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September 3, 2025

Project No. 36461

Bunker Hill Loft, LLC
c/o Evan Gerber
703 16th Street, Suite 200
San Diego, CA 92101

Subject: Assumption of Geotechnical Engineer of Record, Geotechnical Update, and Response to City of San Diego Review Comments (PRJ- 1132845)
Bunker Hill Multi-Dwelling Units
2917 Bunker Hill Street, APN No. 424-321-21-00
San Diego, California 92109

Assumption of Geotechnical Engineer-of-Record

In accordance with your request and authorization, Verdantas Inc. (Verdantas) will assume the role of Geotechnical Engineer-of-Record (GEOR) for the proposed Bunker Hill Project. Associated with this action, Verdantas has reviewed the referenced reports and the project development plans. We understand that the project consists of construction of a three-story building with 17 multi-dwelling units (MDU's) and associated site grading. A geotechnical investigation report (NOVA, 2023a) was prepared for the proposed development. Verdantas concurs with the findings of the referenced geotechnical report unless otherwise discussed in this addendum letter. All conclusions and recommendations presented in this letter supersede those provided in the referenced geotechnical report (NOVA, 2023a).

Introduction and Project Description

In accordance with your request and authorization, Verdantas is providing a geotechnical update letter and response to City of San Diego review comments (PRJ-1132845) for the proposed Bunker Hill Multi-Dwelling Units project. The project consists of the design and construction of a three-level building with 20 multi-dwelling units (MDU's). NOVA (2023a) prepared a geotechnical investigation report for the proposed development. NOVA performed a field investigation that included drilling 1 hollow stem auger boring to a depth of 36.5 feet below ground surface (bgs) and advancing 1 cone penetration sounding to a depth of 86 feet bgs. Two percolation borings were all advanced to a depth of 5.5 feet bgs. As part of their work, NOVA also performed a geotechnical investigation for the neighboring property to the east (NOVA, 2023b). That work for the neighboring property also included 1 hollow-stem auger boring, 1 CPT sounding, and 2 percolation test borings. Results from the investigation of the neighboring site were incorporated in their geotechnical report for the subject property.

As part of the responsibilities of assuming the role of GEOR, Verdantas has reviewed the referenced geotechnical documents (NOVA, 2023a). Verdantas performed our own liquefaction analyses and are providing subsequent recommendations that supersede those provided by NOVA.

Liquefaction and Dynamic Settlement

Liquefaction and dynamic settlement analyses were revised as part of this update letter. The subsurface investigations performed by NOVA were utilized in our analyses.

Liquefaction and dynamic settlement of soils can be caused by strong vibratory motion due to earthquakes. Granular soils tend to densify when subjected to shear strains induced by ground shaking during earthquakes. Research and historical data indicate that loose granular soils underlain by a near surface groundwater table are most susceptible to liquefaction, while the most clayey materials are not susceptible to liquefaction. Liquefaction is characterized by a loss of shear strength in the affected soil layer, thereby causing the soil to behave as a viscous liquid. This effect may be manifested at the ground surface by settlement and, possibly, sand boils where insufficient confining overburden is present over liquefied layers. Where sloping ground conditions are present, liquefaction-induced instability can result.

As discussed in NOVA (2023a), design ground motion considered in our liquefaction triggering analyses was the deaggregated modal magnitude (M_w) of 6.89 and peak ground acceleration (PGA) of 0.683g. In the determination of the design magnitude, the USGS Earthquake Unified Hazard Tool was used, which calculates the most probable modal magnitude based on a probabilistic Seismic Hazard Deaggregation of maximum magnitude earthquake at the site.

Liquefaction analyses were performed considering a seasonally averaged groundwater elevation of +3.75 feet (NAVD 88) which corresponds to a depth of approximately 15 feet bgs. Liquefaction-induced settlement was evaluated using CPT data and the computer program CLiq version 3.5.3.10 developed by GeoLogismiki. Dynamic and post-liquefaction settlement was evaluated utilizing NCEER (Youd et al, 2001) method. The depth weighting factor introduced by Cetin et al. (2009) that accounts for the influence of confining layers on volumetric strain has been incorporated in the settlement analysis. Summary plots of the analyses from CLiq are provided in Appendix A.

The results of the liquefaction analyses indicate that potentially discontinuous layers of the soil materials at the site as encountered in the CPT soundings are considered susceptible to liquefaction at the design earthquake ground motion. Results of the analyses indicate total liquefaction-induced settlement ranging from 1 to 2 inches can be anticipated as a result of the design earthquake event at the site. The differential settlement is estimated to be approximately 1 inch over 40 feet. Mat foundations or post-tensioned foundations combined with remedial grading are recommended for the proposed building.

It should be noted that the revised calculated liquefaction-induced settlement presented in this letter is less than the result presented by NOVA (2023a). The primary reason for this is the use of a depth weighting factor and transition layers in our model which is a common industry standard for liquefaction analyses.

Recommendations

Based on our geotechnical evaluation, the primary geotechnical concern at the site is the existing compressible undocumented fill and young alluvial materials which are susceptible to settlement under building loads and seismically induced settlement resulting from liquefaction in their current condition. Mat foundations are recommended to reduce the adverse effects of differential settlement and to accommodate the requirements of the 2022 CBC and ASCE 7-16. Alternatively, post-tensioned foundations may be used. These foundations should be combined with remedial grading recommendations. Plans for the development of the site were reviewed at the time of this report. Once grading and structural plans have incorporated the revised recommendations in this report, they should be sent to our office so that we can verify that these preliminary recommendations provided in our report are still valid with respect to the proposed improvements.

Earthwork and Remedial Grading

We anticipate that earthwork at the site will consist of site preparation, excavation, and placement of backfill. We recommend that earthwork on the site be performed in accordance with the following recommendations and the General Earthwork and Grading Specifications for Rough Grading included in Appendix B. In case of conflict, the following recommendations supersede those presented in Appendix B.

Prior to grading, all areas to receive structural fill or engineered structures should be cleared of surface and subsurface obstructions, including any existing debris and undocumented or loose fill soils, and stripped of vegetation. Removed vegetation and debris should be properly disposed off-site. All areas to receive fill and/or other surface improvements should be scarified to a minimum depth of 6 inches, brought to above-optimum moisture conditions, and recompacted to at least 90 percent relative compaction (based on ASTM Test Method D 1557).

Potentially compressible undocumented fill, Young Alluvial Deposits at the site may settle as a result of wetting or settle under the surcharge of engineered fill and/or structural loads supported on shallow foundations. In addition, surface manifestations of liquefaction may occur including settlement and sand boils. To limit the effects of compressible soils and the potential for liquefaction, we recommend the removal and recompaction of the existing soils to a depth of at least 6 feet below the existing grade or 3 feet below the bottom of foundations, whichever is deeper. In addition, removals should extend laterally a distance equal to depth of compacted fill below the footings or a minimum of 5 feet beyond the limits of the proposed improvements at the bottom of the removals where feasible.

In areas of proposed pavements and hardscape, removals should be performed to a depth of at least 2 feet below the proposed subgrade, and extend at least 2 feet beyond the limits of the proposed improvements. The bottom of all removals should be evaluated by a Certified Engineering Geologist to confirm conditions are as anticipated.

In general, the soil that is removed may be reused and placed as engineered fill provided the material is moisture conditioned to above optimum moisture content, and then recompacted prior to additional fill placement or construction. Soil with an expansion index greater than 50 should not be used within 5 feet of finish grade in the building pad. The actual depth and extent of the required removals should be confirmed during grading operations by the geotechnical consultant.

Engineered Fill

In areas proposed to receive engineered fill, the existing upper 8 inches of subgrade soils should be scarified then moisture conditioned to a moisture content at or above the optimum content and compacted to 90 percent or more relative to the maximum laboratory dry density, as evaluated by ASTM D 1557. During grading operations and the construction of underground utilities and shallow foundation elements, care should be taken to not disturb the geotextile.

Soil materials utilized as fill should be free of oversized rock, organic materials, and deleterious debris. Rocks greater than 4 inches in diameter should not be placed within 5 feet of finished grade. Fill should be moisture conditioned to at least 2 percent above the optimum moisture content and compacted to 90 percent or more relative to the maximum laboratory dry density, as evaluated by ASTM D 1557. Although the optimum lift thickness for fill soils will be dependent on the type of compaction equipment utilized, fill should generally be placed in uniform lifts not exceeding approximately 8 inches in loose thickness.

In vehicle pavement and trash enclosure areas the upper 12 inches of subgrade soils should be scarified then moisture conditioned to a moisture content above optimum content and compacted to 95 percent or more relative to the maximum laboratory dry density, as evaluated by ASTM D 1557.

Placement and compaction of fill should be performed in general accordance with current City of San Diego grading ordinances, California Building Code, sound construction practice, these recommendations and the General Earthwork and Grading Specifications for Rough Grading presented in Appendix B.

Preliminary Foundation Design

We recommend the use of a mat foundation to reduce the adverse effects of differential settlement and to accommodate the requirements of the 2022 CBC and ASCE 7-16. Mat foundations should be supported on properly compacted fill material using a static allowable bearing capacity not to exceed 2,000 pounds per square foot. This value may be increased by one-third for short-term wind or seismic loads. Based on our experience, local static and seismic bearing pressures below the mat may exceed these values and should be reviewed by the geotechnical consultant. Mat foundations typically experience some deflection due to loads placed and the reaction of the soils underlying the foundations. A design coefficient of subgrade reaction of K_1, of 200 pounds per cubic inch (pci) may be used for evaluating such deflections at the site. This value is based on support by competent fill soils and is considered as applied to a unit square foot area. The value should be adjusted for the design foundation size. The coefficient of subgrade reaction K_b for a footing of a specific width may be evaluated using the following equation.

$$K_b = K_1 [(b+1)/2b]^2$$

where b is the least width of the foundation

Detailed analysis to evaluate deflection should be carried out by the structural engineer. In some cases, refinement of the geotechnical recommendations may be needed to improve agreement between geotechnical and structural methods.

To accommodate differential settlement that could result from a major seismic event, mat or the conventionally-reinforced ribbed mat foundation should be designed by the project structural engineer for total and differential settlement.

Total and differential settlements for footings designed in accordance with the above recommendations should be less than 1 inch and 1/2 inch, respectively, based on static conditions. Under seismic conditions, the foundations and site walls may experience a differential movement. To accommodate this tendency, differential settlement on the order of 1 inch over 40 feet should be accommodated by increased foundation and structure rigidity or by flexible structural detailing.

Slab Design

All floor slabs should have a minimum thickness of 6 inches, structurally isolated from column footings, and reinforced in accordance with the structural engineer. As a minimum we recommend No. 3 rebars 12 inches on center or No. 4 rebars at 18 inches on-center each way (minimum) placed at midheight in the slab. Slabs subjected to heavy loading may require greater thickness and increased reinforcement. We emphasize that it is the responsibility of the contractor to ensure that the slab reinforcement is placed at proper height.

Post-Tension Foundation Recommendations

As an alternative to the mat or ribbed foundations for the buildings, post-tensioned foundations may be used. We recommend post-tensioned foundations be designed in accordance with the following design parameters presented in the following table and the criteria used in the 3rd Edition of Post Tension Institute (PTI) Design Manual. Based on an evaluation of the depths of fill beneath the building pads, Table 1 below presents the recommended post-tension foundation category for residential buildings on subject site. Final post-tension recommendations should be revised once grading and expansion testing is performed at the completion of grading.

Table 1. Post-Tensioned Foundation Design Recommendations

Design Criteria		Category I Very Low to Low Expansion Potential (EI 0 to 50)	Category II Medium Expansion Potential (EI 50 to 90)	Category III High Expansion Potential (EI 90 to 130)
Edge Moisture Variation, e_m	Center Lift:	9.0 feet	8.3 feet	7.0 feet
	Edge Lift:	4.8 feet	4.2 feet	3.7 feet
Differential Swell, y_m	Center Lift:	0.46 inches	0.75 inches	1.09 inches
	Edge Lift:	0.78 inches	1.32 inches	1.99 inches
Perimeter Footing Depth:		18 inches	24 inches	30 inches
Allowable Bearing Capacity		2,000 psf		

The post-tensioned (PT) foundation and slab should also be designed in accordance with structural considerations. For a ribbed PT foundation, the concrete slabs section should be at least 5 inches thick. Continuous footings (ribs or thickened edges) with a minimum width of 12 inches and a minimum depth of 18 inches below lowest adjacent soil grade may be designed for a maximum allowable bearing pressure of 2,000 pounds per square foot. For a uniform thickness “mat” PT foundation, the perimeter cut off wall should be at least 8 inches below the lowest adjacent grade. However, note that where a foundation footing or perimeter cut off wall is within 3 feet (horizontally) of adjacent drainage swales, the adjacent footing should be embedded a minimum depth of 12 inches below the swale flow line. The allowable bearing capacity may be increased by one-third for short-term loading.

The slab should be underlain by 2-inch layer of clean sand (S.E. greater than 30). A moisture barrier (10-mil non-recycled plastic sheeting) should be placed below the sand layer if reduction of moisture vapor up through the concrete slab is desired (such as below equipment, office areas, etc.), which is in turn underlain by an additional 2-inches of clean sand. Note that moisture barriers can retard, but not eliminate moisture vapor movement from the underlying soils up through the slabs. We recommend that the floor covering installer test the moisture vapor flux rate prior to attempting applications of the flooring. "Breathable" floor coverings should be considered if the vapor flux rates are high. A slip-sheet or equivalent should be utilized above the concrete slab if crack-sensitive floor coverings (such as ceramic tiles, etc.) are to be placed directly on the concrete slab. Additional guidance is provided in ACI Publications 302.1R-04 Guide for Concrete Floor and Slab Construction and 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Floor Materials.

Response to City of San Diego Review Comments (PRJ-1132845)

Comment 38: *The project's geotechnical consultant must submit an addendum geotechnical or update for the purpose of an environmental review that references the development plans and addresses the following:*

> **Response:** The development plans prepared by Arch5 Design (2025) were reviewed and referenced herein.

Comment 39: *The geotechnical investigation report must contain an updated site-specific geologic/geotechnical map that shows the distribution of fill and geologic units, that depicts geologic structure (bedding, joints, landslide structure, etc.), and the proposed development. Circumscribe the limits of recommended remedial grading to provide the limits of the project.*

> **Response:** The attached Figure 2 depicts

Comment 40: *Explain why the depth of the liquefaction analysis was limited to 30 feet for CPT-1.*

> **Response:** Following review of the referenced geotechnical report (NOVA, 2023a), it appears the material below a depth of 30 feet (Old Paralic Deposits) was assumed to not be liquefiable based on the geologic age of deposition, which is of the early Pleistocene. However, based on our review of the geotechnical investigation, including blow counts and CPT sounding results, we believe the Old Paralic Deposits are susceptible to liquefaction and should be included in any liquefaction analyses. The revised liquefaction analyses are presented in Appendix A and did not limit the depth of the liquefaction analysis.

