DETAIL SHOULD BE INSTALLED BEHIND THE RETAINING WALL
4. DYNAMIC LATERAL EARTH PRESSURE IS BASED ON A MAPPED DESIGN PEAK GROUND ACCELERATION OF 0.64g
5. P_E IS CALCULATED IN ACCORDANCE WITH THE RECOMMENDATIONS OF MONONOBE AND MATSUO (1929), AND ATIK AND SITAR (2010)
6. SURCHARGE PRESSURES CAUSED BY VEHICLES OR NEARBY STRUCTURES ARE NOT INCLUDED
7. H AND D ARE IN FEET

RECOMMENDED GEOTECHNICAL DESIGN PARAMETERS

Lateral Earth Pressure	Equivalent Fluid Pressure (lb/ft ² /ft) ⁽¹⁾	
	P_o	Level Backfill with Granular Soils ⁽²⁾
50H		75H
P_E	27H	
P_p	Level Ground (Submerged)	2H:1V Descending Ground
	300D (140D)	130D

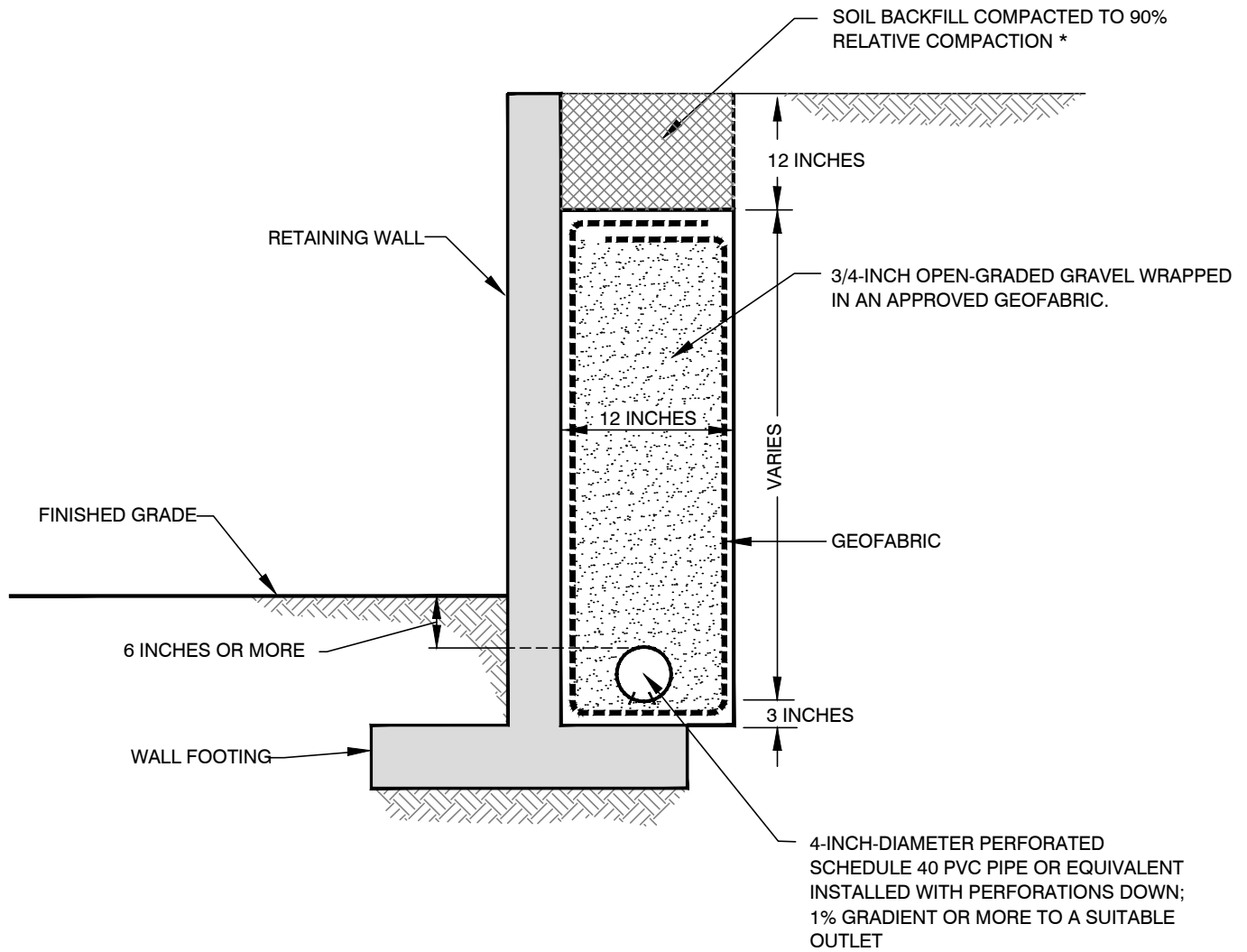
NOT TO SCALE

FIGURE 11

LATERAL EARTH PRESSURES FOR RESTRAINED RETAINING WALLS

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA

109052001.DETAIL FIGURES.DWG AOB



*BASED ON ASTM D1557

NOT TO SCALE

FIGURE 12

RETAINING WALL DRAINAGE DETAIL

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA



APPENDIX A

Boring Logs

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Sampler

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The sampler was driven into the ground 12 to 18 inches with a 140-pound hammer free falling from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the sampler, bagged, sealed and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

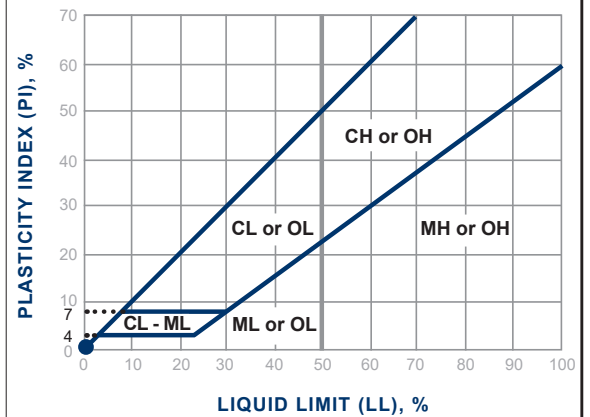
ASTM D 2488

Primary Divisions		Secondary Divisions		
		Group Symbol	Group Name	
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	GRAVEL more than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL	GW	well-graded GRAVEL
			GP	poorly graded GRAVEL
		GRAVEL with DUAL CLASSIFICATIONS	GW-GM	well-graded GRAVEL with silt
			GP-GM	poorly graded GRAVEL with silt
			GW-GC	well-graded GRAVEL with clay
			GP-GC	poorly graded GRAVEL with
			GM	silty GRAVEL
		GRAVEL with FINES more than	GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	CLEAN SAND		SW	well-graded SAND
			SP	poorly graded SAND
		SAND with DUAL CLASSIFICATIONS	SW-SM	well-graded SAND with silt
			SP-SM	poorly graded SAND with silt
			SW-SC	well-graded SAND with clay
			SP-SC	poorly graded SAND with clay
	SAND with FINES more than	SM	silty SAND	
		SC	clayey SAND	
		SC-SM	silty, clayey SAND	
SILT and CLAY liquid limit less than 50%		INORGANIC	CL	lean CLAY
	ML		SILT	
	CL-ML		silty CLAY	
	ORGANIC	OL (PI > 4)	organic CLAY	
		OL (PI < 4)	organic SILT	
		INORGANIC	CH	fat CLAY
			MH	elastic SILT
	ORGANIC	OH (plots on or above "A"-line)	organic CLAY	
		OH (plots below "A"-line)	organic SILT	
		Highly Organic Soils	PT	Peat

Grain Size

Description	Sieve Size	Grain Size	Approximate Size
Boulders	> 12"	> 12"	Larger than basketball-sized
Cobbles	3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4 - 3"	Thumb-sized to
	Fine	#4 - 3/4"	Pea-sized to thumb-sized
Sand	Coarse	#10 - #4	Rock-salt-sized to pea-sized
	Medium	#40 - #10	Sugar-sized to rock-salt-sized
	Fine	#200 - #40	Flour-sized to sugar-sized
Fines	Passing #200	< 0.0029"	Flour-sized and smaller

Plasticity Chart



Apparent Density - Coarse-Grained Soil

Apparent Density	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Split Barrel (blows/foot)	SPT (blows/foot)	Split Barrel (blows/foot)
Very Loose	≤ 4	≤ 8	≤ 3	≤ 5
Loose	5 - 10	9 - 21	4 - 7	6 - 14
Medium Dense	11 - 30	22 - 63	8 - 20	15 - 42
Dense	31 - 50	64 - 105	21 - 33	43 - 70
Very Dense	> 50	> 105	> 33	> 70

Consistency - Fine-Grained Soil

Consistency	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Split Barrel (blows/foot)	SPT (blows/foot)	Split Barrel (blows/foot)
Very Soft	< 2	< 3	< 1	< 2
Soft	2 - 4	3 - 5	1 - 3	2 - 3
Firm	5 - 8	6 - 10	4 - 5	4 - 6
	9 - 15	11 - 20	6 - 10	7 - 13
V	16 - 30	21 - 39	11 - 20	14 - 26
Hard	> 30	> 39	> 20	> 26

BORING LOG EXPLANATION SHEET

DEPTH (feet)	Bulk Driven SAMPLES	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
0	█						<p>Bulk sample.</p> <p>Modified split-barrel drive sampler.</p> <p>No recovery with modified split-barrel drive sampler.</p> <p>Sample retained by others.</p> <p>Standard Penetration Test (SPT).</p> <p>No recovery with a SPT.</p> <p>Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.</p> <p>No recovery with Shelby tube sampler.</p> <p>Continuous Push Sample.</p> <p>Seepage.</p> <p>Groundwater encountered during drilling.</p> <p>Groundwater measured after drilling.</p>
5	XX/XX		↕				
10			↕		█	SM	<p><u>MAJOR MATERIAL TYPE (SOIL):</u> Solid line denotes unit change.</p>
15					- - -	CL	<p>Dashed line denotes material change.</p> <p>Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Shear Bedding Surface</p>
20							<p>The total depth line is a solid line that is drawn at the bottom of the boring.</p>

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED <u>7/30/20</u> BORING NO. <u>B-1</u> GROUND ELEVATION <u>90' ± (MSL)</u> SHEET <u>1</u> OF <u>1</u> METHOD OF DRILLING <u>6" Diameter Hollow Stem Auger (Pacific Drilling) (Fraste)</u> DRIVE WEIGHT <u>140 lbs. (Auto-Trip)</u> DROP <u>30"</u> SAMPLED BY <u>CMK</u> LOGGED BY <u>CMK</u> REVIEWED BY <u>CAT</u>		
	Bulk	Driven						DESCRIPTION/INTERPRETATION		
0							SM	FILL: Light brown, moist, medium dense, silty fine SAND with gravel and cobble fragments.		
			28				SM	Grinding on cobbles/gravel. ALLUVIUM: Brownish yellow, moist, medium dense, silty fine SAND.		
			50/4"				GM	Gray and red, moist, medium dense, silty, fine to coarse sandy GRAVEL.		
10							SM	Yellowish brown, moist, medium dense, silty fine SAND with clay.		
			32							
			69					SAN DIEGO FORMATION: Yellow and gray, moist, moderately cemented, silty fine- to medium-grained SANDSTONE.		
20								Light brown and yellow.		
			54							
			41							
			46					Light gray and white, moist, moderately cemented, fine-grained SANDSTONE.		
30								Total Depth = 30 feet. Groundwater not encountered during drilling. Backfilled with approximately 10.5 cubic feet of bentonite grout shortly after drilling on 7/30/20.		
								Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.		
								The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.		
40										

FIGURE A- 1

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.				
	Bulk	Driven						7/30/20	B-2				
								GROUND ELEVATION	85' ± (MSL)	SHEET	1	OF	1
								METHOD OF DRILLING	Manual				
								DRIVE WEIGHT	N/A	DROP	N/A		
								SAMPLED BY	CMK	LOGGED BY	CMK	REVIEWED BY	CAT
								DESCRIPTION/INTERPRETATION					
0								<p>PORTLAND CEMENT CONCRETE: Approximately 9 inches thick.</p> <p>AGGREGATE BASE: Approximately 3 inches thick.</p> <p>FILL: Light brown, moist, medium dense, sandy poorly graded GRAVEL with cobbles. Total Depth = 1.5 feet. (Refusal) Groundwater not encountered during drilling. Backfilled shortly after drilling on 7/30/20.</p> <p><u>Note:</u> Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.</p> <p>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.</p>					
							GP						
10													
20													
30													
40													

FIGURE A- 2

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.				
	Bulk	Driven						7/29/20	B-3				
								GROUND ELEVATION	SHEET	OF			
								METHOD OF DRILLING	6" Diameter Hollow Stem Auger (Pacific Drilling) (Fraste)				
								DRIVE WEIGHT	140 lbs. (Auto-Trip)	DROP	30"		
								SAMPLED BY	CMK	LOGGED BY	CMK	REVIEWED BY	CAT
								DESCRIPTION/INTERPRETATION					
0							SM	FILL: Light brown and brown, moist, medium dense, silty fine to medium SAND with gravel and cobbles.					
			27	3.1			SP	Light yellow, moist, medium dense, poorly graded SAND.					
10			50/6" 50/3"				GP	ALLUVIUM: Brown, moist, medium dense, sandy poorly graded GRAVEL with silt; cobble fragments.					
								SAN DIEGO FORMATION: Brown, moist, moderately cemented, silty fine to coarse SANDSTONE.					
								Light yellow and light gray, moist, moderately cemented, fine-grained SANDSTONE.					
20			24					Light gray and white.					
30								Total Depth = 28.5 feet. Groundwater not encountered during drilling. Backfilled with approximately 10.5 cubic feet of bentonite grout shortly after drilling on 7/29/20.					
								Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.					
								The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.					
40													

FIGURE A- 3

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.				
	Bulk	Driven						7/30/20	B-4				
								GROUND ELEVATION	88' ± (MSL)	SHEET	1	OF	1
								METHOD OF DRILLING	Manual				
								DRIVE WEIGHT	N/A	DROP	N/A		
								SAMPLED BY	CMK	LOGGED BY	CMK	REVIEWED BY	CAT
DESCRIPTION/INTERPRETATION													
0							SM	PORTLAND CEMENT CONCRETE: Approximately 8 inches thick; rebar encountered.					
							SM	FILL: Reddish brown and light brown, moist, medium dense, silty fine to medium SAND; gravel and cobble fragments; scattered roots and brick debris; cobbles up to approximately 6 inches in diameter.					
								ALLUVIUM: Light brown, moist, medium dense, silty fine SAND. Total Depth = 4 feet. Groundwater not encountered during drilling. Backfilled shortly after drilling on 7/30/20.					
10								Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.					
								The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.					
20													
30													
40													

FIGURE A- 4

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.				
	Bulk	Driven						7/29/20	B-5				
								GROUND ELEVATION	96' ± (MSL)	SHEET	1	OF	1
								METHOD OF DRILLING 6" Diameter Hollow Stem Auger (Pacific Drilling) (Fraste)					
								DRIVE WEIGHT	140 lbs. (Auto-Trip)	DROP	30"		
								SAMPLED BY	CMK	LOGGED BY	CMK	REVIEWED BY	CAT
								DESCRIPTION/INTERPRETATION					
0							SM	FILL: Light brown, moist, medium dense, silty fine SAND with gravel and cobble fragments.					
			25	12.5	91.9		SM	ALLUVIUM: Light yellowish brown, moist, silty medium to coarse SAND; scattered gravel.					
10			50					SAN DIEGO FORMATION: Yellowish brown, moist, moderately cemented, silty fine- to coarse-grained SANDSTONE; scattered clay. Light gray and white; fine- to medium-grained. @ 24': Clay lenses.					
			51	15.4	99.2								
20			30										
			44										
			42										
30								Total Depth = 30 feet. Groundwater not encountered during drilling. Backfilled with approximately 10.5 cubic feet of bentonite grout shortly after drilling on 7/29/20. <u>Note:</u> Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.					
40													

FIGURE A- 5

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.				
	Bulk	Driven						8/06/20	B-6				
								GROUND ELEVATION	SHEET	OF			
								METHOD OF DRILLING	Manual				
								DRIVE WEIGHT	N/A	DROP	N/A		
								SAMPLED BY	CMK	LOGGED BY	CMK	REVIEWED BY	CAT
								DESCRIPTION/INTERPRETATION					
0							SM	<p>TOPSOIL: Light gray, dry, loose, silty SAND with gravel. Reddish brown; moist; medium dense; fine to medium; with gravel and clay pockets.</p> <p>Red and brown; coarse.</p>					
								<p>Total Depth = 4 feet. Groundwater not encountered during drilling. Backfilled shortly after drilling on 8/06/20.</p> <p><u>Note:</u> Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.</p> <p>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.</p>					
10													
20													
30													
40													

FIGURE A- 6

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.				
	Bulk	Driven						8/06/20	B-7				
								GROUND ELEVATION	SHEET	OF			
								METHOD OF DRILLING	Manual	1	1		
								DRIVE WEIGHT	N/A	DROP	N/A		
								SAMPLED BY	CMK	LOGGED BY	CMK	REVIEWED BY	CAT
								DESCRIPTION/INTERPRETATION					
0							SM	FILL: Light brown, loose, dry, silty SAND with gravel. Light reddish brown; moist; medium dense; with gravel and cobbles.					
							SC	Dark red. Light brown, moist, medium dense, clayey SAND with gravel and cobbles; clay pockets.					
								Total Depth = 4 feet. Groundwater not encountered during drilling. Backfilled shortly after drilling on 8/06/20.					
								<u>Note:</u> Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.					
10								The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.					
20													
30													
40													

FIGURE A- 7



APPENDIX B

Geotechnical Laboratory Testing

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory borings in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory borings in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures B-1 through B-4. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

Direct Shear Tests

Direct shear tests were performed on relatively undisturbed samples in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of the selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures B-5 through B-7.

Expansion Index Tests

The expansion indices of selected materials were evaluated in general accordance with ASTM D 4829. The specimens were molded under a specified compactive energy at approximately 50 percent saturation. The prepared 1-inch thick by 4-inch diameter specimens were loaded with a surcharge of 144 psf and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of the tests are presented on Figure B-8.

Proctor Density Tests

The maximum dry density and optimum moisture content of selected representative soil samples were evaluated using the Standard Proctor method in general accordance with ASTM D 698. The results of this test is summarized on Figure B-9.

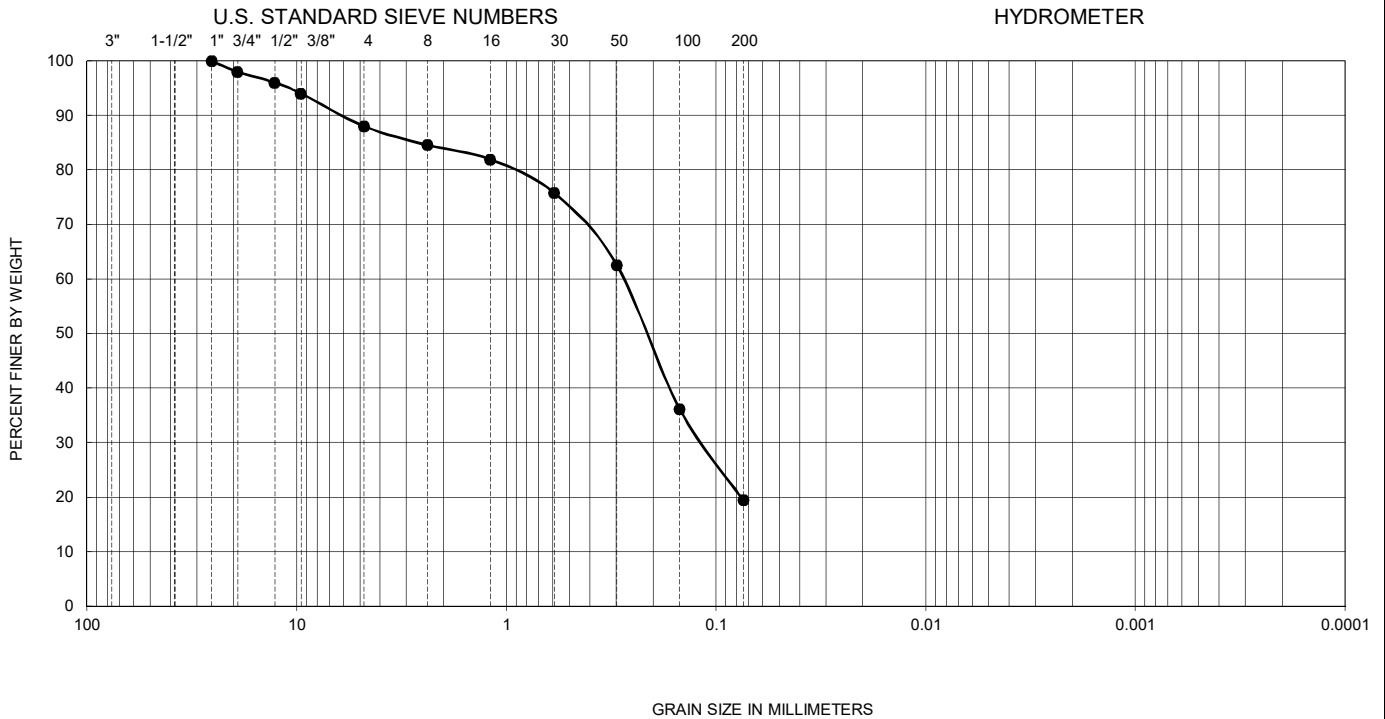
Soil Corrosivity Tests

Soil pH and electrical resistivity tests were performed on representative samples in general accordance with CT 643. The sulfate and chloride contents of the selected samples were evaluated in general accordance with CT 417 and 422, respectively. The test results are shown on Figure B-10.