Comment 41: *Provide a conclusion regarding if the proposed development will destabilize or result in settlement of adjacent property or the right of way.*

> **Response:** It is our opinion that the proposed development will not destabilize or result in the settlement of adjacent property or right of way provided the recommendations in this update letter and by NOVA (2023a) are adhered to.

Comment 42: *Provide a conclusion regarding if the proposed development will destabilize or result in settlement of adjacent property or the right of way.*

> **Response:** Same comment as Comment 41.

Comment 43: *The geotechnical consultant should review the development plan set and indicate if the plan set is in accordance with their recommendations, and indicate whether or not additional recommendations are necessary.*

> **Response:** The referenced development plans prepared by Arch5 Design (2025) were reviewed as part of this geotechnical update. As discussed previously, revised

recommendations for the foundation design were provided and should be incorporated into the development plans. Those revised plans should be reviewed and approved by Verdantas.

Closure

If you have any questions regarding our review, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

Verdantas Inc.

Steven A. Norton, CEG 2806
Project Geologist
snorton@verdantas.com

Nicholas Tracy, GE 3058
Associate Engineer
ntracy@verdantas.com

Attachments: References
Figure 1 – Site Location Map
Figure 2 – Geotechnical Map from NOVA (2023a)
Figure 3 – Geologic Cross Section from NOVA (2023a)
Appendix A – Liquefaction Analyses
Appendix B – Grading Recommendations

Distribution: (1) Addressee

REFERENCES

Arch5 Design, 2025, Bunker Hill Lofts, 3-Story – 20 Units MDU's, 2917 Bunker Hill Street, Can Diego, California, dated March 26, 2025.

California Geological Survey (CGS), 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117a.

CGS, 2018, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning with Index to Special Study Zones Maps: Department of Conservation, Division of Mines and Geology, Special Publication 42.

California Building Standards Commission (CBSC), 2022, California Building Code (CBC).

Cetin et al., 2009, Probabilistic model for assessment of cyclically induced reconsolidation (volumetric)strains, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Vol 135, No 3, pp 387-389.

City of San Diego, 2008, Seismic Safety Study, Sheet 17, dated April 3.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas; California Division of Mines and Geology, Geologic Data Map 6, Scale 1:750,000.

Kennedy, M.P., 1975, Geology of the San Diego Metropolitan Area, California Section A-Western San Diego Metropolitan Area: California Division of Mines and Geology Bulletin 200, 38p.

Kennedy and Tan, 2008, Geologic Map of San Diego, 30'x60' Quad, California.

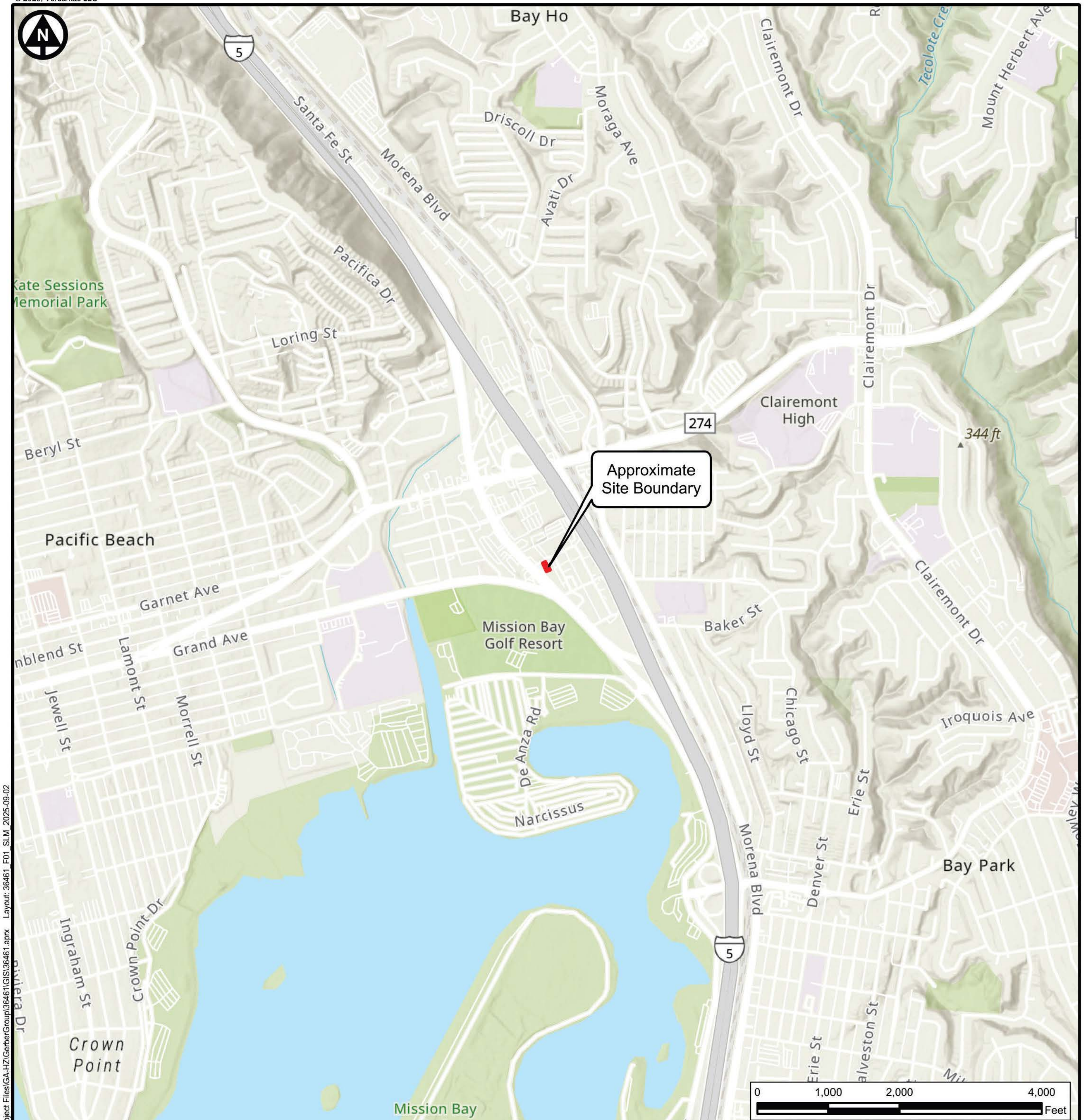
NOVA Services, 2023a, Geotechnical Investigation, Bunker Hill Multi-Dwelling Units, APN Nos. 424-321-21-00, Bunker Hill Street and Revere Avenue, San Diego, California, Dated June 5, 2023.

NOVA Services, 2023b, Geotechnical Investigation, Bunker Hill Multi-Dwelling Units, APN Nos. 424-321-03 and 424-321-04, Bunker Hill Street, San Diego, California, Dated July 7, 2023, dated August 30, 2024.

Treiman, J.A., 1984, The Rose Canyon Fault Zone: A Review and Analysis, California Division of Mines and Geology, Funded by Federal Management Agency Cooperative Agreement EMF-83-K-0148.

Treiman, J.A, 1993, The Rose Canyon Fault Zone, Southern California: California Division of Mines and Geology, Open-File Report 93-2, 45p.

Figures



Approximate Site Boundary

DISCLAIMER: Verdantas Inc. has furnished this map to the Client for its sole and exclusive use as a preliminary planning and screening tool. This map is reproduced from geospatial information compiled from third-party sources which may change over time and are not accurate as to mapping, surveying or engineering standards. Verdantas Inc. makes no representation or warranty as to the content, accuracy, timeliness or completeness of any information. In no event will Verdantas Inc., its owners, officers, employees or agents, be liable for damages of any kind arising out of the use of this map by Client or any other party.

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Sources:
Aerial Imagery: Esri Imagery Web Service dated 2021.

Topographic Map: National Geographic Society Web Service.

Quadrangle: La Jolla, California

2917 Bunker Hill Street
San Diego, California

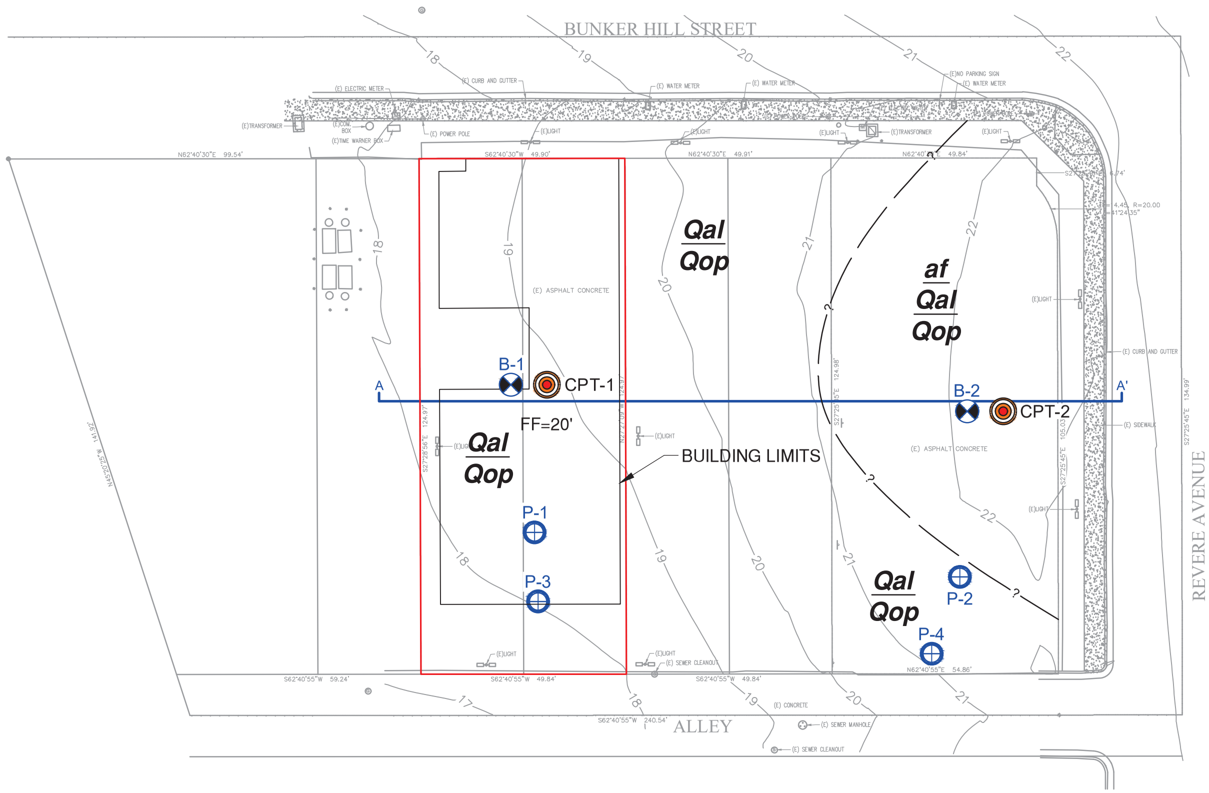
Site Location Map

Bunker Hill Multi-Dwelling Units

Project Number	36461
Date	09/2025
Author	mmurphy
Scale	1 in = 2,000 ft
Figure	1

Edited: 9/2/2025 File Location: C:\Users\MaryMurphy\OneDrive - Verdantas\Files\Project Files\GA-HZ\GerberGroup\36461\GIS\36461.aprx Layout: 36461_F01_SLM_2025-09-02

Produced Using Esri's ArcGIS Software



KEY TO SYMBOLS

af	UNDOCUMENTED FILL
Qal	ALLUVIUM
Qop	OLD PARALIC DEPOSITS
B-2	GEOTECHNICAL BORING
P-4	PERCOLATION TEST BORING
CPT-2	CONE PENETRATION TEST
(red line)	SITE LIMITS\ LIMITS OF REMEDIAL GRADING
—?—	GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN
A A'	GEOLOGIC CROSS-SECTION

0 30' 60'

*BASE MAP: J&B, 2022

*NOTE: LOCATIONS APPROXIMATE
FF=FINISHED FLOOR

NOVA
GEOTECHNICAL
MATERIALS
SPECIAL INSPECTION
DVBE • SBE • SDVOSB • SLBE

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BUNKER HILL MULTI-DWELLING UNITS

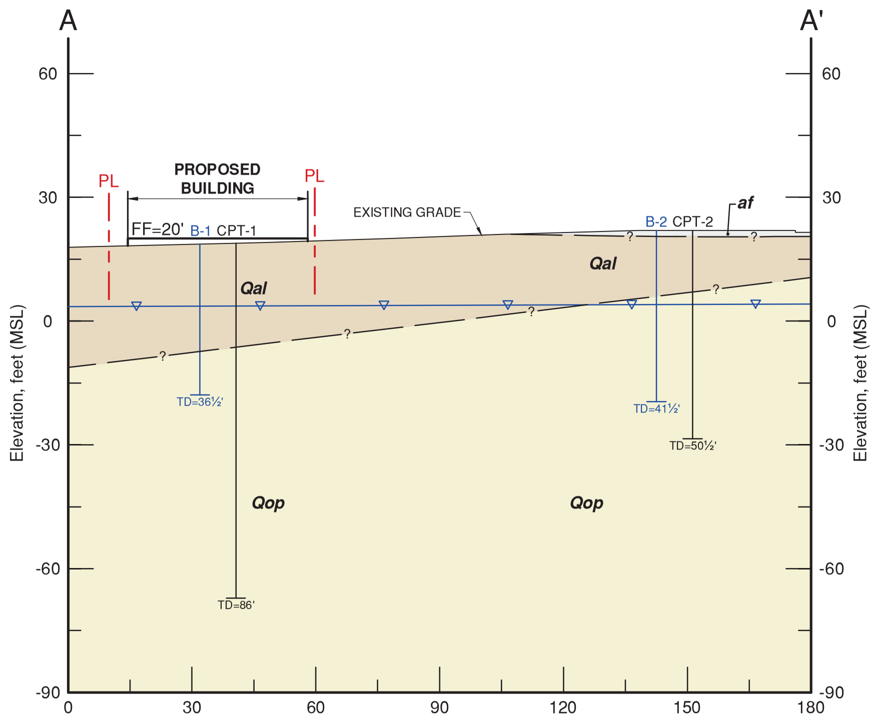
APNs 424-321-03 AND 424-321-04
BUNKER HILL STREET
SAN DIEGO, CA 92109

PROJECT NO.:	2022168
DATE:	JULY 2023
DRAWN BY:	DTJ
REVIEWED BY:	MS
SCALE:	1"=30'

DRAWING TITLE:

GEOTECHNICAL MAP

PLATE NO. 1 OF 2



KEY TO SYMBOLS

af	UNDOCUMENTED FILL
Qal	ALLUVIUM
Qop	OLD PARALIC DEPOSITS
B-2	GEOTECHNICAL BORING
CPT-2	CONE PENETRATION TEST
—?—	GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN
	APPROXIMATE GROUNDWATER LEVEL
	EXISTING GRADE
	PROPOSED GRADE

0 30' 60'

*NOTE: LOCATIONS APPROXIMATE
FF=FINISHED FLOOR

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BUNKER HILL MULTI-DWELLING UNITS

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PROJECT NO.:	2022168
DATE:	JULY 2023
DRAWN BY:	DTJ
REVIEWED BY:	MS
SCALE:	1"=30'
DRAWING TITLE:	

GEOLOGIC
CROSS-SECTION

PLATE NO. 2 OF 2

Appendix A – Liquefaction Analyses

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

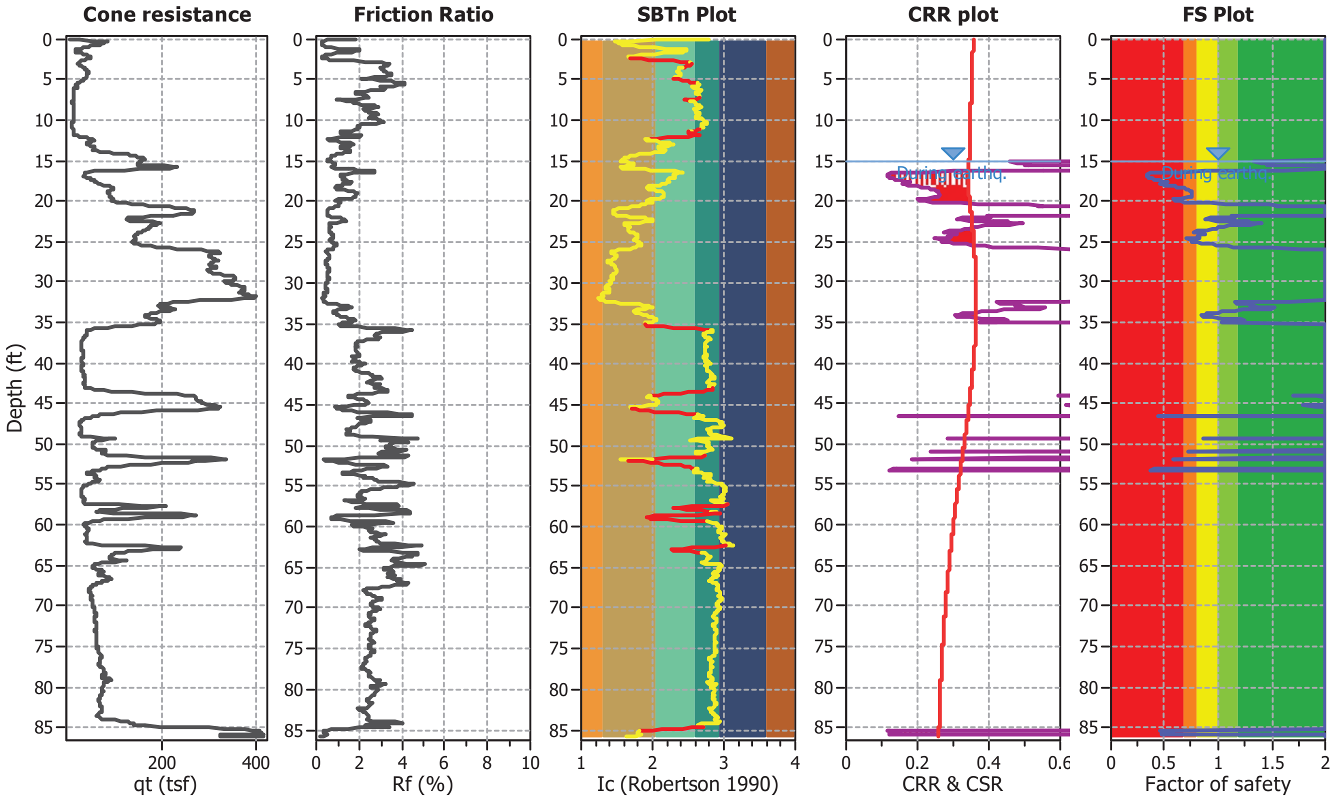
LIQUEFACTION ANALYSIS REPORT

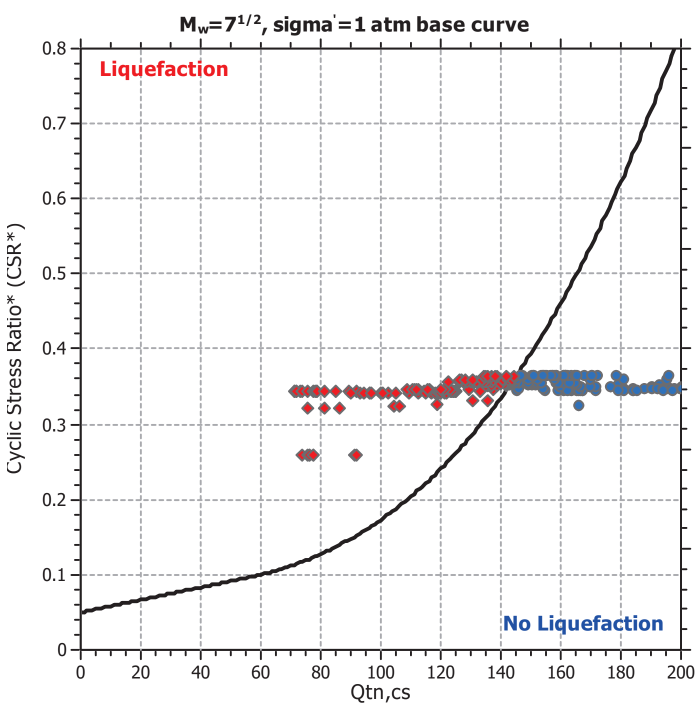
Project title : **Location :**

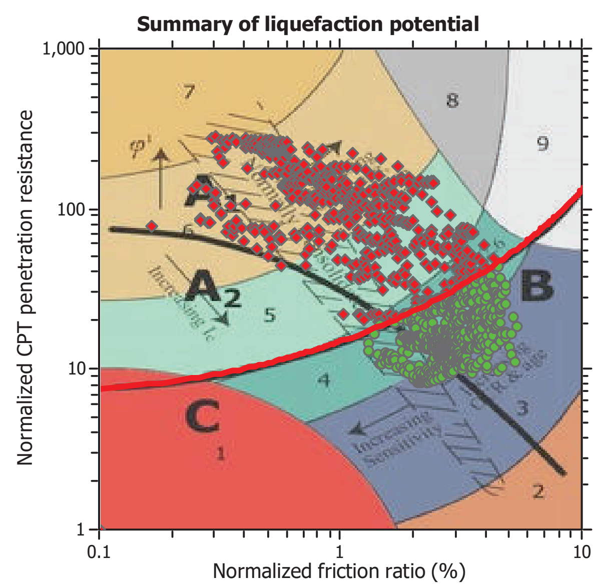
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	15.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.89	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

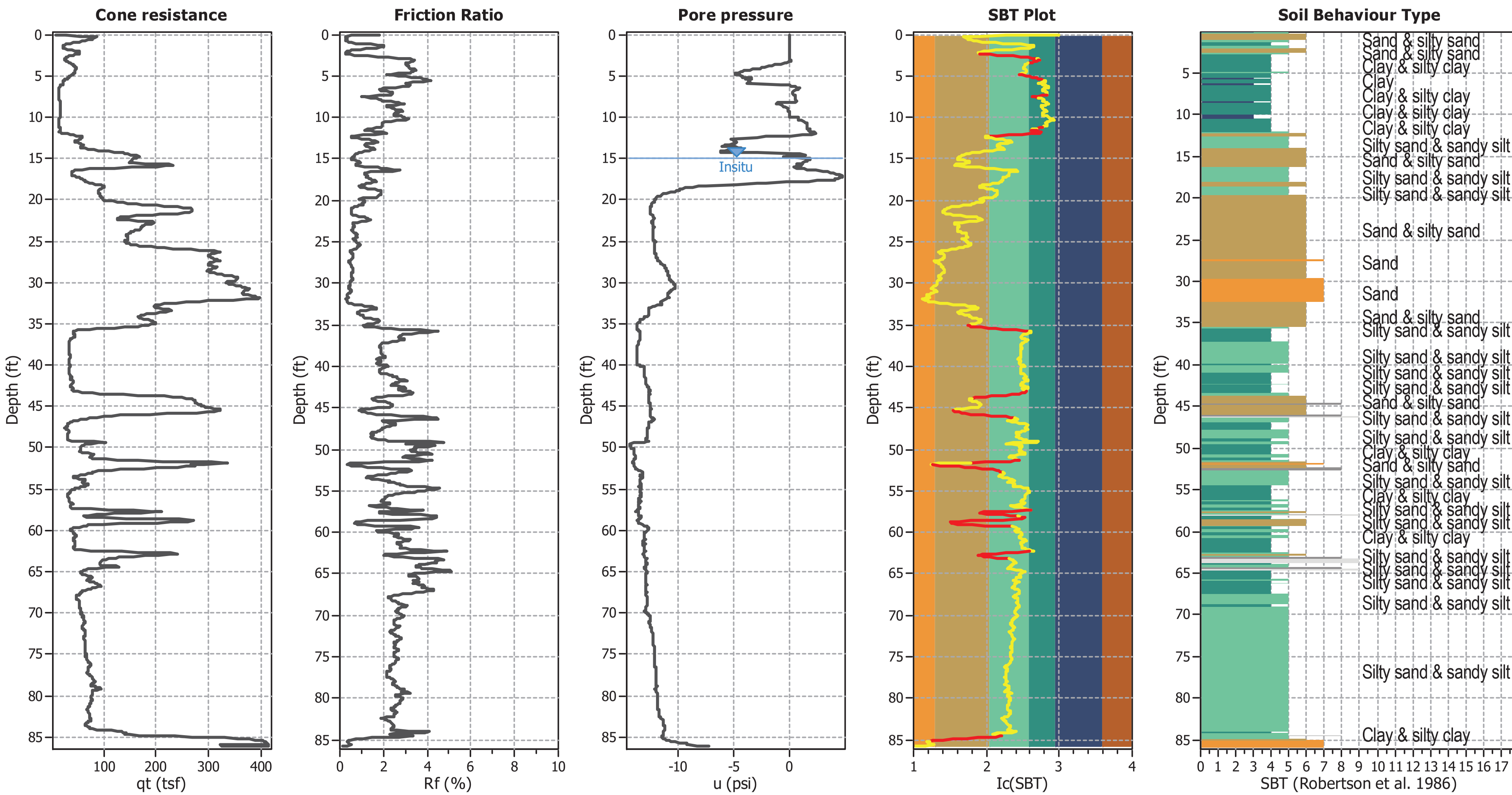






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Input parameters and analysis data

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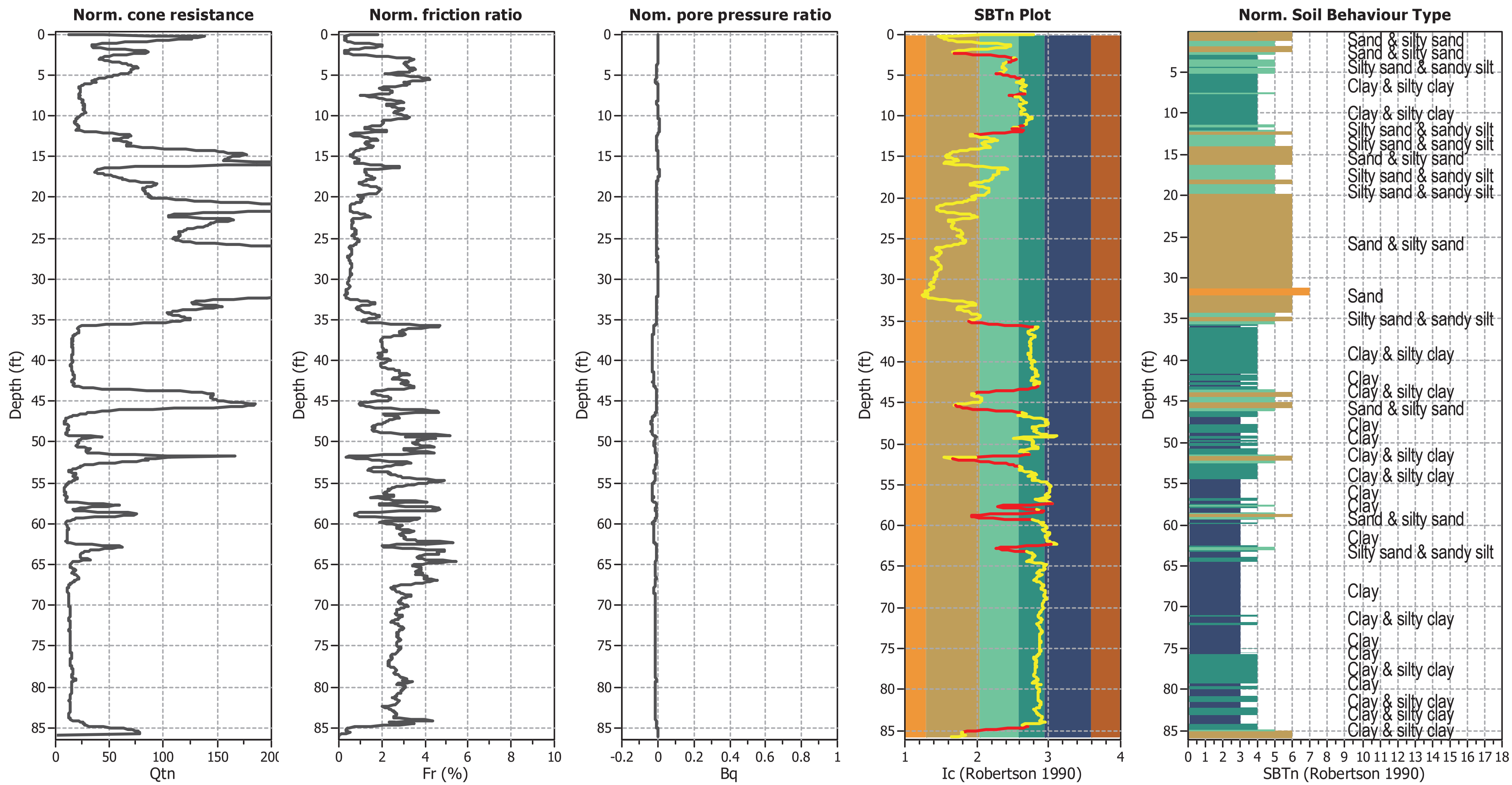
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