R-Value

The resistance value, or R-value, for site soils were evaluated in general accordance with CT 301. Samples were prepared and evaluated for exudation pressure and expansion pressure. The equilibrium R-value is reported as the lesser or more conservative of the two calculated results. The test results are shown on Figure B-11.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D ₁₀	D ₃₀	D ₆₀	C _u	C _c	Passing No. 200 (percent)	USCS
●	B-1	0.0-5.0	--	--	--	--	--	--	--	--	19	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

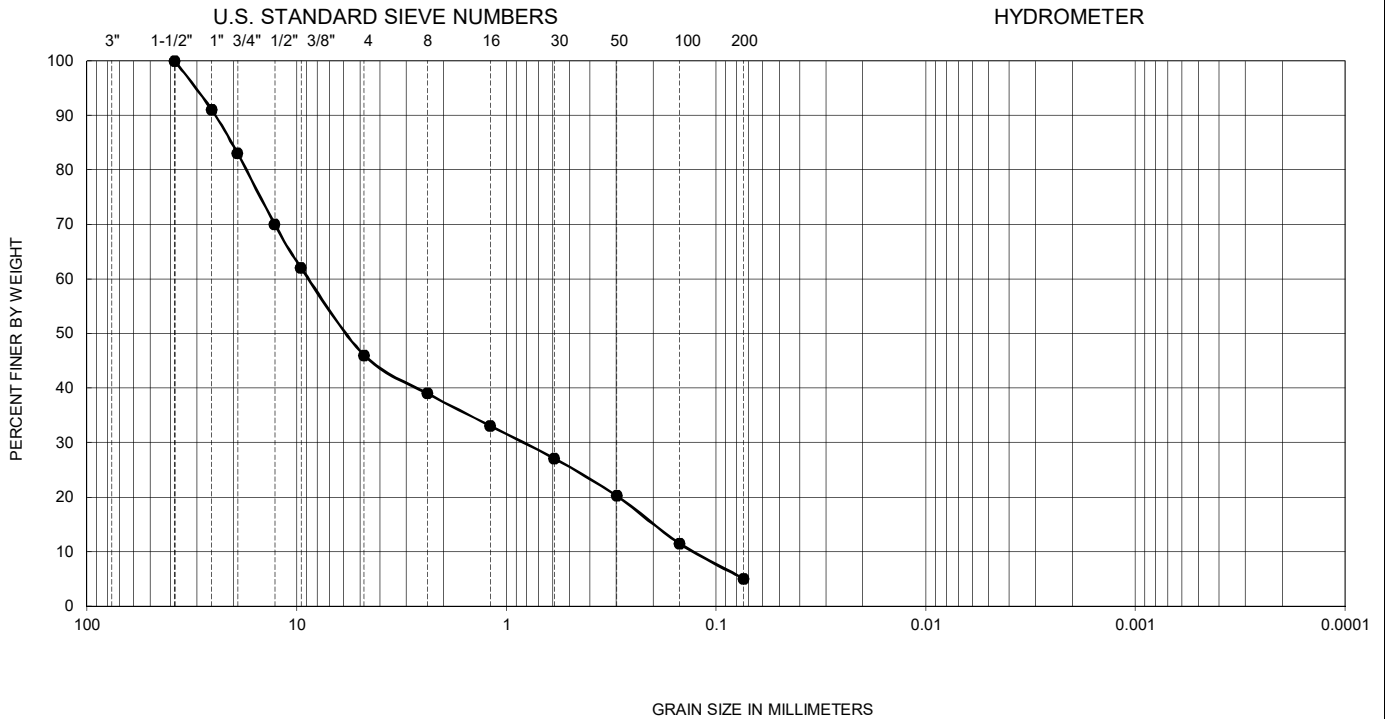
FIGURE B-1

GRADATION TEST RESULTS

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA



GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D ₁₀	D ₃₀	D ₆₀	C _u	C _c	Passing No. 200 (percent)	USCS
●	B-3	9.0-10.0	--	--	--	0.14	0.80	8.70	62.1	0.5	5	GP-GM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

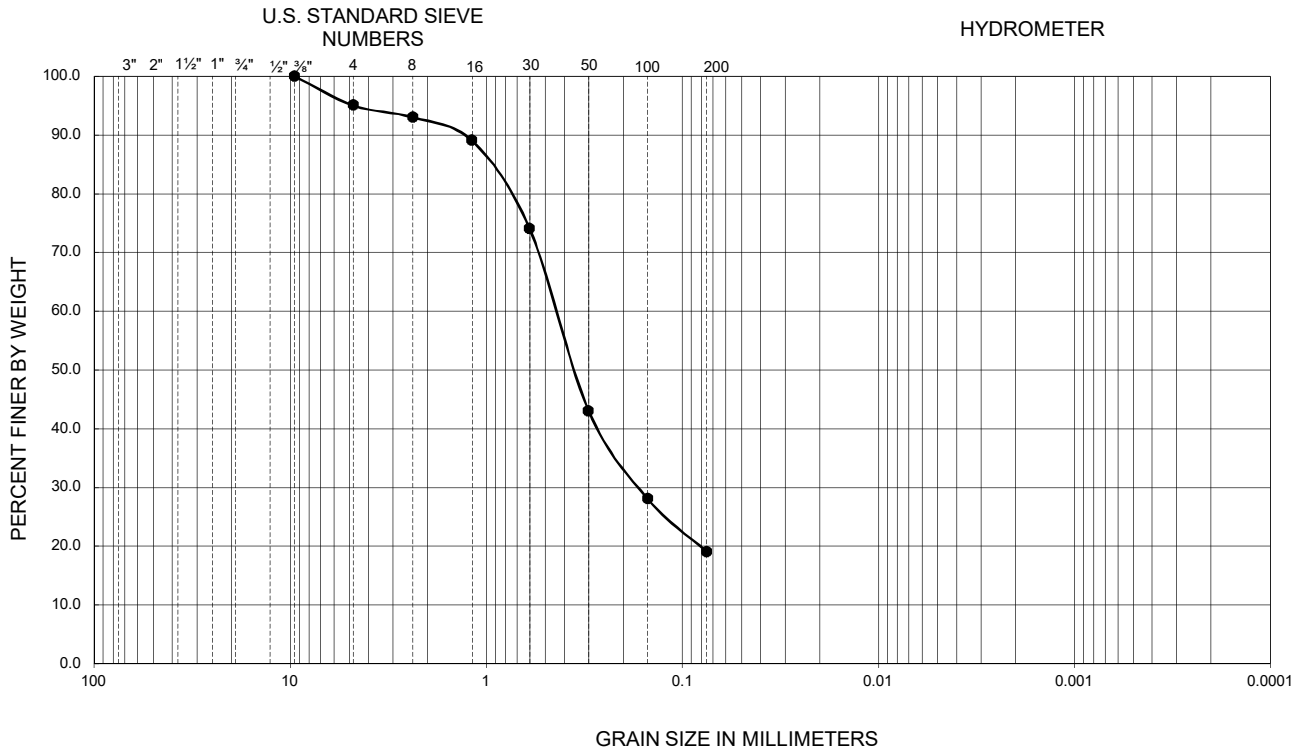
FIGURE B-3

GRADATION TEST RESULTS

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT
SAN DIEGO, CALIFORNIA



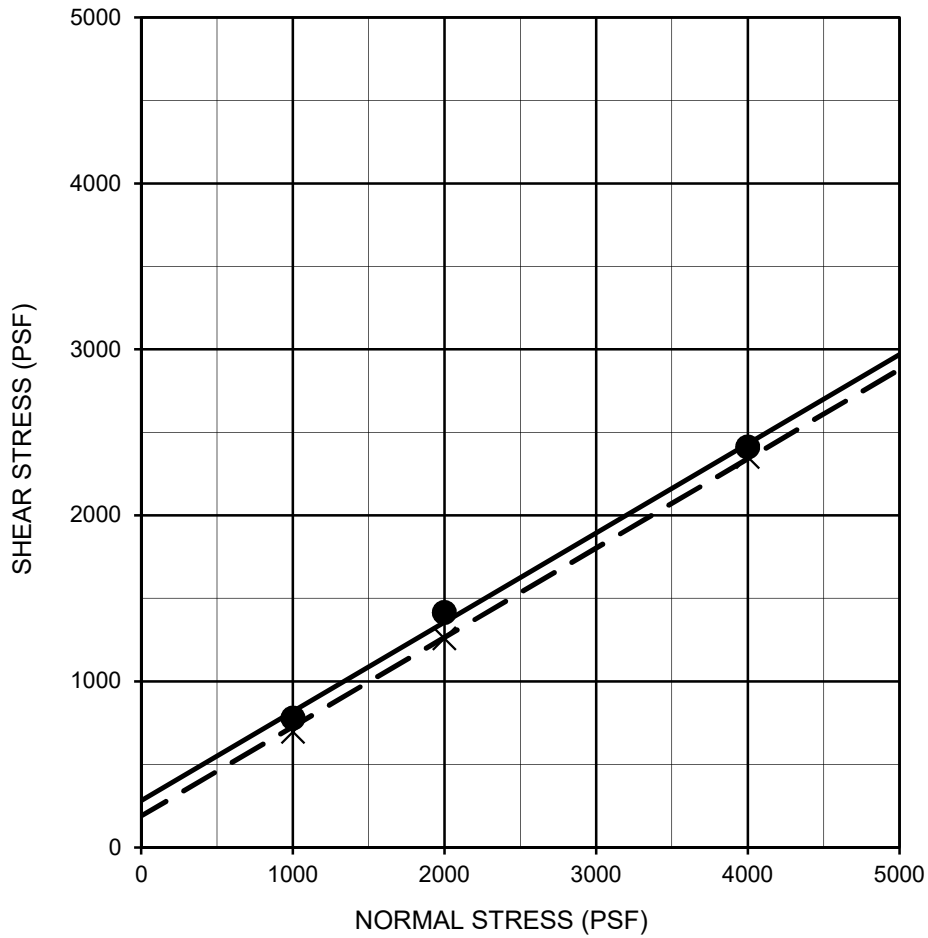
GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D ₁₀	D ₃₀	D ₆₀	C _u	C _c	Passing No. 200 (percent)	USCS
●	B-5	10.0-11.5	--	--	--	--	--	--	--	--	19	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

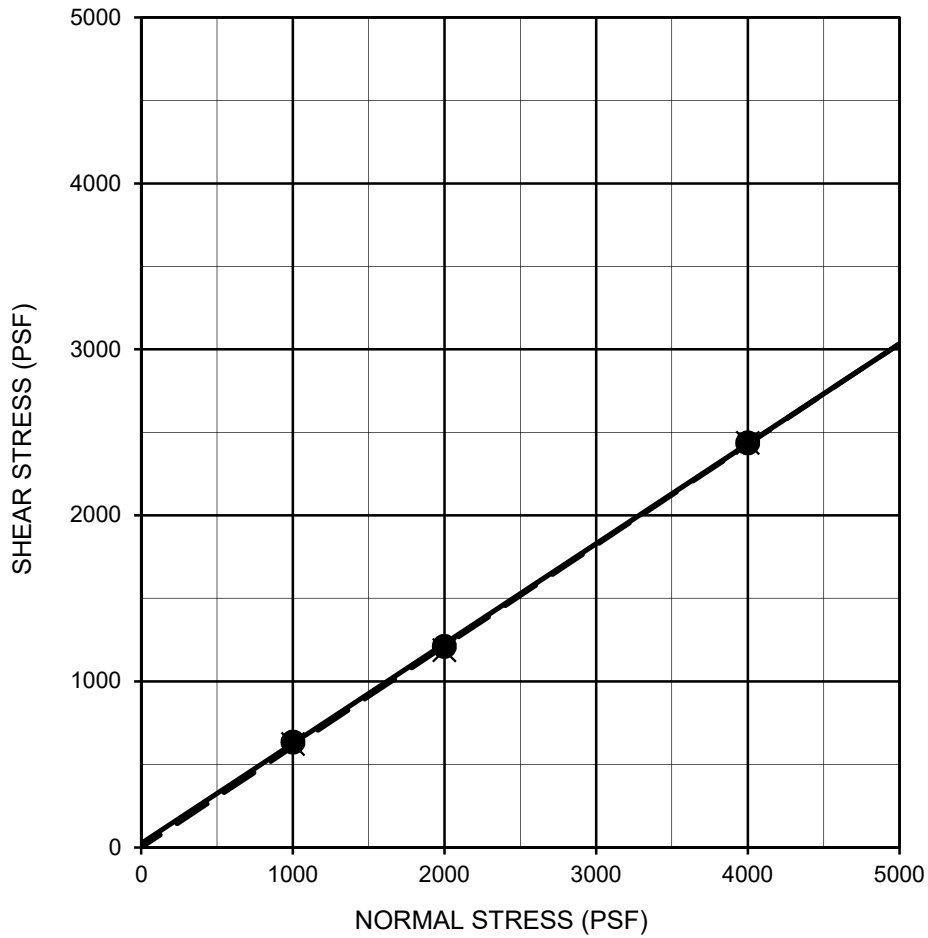
FIGURE B-4



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Soil Type
Remolded @ 90% Relative Compaction	—●—	B-1	0.0-5.0	Peak	280	28	SM
	- - X - -	B-1	0.0-5.0	Ultimate	190	28	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

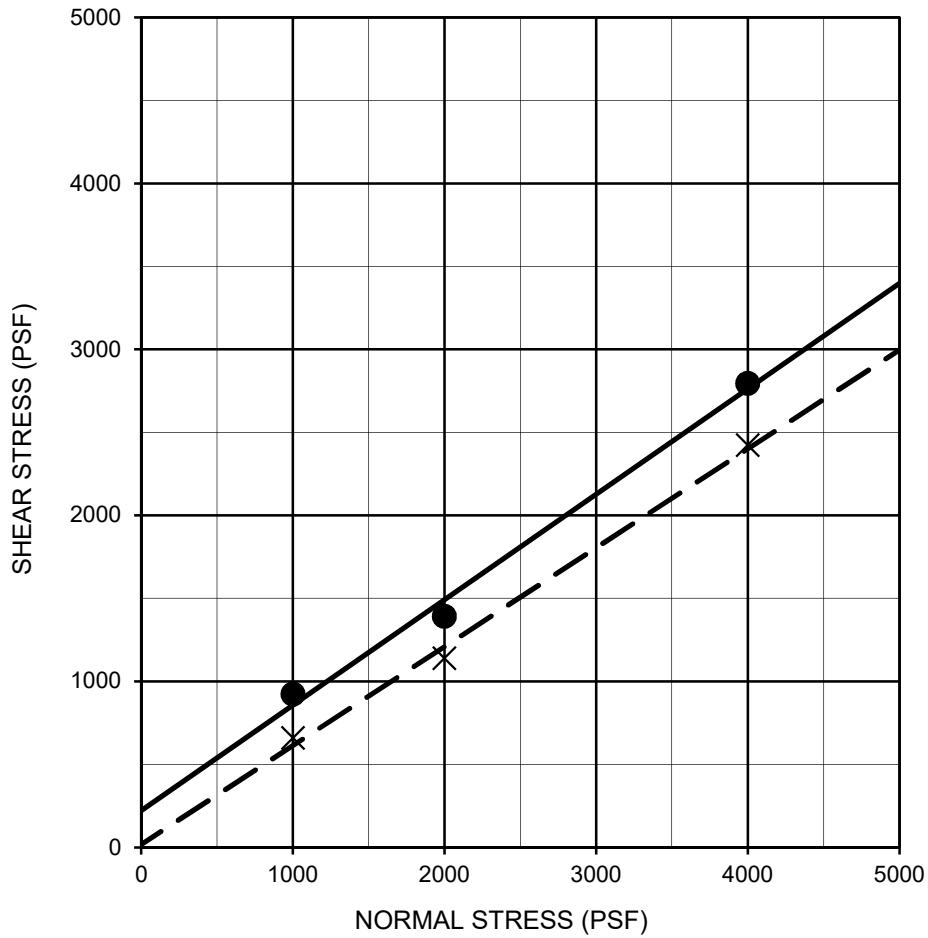
FIGURE B-5



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Soil Type
Silty SAND	—●—	B-5	5.0-6.5	Peak	20	31	SM
Silty SAND	- - X - -	B-5	5.0-6.5	Ultimate	0	31	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

FIGURE B-6



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Soil Type
Silty SANDSTONE	—●—	B-5	15.0-16.5	Peak	220	32	Formation
Silty SANDSTONE	- - X - -	B-5	15.0-16.5	Ultimate	20	31	Formation

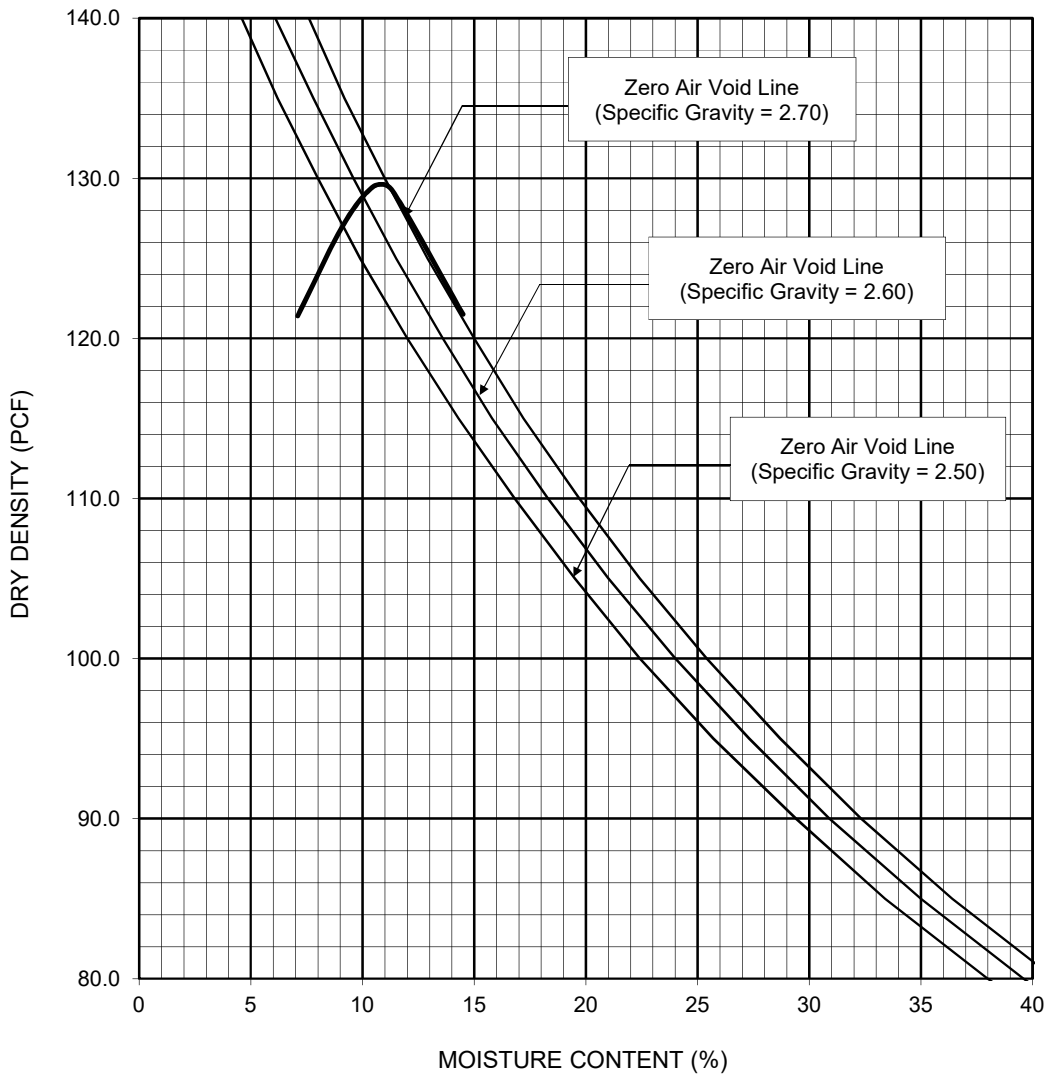
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

FIGURE B-7

SAMPLE LOCATION	SAMPLE DEPTH (ft)	INITIAL MOISTURE (percent)	COMPACTED DRY DENSITY (pcf)	FINAL MOISTURE (percent)	VOLUMETRIC SWELL (in)	EXPANSION INDEX	POTENTIAL EXPANSION
B-6	0.5-3.0	8.5	116.8	20.0	0.005	5	Very Low
B-7	2.0-4.0	8.0	117.0	17.2	0.005	5	Very Low

PERFORMED IN GENERAL ACCORDANCE WITH UBC STANDARD 18-2 ASTM D 4829

FIGURE B-8



Sample Location	Depth (ft)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (percent)
B-1	0.0-5.0	Silty SAND	129.5	10.5

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1557 ASTM D 698 METHOD A B C

FIGURE B-9

SAMPLE LOCATION	SAMPLE DEPTH (ft)	pH ¹	RESISTIVITY ¹ (ohm-cm)	SULFATE CONTENT ²		CHLORIDE CONTENT ³ (ppm)
				(ppm)	(%)	
B-1	0.0-5.0	7.6	3,300	30	0.003	50
B-4	0.8-2.0	9.6	1,700	140	0.014	70
B-7	2.0-4.0	7.0	1,200	130	0.013	100

¹ PERFORMED IN ACCORDANCE WITH CALIFORNIA TEST METHOD 643

² PERFORMED IN ACCORDANCE WITH CALIFORNIA TEST METHOD 417

³ PERFORMED IN ACCORDANCE WITH CALIFORNIA TEST METHOD 422

FIGURE B-10

SAMPLE LOCATION	SAMPLE DEPTH (ft)	SOIL TYPE	R-VALUE
B-6	0.5-3.0	Clayey SAND (SC)	39

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2844/CT 301

FIGURE B-11



APPENDIX C

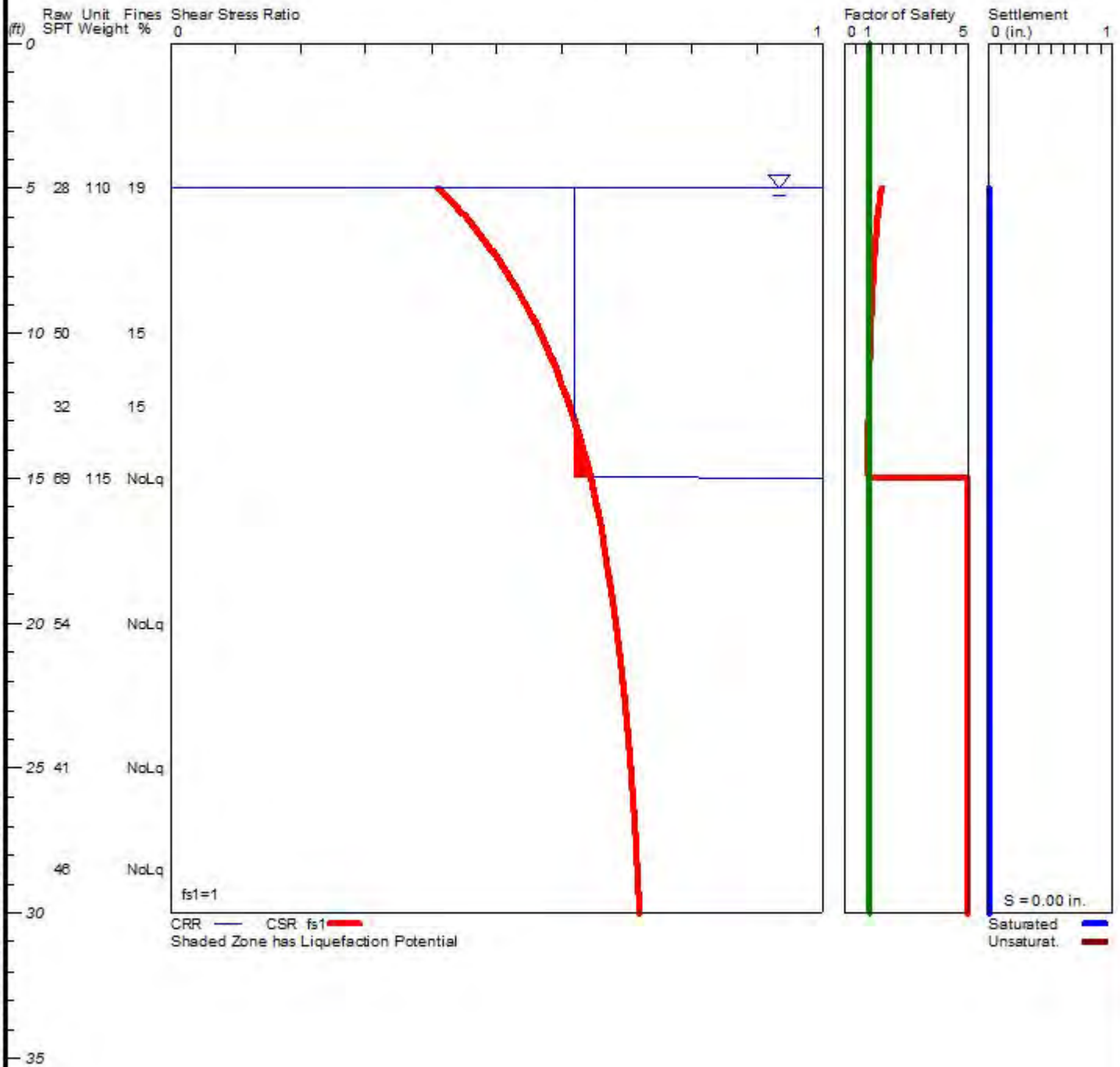
Liquefaction Analysis

LIQUEFACTION ANALYSIS

Federal Boulevard Dechannelization and Trail Proje

Hole No.=B-1 Water Depth=5 ft Surface Elev.=90

Magnitude=6.9
Acceleration=0.64g



LiquifyPro - CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS SUMMARY

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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 9/3/2020 8:44:15 AM

Input File Name: G:\File Share\CMK.temp\Projects\109052001 Federal Blvd
Dechannelization\Engineering\B-1.liq
Title: Federal Boulevard Dechannelization and Trail Proje
Subtitle: 109052001

Surface Elev.=90
Hole No.=B-1
Depth of Hole= 30.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 5.00 ft
Max. Acceleration= 0.64 g
Earthquake Magnitude= 6.90

Input Data:

Surface Elev.=90
Hole No.=B-1
Depth of Hole=30.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 5.00 ft
Max. Acceleration=0.64 g
Earthquake Magnitude=6.90
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Tokimatsu/Seed
 3. Fines Correction for Liquefaction: Idriss/Seed
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.25
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1
 9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
5.00	28.00	110.00	19.00
10.00	50.00	110.00	15.00
12.50	32.00	110.00	15.00
15.00	69.00	115.00	NoLiq
20.00	54.00	115.00	NoLiq
25.00	41.00	115.00	NoLiq
28.50	46.00	115.00	NoLiq

Output Results:

Settlement of Saturated Sands=0.00 in.

Settlement of Unsaturated Sands=0.00 in.

Total Settlement of Saturated and Unsaturated Sands=0.00 in.

Differential Settlement=0.000 to 0.000 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
5.00	0.62	0.41	1.50	0.00	0.00	0.00
5.05	0.62	0.41	1.50	0.00	0.00	0.00
5.10	0.62	0.42	1.49	0.00	0.00	0.00
5.15	0.62	0.42	1.48	0.00	0.00	0.00
5.20	0.62	0.42	1.47	0.00	0.00	0.00
5.25	0.62	0.42	1.47	0.00	0.00	0.00
5.30	0.62	0.42	1.46	0.00	0.00	0.00
5.35	0.62	0.43	1.45	0.00	0.00	0.00
5.40	0.62	0.43	1.44	0.00	0.00	0.00
5.45	0.62	0.43	1.44	0.00	0.00	0.00
5.50	0.62	0.43	1.43	0.00	0.00	0.00
5.55	0.62	0.44	1.42	0.00	0.00	0.00
5.60	0.62	0.44	1.42	0.00	0.00	0.00
5.65	0.62	0.44	1.41	0.00	0.00	0.00
5.70	0.62	0.44	1.40	0.00	0.00	0.00
5.75	0.62	0.44	1.40	0.00	0.00	0.00
5.80	0.62	0.45	1.39	0.00	0.00	0.00
5.85	0.62	0.45	1.38	0.00	0.00	0.00
5.90	0.62	0.45	1.38	0.00	0.00	0.00
5.95	0.62	0.45	1.37	0.00	0.00	0.00
6.00	0.62	0.45	1.37	0.00	0.00	0.00
6.05	0.62	0.45	1.36	0.00	0.00	0.00
6.10	0.62	0.46	1.35	0.00	0.00	0.00
6.15	0.62	0.46	1.35	0.00	0.00	0.00
6.20	0.62	0.46	1.34	0.00	0.00	0.00
6.25	0.62	0.46	1.34	0.00	0.00	0.00
6.30	0.62	0.46	1.33	0.00	0.00	0.00
6.35	0.62	0.47	1.33	0.00	0.00	0.00
6.40	0.62	0.47	1.32	0.00	0.00	0.00

6.45	0.62	0.47	1.32	0.00	0.00	0.00
6.50	0.62	0.47	1.31	0.00	0.00	0.00
6.55	0.62	0.47	1.31	0.00	0.00	0.00
6.60	0.62	0.47	1.30	0.00	0.00	0.00
6.65	0.62	0.48	1.30	0.00	0.00	0.00
6.70	0.62	0.48	1.29	0.00	0.00	0.00
6.75	0.62	0.48	1.29	0.00	0.00	0.00
6.80	0.62	0.48	1.28	0.00	0.00	0.00
6.85	0.62	0.48	1.28	0.00	0.00	0.00
6.90	0.62	0.49	1.28	0.00	0.00	0.00
6.95	0.62	0.49	1.27	0.00	0.00	0.00
7.00	0.62	0.49	1.27	0.00	0.00	0.00
7.05	0.62	0.49	1.26	0.00	0.00	0.00
7.10	0.62	0.49	1.26	0.00	0.00	0.00
7.15	0.62	0.49	1.25	0.00	0.00	0.00
7.20	0.62	0.49	1.25	0.00	0.00	0.00
7.25	0.62	0.50	1.25	0.00	0.00	0.00
7.30	0.62	0.50	1.24	0.00	0.00	0.00
7.35	0.62	0.50	1.24	0.00	0.00	0.00
7.40	0.62	0.50	1.24	0.00	0.00	0.00
7.45	0.62	0.50	1.23	0.00	0.00	0.00
7.50	0.62	0.50	1.23	0.00	0.00	0.00
7.55	0.62	0.51	1.22	0.00	0.00	0.00
7.60	0.62	0.51	1.22	0.00	0.00	0.00
7.65	0.62	0.51	1.22	0.00	0.00	0.00
7.70	0.62	0.51	1.21	0.00	0.00	0.00
7.75	0.62	0.51	1.21	0.00	0.00	0.00
7.80	0.62	0.51	1.21	0.00	0.00	0.00
7.85	0.62	0.51	1.20	0.00	0.00	0.00
7.90	0.62	0.52	1.20	0.00	0.00	0.00
7.95	0.62	0.52	1.20	0.00	0.00	0.00
8.00	0.62	0.52	1.19	0.00	0.00	0.00
8.05	0.62	0.52	1.19	0.00	0.00	0.00
8.10	0.62	0.52	1.19	0.00	0.00	0.00
8.15	0.62	0.52	1.18	0.00	0.00	0.00
8.20	0.62	0.52	1.18	0.00	0.00	0.00
8.25	0.62	0.53	1.18	0.00	0.00	0.00
8.30	0.62	0.53	1.17	0.00	0.00	0.00
8.35	0.62	0.53	1.17	0.00	0.00	0.00
8.40	0.62	0.53	1.17	0.00	0.00	0.00
8.45	0.62	0.53	1.17	0.00	0.00	0.00
8.50	0.62	0.53	1.16	0.00	0.00	0.00
8.55	0.62	0.53	1.16	0.00	0.00	0.00
8.60	0.62	0.53	1.16	0.00	0.00	0.00
8.65	0.62	0.54	1.15	0.00	0.00	0.00
8.70	0.62	0.54	1.15	0.00	0.00	0.00
8.75	0.62	0.54	1.15	0.00	0.00	0.00
8.80	0.62	0.54	1.15	0.00	0.00	0.00
8.85	0.62	0.54	1.14	0.00	0.00	0.00
8.90	0.62	0.54	1.14	0.00	0.00	0.00

8.95	0.62	0.54	1.14	0.00	0.00	0.00
9.00	0.62	0.54	1.14	0.00	0.00	0.00
9.05	0.62	0.55	1.13	0.00	0.00	0.00
9.10	0.62	0.55	1.13	0.00	0.00	0.00
9.15	0.62	0.55	1.13	0.00	0.00	0.00
9.20	0.62	0.55	1.13	0.00	0.00	0.00
9.25	0.62	0.55	1.12	0.00	0.00	0.00
9.30	0.62	0.55	1.12	0.00	0.00	0.00
9.35	0.62	0.55	1.12	0.00	0.00	0.00
9.40	0.62	0.55	1.12	0.00	0.00	0.00
9.45	0.62	0.56	1.11	0.00	0.00	0.00
9.50	0.62	0.56	1.11	0.00	0.00	0.00
9.55	0.62	0.56	1.11	0.00	0.00	0.00
9.60	0.62	0.56	1.11	0.00	0.00	0.00
9.65	0.62	0.56	1.11	0.00	0.00	0.00
9.70	0.62	0.56	1.10	0.00	0.00	0.00
9.75	0.62	0.56	1.10	0.00	0.00	0.00
9.80	0.62	0.56	1.10	0.00	0.00	0.00
9.85	0.62	0.56	1.10	0.00	0.00	0.00
9.90	0.62	0.57	1.10	0.00	0.00	0.00
9.95	0.62	0.57	1.09	0.00	0.00	0.00
10.00	0.62	0.57	1.09	0.00	0.00	0.00
10.05	0.62	0.57	1.09	0.00	0.00	0.00
10.10	0.62	0.57	1.09	0.00	0.00	0.00
10.15	0.62	0.57	1.08	0.00	0.00	0.00
10.20	0.62	0.57	1.08	0.00	0.00	0.00
10.25	0.62	0.57	1.08	0.00	0.00	0.00
10.30	0.62	0.57	1.08	0.00	0.00	0.00
10.35	0.62	0.57	1.08	0.00	0.00	0.00
10.40	0.62	0.58	1.08	0.00	0.00	0.00
10.45	0.62	0.58	1.07	0.00	0.00	0.00
10.50	0.62	0.58	1.07	0.00	0.00	0.00
10.55	0.62	0.58	1.07	0.00	0.00	0.00
10.60	0.62	0.58	1.07	0.00	0.00	0.00
10.65	0.62	0.58	1.07	0.00	0.00	0.00
10.70	0.62	0.58	1.06	0.00	0.00	0.00
10.75	0.62	0.58	1.06	0.00	0.00	0.00
10.80	0.62	0.58	1.06	0.00	0.00	0.00
10.85	0.62	0.58	1.06	0.00	0.00	0.00
10.90	0.62	0.59	1.06	0.00	0.00	0.00
10.95	0.62	0.59	1.06	0.00	0.00	0.00
11.00	0.62	0.59	1.05	0.00	0.00	0.00
11.05	0.62	0.59	1.05	0.00	0.00	0.00
11.10	0.62	0.59	1.05	0.00	0.00	0.00
11.15	0.62	0.59	1.05	0.00	0.00	0.00
11.20	0.62	0.59	1.05	0.00	0.00	0.00
11.25	0.62	0.59	1.05	0.00	0.00	0.00
11.30	0.62	0.59	1.04	0.00	0.00	0.00
11.35	0.62	0.59	1.04	0.00	0.00	0.00
11.40	0.62	0.59	1.04	0.00	0.00	0.00

11.45	0.62	0.60	1.04	0.00	0.00	0.00
11.50	0.62	0.60	1.04	0.00	0.00	0.00
11.55	0.62	0.60	1.04	0.00	0.00	0.00
11.60	0.62	0.60	1.04	0.00	0.00	0.00
11.65	0.62	0.60	1.03	0.00	0.00	0.00
11.70	0.62	0.60	1.03	0.00	0.00	0.00
11.75	0.62	0.60	1.03	0.00	0.00	0.00
11.80	0.62	0.60	1.03	0.00	0.00	0.00
11.85	0.62	0.60	1.03	0.00	0.00	0.00
11.90	0.62	0.60	1.03	0.00	0.00	0.00
11.95	0.62	0.60	1.03	0.00	0.00	0.00
12.00	0.62	0.60	1.02	0.00	0.00	0.00
12.05	0.62	0.61	1.02	0.00	0.00	0.00
12.10	0.62	0.61	1.02	0.00	0.00	0.00
12.15	0.62	0.61	1.02	0.00	0.00	0.00
12.20	0.62	0.61	1.02	0.00	0.00	0.00
12.25	0.62	0.61	1.02	0.00	0.00	0.00
12.30	0.62	0.61	1.02	0.00	0.00	0.00
12.35	0.62	0.61	1.01	0.00	0.00	0.00
12.40	0.62	0.61	1.01	0.00	0.00	0.00
12.45	0.62	0.61	1.01	0.00	0.00	0.00
12.50	0.62	0.61	1.01	0.00	0.00	0.00
12.55	0.62	0.61	1.01	0.00	0.00	0.00
12.60	0.62	0.61	1.01	0.00	0.00	0.00
12.65	0.62	0.61	1.01	0.00	0.00	0.00
12.70	0.62	0.62	1.01	0.00	0.00	0.00
12.75	0.62	0.62	1.00	0.00	0.00	0.00
12.80	0.62	0.62	1.00	0.00	0.00	0.00
12.85	0.62	0.62	1.00	0.00	0.00	0.00
12.90	0.62	0.62	1.00	0.00	0.00	0.00
12.95	0.62	0.62	1.00*	0.00	0.00	0.00
13.00	0.62	0.62	1.00*	0.00	0.00	0.00
13.05	0.62	0.62	1.00*	0.00	0.00	0.00
13.10	0.62	0.62	1.00*	0.00	0.00	0.00
13.15	0.62	0.62	1.00*	0.00	0.00	0.00
13.20	0.62	0.62	0.99*	0.00	0.00	0.00
13.25	0.62	0.62	0.99*	0.00	0.00	0.00
13.30	0.62	0.62	0.99*	0.00	0.00	0.00
13.35	0.62	0.62	0.99*	0.00	0.00	0.00
13.40	0.62	0.63	0.99*	0.00	0.00	0.00
13.45	0.62	0.63	0.99*	0.00	0.00	0.00
13.50	0.62	0.63	0.99*	0.00	0.00	0.00
13.55	0.62	0.63	0.99*	0.00	0.00	0.00
13.60	0.62	0.63	0.99*	0.00	0.00	0.00
13.65	0.62	0.63	0.98*	0.00	0.00	0.00
13.70	0.62	0.63	0.98*	0.00	0.00	0.00
13.75	0.62	0.63	0.98*	0.00	0.00	0.00
13.80	0.62	0.63	0.98*	0.00	0.00	0.00
13.85	0.62	0.63	0.98*	0.00	0.00	0.00
13.90	0.62	0.63	0.98*	0.00	0.00	0.00

13.95	0.62	0.63	0.98*	0.00	0.00	0.00
14.00	0.62	0.63	0.98*	0.00	0.00	0.00
14.05	0.62	0.63	0.98*	0.00	0.00	0.00
14.10	0.62	0.63	0.98*	0.00	0.00	0.00
14.15	0.62	0.63	0.97*	0.00	0.00	0.00
14.20	0.62	0.64	0.97*	0.00	0.00	0.00
14.25	0.62	0.64	0.97*	0.00	0.00	0.00
14.30	0.62	0.64	0.97*	0.00	0.00	0.00
14.35	0.62	0.64	0.97*	0.00	0.00	0.00
14.40	0.62	0.64	0.97*	0.00	0.00	0.00
14.45	0.62	0.64	0.97*	0.00	0.00	0.00
14.50	0.62	0.64	0.97*	0.00	0.00	0.00
14.55	0.62	0.64	0.97*	0.00	0.00	0.00
14.60	0.62	0.64	0.97*	0.00	0.00	0.00
14.65	0.62	0.64	0.97*	0.00	0.00	0.00
14.70	0.62	0.64	0.97*	0.00	0.00	0.00
14.75	0.62	0.64	0.96*	0.00	0.00	0.00
14.80	0.62	0.64	0.96*	0.00	0.00	0.00
14.85	0.62	0.64	0.96*	0.00	0.00	0.00
14.90	0.62	0.64	0.96*	0.00	0.00	0.00
14.95	0.62	0.64	0.96*	0.00	0.00	0.00
15.00	2.00	0.64	5.00	0.00	0.00	0.00
15.05	2.00	0.64	5.00	0.00	0.00	0.00
15.10	2.00	0.65	5.00	0.00	0.00	0.00
15.15	2.00	0.65	5.00	0.00	0.00	0.00
15.20	2.00	0.65	5.00	0.00	0.00	0.00
15.25	2.00	0.65	5.00	0.00	0.00	0.00
15.30	2.00	0.65	5.00	0.00	0.00	0.00
15.35	2.00	0.65	5.00	0.00	0.00	0.00
15.40	2.00	0.65	5.00	0.00	0.00	0.00
15.45	2.00	0.65	5.00	0.00	0.00	0.00
15.50	2.00	0.65	5.00	0.00	0.00	0.00
15.55	2.00	0.65	5.00	0.00	0.00	0.00
15.60	2.00	0.65	5.00	0.00	0.00	0.00
15.65	2.00	0.65	5.00	0.00	0.00	0.00
15.70	2.00	0.65	5.00	0.00	0.00	0.00
15.75	2.00	0.65	5.00	0.00	0.00	0.00
15.80	2.00	0.65	5.00	0.00	0.00	0.00
15.85	2.00	0.65	5.00	0.00	0.00	0.00
15.90	2.00	0.65	5.00	0.00	0.00	0.00
15.95	2.00	0.65	5.00	0.00	0.00	0.00
16.00	2.00	0.65	5.00	0.00	0.00	0.00
16.05	2.00	0.65	5.00	0.00	0.00	0.00
16.10	2.00	0.65	5.00	0.00	0.00	0.00
16.15	2.00	0.66	5.00	0.00	0.00	0.00
16.20	2.00	0.66	5.00	0.00	0.00	0.00
16.25	2.00	0.66	5.00	0.00	0.00	0.00
16.30	2.00	0.66	5.00	0.00	0.00	0.00
16.35	2.00	0.66	5.00	0.00	0.00	0.00
16.40	2.00	0.66	5.00	0.00	0.00	0.00