Input parameters and analysis data

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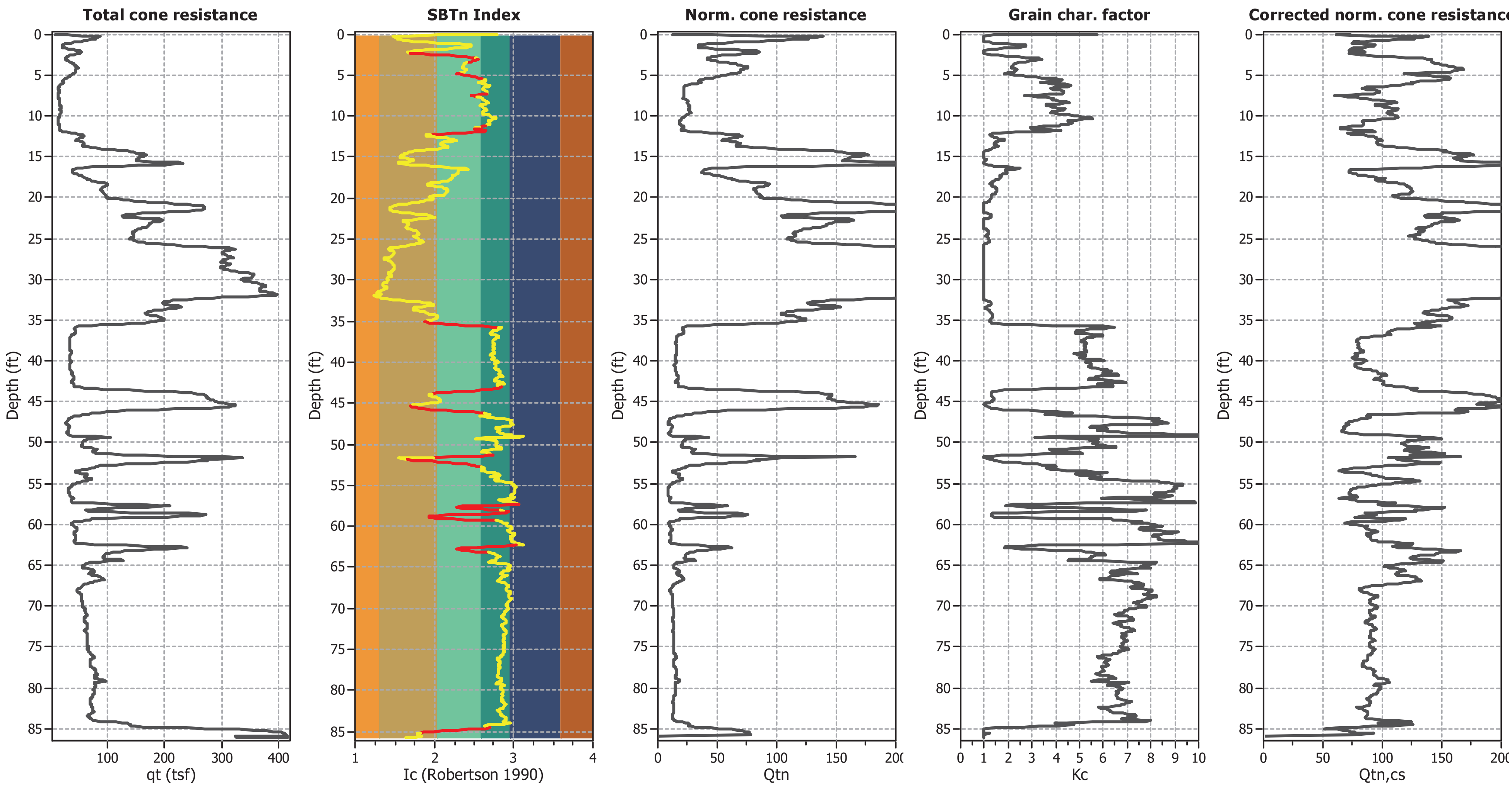
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

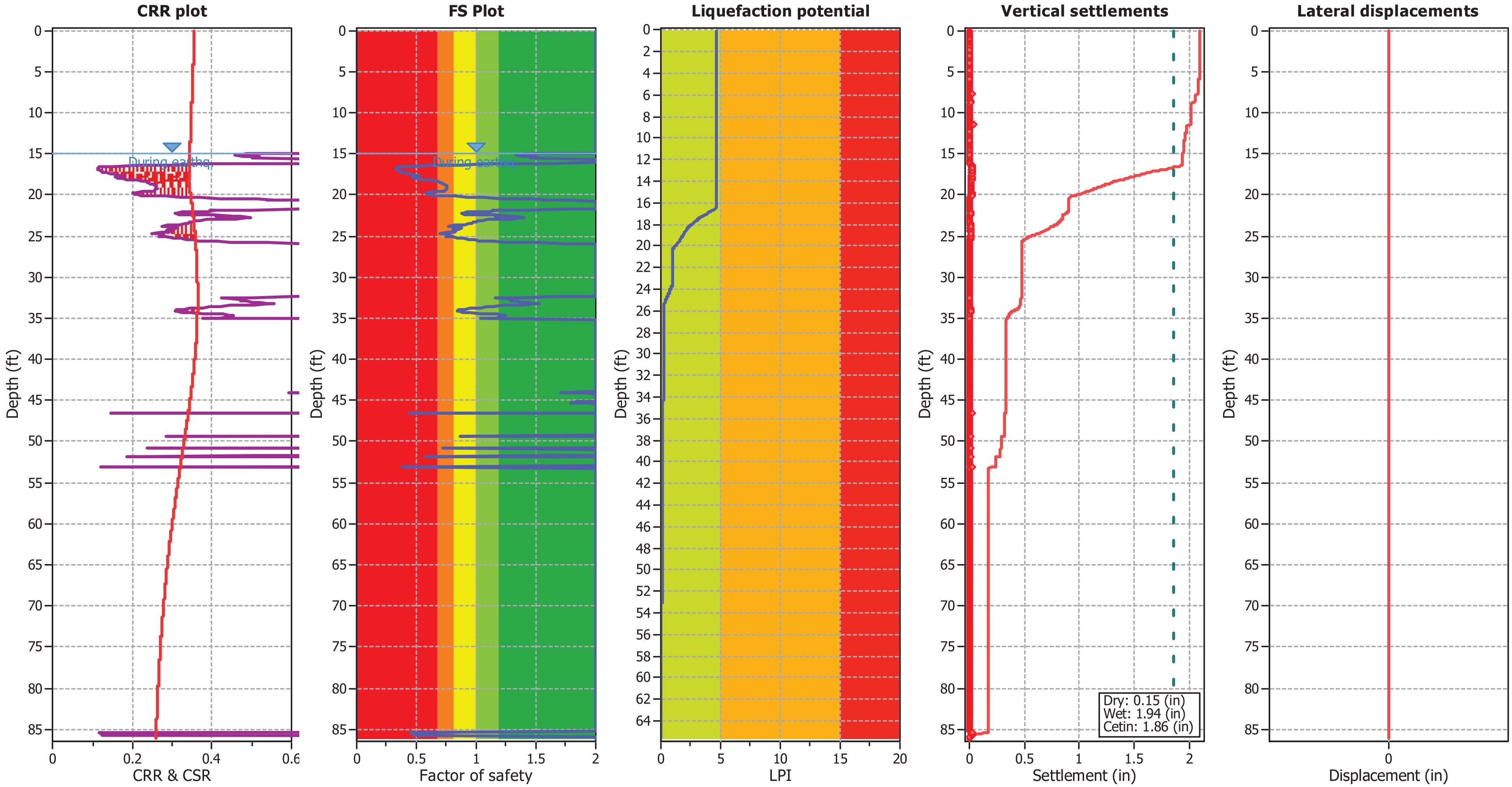
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

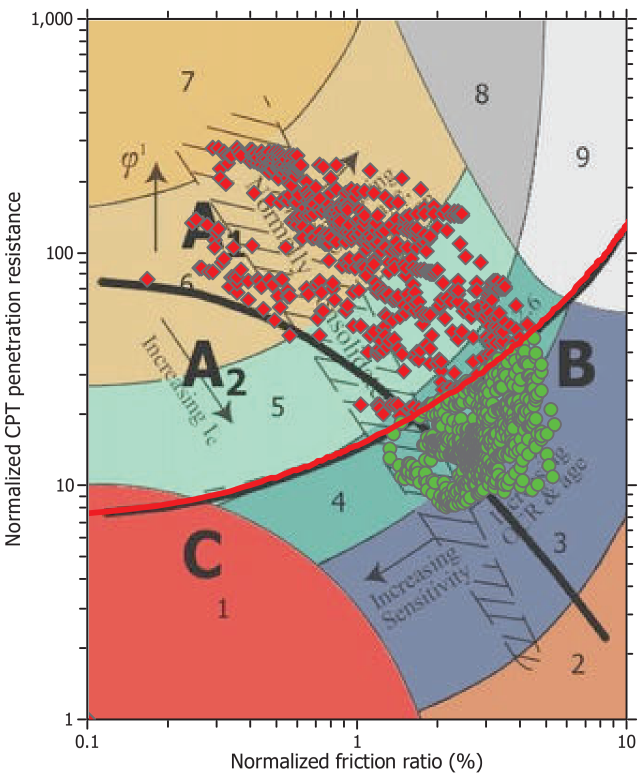
F.S. color scheme

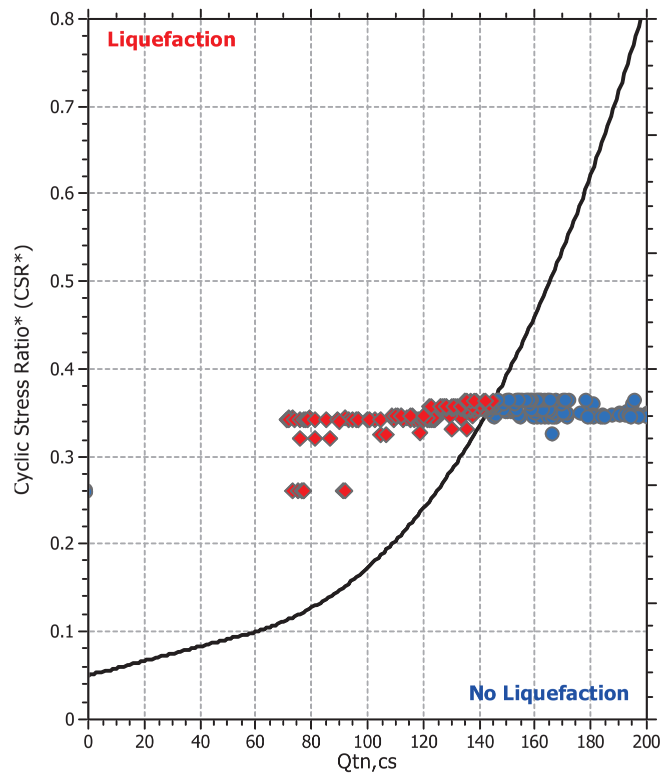
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

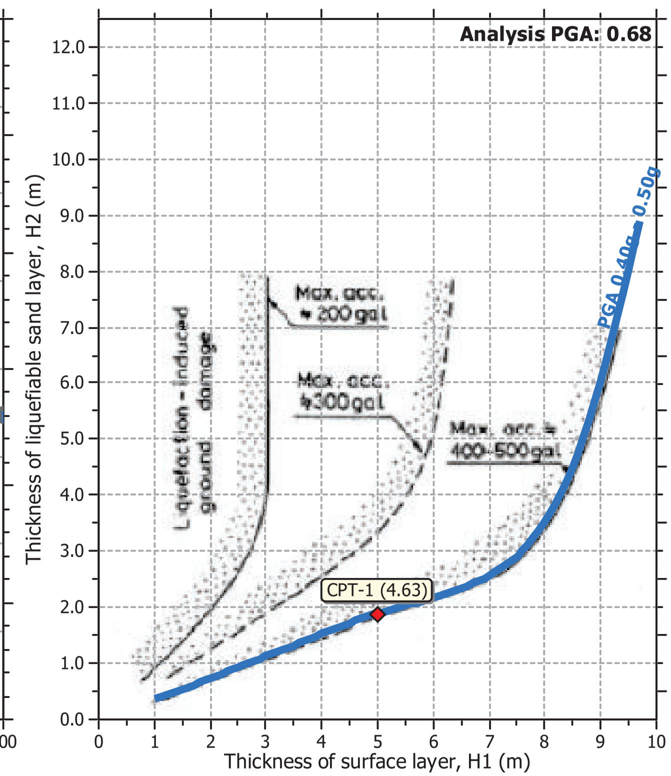
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