16.45	2.00	0.66	5.00	0.00	0.00	0.00
16.50	2.00	0.66	5.00	0.00	0.00	0.00
16.55	2.00	0.66	5.00	0.00	0.00	0.00
16.60	2.00	0.66	5.00	0.00	0.00	0.00
16.65	2.00	0.66	5.00	0.00	0.00	0.00
16.70	2.00	0.66	5.00	0.00	0.00	0.00
16.75	2.00	0.66	5.00	0.00	0.00	0.00
16.80	2.00	0.66	5.00	0.00	0.00	0.00
16.85	2.00	0.66	5.00	0.00	0.00	0.00
16.90	2.00	0.66	5.00	0.00	0.00	0.00
16.95	2.00	0.66	5.00	0.00	0.00	0.00
17.00	2.00	0.66	5.00	0.00	0.00	0.00
17.05	2.00	0.66	5.00	0.00	0.00	0.00
17.10	2.00	0.66	5.00	0.00	0.00	0.00
17.15	2.00	0.66	5.00	0.00	0.00	0.00
17.20	2.00	0.66	5.00	0.00	0.00	0.00
17.25	2.00	0.66	5.00	0.00	0.00	0.00
17.30	2.00	0.66	5.00	0.00	0.00	0.00
17.35	2.00	0.67	5.00	0.00	0.00	0.00
17.40	2.00	0.67	5.00	0.00	0.00	0.00
17.45	2.00	0.67	5.00	0.00	0.00	0.00
17.50	2.00	0.67	5.00	0.00	0.00	0.00
17.55	2.00	0.67	5.00	0.00	0.00	0.00
17.60	2.00	0.67	5.00	0.00	0.00	0.00
17.65	2.00	0.67	5.00	0.00	0.00	0.00
17.70	2.00	0.67	5.00	0.00	0.00	0.00
17.75	2.00	0.67	5.00	0.00	0.00	0.00
17.80	2.00	0.67	5.00	0.00	0.00	0.00
17.85	2.00	0.67	5.00	0.00	0.00	0.00
17.90	2.00	0.67	5.00	0.00	0.00	0.00
17.95	2.00	0.67	5.00	0.00	0.00	0.00
18.00	2.00	0.67	5.00	0.00	0.00	0.00
18.05	2.00	0.67	5.00	0.00	0.00	0.00
18.10	2.00	0.67	5.00	0.00	0.00	0.00
18.15	2.00	0.67	5.00	0.00	0.00	0.00
18.20	2.00	0.67	5.00	0.00	0.00	0.00
18.25	2.00	0.67	5.00	0.00	0.00	0.00
18.30	2.00	0.67	5.00	0.00	0.00	0.00
18.35	2.00	0.67	5.00	0.00	0.00	0.00
18.40	2.00	0.67	5.00	0.00	0.00	0.00
18.45	2.00	0.67	5.00	0.00	0.00	0.00
18.50	2.00	0.67	5.00	0.00	0.00	0.00
18.55	2.00	0.67	5.00	0.00	0.00	0.00
18.60	2.00	0.67	5.00	0.00	0.00	0.00
18.65	2.00	0.67	5.00	0.00	0.00	0.00
18.70	2.00	0.68	5.00	0.00	0.00	0.00
18.75	2.00	0.68	5.00	0.00	0.00	0.00
18.80	2.00	0.68	5.00	0.00	0.00	0.00
18.85	2.00	0.68	5.00	0.00	0.00	0.00
18.90	2.00	0.68	5.00	0.00	0.00	0.00

18.95	2.00	0.68	5.00	0.00	0.00	0.00
19.00	2.00	0.68	5.00	0.00	0.00	0.00
19.05	2.00	0.68	5.00	0.00	0.00	0.00
19.10	2.00	0.68	5.00	0.00	0.00	0.00
19.15	2.00	0.68	5.00	0.00	0.00	0.00
19.20	2.00	0.68	5.00	0.00	0.00	0.00
19.25	2.00	0.68	5.00	0.00	0.00	0.00
19.30	2.00	0.68	5.00	0.00	0.00	0.00
19.35	2.00	0.68	5.00	0.00	0.00	0.00
19.40	2.00	0.68	5.00	0.00	0.00	0.00
19.45	2.00	0.68	5.00	0.00	0.00	0.00
19.50	2.00	0.68	5.00	0.00	0.00	0.00
19.55	2.00	0.68	5.00	0.00	0.00	0.00
19.60	2.00	0.68	5.00	0.00	0.00	0.00
19.65	2.00	0.68	5.00	0.00	0.00	0.00
19.70	2.00	0.68	5.00	0.00	0.00	0.00
19.75	2.00	0.68	5.00	0.00	0.00	0.00
19.80	2.00	0.68	5.00	0.00	0.00	0.00
19.85	2.00	0.68	5.00	0.00	0.00	0.00
19.90	2.00	0.68	5.00	0.00	0.00	0.00
19.95	2.00	0.68	5.00	0.00	0.00	0.00
20.00	2.00	0.68	5.00	0.00	0.00	0.00
20.05	2.00	0.68	5.00	0.00	0.00	0.00
20.10	2.00	0.68	5.00	0.00	0.00	0.00
20.15	2.00	0.68	5.00	0.00	0.00	0.00
20.20	2.00	0.68	5.00	0.00	0.00	0.00
20.25	2.00	0.68	5.00	0.00	0.00	0.00
20.30	2.00	0.68	5.00	0.00	0.00	0.00
20.35	2.00	0.69	5.00	0.00	0.00	0.00
20.40	2.00	0.69	5.00	0.00	0.00	0.00
20.45	2.00	0.69	5.00	0.00	0.00	0.00
20.50	2.00	0.69	5.00	0.00	0.00	0.00
20.55	2.00	0.69	5.00	0.00	0.00	0.00
20.60	2.00	0.69	5.00	0.00	0.00	0.00
20.65	2.00	0.69	5.00	0.00	0.00	0.00
20.70	2.00	0.69	5.00	0.00	0.00	0.00
20.75	2.00	0.69	5.00	0.00	0.00	0.00
20.80	2.00	0.69	5.00	0.00	0.00	0.00
20.85	2.00	0.69	5.00	0.00	0.00	0.00
20.90	2.00	0.69	5.00	0.00	0.00	0.00
20.95	2.00	0.69	5.00	0.00	0.00	0.00
21.00	2.00	0.69	5.00	0.00	0.00	0.00
21.05	2.00	0.69	5.00	0.00	0.00	0.00
21.10	2.00	0.69	5.00	0.00	0.00	0.00
21.15	2.00	0.69	5.00	0.00	0.00	0.00
21.20	2.00	0.69	5.00	0.00	0.00	0.00
21.25	2.00	0.69	5.00	0.00	0.00	0.00
21.30	2.00	0.69	5.00	0.00	0.00	0.00
21.35	2.00	0.69	5.00	0.00	0.00	0.00
21.40	2.00	0.69	5.00	0.00	0.00	0.00

21.45	2.00	0.69	5.00	0.00	0.00	0.00
21.50	2.00	0.69	5.00	0.00	0.00	0.00
21.55	2.00	0.69	5.00	0.00	0.00	0.00
21.60	2.00	0.69	5.00	0.00	0.00	0.00
21.65	2.00	0.69	5.00	0.00	0.00	0.00
21.70	2.00	0.69	5.00	0.00	0.00	0.00
21.75	2.00	0.69	5.00	0.00	0.00	0.00
21.80	2.00	0.69	5.00	0.00	0.00	0.00
21.85	2.00	0.69	5.00	0.00	0.00	0.00
21.90	2.00	0.69	5.00	0.00	0.00	0.00
21.95	2.00	0.69	5.00	0.00	0.00	0.00
22.00	2.00	0.69	5.00	0.00	0.00	0.00
22.05	2.00	0.69	5.00	0.00	0.00	0.00
22.10	2.00	0.69	5.00	0.00	0.00	0.00
22.15	2.00	0.69	5.00	0.00	0.00	0.00
22.20	2.00	0.69	5.00	0.00	0.00	0.00
22.25	2.00	0.69	5.00	0.00	0.00	0.00
22.30	2.00	0.70	5.00	0.00	0.00	0.00
22.35	2.00	0.70	5.00	0.00	0.00	0.00
22.40	2.00	0.70	5.00	0.00	0.00	0.00
22.45	2.00	0.70	5.00	0.00	0.00	0.00
22.50	2.00	0.70	5.00	0.00	0.00	0.00
22.55	2.00	0.70	5.00	0.00	0.00	0.00
22.60	2.00	0.70	5.00	0.00	0.00	0.00
22.65	2.00	0.70	5.00	0.00	0.00	0.00
22.70	2.00	0.70	5.00	0.00	0.00	0.00
22.75	2.00	0.70	5.00	0.00	0.00	0.00
22.80	2.00	0.70	5.00	0.00	0.00	0.00
22.85	2.00	0.70	5.00	0.00	0.00	0.00
22.90	2.00	0.70	5.00	0.00	0.00	0.00
22.95	2.00	0.70	5.00	0.00	0.00	0.00
23.00	2.00	0.70	5.00	0.00	0.00	0.00
23.05	2.00	0.70	5.00	0.00	0.00	0.00
23.10	2.00	0.70	5.00	0.00	0.00	0.00
23.15	2.00	0.70	5.00	0.00	0.00	0.00
23.20	2.00	0.70	5.00	0.00	0.00	0.00
23.25	2.00	0.70	5.00	0.00	0.00	0.00
23.30	2.00	0.70	5.00	0.00	0.00	0.00
23.35	2.00	0.70	5.00	0.00	0.00	0.00
23.40	2.00	0.70	5.00	0.00	0.00	0.00
23.45	2.00	0.70	5.00	0.00	0.00	0.00
23.50	2.00	0.70	5.00	0.00	0.00	0.00
23.55	2.00	0.70	5.00	0.00	0.00	0.00
23.60	2.00	0.70	5.00	0.00	0.00	0.00
23.65	2.00	0.70	5.00	0.00	0.00	0.00
23.70	2.00	0.70	5.00	0.00	0.00	0.00
23.75	2.00	0.70	5.00	0.00	0.00	0.00
23.80	2.00	0.70	5.00	0.00	0.00	0.00
23.85	2.00	0.70	5.00	0.00	0.00	0.00
23.90	2.00	0.70	5.00	0.00	0.00	0.00

23.95	2.00	0.70	5.00	0.00	0.00	0.00
24.00	2.00	0.70	5.00	0.00	0.00	0.00
24.05	2.00	0.70	5.00	0.00	0.00	0.00
24.10	2.00	0.70	5.00	0.00	0.00	0.00
24.15	2.00	0.70	5.00	0.00	0.00	0.00
24.20	2.00	0.70	5.00	0.00	0.00	0.00
24.25	2.00	0.70	5.00	0.00	0.00	0.00
24.30	2.00	0.70	5.00	0.00	0.00	0.00
24.35	2.00	0.70	5.00	0.00	0.00	0.00
24.40	2.00	0.70	5.00	0.00	0.00	0.00
24.45	2.00	0.70	5.00	0.00	0.00	0.00
24.50	2.00	0.70	5.00	0.00	0.00	0.00
24.55	2.00	0.70	5.00	0.00	0.00	0.00
24.60	2.00	0.70	5.00	0.00	0.00	0.00
24.65	2.00	0.70	5.00	0.00	0.00	0.00
24.70	2.00	0.70	5.00	0.00	0.00	0.00
24.75	2.00	0.70	5.00	0.00	0.00	0.00
24.80	2.00	0.70	5.00	0.00	0.00	0.00
24.85	2.00	0.71	5.00	0.00	0.00	0.00
24.90	2.00	0.71	5.00	0.00	0.00	0.00
24.95	2.00	0.71	5.00	0.00	0.00	0.00
25.00	2.00	0.71	5.00	0.00	0.00	0.00
25.05	2.00	0.71	5.00	0.00	0.00	0.00
25.10	2.00	0.71	5.00	0.00	0.00	0.00
25.15	2.00	0.71	5.00	0.00	0.00	0.00
25.20	2.00	0.71	5.00	0.00	0.00	0.00
25.25	2.00	0.71	5.00	0.00	0.00	0.00
25.30	2.00	0.71	5.00	0.00	0.00	0.00
25.35	2.00	0.71	5.00	0.00	0.00	0.00
25.40	2.00	0.71	5.00	0.00	0.00	0.00
25.45	2.00	0.71	5.00	0.00	0.00	0.00
25.50	2.00	0.71	5.00	0.00	0.00	0.00
25.55	2.00	0.71	5.00	0.00	0.00	0.00
25.60	2.00	0.71	5.00	0.00	0.00	0.00
25.65	2.00	0.71	5.00	0.00	0.00	0.00
25.70	2.00	0.71	5.00	0.00	0.00	0.00
25.75	2.00	0.71	5.00	0.00	0.00	0.00
25.80	2.00	0.71	5.00	0.00	0.00	0.00
25.85	2.00	0.71	5.00	0.00	0.00	0.00
25.90	2.00	0.71	5.00	0.00	0.00	0.00
25.95	2.00	0.71	5.00	0.00	0.00	0.00
26.00	2.00	0.71	5.00	0.00	0.00	0.00
26.05	2.00	0.71	5.00	0.00	0.00	0.00
26.10	2.00	0.71	5.00	0.00	0.00	0.00
26.15	2.00	0.71	5.00	0.00	0.00	0.00
26.20	2.00	0.71	5.00	0.00	0.00	0.00
26.25	2.00	0.71	5.00	0.00	0.00	0.00
26.30	2.00	0.71	5.00	0.00	0.00	0.00
26.35	2.00	0.71	5.00	0.00	0.00	0.00
26.40	2.00	0.71	5.00	0.00	0.00	0.00

26.45	2.00	0.71	5.00	0.00	0.00	0.00
26.50	2.00	0.71	5.00	0.00	0.00	0.00
26.55	2.00	0.71	5.00	0.00	0.00	0.00
26.60	2.00	0.71	5.00	0.00	0.00	0.00
26.65	2.00	0.71	5.00	0.00	0.00	0.00
26.70	2.00	0.71	5.00	0.00	0.00	0.00
26.75	2.00	0.71	5.00	0.00	0.00	0.00
26.80	2.00	0.71	5.00	0.00	0.00	0.00
26.85	2.00	0.71	5.00	0.00	0.00	0.00
26.90	2.00	0.71	5.00	0.00	0.00	0.00
26.95	2.00	0.71	5.00	0.00	0.00	0.00
27.00	2.00	0.71	5.00	0.00	0.00	0.00
27.05	2.00	0.71	5.00	0.00	0.00	0.00
27.10	2.00	0.71	5.00	0.00	0.00	0.00
27.15	2.00	0.71	5.00	0.00	0.00	0.00
27.20	2.00	0.71	5.00	0.00	0.00	0.00
27.25	2.00	0.71	5.00	0.00	0.00	0.00
27.30	2.00	0.71	5.00	0.00	0.00	0.00
27.35	2.00	0.71	5.00	0.00	0.00	0.00
27.40	2.00	0.71	5.00	0.00	0.00	0.00
27.45	2.00	0.71	5.00	0.00	0.00	0.00
27.50	2.00	0.71	5.00	0.00	0.00	0.00
27.55	2.00	0.71	5.00	0.00	0.00	0.00
27.60	2.00	0.71	5.00	0.00	0.00	0.00
27.65	2.00	0.71	5.00	0.00	0.00	0.00
27.70	2.00	0.71	5.00	0.00	0.00	0.00
27.75	2.00	0.71	5.00	0.00	0.00	0.00
27.80	2.00	0.71	5.00	0.00	0.00	0.00
27.85	2.00	0.71	5.00	0.00	0.00	0.00
27.90	2.00	0.71	5.00	0.00	0.00	0.00
27.95	2.00	0.71	5.00	0.00	0.00	0.00
28.00	2.00	0.71	5.00	0.00	0.00	0.00
28.05	2.00	0.71	5.00	0.00	0.00	0.00
28.10	2.00	0.71	5.00	0.00	0.00	0.00
28.15	2.00	0.71	5.00	0.00	0.00	0.00
28.20	2.00	0.71	5.00	0.00	0.00	0.00
28.25	2.00	0.71	5.00	0.00	0.00	0.00
28.30	2.00	0.71	5.00	0.00	0.00	0.00
28.35	2.00	0.71	5.00	0.00	0.00	0.00
28.40	2.00	0.71	5.00	0.00	0.00	0.00
28.45	2.00	0.72	5.00	0.00	0.00	0.00
28.50	2.00	0.72	5.00	0.00	0.00	0.00
28.55	2.00	0.72	5.00	0.00	0.00	0.00
28.60	2.00	0.72	5.00	0.00	0.00	0.00
28.65	2.00	0.72	5.00	0.00	0.00	0.00
28.70	2.00	0.72	5.00	0.00	0.00	0.00
28.75	2.00	0.72	5.00	0.00	0.00	0.00
28.80	2.00	0.72	5.00	0.00	0.00	0.00
28.85	2.00	0.72	5.00	0.00	0.00	0.00
28.90	2.00	0.72	5.00	0.00	0.00	0.00

28.95	2.00	0.72	5.00	0.00	0.00	0.00
29.00	2.00	0.72	5.00	0.00	0.00	0.00
29.05	2.00	0.72	5.00	0.00	0.00	0.00
29.10	2.00	0.72	5.00	0.00	0.00	0.00
29.15	2.00	0.72	5.00	0.00	0.00	0.00
29.20	2.00	0.72	5.00	0.00	0.00	0.00
29.25	2.00	0.72	5.00	0.00	0.00	0.00
29.30	2.00	0.72	5.00	0.00	0.00	0.00
29.35	2.00	0.72	5.00	0.00	0.00	0.00
29.40	2.00	0.72	5.00	0.00	0.00	0.00
29.45	2.00	0.72	5.00	0.00	0.00	0.00
29.50	2.00	0.72	5.00	0.00	0.00	0.00
29.55	2.00	0.72	5.00	0.00	0.00	0.00
29.60	2.00	0.72	5.00	0.00	0.00	0.00
29.65	2.00	0.72	5.00	0.00	0.00	0.00
29.70	2.00	0.72	5.00	0.00	0.00	0.00
29.75	2.00	0.72	5.00	0.00	0.00	0.00
29.80	2.00	0.72	5.00	0.00	0.00	0.00
29.85	2.00	0.72	5.00	0.00	0.00	0.00
29.90	2.00	0.72	5.00	0.00	0.00	0.00
29.95	2.00	0.72	5.00	0.00	0.00	0.00
30.00	2.00	0.72	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

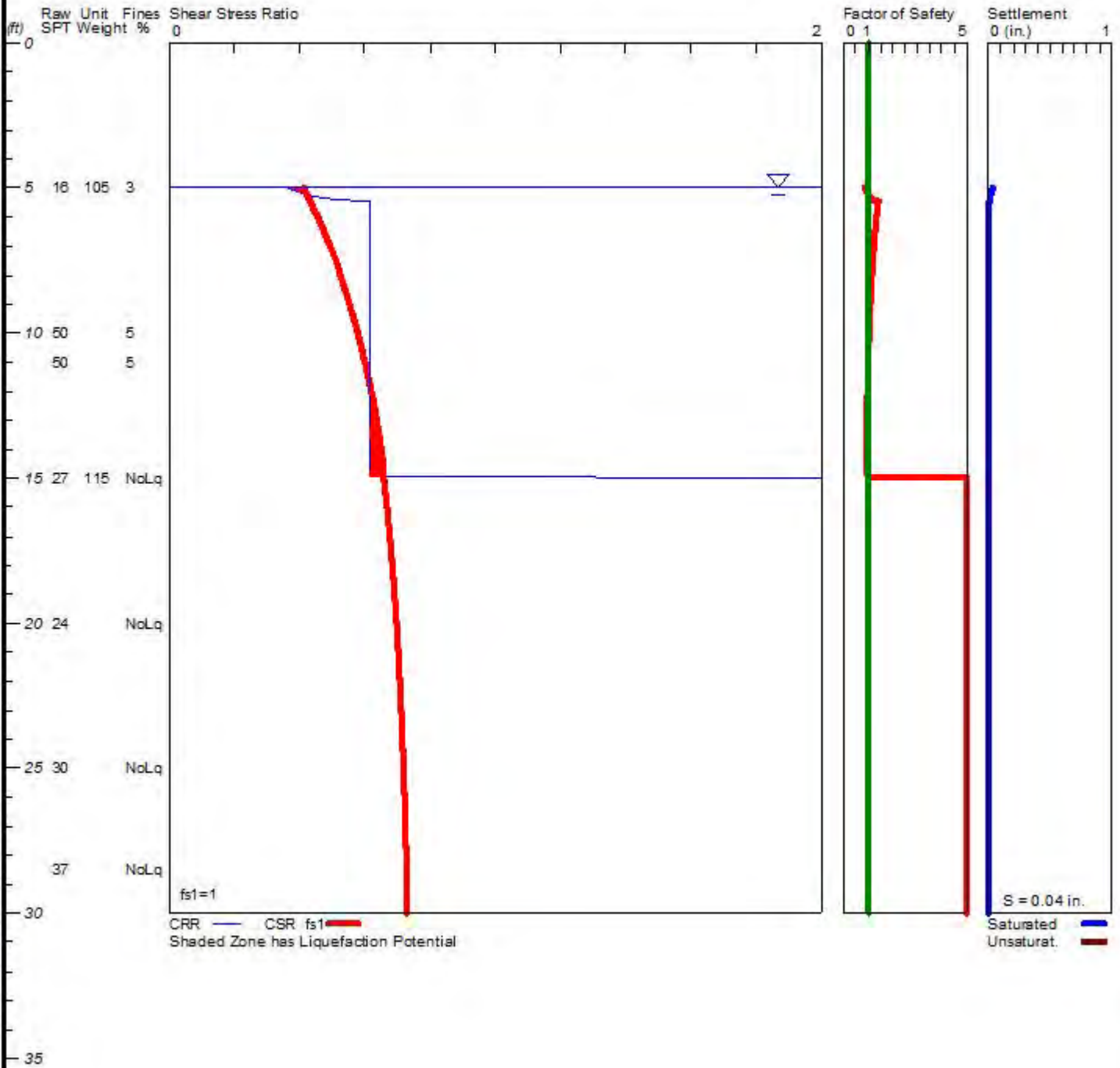
—
1 atm (atmosphere) = 1 tsf (ton/ft²)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with
user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

LIQUEFACTION ANALYSIS

Federal Boulevard Dechannelization and Trail Proje

Hole No.=B-3 Water Depth=5 ft Surface Elev.=92

Magnitude=6.9
Acceleration=0.64g



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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: G:\File Share\CMK.temp\Projects\109052001 Federal Blvd
Dechannelization\Engineering\B-3.liq
Title: Federal Boulevard Dechannelization and Trail Proje
Subtitle: 109052001

Surface Elev.=92
Hole No.=B-3
Depth of Hole= 30.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 5.00 ft
Max. Acceleration= 0.64 g
Earthquake Magnitude= 6.90

Input Data:

Surface Elev.=92
Hole No.=B-3
Depth of Hole=30.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 5.00 ft
Max. Acceleration=0.64 g
Earthquake Magnitude=6.90
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Ishihara / Yoshimine
 3. Fines Correction for Liquefaction: Idriss/Seed
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.25
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1
 9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
5.00	16.00	105.00	3.00
10.00	50.00	105.00	5.00
11.00	50.00	105.00	5.00
15.00	27.00	115.00	NoLiq
20.00	24.00	115.00	NoLiq
25.00	30.00	115.00	NoLiq
28.50	37.00	115.00	NoLiq

Output Results:

Settlement of Saturated Sands=0.04 in.