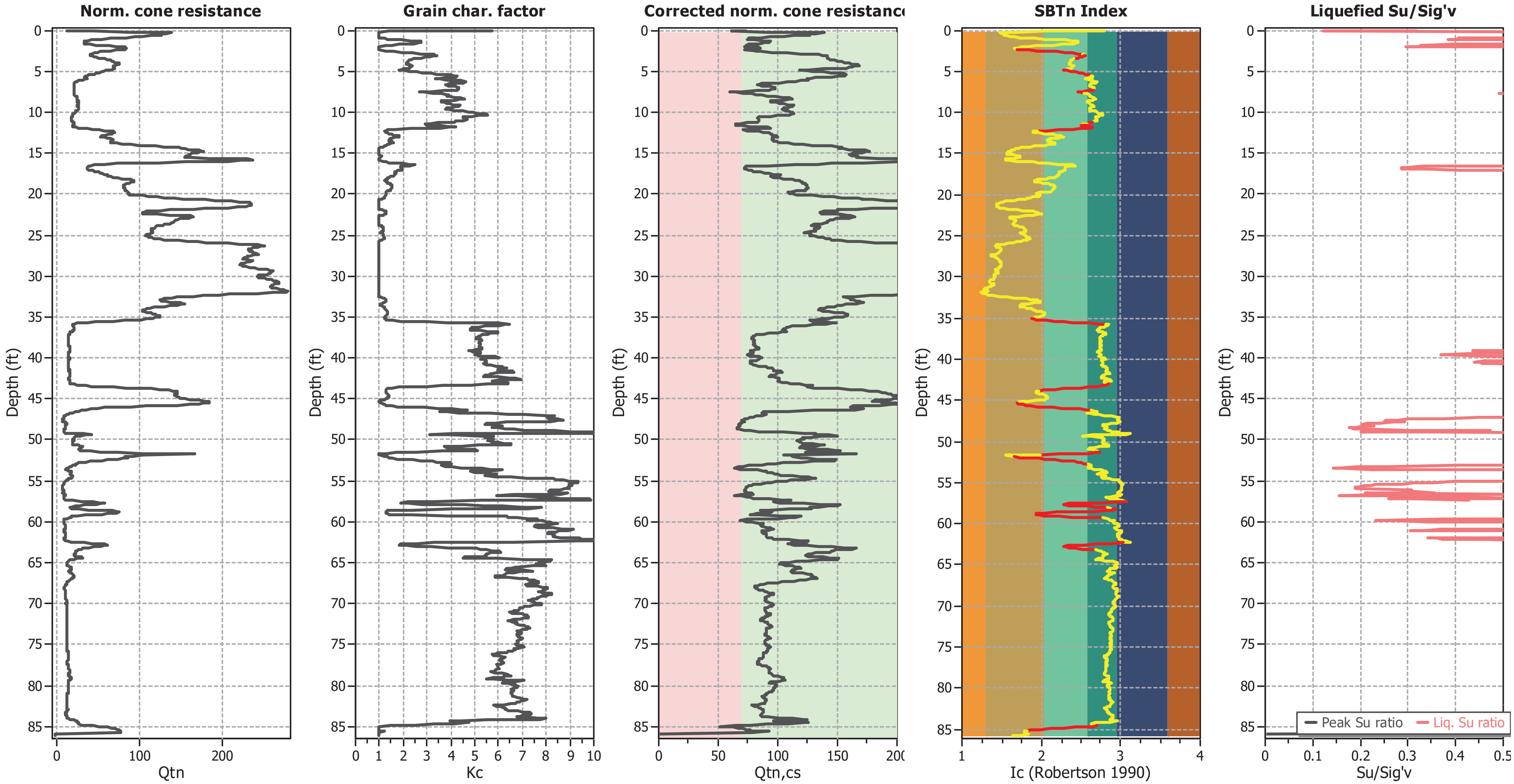




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

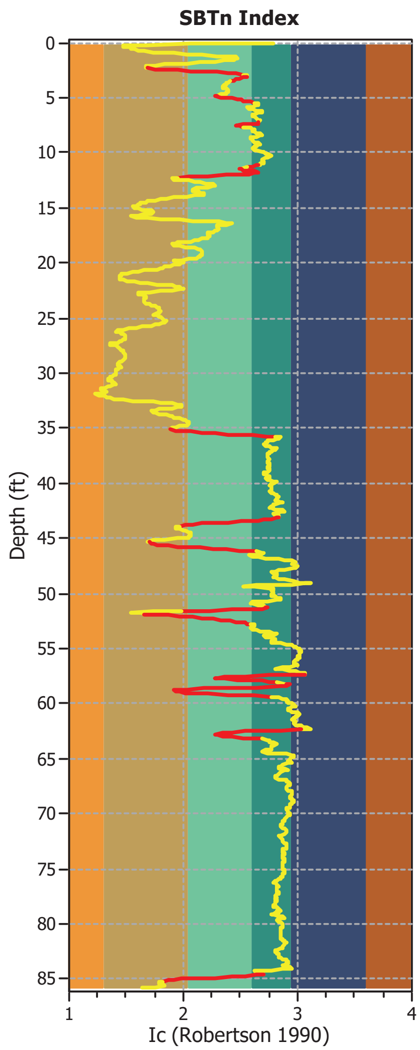
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

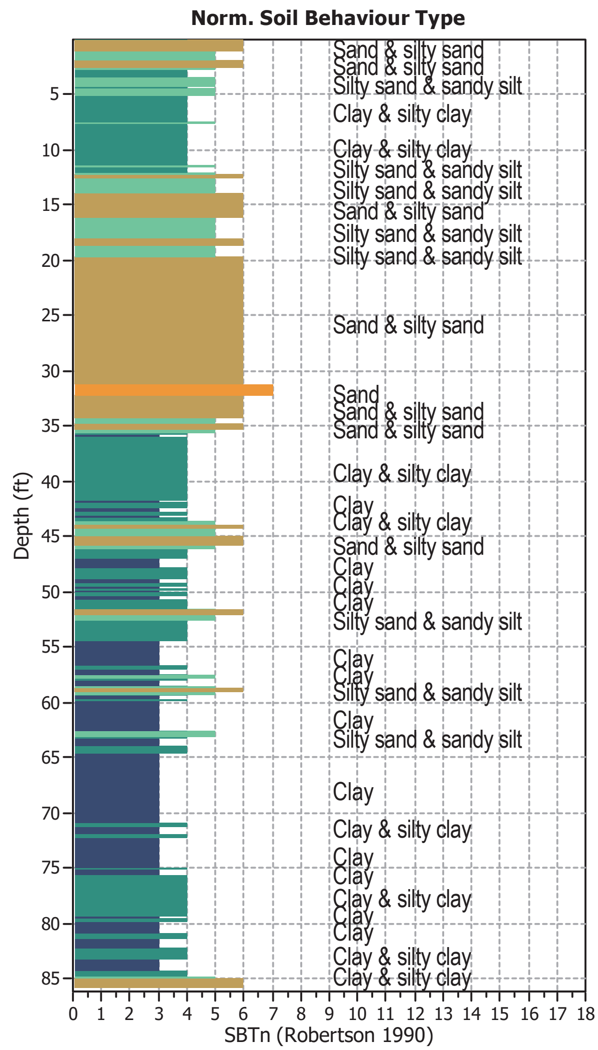
TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

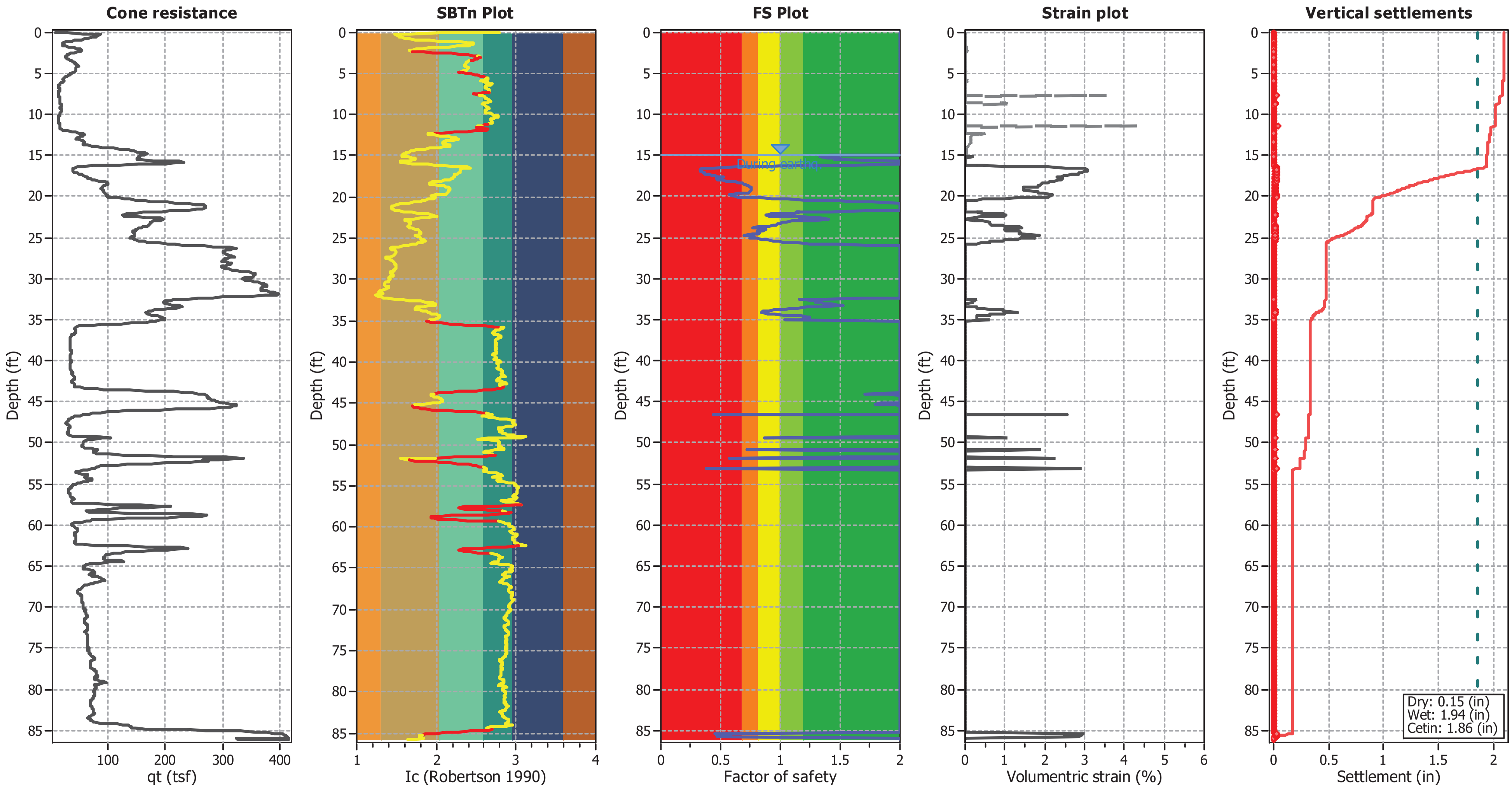
The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





Transition layer algorithm properties		**General statistics**	
I_c minimum check value:	1.70	Total points in CPT file:	1312
I_c maximum check value:	3.00	Total points excluded:	172
I_c change ratio value:	0.0250	Exclusion percentage:	13.11%
Minimum number of points in layer:	4	Number of layers detected:	20

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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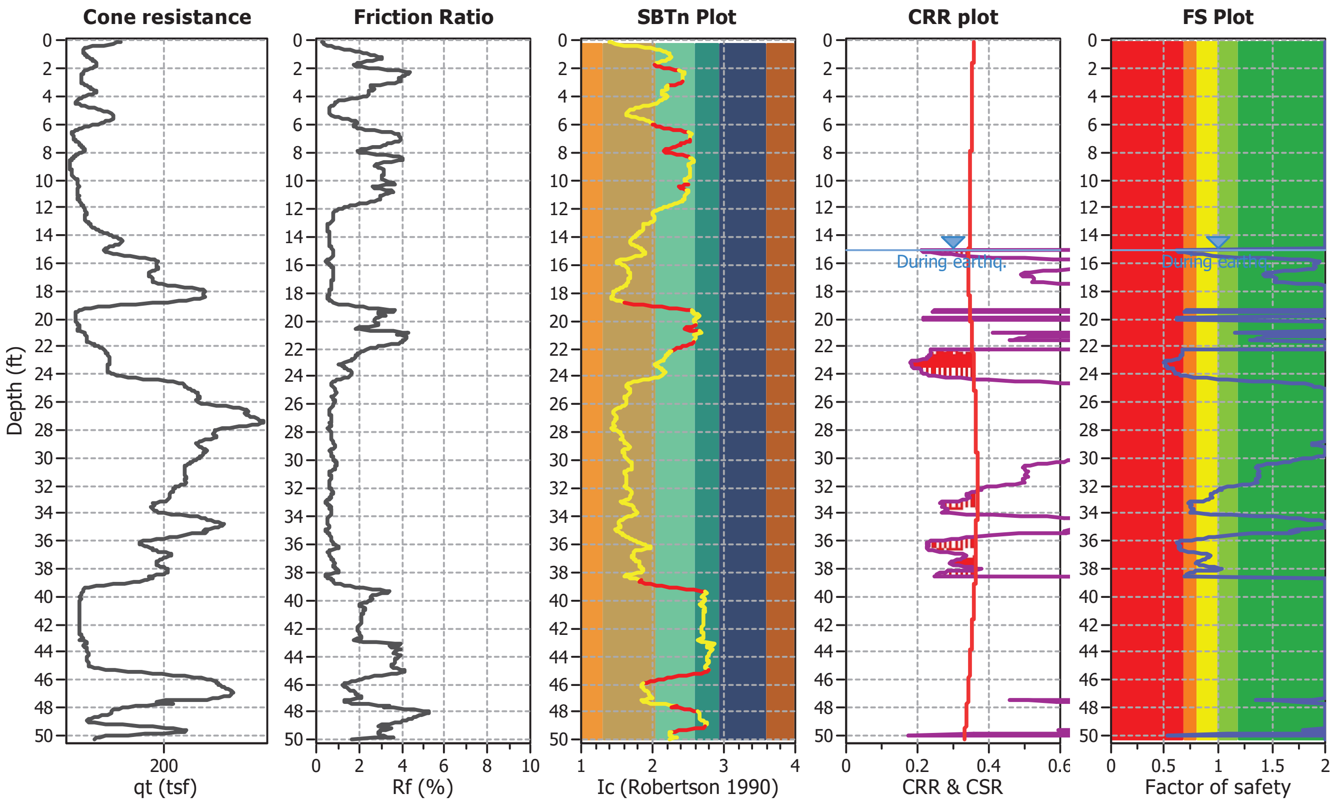
LIQUEFACTION ANALYSIS REPORT

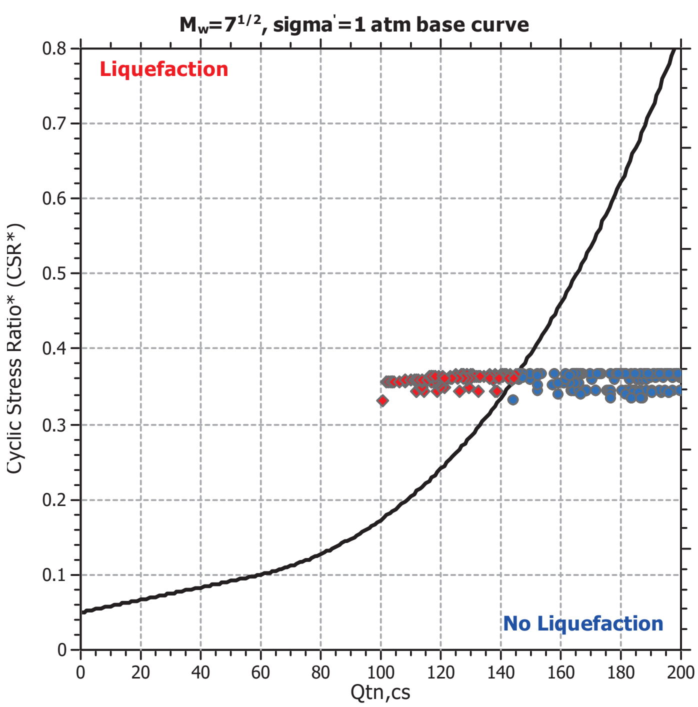
Project title : **Location :**

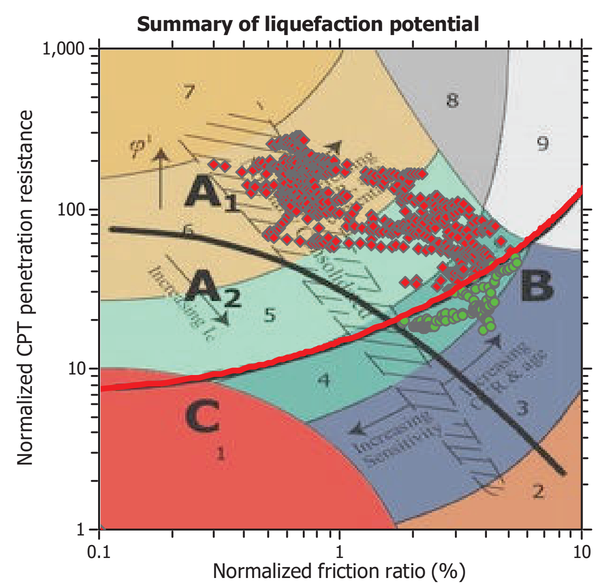
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	15.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.89	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

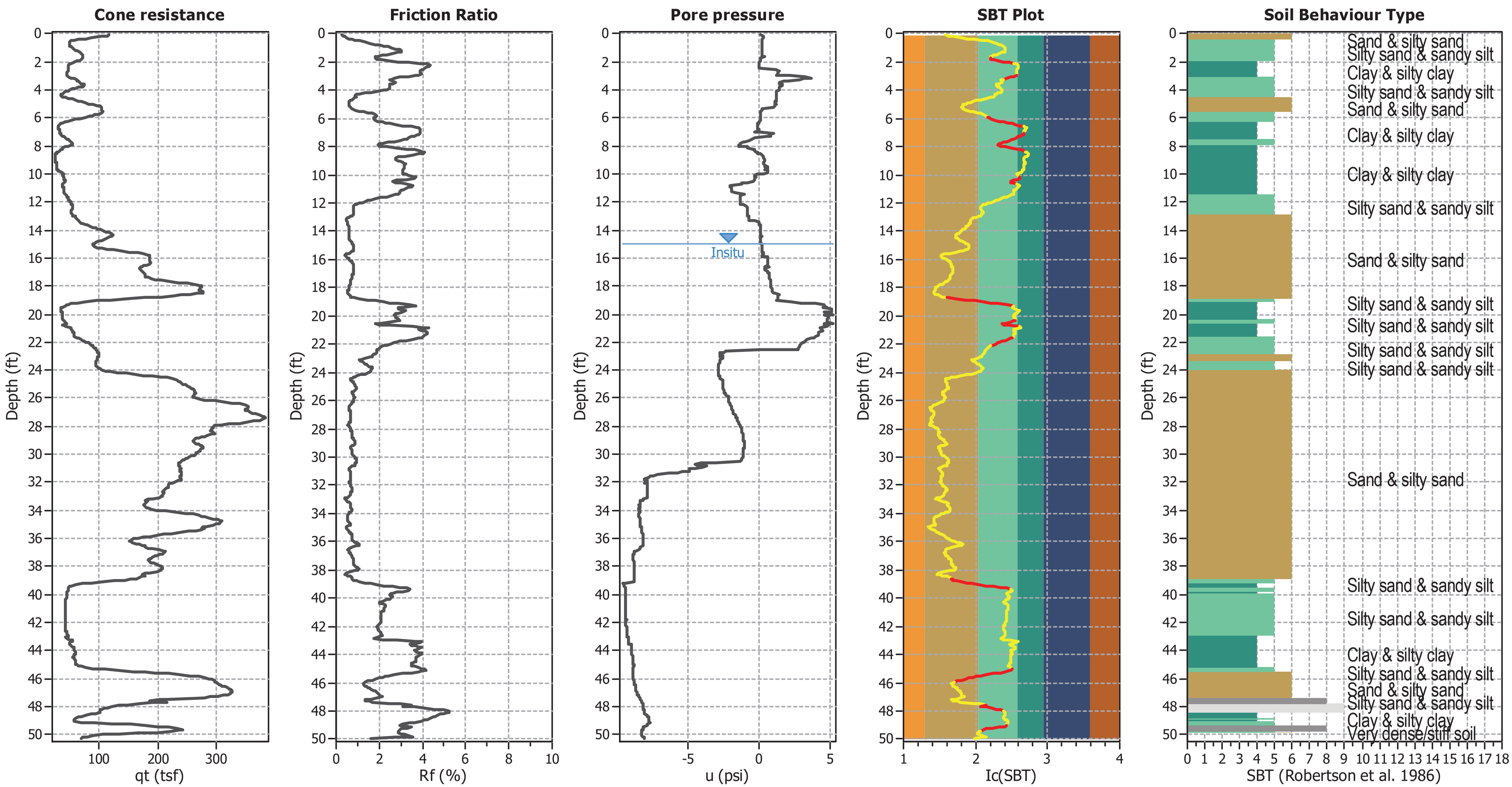






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



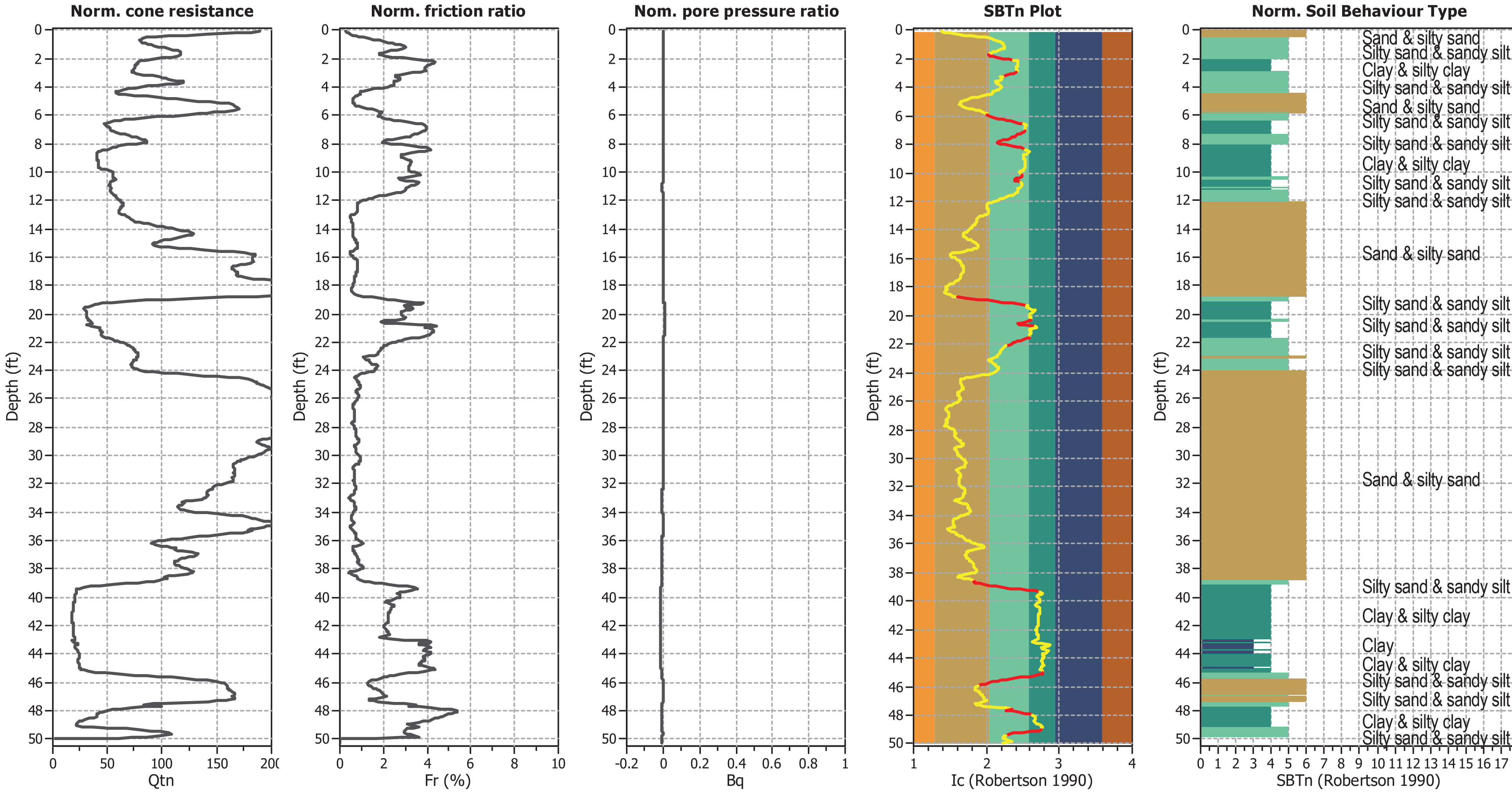
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



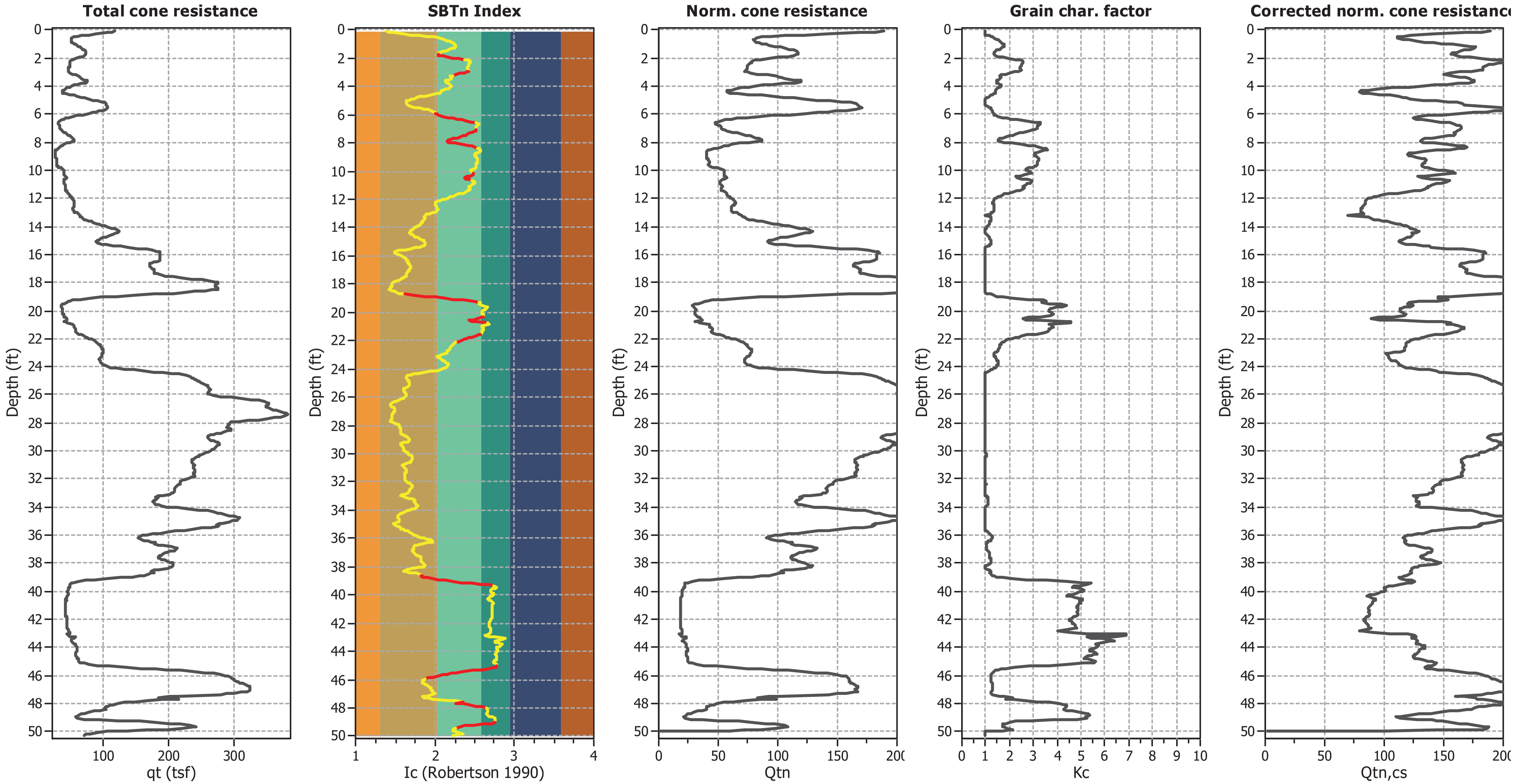
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

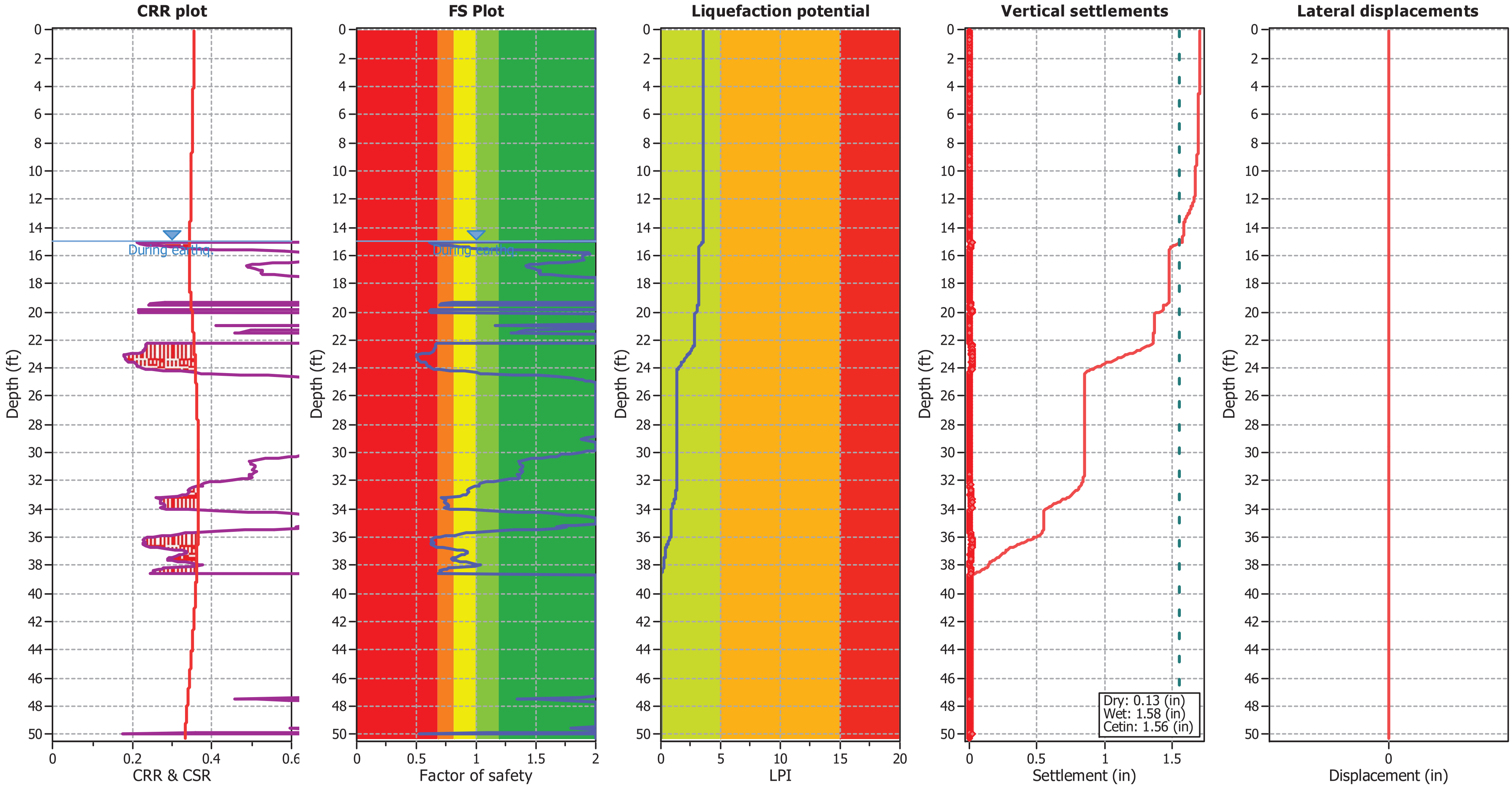
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