Settlement of Unsaturated Sands=0.00 in.

Total Settlement of Saturated and Unsaturated Sands=0.04 in.

Differential Settlement=0.018 to 0.024 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
5.00	0.36	0.41	0.88*	0.04	0.00	0.04
5.05	0.37	0.41	0.90*	0.03	0.00	0.03
5.10	0.38	0.42	0.93*	0.03	0.00	0.03
5.15	0.40	0.42	0.95*	0.02	0.00	0.02
5.20	0.41	0.42	0.98*	0.02	0.00	0.02
5.25	0.43	0.42	1.02	0.01	0.00	0.01
5.30	0.45	0.43	1.06	0.01	0.00	0.01
5.35	0.48	0.43	1.12	0.01	0.00	0.01
5.40	0.53	0.43	1.24	0.01	0.00	0.01
5.45	0.62	0.43	1.43	0.00	0.00	0.00
5.50	0.62	0.43	1.43	0.00	0.00	0.00
5.55	0.62	0.44	1.42	0.00	0.00	0.00
5.60	0.62	0.44	1.41	0.00	0.00	0.00
5.65	0.62	0.44	1.40	0.00	0.00	0.00
5.70	0.62	0.44	1.40	0.00	0.00	0.00
5.75	0.62	0.44	1.39	0.00	0.00	0.00
5.80	0.62	0.45	1.38	0.00	0.00	0.00
5.85	0.62	0.45	1.38	0.00	0.00	0.00
5.90	0.62	0.45	1.37	0.00	0.00	0.00
5.95	0.62	0.45	1.37	0.00	0.00	0.00
6.00	0.62	0.46	1.36	0.00	0.00	0.00
6.05	0.62	0.46	1.35	0.00	0.00	0.00
6.10	0.62	0.46	1.35	0.00	0.00	0.00
6.15	0.62	0.46	1.34	0.00	0.00	0.00
6.20	0.62	0.46	1.34	0.00	0.00	0.00
6.25	0.62	0.47	1.33	0.00	0.00	0.00
6.30	0.62	0.47	1.32	0.00	0.00	0.00
6.35	0.62	0.47	1.32	0.00	0.00	0.00
6.40	0.62	0.47	1.31	0.00	0.00	0.00

6.45	0.62	0.47	1.31	0.00	0.00	0.00
6.50	0.62	0.47	1.30	0.00	0.00	0.00
6.55	0.62	0.48	1.30	0.00	0.00	0.00
6.60	0.62	0.48	1.29	0.00	0.00	0.00
6.65	0.62	0.48	1.29	0.00	0.00	0.00
6.70	0.62	0.48	1.28	0.00	0.00	0.00
6.75	0.62	0.48	1.28	0.00	0.00	0.00
6.80	0.62	0.49	1.27	0.00	0.00	0.00
6.85	0.62	0.49	1.27	0.00	0.00	0.00
6.90	0.62	0.49	1.26	0.00	0.00	0.00
6.95	0.62	0.49	1.26	0.00	0.00	0.00
7.00	0.62	0.49	1.26	0.00	0.00	0.00
7.05	0.62	0.49	1.25	0.00	0.00	0.00
7.10	0.62	0.50	1.25	0.00	0.00	0.00
7.15	0.62	0.50	1.24	0.00	0.00	0.00
7.20	0.62	0.50	1.24	0.00	0.00	0.00
7.25	0.62	0.50	1.23	0.00	0.00	0.00
7.30	0.62	0.50	1.23	0.00	0.00	0.00
7.35	0.62	0.50	1.23	0.00	0.00	0.00
7.40	0.62	0.51	1.22	0.00	0.00	0.00
7.45	0.62	0.51	1.22	0.00	0.00	0.00
7.50	0.62	0.51	1.21	0.00	0.00	0.00
7.55	0.62	0.51	1.21	0.00	0.00	0.00
7.60	0.62	0.51	1.21	0.00	0.00	0.00
7.65	0.62	0.51	1.20	0.00	0.00	0.00
7.70	0.62	0.52	1.20	0.00	0.00	0.00
7.75	0.62	0.52	1.20	0.00	0.00	0.00
7.80	0.62	0.52	1.19	0.00	0.00	0.00
7.85	0.62	0.52	1.19	0.00	0.00	0.00
7.90	0.62	0.52	1.18	0.00	0.00	0.00
7.95	0.62	0.52	1.18	0.00	0.00	0.00
8.00	0.62	0.53	1.18	0.00	0.00	0.00
8.05	0.62	0.53	1.17	0.00	0.00	0.00
8.10	0.62	0.53	1.17	0.00	0.00	0.00
8.15	0.62	0.53	1.17	0.00	0.00	0.00
8.20	0.62	0.53	1.16	0.00	0.00	0.00
8.25	0.62	0.53	1.16	0.00	0.00	0.00
8.30	0.62	0.53	1.16	0.00	0.00	0.00
8.35	0.62	0.54	1.16	0.00	0.00	0.00
8.40	0.62	0.54	1.15	0.00	0.00	0.00
8.45	0.62	0.54	1.15	0.00	0.00	0.00
8.50	0.62	0.54	1.15	0.00	0.00	0.00
8.55	0.62	0.54	1.14	0.00	0.00	0.00
8.60	0.62	0.54	1.14	0.00	0.00	0.00
8.65	0.62	0.54	1.14	0.00	0.00	0.00
8.70	0.62	0.55	1.13	0.00	0.00	0.00
8.75	0.62	0.55	1.13	0.00	0.00	0.00
8.80	0.62	0.55	1.13	0.00	0.00	0.00
8.85	0.62	0.55	1.13	0.00	0.00	0.00
8.90	0.62	0.55	1.12	0.00	0.00	0.00

8.95	0.62	0.55	1.12	0.00	0.00	0.00
9.00	0.62	0.55	1.12	0.00	0.00	0.00
9.05	0.62	0.55	1.12	0.00	0.00	0.00
9.10	0.62	0.56	1.11	0.00	0.00	0.00
9.15	0.62	0.56	1.11	0.00	0.00	0.00
9.20	0.62	0.56	1.11	0.00	0.00	0.00
9.25	0.62	0.56	1.11	0.00	0.00	0.00
9.30	0.62	0.56	1.10	0.00	0.00	0.00
9.35	0.62	0.56	1.10	0.00	0.00	0.00
9.40	0.62	0.56	1.10	0.00	0.00	0.00
9.45	0.62	0.56	1.10	0.00	0.00	0.00
9.50	0.62	0.57	1.09	0.00	0.00	0.00
9.55	0.62	0.57	1.09	0.00	0.00	0.00
9.60	0.62	0.57	1.09	0.00	0.00	0.00
9.65	0.62	0.57	1.09	0.00	0.00	0.00
9.70	0.62	0.57	1.08	0.00	0.00	0.00
9.75	0.62	0.57	1.08	0.00	0.00	0.00
9.80	0.62	0.57	1.08	0.00	0.00	0.00
9.85	0.62	0.57	1.08	0.00	0.00	0.00
9.90	0.62	0.58	1.07	0.00	0.00	0.00
9.95	0.62	0.58	1.07	0.00	0.00	0.00
10.00	0.62	0.58	1.07	0.00	0.00	0.00
10.05	0.62	0.58	1.07	0.00	0.00	0.00
10.10	0.62	0.58	1.07	0.00	0.00	0.00
10.15	0.62	0.58	1.06	0.00	0.00	0.00
10.20	0.62	0.58	1.06	0.00	0.00	0.00
10.25	0.62	0.58	1.06	0.00	0.00	0.00
10.30	0.62	0.58	1.06	0.00	0.00	0.00
10.35	0.62	0.59	1.06	0.00	0.00	0.00
10.40	0.62	0.59	1.05	0.00	0.00	0.00
10.45	0.62	0.59	1.05	0.00	0.00	0.00
10.50	0.62	0.59	1.05	0.00	0.00	0.00
10.55	0.62	0.59	1.05	0.00	0.00	0.00
10.60	0.62	0.59	1.05	0.00	0.00	0.00
10.65	0.62	0.59	1.04	0.00	0.00	0.00
10.70	0.62	0.59	1.04	0.00	0.00	0.00
10.75	0.62	0.59	1.04	0.00	0.00	0.00
10.80	0.62	0.60	1.04	0.00	0.00	0.00
10.85	0.62	0.60	1.04	0.00	0.00	0.00
10.90	0.62	0.60	1.04	0.00	0.00	0.00
10.95	0.62	0.60	1.03	0.00	0.00	0.00
11.00	0.62	0.60	1.03	0.00	0.00	0.00
11.05	0.62	0.60	1.03	0.00	0.00	0.00
11.10	0.62	0.60	1.03	0.00	0.00	0.00
11.15	0.62	0.60	1.03	0.00	0.00	0.00
11.20	0.62	0.60	1.02	0.00	0.00	0.00
11.25	0.62	0.60	1.02	0.00	0.00	0.00
11.30	0.62	0.61	1.02	0.00	0.00	0.00
11.35	0.62	0.61	1.02	0.00	0.00	0.00
11.40	0.62	0.61	1.02	0.00	0.00	0.00

11.45	0.62	0.61	1.02	0.00	0.00	0.00
11.50	0.62	0.61	1.02	0.00	0.00	0.00
11.55	0.62	0.61	1.01	0.00	0.00	0.00
11.60	0.62	0.61	1.01	0.00	0.00	0.00
11.65	0.62	0.61	1.01	0.00	0.00	0.00
11.70	0.62	0.61	1.01	0.00	0.00	0.00
11.75	0.62	0.61	1.01	0.00	0.00	0.00
11.80	0.62	0.62	1.01	0.00	0.00	0.00
11.85	0.62	0.62	1.00	0.00	0.00	0.00
11.90	0.62	0.62	1.00	0.00	0.00	0.00
11.95	0.62	0.62	1.00	0.00	0.00	0.00
12.00	0.62	0.62	1.00	0.00	0.00	0.00
12.05	0.62	0.62	1.00*	0.00	0.00	0.00
12.10	0.62	0.62	1.00*	0.00	0.00	0.00
12.15	0.62	0.62	1.00*	0.00	0.00	0.00
12.20	0.62	0.62	0.99*	0.00	0.00	0.00
12.25	0.62	0.62	0.99*	0.00	0.00	0.00
12.30	0.62	0.62	0.99*	0.00	0.00	0.00
12.35	0.62	0.62	0.99*	0.00	0.00	0.00
12.40	0.62	0.63	0.99*	0.00	0.00	0.00
12.45	0.62	0.63	0.99*	0.00	0.00	0.00
12.50	0.62	0.63	0.99*	0.00	0.00	0.00
12.55	0.62	0.63	0.99*	0.00	0.00	0.00
12.60	0.62	0.63	0.98*	0.00	0.00	0.00
12.65	0.62	0.63	0.98*	0.00	0.00	0.00
12.70	0.62	0.63	0.98*	0.00	0.00	0.00
12.75	0.62	0.63	0.98*	0.00	0.00	0.00
12.80	0.62	0.63	0.98*	0.00	0.00	0.00
12.85	0.62	0.63	0.98*	0.00	0.00	0.00
12.90	0.62	0.63	0.98*	0.00	0.00	0.00
12.95	0.62	0.63	0.98*	0.00	0.00	0.00
13.00	0.62	0.63	0.97*	0.00	0.00	0.00
13.05	0.62	0.64	0.97*	0.00	0.00	0.00
13.10	0.62	0.64	0.97*	0.00	0.00	0.00
13.15	0.62	0.64	0.97*	0.00	0.00	0.00
13.20	0.62	0.64	0.97*	0.00	0.00	0.00
13.25	0.62	0.64	0.97*	0.00	0.00	0.00
13.30	0.62	0.64	0.97*	0.00	0.00	0.00
13.35	0.62	0.64	0.97*	0.00	0.00	0.00
13.40	0.62	0.64	0.97*	0.00	0.00	0.00
13.45	0.62	0.64	0.97*	0.00	0.00	0.00
13.50	0.62	0.64	0.96*	0.00	0.00	0.00
13.55	0.62	0.64	0.96*	0.00	0.00	0.00
13.60	0.62	0.64	0.96*	0.00	0.00	0.00
13.65	0.62	0.64	0.96*	0.00	0.00	0.00
13.70	0.62	0.64	0.96*	0.00	0.00	0.00
13.75	0.62	0.65	0.96*	0.00	0.00	0.00
13.80	0.62	0.65	0.96*	0.00	0.00	0.00
13.85	0.62	0.65	0.96*	0.00	0.00	0.00
13.90	0.62	0.65	0.96*	0.00	0.00	0.00

13.95	0.62	0.65	0.96*	0.00	0.00	0.00
14.00	0.62	0.65	0.95*	0.00	0.00	0.00
14.05	0.62	0.65	0.95*	0.00	0.00	0.00
14.10	0.62	0.65	0.95*	0.00	0.00	0.00
14.15	0.62	0.65	0.95*	0.00	0.00	0.00
14.20	0.62	0.65	0.95*	0.00	0.00	0.00
14.25	0.62	0.65	0.95*	0.00	0.00	0.00
14.30	0.62	0.65	0.95*	0.00	0.00	0.00
14.35	0.62	0.65	0.95*	0.00	0.00	0.00
14.40	0.62	0.65	0.95*	0.00	0.00	0.00
14.45	0.62	0.65	0.95*	0.00	0.00	0.00
14.50	0.62	0.65	0.95*	0.00	0.00	0.00
14.55	0.62	0.65	0.95*	0.00	0.00	0.00
14.60	0.62	0.66	0.94*	0.00	0.00	0.00
14.65	0.62	0.66	0.94*	0.00	0.00	0.00
14.70	0.62	0.66	0.94*	0.00	0.00	0.00
14.75	0.62	0.66	0.94*	0.00	0.00	0.00
14.80	0.62	0.66	0.94*	0.00	0.00	0.00
14.85	0.62	0.66	0.94*	0.00	0.00	0.00
14.90	0.62	0.66	0.94*	0.00	0.00	0.00
14.95	0.62	0.66	0.94*	0.00	0.00	0.00
15.00	2.00	0.66	5.00	0.00	0.00	0.00
15.05	2.00	0.66	5.00	0.00	0.00	0.00
15.10	2.00	0.66	5.00	0.00	0.00	0.00
15.15	2.00	0.66	5.00	0.00	0.00	0.00
15.20	2.00	0.66	5.00	0.00	0.00	0.00
15.25	2.00	0.66	5.00	0.00	0.00	0.00
15.30	2.00	0.66	5.00	0.00	0.00	0.00
15.35	2.00	0.66	5.00	0.00	0.00	0.00
15.40	2.00	0.66	5.00	0.00	0.00	0.00
15.45	2.00	0.66	5.00	0.00	0.00	0.00
15.50	2.00	0.66	5.00	0.00	0.00	0.00
15.55	2.00	0.66	5.00	0.00	0.00	0.00
15.60	2.00	0.67	5.00	0.00	0.00	0.00
15.65	2.00	0.67	5.00	0.00	0.00	0.00
15.70	2.00	0.67	5.00	0.00	0.00	0.00
15.75	2.00	0.67	5.00	0.00	0.00	0.00
15.80	2.00	0.67	5.00	0.00	0.00	0.00
15.85	2.00	0.67	5.00	0.00	0.00	0.00
15.90	2.00	0.67	5.00	0.00	0.00	0.00
15.95	2.00	0.67	5.00	0.00	0.00	0.00
16.00	2.00	0.67	5.00	0.00	0.00	0.00
16.05	2.00	0.67	5.00	0.00	0.00	0.00
16.10	2.00	0.67	5.00	0.00	0.00	0.00
16.15	2.00	0.67	5.00	0.00	0.00	0.00
16.20	2.00	0.67	5.00	0.00	0.00	0.00
16.25	2.00	0.67	5.00	0.00	0.00	0.00
16.30	2.00	0.67	5.00	0.00	0.00	0.00
16.35	2.00	0.67	5.00	0.00	0.00	0.00
16.40	2.00	0.67	5.00	0.00	0.00	0.00

16.45	2.00	0.67	5.00	0.00	0.00	0.00
16.50	2.00	0.67	5.00	0.00	0.00	0.00
16.55	2.00	0.67	5.00	0.00	0.00	0.00
16.60	2.00	0.67	5.00	0.00	0.00	0.00
16.65	2.00	0.67	5.00	0.00	0.00	0.00
16.70	2.00	0.68	5.00	0.00	0.00	0.00
16.75	2.00	0.68	5.00	0.00	0.00	0.00
16.80	2.00	0.68	5.00	0.00	0.00	0.00
16.85	2.00	0.68	5.00	0.00	0.00	0.00
16.90	2.00	0.68	5.00	0.00	0.00	0.00
16.95	2.00	0.68	5.00	0.00	0.00	0.00
17.00	2.00	0.68	5.00	0.00	0.00	0.00
17.05	2.00	0.68	5.00	0.00	0.00	0.00
17.10	2.00	0.68	5.00	0.00	0.00	0.00
17.15	2.00	0.68	5.00	0.00	0.00	0.00
17.20	2.00	0.68	5.00	0.00	0.00	0.00
17.25	2.00	0.68	5.00	0.00	0.00	0.00
17.30	2.00	0.68	5.00	0.00	0.00	0.00
17.35	2.00	0.68	5.00	0.00	0.00	0.00
17.40	2.00	0.68	5.00	0.00	0.00	0.00
17.45	2.00	0.68	5.00	0.00	0.00	0.00
17.50	2.00	0.68	5.00	0.00	0.00	0.00
17.55	2.00	0.68	5.00	0.00	0.00	0.00
17.60	2.00	0.68	5.00	0.00	0.00	0.00
17.65	2.00	0.68	5.00	0.00	0.00	0.00
17.70	2.00	0.68	5.00	0.00	0.00	0.00
17.75	2.00	0.68	5.00	0.00	0.00	0.00
17.80	2.00	0.68	5.00	0.00	0.00	0.00
17.85	2.00	0.68	5.00	0.00	0.00	0.00
17.90	2.00	0.68	5.00	0.00	0.00	0.00
17.95	2.00	0.68	5.00	0.00	0.00	0.00
18.00	2.00	0.69	5.00	0.00	0.00	0.00
18.05	2.00	0.69	5.00	0.00	0.00	0.00
18.10	2.00	0.69	5.00	0.00	0.00	0.00
18.15	2.00	0.69	5.00	0.00	0.00	0.00
18.20	2.00	0.69	5.00	0.00	0.00	0.00
18.25	2.00	0.69	5.00	0.00	0.00	0.00
18.30	2.00	0.69	5.00	0.00	0.00	0.00
18.35	2.00	0.69	5.00	0.00	0.00	0.00
18.40	2.00	0.69	5.00	0.00	0.00	0.00
18.45	2.00	0.69	5.00	0.00	0.00	0.00
18.50	2.00	0.69	5.00	0.00	0.00	0.00
18.55	2.00	0.69	5.00	0.00	0.00	0.00
18.60	2.00	0.69	5.00	0.00	0.00	0.00
18.65	2.00	0.69	5.00	0.00	0.00	0.00
18.70	2.00	0.69	5.00	0.00	0.00	0.00
18.75	2.00	0.69	5.00	0.00	0.00	0.00
18.80	2.00	0.69	5.00	0.00	0.00	0.00
18.85	2.00	0.69	5.00	0.00	0.00	0.00
18.90	2.00	0.69	5.00	0.00	0.00	0.00

18.95	2.00	0.69	5.00	0.00	0.00	0.00
19.00	2.00	0.69	5.00	0.00	0.00	0.00
19.05	2.00	0.69	5.00	0.00	0.00	0.00
19.10	2.00	0.69	5.00	0.00	0.00	0.00
19.15	2.00	0.69	5.00	0.00	0.00	0.00
19.20	2.00	0.69	5.00	0.00	0.00	0.00
19.25	2.00	0.69	5.00	0.00	0.00	0.00
19.30	2.00	0.69	5.00	0.00	0.00	0.00
19.35	2.00	0.69	5.00	0.00	0.00	0.00
19.40	2.00	0.69	5.00	0.00	0.00	0.00
19.45	2.00	0.69	5.00	0.00	0.00	0.00
19.50	2.00	0.69	5.00	0.00	0.00	0.00
19.55	2.00	0.69	5.00	0.00	0.00	0.00
19.60	2.00	0.70	5.00	0.00	0.00	0.00
19.65	2.00	0.70	5.00	0.00	0.00	0.00
19.70	2.00	0.70	5.00	0.00	0.00	0.00
19.75	2.00	0.70	5.00	0.00	0.00	0.00
19.80	2.00	0.70	5.00	0.00	0.00	0.00
19.85	2.00	0.70	5.00	0.00	0.00	0.00
19.90	2.00	0.70	5.00	0.00	0.00	0.00
19.95	2.00	0.70	5.00	0.00	0.00	0.00
20.00	2.00	0.70	5.00	0.00	0.00	0.00
20.05	2.00	0.70	5.00	0.00	0.00	0.00
20.10	2.00	0.70	5.00	0.00	0.00	0.00
20.15	2.00	0.70	5.00	0.00	0.00	0.00
20.20	2.00	0.70	5.00	0.00	0.00	0.00
20.25	2.00	0.70	5.00	0.00	0.00	0.00
20.30	2.00	0.70	5.00	0.00	0.00	0.00
20.35	2.00	0.70	5.00	0.00	0.00	0.00
20.40	2.00	0.70	5.00	0.00	0.00	0.00
20.45	2.00	0.70	5.00	0.00	0.00	0.00
20.50	2.00	0.70	5.00	0.00	0.00	0.00
20.55	2.00	0.70	5.00	0.00	0.00	0.00
20.60	2.00	0.70	5.00	0.00	0.00	0.00
20.65	2.00	0.70	5.00	0.00	0.00	0.00
20.70	2.00	0.70	5.00	0.00	0.00	0.00
20.75	2.00	0.70	5.00	0.00	0.00	0.00
20.80	2.00	0.70	5.00	0.00	0.00	0.00
20.85	2.00	0.70	5.00	0.00	0.00	0.00
20.90	2.00	0.70	5.00	0.00	0.00	0.00
20.95	2.00	0.70	5.00	0.00	0.00	0.00
21.00	2.00	0.70	5.00	0.00	0.00	0.00
21.05	2.00	0.70	5.00	0.00	0.00	0.00
21.10	2.00	0.70	5.00	0.00	0.00	0.00
21.15	2.00	0.70	5.00	0.00	0.00	0.00
21.20	2.00	0.70	5.00	0.00	0.00	0.00
21.25	2.00	0.70	5.00	0.00	0.00	0.00
21.30	2.00	0.70	5.00	0.00	0.00	0.00
21.35	2.00	0.70	5.00	0.00	0.00	0.00
21.40	2.00	0.70	5.00	0.00	0.00	0.00