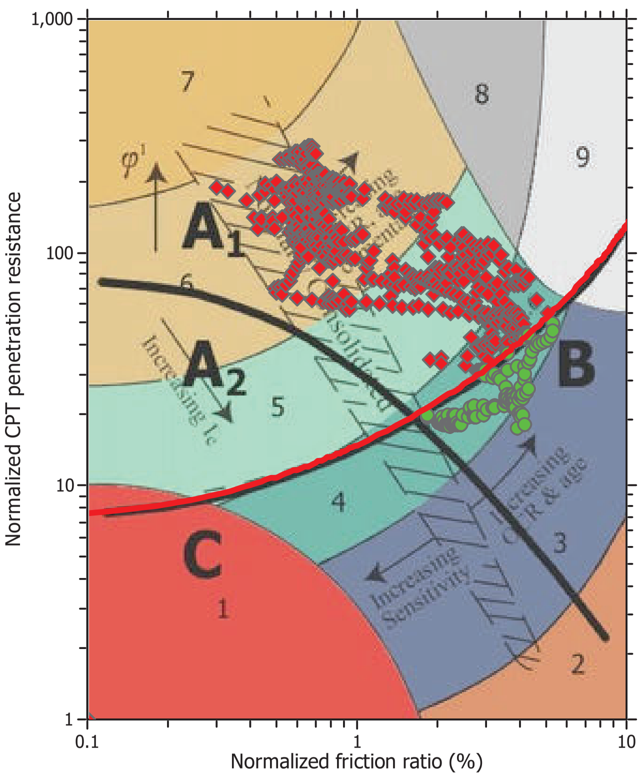
F.S. color scheme

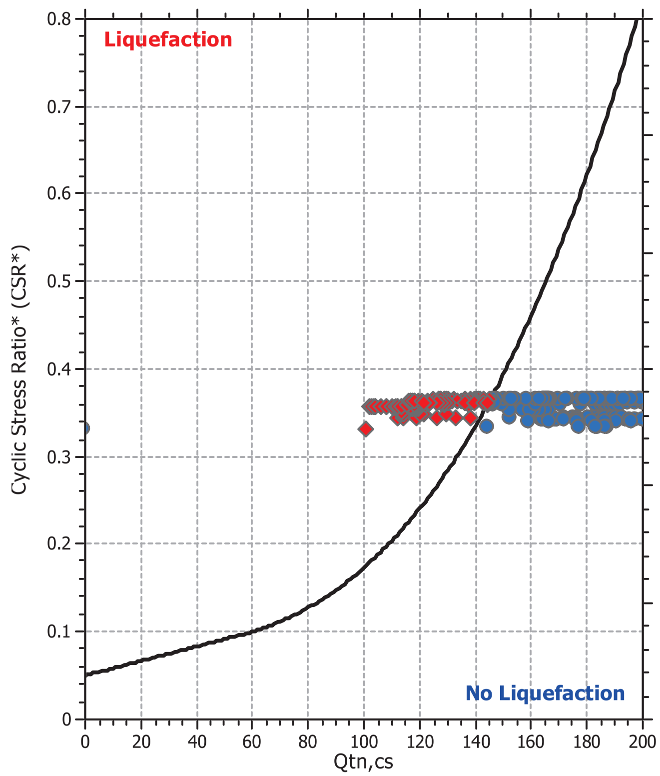
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

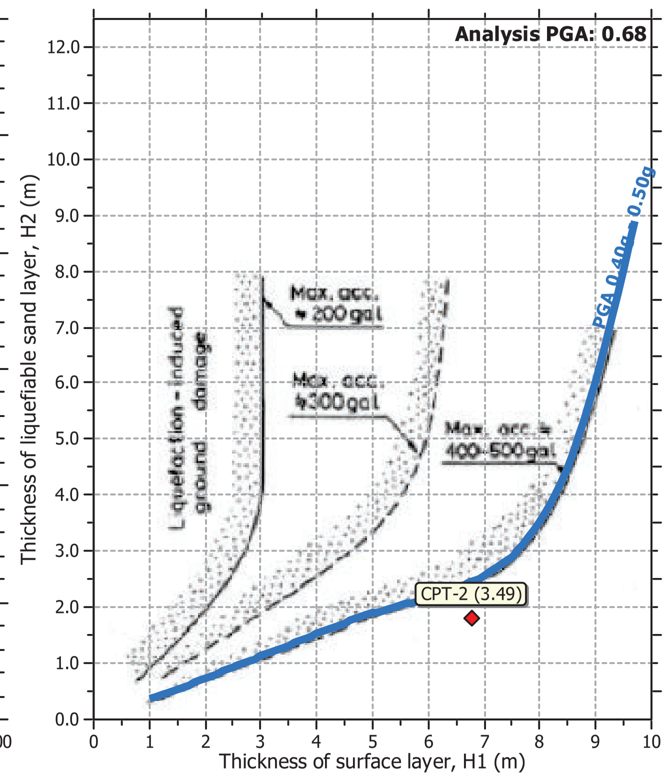
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



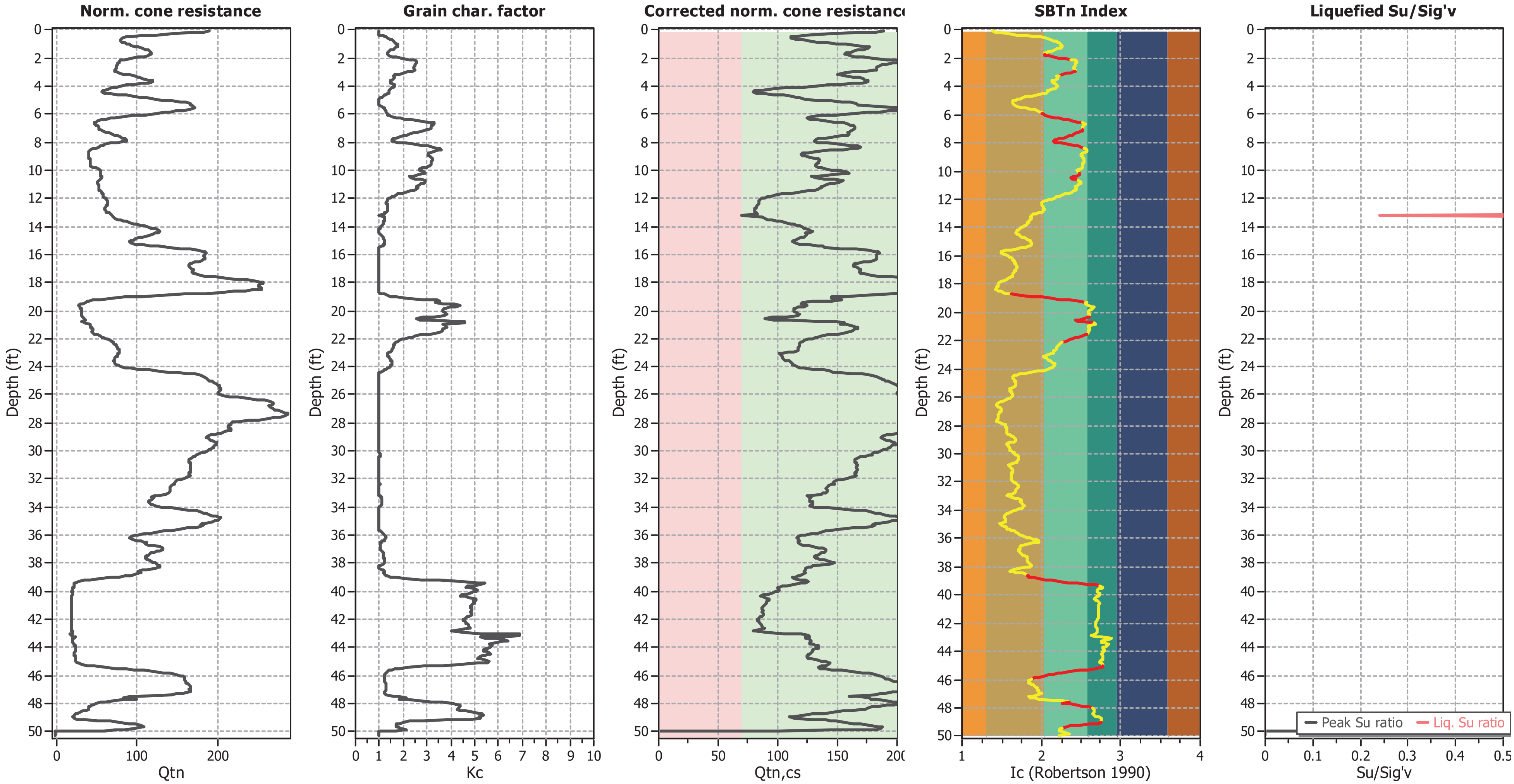




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

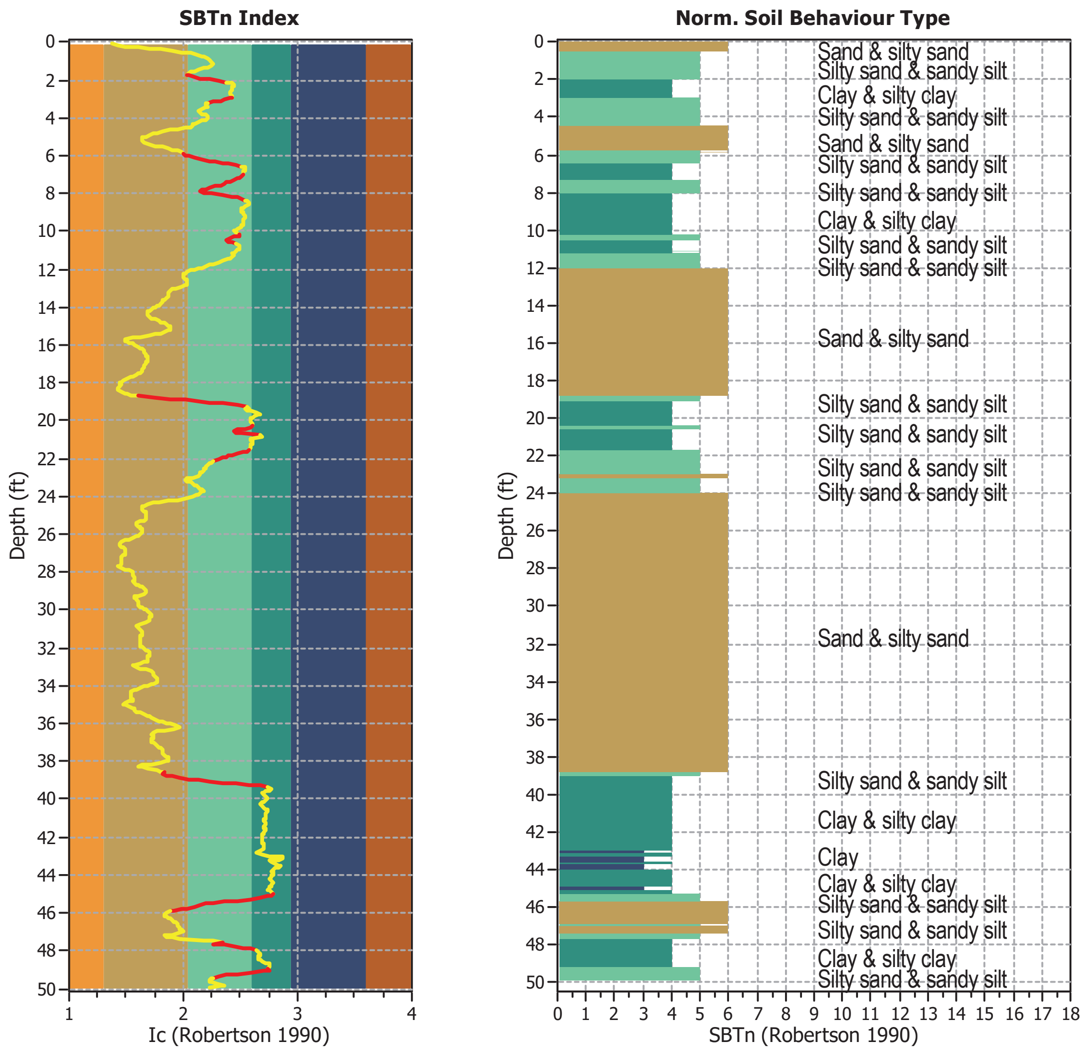
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.89	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	N/A