21.45	2.00	0.70	5.00	0.00	0.00	0.00
21.50	2.00	0.71	5.00	0.00	0.00	0.00
21.55	2.00	0.71	5.00	0.00	0.00	0.00
21.60	2.00	0.71	5.00	0.00	0.00	0.00
21.65	2.00	0.71	5.00	0.00	0.00	0.00
21.70	2.00	0.71	5.00	0.00	0.00	0.00
21.75	2.00	0.71	5.00	0.00	0.00	0.00
21.80	2.00	0.71	5.00	0.00	0.00	0.00
21.85	2.00	0.71	5.00	0.00	0.00	0.00
21.90	2.00	0.71	5.00	0.00	0.00	0.00
21.95	2.00	0.71	5.00	0.00	0.00	0.00
22.00	2.00	0.71	5.00	0.00	0.00	0.00
22.05	2.00	0.71	5.00	0.00	0.00	0.00
22.10	2.00	0.71	5.00	0.00	0.00	0.00
22.15	2.00	0.71	5.00	0.00	0.00	0.00
22.20	2.00	0.71	5.00	0.00	0.00	0.00
22.25	2.00	0.71	5.00	0.00	0.00	0.00
22.30	2.00	0.71	5.00	0.00	0.00	0.00
22.35	2.00	0.71	5.00	0.00	0.00	0.00
22.40	2.00	0.71	5.00	0.00	0.00	0.00
22.45	2.00	0.71	5.00	0.00	0.00	0.00
22.50	2.00	0.71	5.00	0.00	0.00	0.00
22.55	2.00	0.71	5.00	0.00	0.00	0.00
22.60	2.00	0.71	5.00	0.00	0.00	0.00
22.65	2.00	0.71	5.00	0.00	0.00	0.00
22.70	2.00	0.71	5.00	0.00	0.00	0.00
22.75	2.00	0.71	5.00	0.00	0.00	0.00
22.80	2.00	0.71	5.00	0.00	0.00	0.00
22.85	2.00	0.71	5.00	0.00	0.00	0.00
22.90	2.00	0.71	5.00	0.00	0.00	0.00
22.95	2.00	0.71	5.00	0.00	0.00	0.00
23.00	2.00	0.71	5.00	0.00	0.00	0.00
23.05	2.00	0.71	5.00	0.00	0.00	0.00
23.10	2.00	0.71	5.00	0.00	0.00	0.00
23.15	2.00	0.71	5.00	0.00	0.00	0.00
23.20	2.00	0.71	5.00	0.00	0.00	0.00
23.25	2.00	0.71	5.00	0.00	0.00	0.00
23.30	2.00	0.71	5.00	0.00	0.00	0.00
23.35	2.00	0.71	5.00	0.00	0.00	0.00
23.40	2.00	0.71	5.00	0.00	0.00	0.00
23.45	2.00	0.71	5.00	0.00	0.00	0.00
23.50	2.00	0.71	5.00	0.00	0.00	0.00
23.55	2.00	0.71	5.00	0.00	0.00	0.00
23.60	2.00	0.71	5.00	0.00	0.00	0.00
23.65	2.00	0.71	5.00	0.00	0.00	0.00
23.70	2.00	0.71	5.00	0.00	0.00	0.00
23.75	2.00	0.71	5.00	0.00	0.00	0.00
23.80	2.00	0.71	5.00	0.00	0.00	0.00
23.85	2.00	0.71	5.00	0.00	0.00	0.00
23.90	2.00	0.71	5.00	0.00	0.00	0.00

23.95	2.00	0.71	5.00	0.00	0.00	0.00
24.00	2.00	0.72	5.00	0.00	0.00	0.00
24.05	2.00	0.72	5.00	0.00	0.00	0.00
24.10	2.00	0.72	5.00	0.00	0.00	0.00
24.15	2.00	0.72	5.00	0.00	0.00	0.00
24.20	2.00	0.72	5.00	0.00	0.00	0.00
24.25	2.00	0.72	5.00	0.00	0.00	0.00
24.30	2.00	0.72	5.00	0.00	0.00	0.00
24.35	2.00	0.72	5.00	0.00	0.00	0.00
24.40	2.00	0.72	5.00	0.00	0.00	0.00
24.45	2.00	0.72	5.00	0.00	0.00	0.00
24.50	2.00	0.72	5.00	0.00	0.00	0.00
24.55	2.00	0.72	5.00	0.00	0.00	0.00
24.60	2.00	0.72	5.00	0.00	0.00	0.00
24.65	2.00	0.72	5.00	0.00	0.00	0.00
24.70	2.00	0.72	5.00	0.00	0.00	0.00
24.75	2.00	0.72	5.00	0.00	0.00	0.00
24.80	2.00	0.72	5.00	0.00	0.00	0.00
24.85	2.00	0.72	5.00	0.00	0.00	0.00
24.90	2.00	0.72	5.00	0.00	0.00	0.00
24.95	2.00	0.72	5.00	0.00	0.00	0.00
25.00	2.00	0.72	5.00	0.00	0.00	0.00
25.05	2.00	0.72	5.00	0.00	0.00	0.00
25.10	2.00	0.72	5.00	0.00	0.00	0.00
25.15	2.00	0.72	5.00	0.00	0.00	0.00
25.20	2.00	0.72	5.00	0.00	0.00	0.00
25.25	2.00	0.72	5.00	0.00	0.00	0.00
25.30	2.00	0.72	5.00	0.00	0.00	0.00
25.35	2.00	0.72	5.00	0.00	0.00	0.00
25.40	2.00	0.72	5.00	0.00	0.00	0.00
25.45	2.00	0.72	5.00	0.00	0.00	0.00
25.50	2.00	0.72	5.00	0.00	0.00	0.00
25.55	2.00	0.72	5.00	0.00	0.00	0.00
25.60	2.00	0.72	5.00	0.00	0.00	0.00
25.65	2.00	0.72	5.00	0.00	0.00	0.00
25.70	2.00	0.72	5.00	0.00	0.00	0.00
25.75	2.00	0.72	5.00	0.00	0.00	0.00
25.80	2.00	0.72	5.00	0.00	0.00	0.00
25.85	2.00	0.72	5.00	0.00	0.00	0.00
25.90	2.00	0.72	5.00	0.00	0.00	0.00
25.95	2.00	0.72	5.00	0.00	0.00	0.00
26.00	2.00	0.72	5.00	0.00	0.00	0.00
26.05	2.00	0.72	5.00	0.00	0.00	0.00
26.10	2.00	0.72	5.00	0.00	0.00	0.00
26.15	2.00	0.72	5.00	0.00	0.00	0.00
26.20	2.00	0.72	5.00	0.00	0.00	0.00
26.25	2.00	0.72	5.00	0.00	0.00	0.00
26.30	2.00	0.72	5.00	0.00	0.00	0.00
26.35	2.00	0.72	5.00	0.00	0.00	0.00
26.40	2.00	0.72	5.00	0.00	0.00	0.00

26.45	2.00	0.72	5.00	0.00	0.00	0.00
26.50	2.00	0.72	5.00	0.00	0.00	0.00
26.55	2.00	0.72	5.00	0.00	0.00	0.00
26.60	2.00	0.72	5.00	0.00	0.00	0.00
26.65	2.00	0.72	5.00	0.00	0.00	0.00
26.70	2.00	0.72	5.00	0.00	0.00	0.00
26.75	2.00	0.72	5.00	0.00	0.00	0.00
26.80	2.00	0.72	5.00	0.00	0.00	0.00
26.85	2.00	0.72	5.00	0.00	0.00	0.00
26.90	2.00	0.72	5.00	0.00	0.00	0.00
26.95	2.00	0.72	5.00	0.00	0.00	0.00
27.00	2.00	0.72	5.00	0.00	0.00	0.00
27.05	2.00	0.72	5.00	0.00	0.00	0.00
27.10	2.00	0.72	5.00	0.00	0.00	0.00
27.15	2.00	0.72	5.00	0.00	0.00	0.00
27.20	2.00	0.72	5.00	0.00	0.00	0.00
27.25	2.00	0.72	5.00	0.00	0.00	0.00
27.30	2.00	0.72	5.00	0.00	0.00	0.00
27.35	2.00	0.72	5.00	0.00	0.00	0.00
27.40	2.00	0.72	5.00	0.00	0.00	0.00
27.45	2.00	0.72	5.00	0.00	0.00	0.00
27.50	2.00	0.73	5.00	0.00	0.00	0.00
27.55	2.00	0.73	5.00	0.00	0.00	0.00
27.60	2.00	0.73	5.00	0.00	0.00	0.00
27.65	2.00	0.73	5.00	0.00	0.00	0.00
27.70	2.00	0.73	5.00	0.00	0.00	0.00
27.75	2.00	0.73	5.00	0.00	0.00	0.00
27.80	2.00	0.73	5.00	0.00	0.00	0.00
27.85	2.00	0.73	5.00	0.00	0.00	0.00
27.90	2.00	0.73	5.00	0.00	0.00	0.00
27.95	2.00	0.73	5.00	0.00	0.00	0.00
28.00	2.00	0.73	5.00	0.00	0.00	0.00
28.05	2.00	0.73	5.00	0.00	0.00	0.00
28.10	2.00	0.73	5.00	0.00	0.00	0.00
28.15	2.00	0.73	5.00	0.00	0.00	0.00
28.20	2.00	0.73	5.00	0.00	0.00	0.00
28.25	2.00	0.73	5.00	0.00	0.00	0.00
28.30	2.00	0.73	5.00	0.00	0.00	0.00
28.35	2.00	0.73	5.00	0.00	0.00	0.00
28.40	2.00	0.73	5.00	0.00	0.00	0.00
28.45	2.00	0.73	5.00	0.00	0.00	0.00
28.50	2.00	0.73	5.00	0.00	0.00	0.00
28.55	2.00	0.73	5.00	0.00	0.00	0.00
28.60	2.00	0.73	5.00	0.00	0.00	0.00
28.65	2.00	0.73	5.00	0.00	0.00	0.00
28.70	2.00	0.73	5.00	0.00	0.00	0.00
28.75	2.00	0.73	5.00	0.00	0.00	0.00
28.80	2.00	0.73	5.00	0.00	0.00	0.00
28.85	2.00	0.73	5.00	0.00	0.00	0.00
28.90	2.00	0.73	5.00	0.00	0.00	0.00

28.95	2.00	0.73	5.00	0.00	0.00	0.00
29.00	2.00	0.73	5.00	0.00	0.00	0.00
29.05	2.00	0.73	5.00	0.00	0.00	0.00
29.10	2.00	0.73	5.00	0.00	0.00	0.00
29.15	2.00	0.73	5.00	0.00	0.00	0.00
29.20	2.00	0.73	5.00	0.00	0.00	0.00
29.25	2.00	0.73	5.00	0.00	0.00	0.00
29.30	2.00	0.73	5.00	0.00	0.00	0.00
29.35	2.00	0.73	5.00	0.00	0.00	0.00
29.40	2.00	0.73	5.00	0.00	0.00	0.00
29.45	2.00	0.73	5.00	0.00	0.00	0.00
29.50	2.00	0.73	5.00	0.00	0.00	0.00
29.55	2.00	0.73	5.00	0.00	0.00	0.00
29.60	2.00	0.73	5.00	0.00	0.00	0.00
29.65	2.00	0.73	5.00	0.00	0.00	0.00
29.70	2.00	0.73	5.00	0.00	0.00	0.00
29.75	2.00	0.73	5.00	0.00	0.00	0.00
29.80	2.00	0.73	5.00	0.00	0.00	0.00
29.85	2.00	0.73	5.00	0.00	0.00	0.00
29.90	2.00	0.73	5.00	0.00	0.00	0.00
29.95	2.00	0.73	5.00	0.00	0.00	0.00
30.00	2.00	0.73	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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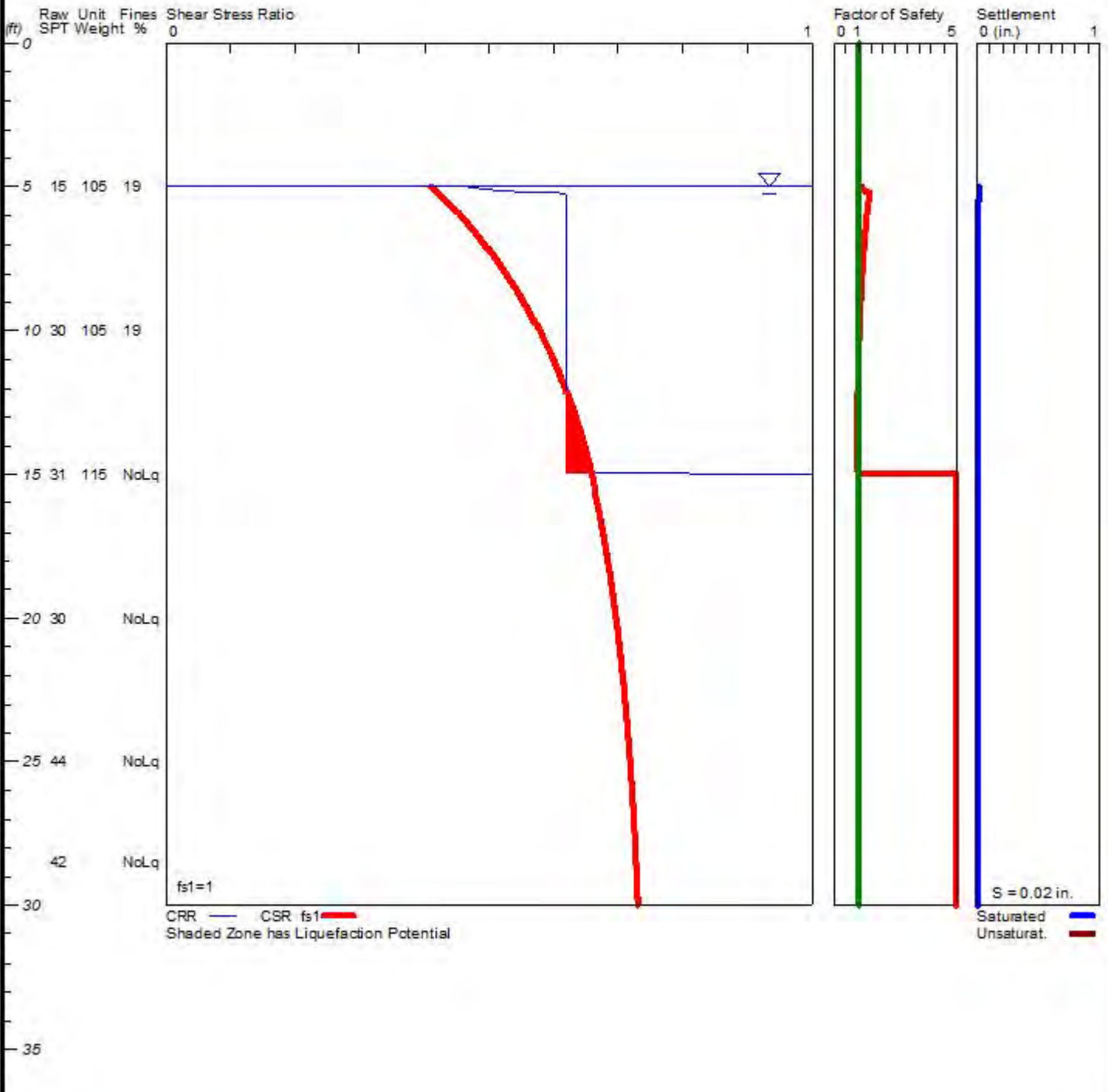
1 atm (atmosphere) = 1 tsf (ton/ft²)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with
user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

LIQUEFACTION ANALYSIS

Federal Boulevard Dechannelization and Trail Proje

Hole No.=B-5 Water Depth=5 ft Surface Elev.=96

Magnitude=6.9
Acceleration=0.64g



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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: G:\File Share\CMK.temp\Projects\109052001 Federal Blvd
Dechannelization\Engineering\B-5.liq
Title: Federal Boulevard Dechannelization and Trail Proje
Subtitle: 109052001

Surface Elev.=96
Hole No.=B-5
Depth of Hole= 30.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 5.00 ft
Max. Acceleration= 0.64 g
Earthquake Magnitude= 6.90

Input Data:

Surface Elev.=96
Hole No.=B-5
Depth of Hole=30.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 5.00 ft
Max. Acceleration=0.64 g
Earthquake Magnitude=6.90
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
 2. Settlement Analysis Method: Ishihara / Yoshimine
 3. Fines Correction for Liquefaction: Idriss/Seed
 4. Fine Correction for Settlement: During Liquefaction*
 5. Settlement Calculation in: All zones*
 6. Hammer Energy Ratio, Ce = 1.25
 7. Borehole Diameter, Cb= 1
 8. Sampling Method, Cs= 1
 9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
 10. Use Curve Smoothing: Yes*
- * Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
5.00	15.00	105.00	19.00
10.00	30.00	105.00	19.00
15.00	31.00	115.00	NoLiq
20.00	30.00	115.00	NoLiq
25.00	44.00	115.00	NoLiq
28.50	42.00	115.00	NoLiq

Output Results:

Settlement of Saturated Sands=0.02 in.

Settlement of Unsaturated Sands=0.00 in.

Total Settlement of Saturated and Unsaturated Sands=0.02 in.

Differential Settlement=0.008 to 0.010 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
5.00	0.47	0.41	1.14	0.02	0.00	0.02
5.05	0.48	0.41	1.17	0.01	0.00	0.01
5.10	0.50	0.42	1.21	0.01	0.00	0.01
5.15	0.54	0.42	1.28	0.01	0.00	0.01
5.20	0.61	0.42	1.44	0.01	0.00	0.01
5.25	0.62	0.42	1.46	0.01	0.00	0.01
5.30	0.62	0.43	1.46	0.01	0.00	0.01
5.35	0.62	0.43	1.45	0.01	0.00	0.01
5.40	0.62	0.43	1.44	0.00	0.00	0.00
5.45	0.62	0.43	1.43	0.00	0.00	0.00
5.50	0.62	0.43	1.43	0.00	0.00	0.00
5.55	0.62	0.44	1.42	0.00	0.00	0.00
5.60	0.62	0.44	1.41	0.00	0.00	0.00
5.65	0.62	0.44	1.40	0.00	0.00	0.00
5.70	0.62	0.44	1.40	0.00	0.00	0.00
5.75	0.62	0.44	1.39	0.00	0.00	0.00
5.80	0.62	0.45	1.38	0.00	0.00	0.00
5.85	0.62	0.45	1.38	0.00	0.00	0.00
5.90	0.62	0.45	1.37	0.00	0.00	0.00
5.95	0.62	0.45	1.37	0.00	0.00	0.00
6.00	0.62	0.46	1.36	0.00	0.00	0.00
6.05	0.62	0.46	1.35	0.00	0.00	0.00
6.10	0.62	0.46	1.35	0.00	0.00	0.00
6.15	0.62	0.46	1.34	0.00	0.00	0.00
6.20	0.62	0.46	1.34	0.00	0.00	0.00
6.25	0.62	0.47	1.33	0.00	0.00	0.00
6.30	0.62	0.47	1.32	0.00	0.00	0.00
6.35	0.62	0.47	1.32	0.00	0.00	0.00
6.40	0.62	0.47	1.31	0.00	0.00	0.00
6.45	0.62	0.47	1.31	0.00	0.00	0.00

6.50	0.62	0.47	1.30	0.00	0.00	0.00
6.55	0.62	0.48	1.30	0.00	0.00	0.00
6.60	0.62	0.48	1.29	0.00	0.00	0.00
6.65	0.62	0.48	1.29	0.00	0.00	0.00
6.70	0.62	0.48	1.28	0.00	0.00	0.00
6.75	0.62	0.48	1.28	0.00	0.00	0.00
6.80	0.62	0.49	1.27	0.00	0.00	0.00
6.85	0.62	0.49	1.27	0.00	0.00	0.00
6.90	0.62	0.49	1.26	0.00	0.00	0.00
6.95	0.62	0.49	1.26	0.00	0.00	0.00
7.00	0.62	0.49	1.26	0.00	0.00	0.00
7.05	0.62	0.49	1.25	0.00	0.00	0.00
7.10	0.62	0.50	1.25	0.00	0.00	0.00
7.15	0.62	0.50	1.24	0.00	0.00	0.00
7.20	0.62	0.50	1.24	0.00	0.00	0.00
7.25	0.62	0.50	1.23	0.00	0.00	0.00
7.30	0.62	0.50	1.23	0.00	0.00	0.00
7.35	0.62	0.50	1.23	0.00	0.00	0.00
7.40	0.62	0.51	1.22	0.00	0.00	0.00
7.45	0.62	0.51	1.22	0.00	0.00	0.00
7.50	0.62	0.51	1.21	0.00	0.00	0.00
7.55	0.62	0.51	1.21	0.00	0.00	0.00
7.60	0.62	0.51	1.21	0.00	0.00	0.00
7.65	0.62	0.51	1.20	0.00	0.00	0.00
7.70	0.62	0.52	1.20	0.00	0.00	0.00
7.75	0.62	0.52	1.20	0.00	0.00	0.00
7.80	0.62	0.52	1.19	0.00	0.00	0.00
7.85	0.62	0.52	1.19	0.00	0.00	0.00
7.90	0.62	0.52	1.18	0.00	0.00	0.00
7.95	0.62	0.52	1.18	0.00	0.00	0.00
8.00	0.62	0.53	1.18	0.00	0.00	0.00
8.05	0.62	0.53	1.17	0.00	0.00	0.00
8.10	0.62	0.53	1.17	0.00	0.00	0.00
8.15	0.62	0.53	1.17	0.00	0.00	0.00
8.20	0.62	0.53	1.16	0.00	0.00	0.00
8.25	0.62	0.53	1.16	0.00	0.00	0.00
8.30	0.62	0.53	1.16	0.00	0.00	0.00
8.35	0.62	0.54	1.16	0.00	0.00	0.00
8.40	0.62	0.54	1.15	0.00	0.00	0.00
8.45	0.62	0.54	1.15	0.00	0.00	0.00
8.50	0.62	0.54	1.15	0.00	0.00	0.00
8.55	0.62	0.54	1.14	0.00	0.00	0.00
8.60	0.62	0.54	1.14	0.00	0.00	0.00
8.65	0.62	0.54	1.14	0.00	0.00	0.00
8.70	0.62	0.55	1.13	0.00	0.00	0.00
8.75	0.62	0.55	1.13	0.00	0.00	0.00
8.80	0.62	0.55	1.13	0.00	0.00	0.00
8.85	0.62	0.55	1.13	0.00	0.00	0.00
8.90	0.62	0.55	1.12	0.00	0.00	0.00
8.95	0.62	0.55	1.12	0.00	0.00	0.00

9.00	0.62	0.55	1.12	0.00	0.00	0.00
9.05	0.62	0.55	1.12	0.00	0.00	0.00
9.10	0.62	0.56	1.11	0.00	0.00	0.00
9.15	0.62	0.56	1.11	0.00	0.00	0.00
9.20	0.62	0.56	1.11	0.00	0.00	0.00
9.25	0.62	0.56	1.11	0.00	0.00	0.00
9.30	0.62	0.56	1.10	0.00	0.00	0.00
9.35	0.62	0.56	1.10	0.00	0.00	0.00
9.40	0.62	0.56	1.10	0.00	0.00	0.00
9.45	0.62	0.56	1.10	0.00	0.00	0.00
9.50	0.62	0.57	1.09	0.00	0.00	0.00
9.55	0.62	0.57	1.09	0.00	0.00	0.00
9.60	0.62	0.57	1.09	0.00	0.00	0.00
9.65	0.62	0.57	1.09	0.00	0.00	0.00
9.70	0.62	0.57	1.08	0.00	0.00	0.00
9.75	0.62	0.57	1.08	0.00	0.00	0.00
9.80	0.62	0.57	1.08	0.00	0.00	0.00
9.85	0.62	0.57	1.08	0.00	0.00	0.00
9.90	0.62	0.58	1.07	0.00	0.00	0.00
9.95	0.62	0.58	1.07	0.00	0.00	0.00
10.00	0.62	0.58	1.07	0.00	0.00	0.00
10.05	0.62	0.58	1.07	0.00	0.00	0.00
10.10	0.62	0.58	1.07	0.00	0.00	0.00
10.15	0.62	0.58	1.06	0.00	0.00	0.00
10.20	0.62	0.58	1.06	0.00	0.00	0.00
10.25	0.62	0.58	1.06	0.00	0.00	0.00
10.30	0.62	0.58	1.06	0.00	0.00	0.00
10.35	0.62	0.59	1.06	0.00	0.00	0.00
10.40	0.62	0.59	1.05	0.00	0.00	0.00
10.45	0.62	0.59	1.05	0.00	0.00	0.00
10.50	0.62	0.59	1.05	0.00	0.00	0.00
10.55	0.62	0.59	1.05	0.00	0.00	0.00
10.60	0.62	0.59	1.05	0.00	0.00	0.00
10.65	0.62	0.59	1.04	0.00	0.00	0.00
10.70	0.62	0.59	1.04	0.00	0.00	0.00
10.75	0.62	0.59	1.04	0.00	0.00	0.00
10.80	0.62	0.60	1.04	0.00	0.00	0.00
10.85	0.62	0.60	1.04	0.00	0.00	0.00
10.90	0.62	0.60	1.04	0.00	0.00	0.00
10.95	0.62	0.60	1.03	0.00	0.00	0.00
11.00	0.62	0.60	1.03	0.00	0.00	0.00
11.05	0.62	0.60	1.03	0.00	0.00	0.00
11.10	0.62	0.60	1.03	0.00	0.00	0.00
11.15	0.62	0.60	1.03	0.00	0.00	0.00
11.20	0.62	0.60	1.03	0.00	0.00	0.00
11.25	0.62	0.60	1.02	0.00	0.00	0.00
11.30	0.62	0.61	1.02	0.00	0.00	0.00
11.35	0.62	0.61	1.02	0.00	0.00	0.00
11.40	0.62	0.61	1.02	0.00	0.00	0.00
11.45	0.62	0.61	1.02	0.00	0.00	0.00

11.50	0.62	0.61	1.02	0.00	0.00	0.00
11.55	0.62	0.61	1.01	0.00	0.00	0.00
11.60	0.62	0.61	1.01	0.00	0.00	0.00
11.65	0.62	0.61	1.01	0.00	0.00	0.00
11.70	0.62	0.61	1.01	0.00	0.00	0.00
11.75	0.62	0.61	1.01	0.00	0.00	0.00
11.80	0.62	0.61	1.01	0.00	0.00	0.00
11.85	0.62	0.62	1.01	0.00	0.00	0.00
11.90	0.62	0.62	1.00	0.00	0.00	0.00
11.95	0.62	0.62	1.00	0.00	0.00	0.00
12.00	0.62	0.62	1.00	0.00	0.00	0.00
12.05	0.62	0.62	1.00*	0.00	0.00	0.00
12.10	0.62	0.62	1.00*	0.00	0.00	0.00
12.15	0.62	0.62	1.00*	0.00	0.00	0.00
12.20	0.62	0.62	1.00*	0.00	0.00	0.00
12.25	0.62	0.62	0.99*	0.00	0.00	0.00
12.30	0.62	0.62	0.99*	0.00	0.00	0.00
12.35	0.62	0.62	0.99*	0.00	0.00	0.00
12.40	0.62	0.62	0.99*	0.00	0.00	0.00
12.45	0.62	0.63	0.99*	0.00	0.00	0.00
12.50	0.62	0.63	0.99*	0.00	0.00	0.00
12.55	0.62	0.63	0.99*	0.00	0.00	0.00
12.60	0.62	0.63	0.99*	0.00	0.00	0.00
12.65	0.62	0.63	0.98*	0.00	0.00	0.00
12.70	0.62	0.63	0.98*	0.00	0.00	0.00
12.75	0.62	0.63	0.98*	0.00	0.00	0.00
12.80	0.62	0.63	0.98*	0.00	0.00	0.00
12.85	0.62	0.63	0.98*	0.00	0.00	0.00
12.90	0.62	0.63	0.98*	0.00	0.00	0.00
12.95	0.62	0.63	0.98*	0.00	0.00	0.00
13.00	0.62	0.63	0.98*	0.00	0.00	0.00
13.05	0.62	0.63	0.98*	0.00	0.00	0.00
13.10	0.62	0.64	0.97*	0.00	0.00	0.00
13.15	0.62	0.64	0.97*	0.00	0.00	0.00
13.20	0.62	0.64	0.97*	0.00	0.00	0.00
13.25	0.62	0.64	0.97*	0.00	0.00	0.00
13.30	0.62	0.64	0.97*	0.00	0.00	0.00
13.35	0.62	0.64	0.97*	0.00	0.00	0.00
13.40	0.62	0.64	0.97*	0.00	0.00	0.00
13.45	0.62	0.64	0.97*	0.00	0.00	0.00
13.50	0.62	0.64	0.97*	0.00	0.00	0.00
13.55	0.62	0.64	0.96*	0.00	0.00	0.00
13.60	0.62	0.64	0.96*	0.00	0.00	0.00
13.65	0.62	0.64	0.96*	0.00	0.00	0.00
13.70	0.62	0.64	0.96*	0.00	0.00	0.00
13.75	0.62	0.64	0.96*	0.00	0.00	0.00
13.80	0.62	0.64	0.96*	0.00	0.00	0.00
13.85	0.62	0.65	0.96*	0.00	0.00	0.00
13.90	0.62	0.65	0.96*	0.00	0.00	0.00
13.95	0.62	0.65	0.96*	0.00	0.00	0.00

14.00	0.62	0.65	0.96*	0.00	0.00	0.00
14.05	0.62	0.65	0.96*	0.00	0.00	0.00
14.10	0.62	0.65	0.95*	0.00	0.00	0.00
14.15	0.62	0.65	0.95*	0.00	0.00	0.00
14.20	0.62	0.65	0.95*	0.00	0.00	0.00
14.25	0.62	0.65	0.95*	0.00	0.00	0.00
14.30	0.62	0.65	0.95*	0.00	0.00	0.00
14.35	0.62	0.65	0.95*	0.00	0.00	0.00
14.40	0.62	0.65	0.95*	0.00	0.00	0.00
14.45	0.62	0.65	0.95*	0.00	0.00	0.00
14.50	0.62	0.65	0.95*	0.00	0.00	0.00
14.55	0.62	0.65	0.95*	0.00	0.00	0.00
14.60	0.62	0.65	0.95*	0.00	0.00	0.00
14.65	0.62	0.65	0.95*	0.00	0.00	0.00
14.70	0.62	0.66	0.94*	0.00	0.00	0.00
14.75	0.62	0.66	0.94*	0.00	0.00	0.00
14.80	0.62	0.66	0.94*	0.00	0.00	0.00
14.85	0.62	0.66	0.94*	0.00	0.00	0.00
14.90	0.62	0.66	0.94*	0.00	0.00	0.00
14.95	0.62	0.66	0.94*	0.00	0.00	0.00
15.00	2.00	0.66	5.00	0.00	0.00	0.00
15.05	2.00	0.66	5.00	0.00	0.00	0.00
15.10	2.00	0.66	5.00	0.00	0.00	0.00
15.15	2.00	0.66	5.00	0.00	0.00	0.00
15.20	2.00	0.66	5.00	0.00	0.00	0.00
15.25	2.00	0.66	5.00	0.00	0.00	0.00
15.30	2.00	0.66	5.00	0.00	0.00	0.00
15.35	2.00	0.66	5.00	0.00	0.00	0.00
15.40	2.00	0.66	5.00	0.00	0.00	0.00
15.45	2.00	0.66	5.00	0.00	0.00	0.00
15.50	2.00	0.66	5.00	0.00	0.00	0.00
15.55	2.00	0.66	5.00	0.00	0.00	0.00
15.60	2.00	0.66	5.00	0.00	0.00	0.00
15.65	2.00	0.66	5.00	0.00	0.00	0.00
15.70	2.00	0.67	5.00	0.00	0.00	0.00
15.75	2.00	0.67	5.00	0.00	0.00	0.00
15.80	2.00	0.67	5.00	0.00	0.00	0.00
15.85	2.00	0.67	5.00	0.00	0.00	0.00
15.90	2.00	0.67	5.00	0.00	0.00	0.00
15.95	2.00	0.67	5.00	0.00	0.00	0.00
16.00	2.00	0.67	5.00	0.00	0.00	0.00
16.05	2.00	0.67	5.00	0.00	0.00	0.00
16.10	2.00	0.67	5.00	0.00	0.00	0.00
16.15	2.00	0.67	5.00	0.00	0.00	0.00
16.20	2.00	0.67	5.00	0.00	0.00	0.00
16.25	2.00	0.67	5.00	0.00	0.00	0.00
16.30	2.00	0.67	5.00	0.00	0.00	0.00
16.35	2.00	0.67	5.00	0.00	0.00	0.00
16.40	2.00	0.67	5.00	0.00	0.00	0.00
16.45	2.00	0.67	5.00	0.00	0.00	0.00

16.50	2.00	0.67	5.00	0.00	0.00	0.00
16.55	2.00	0.67	5.00	0.00	0.00	0.00
16.60	2.00	0.67	5.00	0.00	0.00	0.00
16.65	2.00	0.67	5.00	0.00	0.00	0.00
16.70	2.00	0.67	5.00	0.00	0.00	0.00
16.75	2.00	0.67	5.00	0.00	0.00	0.00
16.80	2.00	0.67	5.00	0.00	0.00	0.00
16.85	2.00	0.68	5.00	0.00	0.00	0.00
16.90	2.00	0.68	5.00	0.00	0.00	0.00
16.95	2.00	0.68	5.00	0.00	0.00	0.00
17.00	2.00	0.68	5.00	0.00	0.00	0.00
17.05	2.00	0.68	5.00	0.00	0.00	0.00
17.10	2.00	0.68	5.00	0.00	0.00	0.00
17.15	2.00	0.68	5.00	0.00	0.00	0.00
17.20	2.00	0.68	5.00	0.00	0.00	0.00
17.25	2.00	0.68	5.00	0.00	0.00	0.00
17.30	2.00	0.68	5.00	0.00	0.00	0.00
17.35	2.00	0.68	5.00	0.00	0.00	0.00
17.40	2.00	0.68	5.00	0.00	0.00	0.00
17.45	2.00	0.68	5.00	0.00	0.00	0.00
17.50	2.00	0.68	5.00	0.00	0.00	0.00
17.55	2.00	0.68	5.00	0.00	0.00	0.00
17.60	2.00	0.68	5.00	0.00	0.00	0.00
17.65	2.00	0.68	5.00	0.00	0.00	0.00
17.70	2.00	0.68	5.00	0.00	0.00	0.00
17.75	2.00	0.68	5.00	0.00	0.00	0.00
17.80	2.00	0.68	5.00	0.00	0.00	0.00
17.85	2.00	0.68	5.00	0.00	0.00	0.00
17.90	2.00	0.68	5.00	0.00	0.00	0.00
17.95	2.00	0.68	5.00	0.00	0.00	0.00
18.00	2.00	0.68	5.00	0.00	0.00	0.00
18.05	2.00	0.68	5.00	0.00	0.00	0.00
18.10	2.00	0.68	5.00	0.00	0.00	0.00
18.15	2.00	0.68	5.00	0.00	0.00	0.00
18.20	2.00	0.69	5.00	0.00	0.00	0.00
18.25	2.00	0.69	5.00	0.00	0.00	0.00
18.30	2.00	0.69	5.00	0.00	0.00	0.00
18.35	2.00	0.69	5.00	0.00	0.00	0.00
18.40	2.00	0.69	5.00	0.00	0.00	0.00
18.45	2.00	0.69	5.00	0.00	0.00	0.00
18.50	2.00	0.69	5.00	0.00	0.00	0.00
18.55	2.00	0.69	5.00	0.00	0.00	0.00
18.60	2.00	0.69	5.00	0.00	0.00	0.00
18.65	2.00	0.69	5.00	0.00	0.00	0.00
18.70	2.00	0.69	5.00	0.00	0.00	0.00
18.75	2.00	0.69	5.00	0.00	0.00	0.00
18.80	2.00	0.69	5.00	0.00	0.00	0.00
18.85	2.00	0.69	5.00	0.00	0.00	0.00
18.90	2.00	0.69	5.00	0.00	0.00	0.00
18.95	2.00	0.69	5.00	0.00	0.00	0.00

19.00	2.00	0.69	5.00	0.00	0.00	0.00
19.05	2.00	0.69	5.00	0.00	0.00	0.00
19.10	2.00	0.69	5.00	0.00	0.00	0.00
19.15	2.00	0.69	5.00	0.00	0.00	0.00
19.20	2.00	0.69	5.00	0.00	0.00	0.00
19.25	2.00	0.69	5.00	0.00	0.00	0.00
19.30	2.00	0.69	5.00	0.00	0.00	0.00
19.35	2.00	0.69	5.00	0.00	0.00	0.00
19.40	2.00	0.69	5.00	0.00	0.00	0.00
19.45	2.00	0.69	5.00	0.00	0.00	0.00
19.50	2.00	0.69	5.00	0.00	0.00	0.00
19.55	2.00	0.69	5.00	0.00	0.00	0.00
19.60	2.00	0.69	5.00	0.00	0.00	0.00
19.65	2.00	0.69	5.00	0.00	0.00	0.00
19.70	2.00	0.69	5.00	0.00	0.00	0.00
19.75	2.00	0.69	5.00	0.00	0.00	0.00
19.80	2.00	0.70	5.00	0.00	0.00	0.00
19.85	2.00	0.70	5.00	0.00	0.00	0.00
19.90	2.00	0.70	5.00	0.00	0.00	0.00
19.95	2.00	0.70	5.00	0.00	0.00	0.00
20.00	2.00	0.70	5.00	0.00	0.00	0.00
20.05	2.00	0.70	5.00	0.00	0.00	0.00
20.10	2.00	0.70	5.00	0.00	0.00	0.00
20.15	2.00	0.70	5.00	0.00	0.00	0.00
20.20	2.00	0.70	5.00	0.00	0.00	0.00
20.25	2.00	0.70	5.00	0.00	0.00	0.00
20.30	2.00	0.70	5.00	0.00	0.00	0.00
20.35	2.00	0.70	5.00	0.00	0.00	0.00
20.40	2.00	0.70	5.00	0.00	0.00	0.00
20.45	2.00	0.70	5.00	0.00	0.00	0.00
20.50	2.00	0.70	5.00	0.00	0.00	0.00
20.55	2.00	0.70	5.00	0.00	0.00	0.00
20.60	2.00	0.70	5.00	0.00	0.00	0.00
20.65	2.00	0.70	5.00	0.00	0.00	0.00
20.70	2.00	0.70	5.00	0.00	0.00	0.00
20.75	2.00	0.70	5.00	0.00	0.00	0.00
20.80	2.00	0.70	5.00	0.00	0.00	0.00
20.85	2.00	0.70	5.00	0.00	0.00	0.00
20.90	2.00	0.70	5.00	0.00	0.00	0.00
20.95	2.00	0.70	5.00	0.00	0.00	0.00
21.00	2.00	0.70	5.00	0.00	0.00	0.00
21.05	2.00	0.70	5.00	0.00	0.00	0.00
21.10	2.00	0.70	5.00	0.00	0.00	0.00
21.15	2.00	0.70	5.00	0.00	0.00	0.00
21.20	2.00	0.70	5.00	0.00	0.00	0.00
21.25	2.00	0.70	5.00	0.00	0.00	0.00
21.30	2.00	0.70	5.00	0.00	0.00	0.00
21.35	2.00	0.70	5.00	0.00	0.00	0.00
21.40	2.00	0.70	5.00	0.00	0.00	0.00
21.45	2.00	0.70	5.00	0.00	0.00	0.00

29.00	2.00	0.73	5.00	0.00	0.00	0.00
29.05	2.00	0.73	5.00	0.00	0.00	0.00
29.10	2.00	0.73	5.00	0.00	0.00	0.00
29.15	2.00	0.73	5.00	0.00	0.00	0.00
29.20	2.00	0.73	5.00	0.00	0.00	0.00
29.25	2.00	0.73	5.00	0.00	0.00	0.00
29.30	2.00	0.73	5.00	0.00	0.00	0.00
29.35	2.00	0.73	5.00	0.00	0.00	0.00
29.40	2.00	0.73	5.00	0.00	0.00	0.00
29.45	2.00	0.73	5.00	0.00	0.00	0.00
29.50	2.00	0.73	5.00	0.00	0.00	0.00
29.55	2.00	0.73	5.00	0.00	0.00	0.00
29.60	2.00	0.73	5.00	0.00	0.00	0.00
29.65	2.00	0.73	5.00	0.00	0.00	0.00
29.70	2.00	0.73	5.00	0.00	0.00	0.00
29.75	2.00	0.73	5.00	0.00	0.00	0.00
29.80	2.00	0.73	5.00	0.00	0.00	0.00
29.85	2.00	0.73	5.00	0.00	0.00	0.00
29.90	2.00	0.73	5.00	0.00	0.00	0.00
29.95	2.00	0.73	5.00	0.00	0.00	0.00
30.00	2.00	0.73	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

—

1 atm (atmosphere) = 1 tsf (ton/ft²)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with
user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils



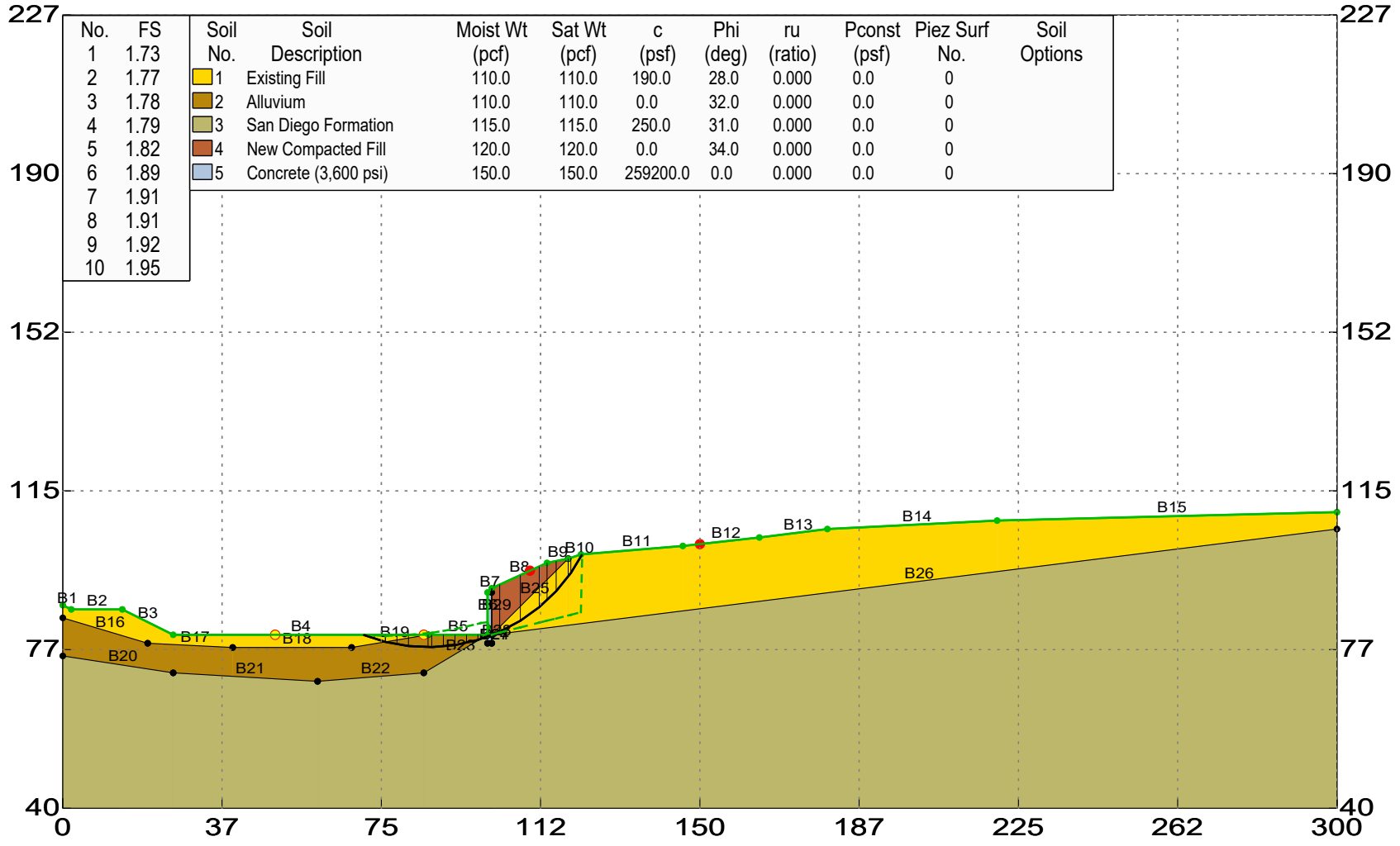
APPENDIX D

Slope Stability Analysis

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT 109052001 (STATIC - FINISHED CONDITION AT SECTION A-A')

NINYO & MOORE - CMK

\109052001 A-A' Proposed Retaining Wall.gsd



GEOSTASE FS = 1.73

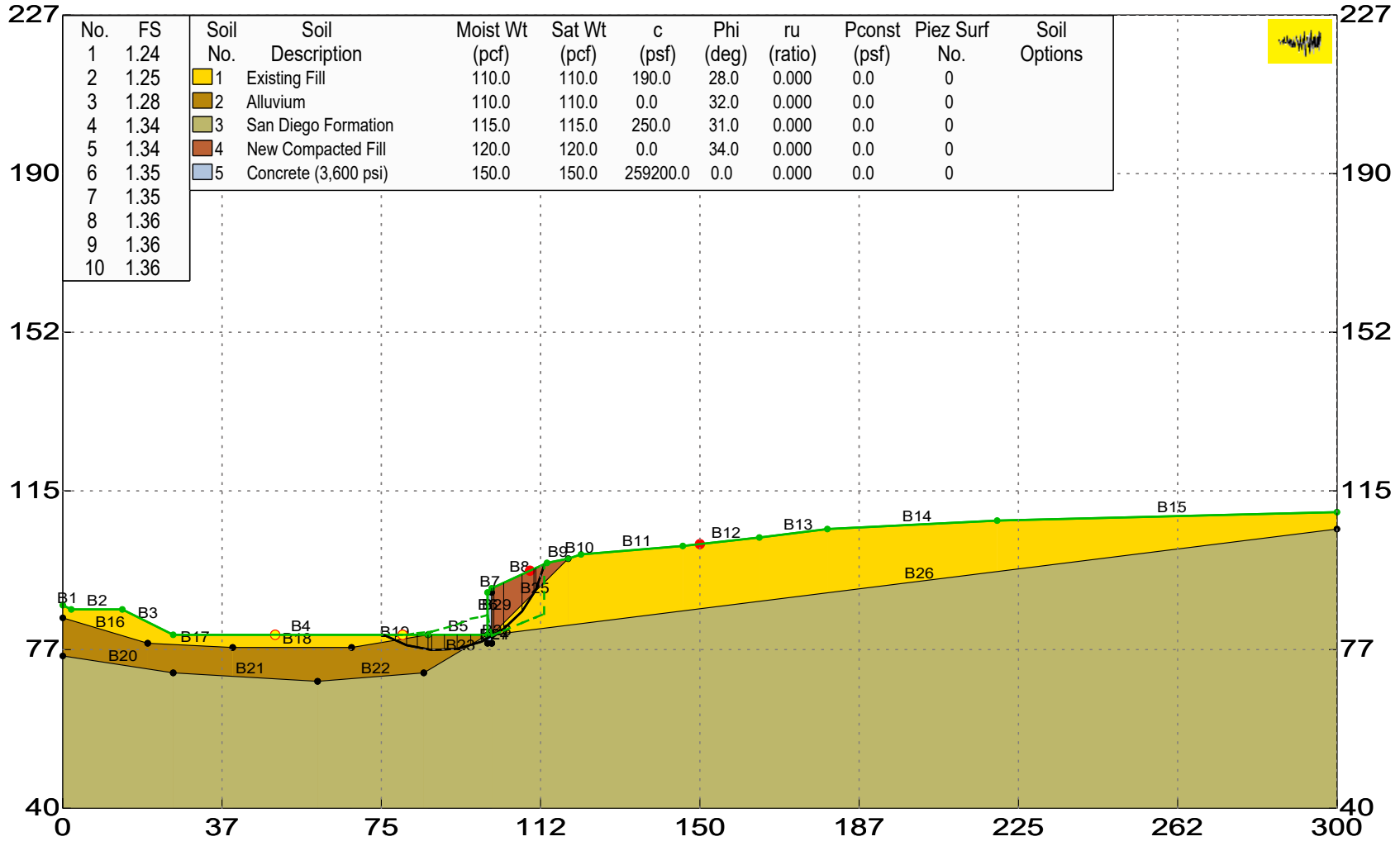
Spencer Method



FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT 109052001 (SEISMIC - FINISHED CONDITION AT SECTION A-A')

NINYO & MOORE - CMK

\109052001 A-A' Proposed Retaining Wall PsuedoStatic.gsd



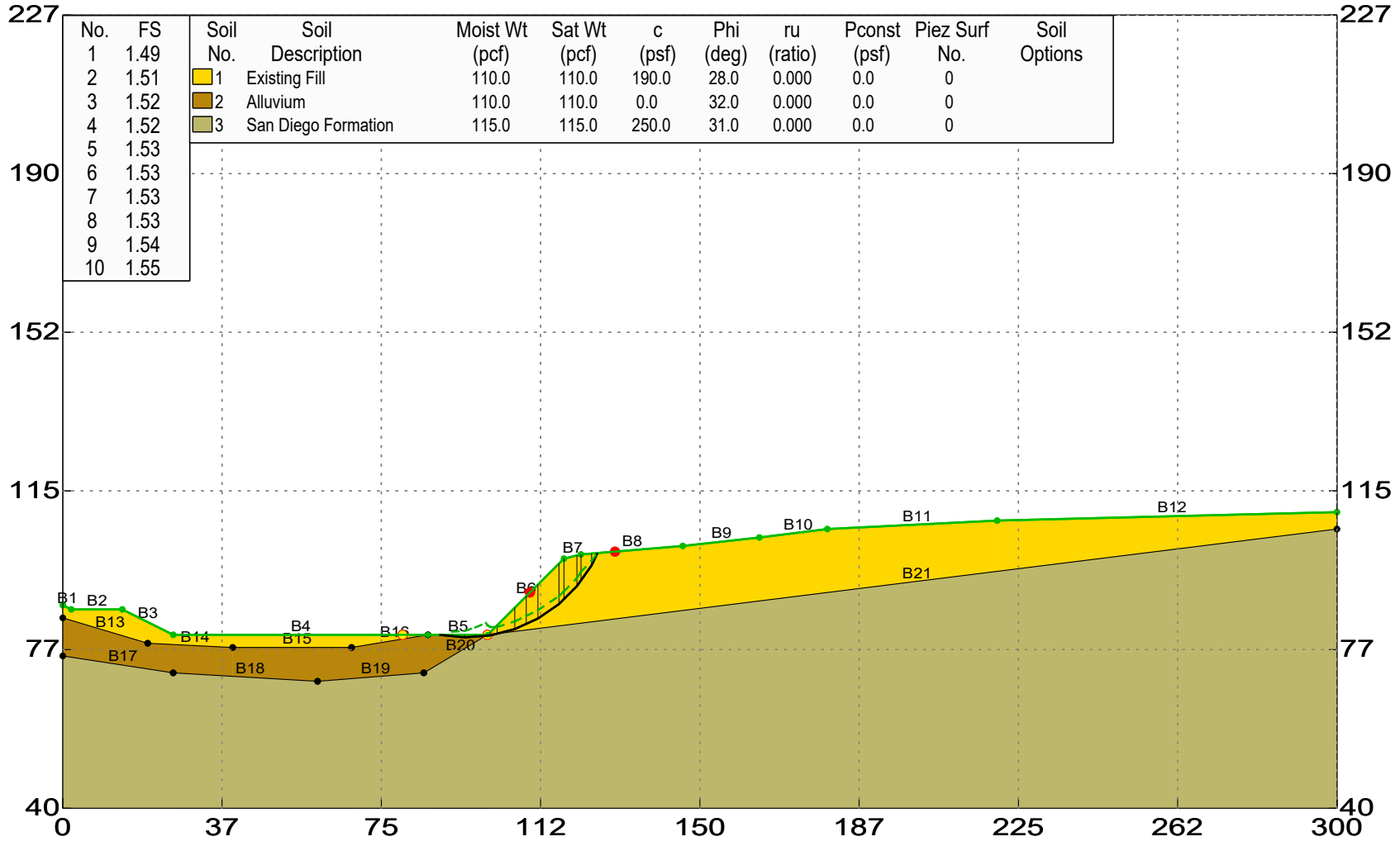
GEOSTASE FS = 1.24

Spencer Method

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT 109052001 (TEMPORARY 1:1 BACKCUT AT SECTION A-A')

NINYO & MOORE - CMK

\\109052001 A-A' Temporary.gsd



GEOSTASE FS = 1.49

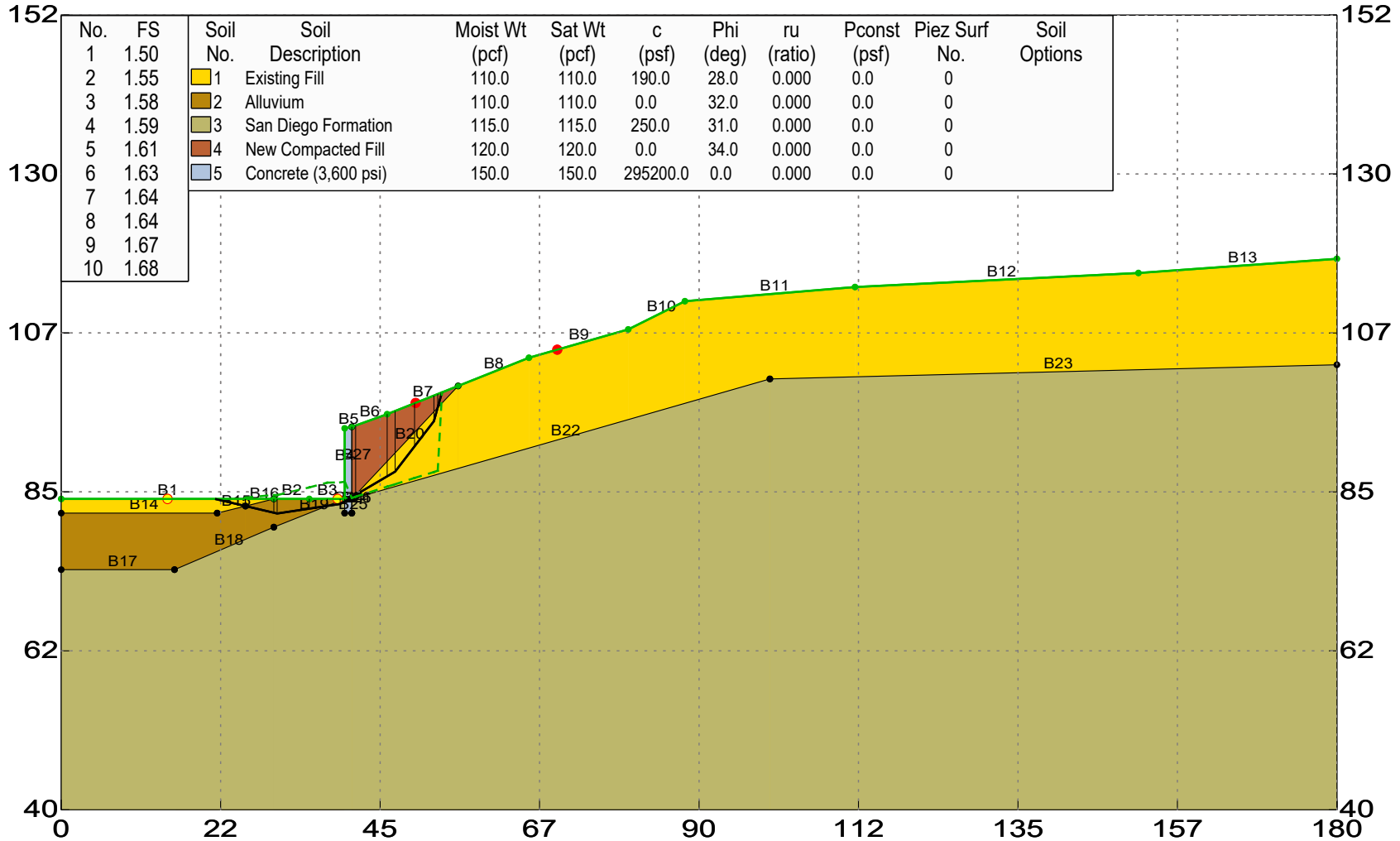
Spencer Method



FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT 109052001 (STATIC - FINISHED CONDITION AT SECTION B-B')

NINYO & MOORE - CMK

\109052001 B-B' Proposed Retaining Wall.gsd



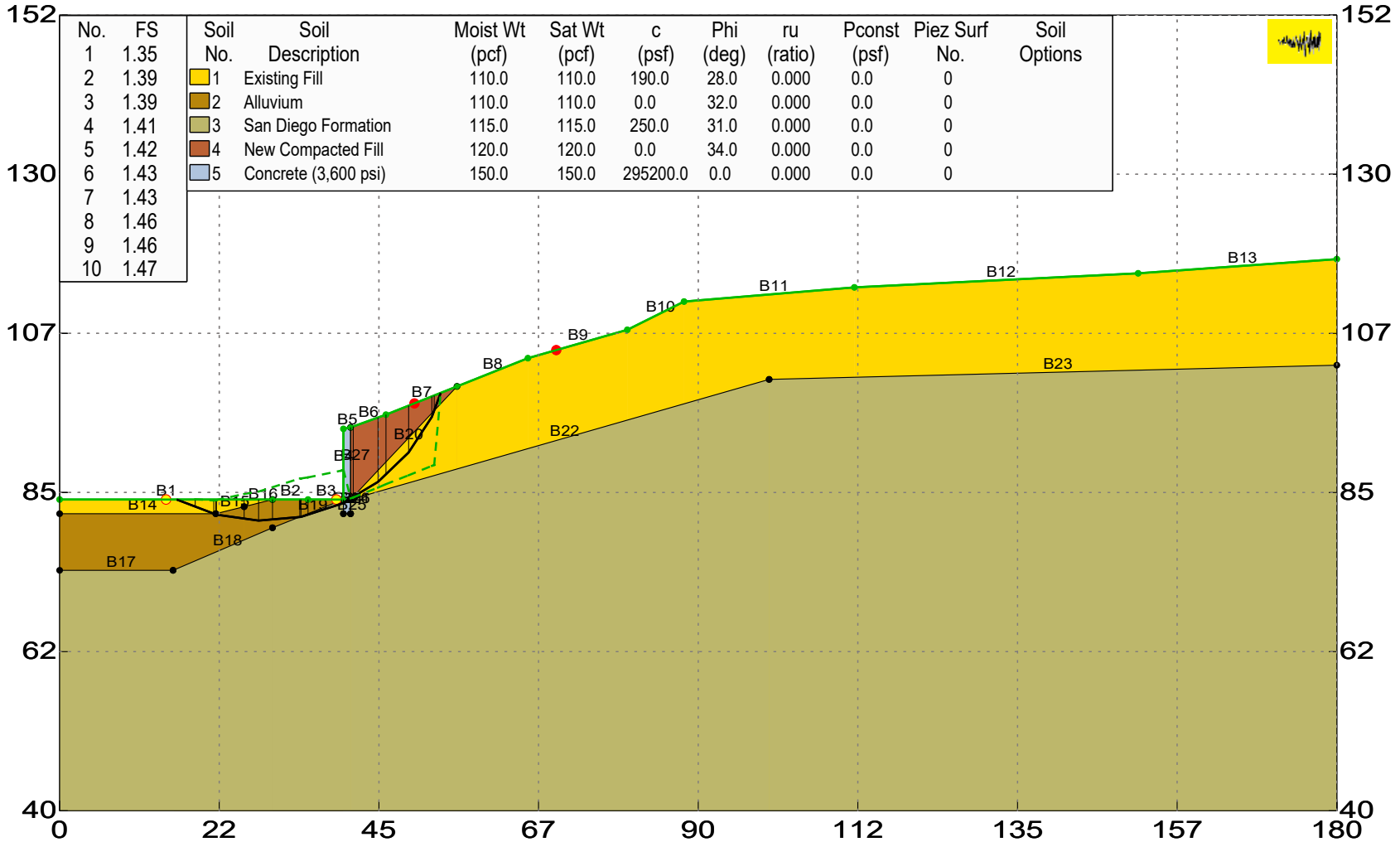
GEOSTASE FS = 1.50

Spencer Method

FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT 109052001 (SEISMIC - FINISHED CONDITION AT SECTION B-B')

NINYO & MOORE - CMK

\109052001 B-B' Proposed Retaining Wall PsuedoStatic.gsd



GEOSTASE FS = 1.35

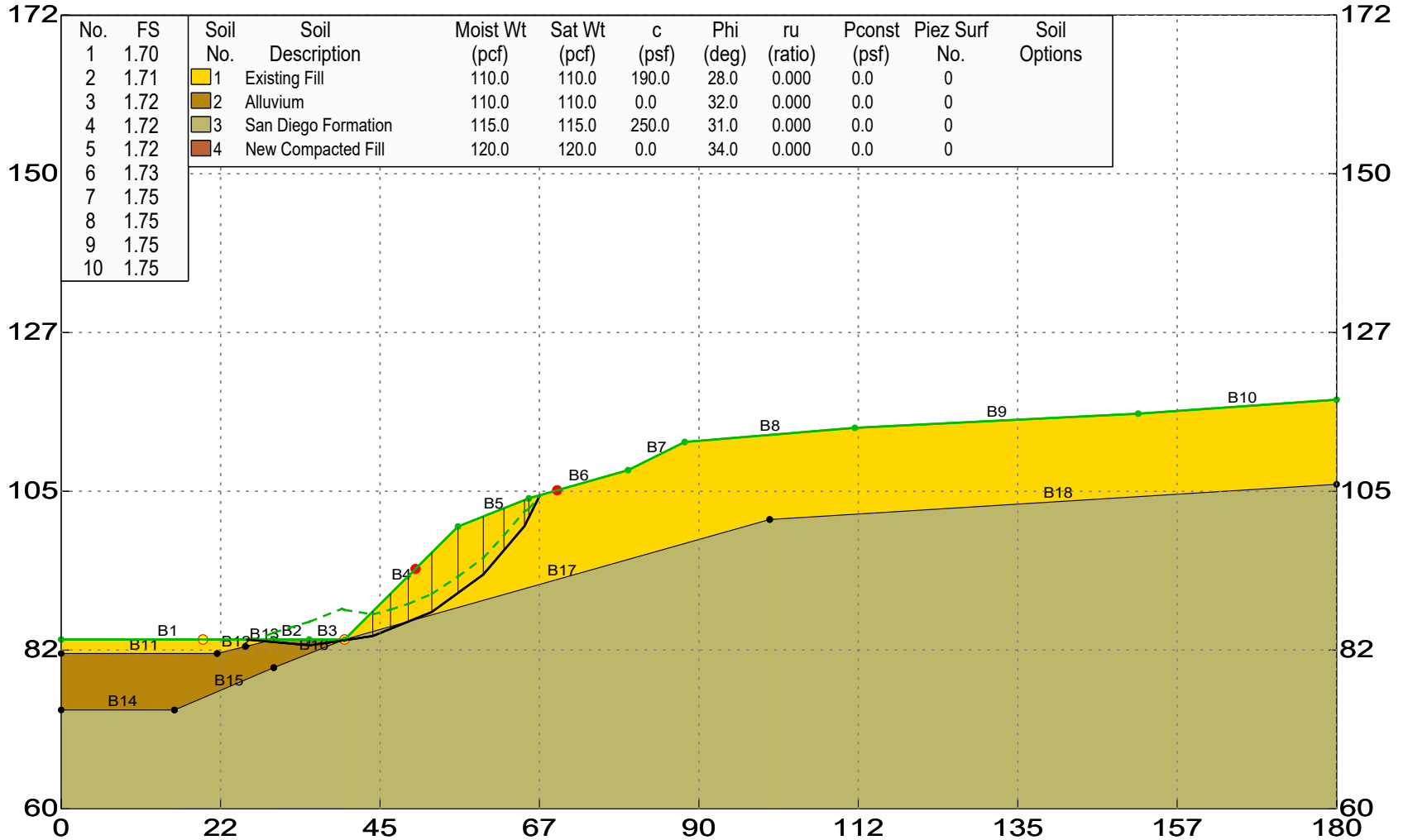
Spencer Method



FEDERAL BOULEVARD DECHANNELIZATION AND TRAIL PROJECT 109052001 (TEMPORARY 1:1 BACKCUT AT SECTION B-B')

NINYO & MOORE - CMK

\\109052001 B-B' Temporary.gsd



GEOSTASE FS = 1.70

Spencer Method





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