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



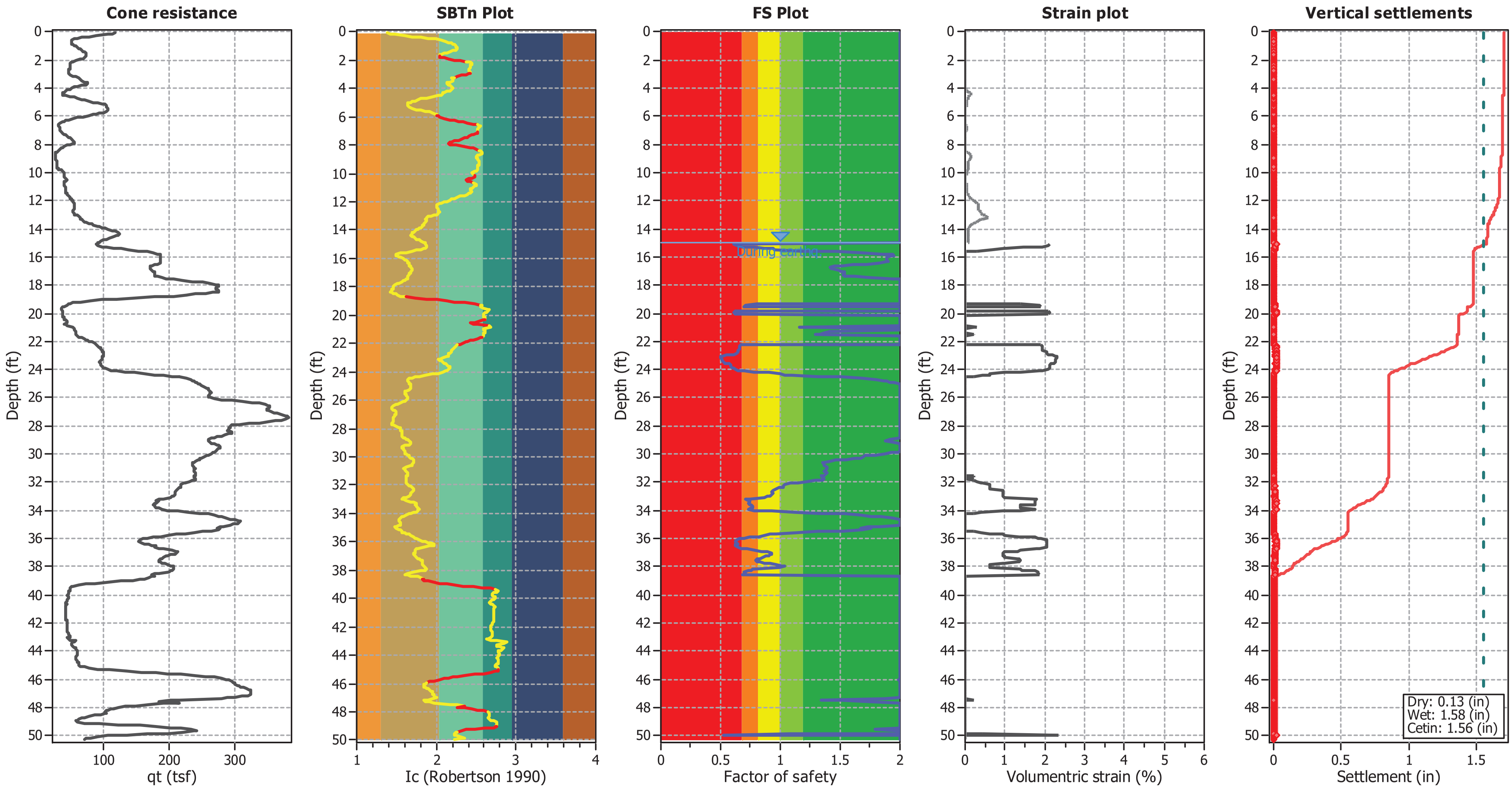
Transition layer algorithm properties

I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0250
Minimum number of points in layer:	4

General statistics

Total points in CPT file:	766
Total points excluded:	123
Exclusion percentage:	16.06%
Number of layers detected:	15

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Appendix B – Grading Recommendations

1.0 General

1.1 Intent

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Verdantas Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Verdantas Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Verdantas Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 Role of Verdantas Inc.

Prior to commencement of earthwork and grading, Verdantas Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Verdantas Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Verdantas Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Verdantas Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Verdantas Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The earthwork contractor (Contractor) shall be qualified, experienced and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Guide Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Verdantas Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Verdantas Inc. is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish earthwork and grading in accordance with the applicable grading codes and agency ordinances, these Guide Specifications, and recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of Verdantas Inc., unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, Verdantas Inc. shall reject the work and may recommend to the owner that earthwork and grading be stopped until unsatisfactory condition(s) are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies and Verdantas Inc.. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the “drip line” of designated trees to remain.

Verdantas Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill, by Verdantas Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be over-excavated as specified in the following Section 2.3. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by Verdantas Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Verdantas Inc.. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Verdantas Inc.. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by Verdantas Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Verdantas Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

3.0 Fill Material

3.1 Fill Quality

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Verdantas Inc. prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to Verdantas Inc. or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Verdantas Inc.. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1, and be free of hazardous materials (“contaminants”) and rock larger than 3-inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than (≤) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Verdantas Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill, as described in Section 2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Verdantas Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM) Test Method D 1557.

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, each layer shall be uniformly compacted to not-less-than (≥) 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. In some cases, structural fill may be specified (see project-specific geotechnical report) to be uniformly compacted to at-least (≥) 95 percent of the ASTM D 1557 modified Proctor laboratory maximum dry density. For fills thicker than (>) 15 feet (4.5 m), the portion of fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557 laboratory maximum density. Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by back rolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Verdantas Inc.. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557 laboratory maximum density.

4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Verdantas Inc.. Location and frequency of tests shall be at our field representative(s) discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Compaction Test Locations

Verdantas Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Verdantas Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

5.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Verdantas Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Verdantas Inc. based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, then observed and reviewed by Verdantas Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Verdantas Inc..

6.0 Trench Backfills

6.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2009 Edition or more current (see also: http://www.dir.ca.gov/title8/sb4a6.html).

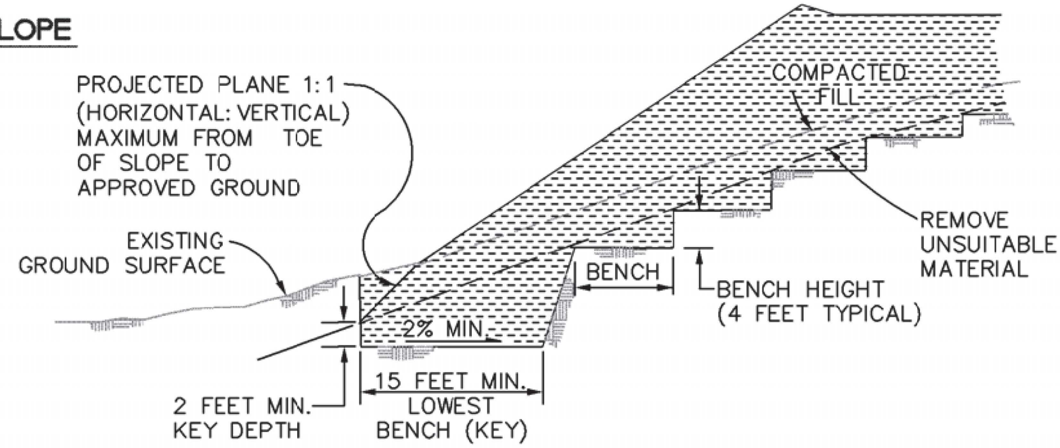
6.2 Bedding and Backfill

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2018 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise, the pipe-bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2018 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Verdantas Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Verdantas Inc..

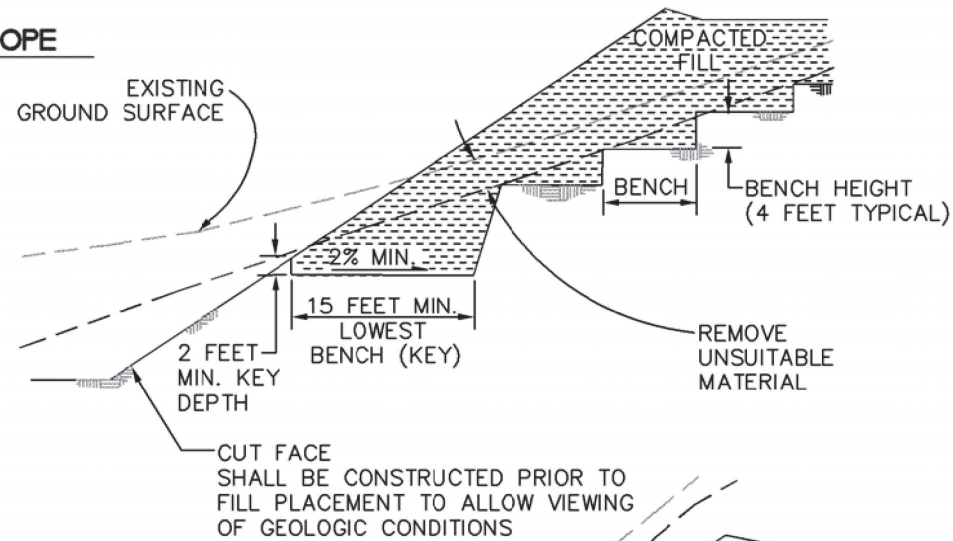
6.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to Verdantas Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.

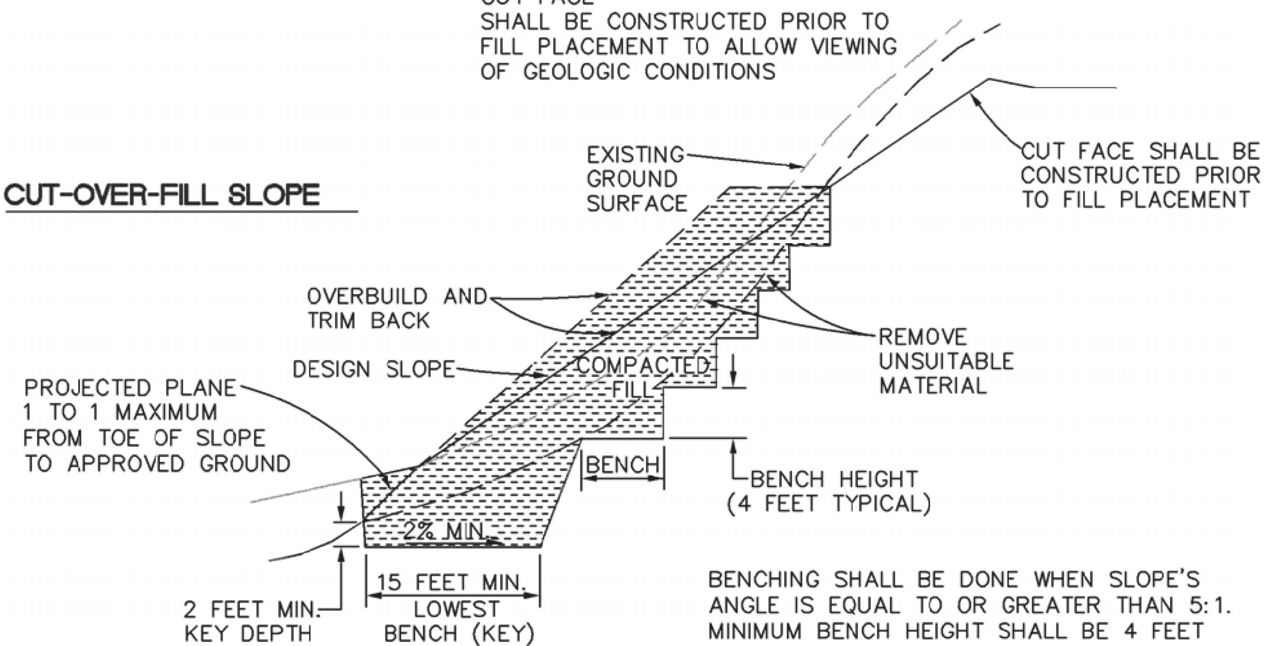
FILL SLOPE



FILL-OVER-CUT SLOPE

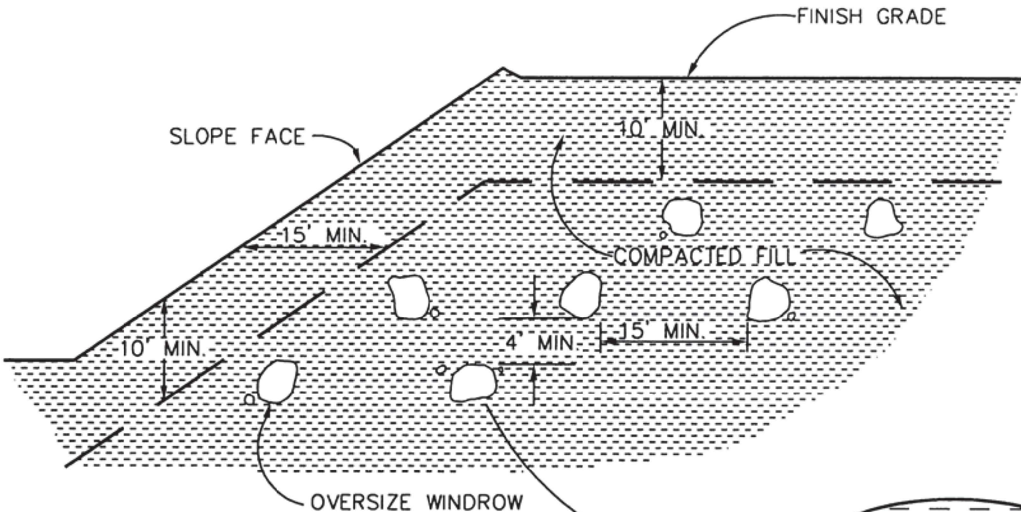


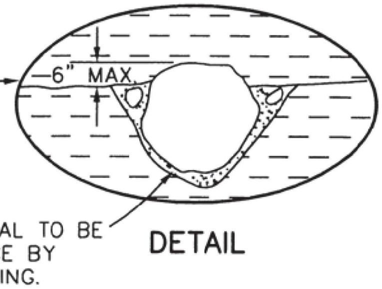
CUT-OVER-FILL SLOPE



BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

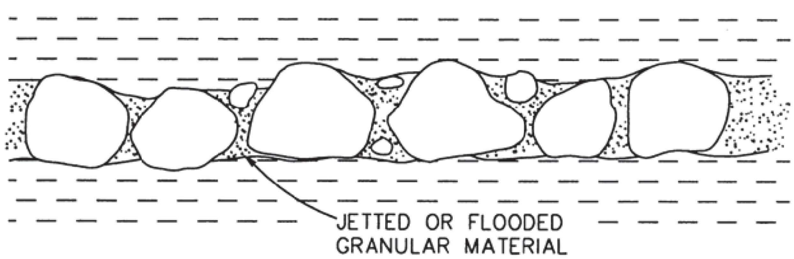
KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAIL A





DETAIL

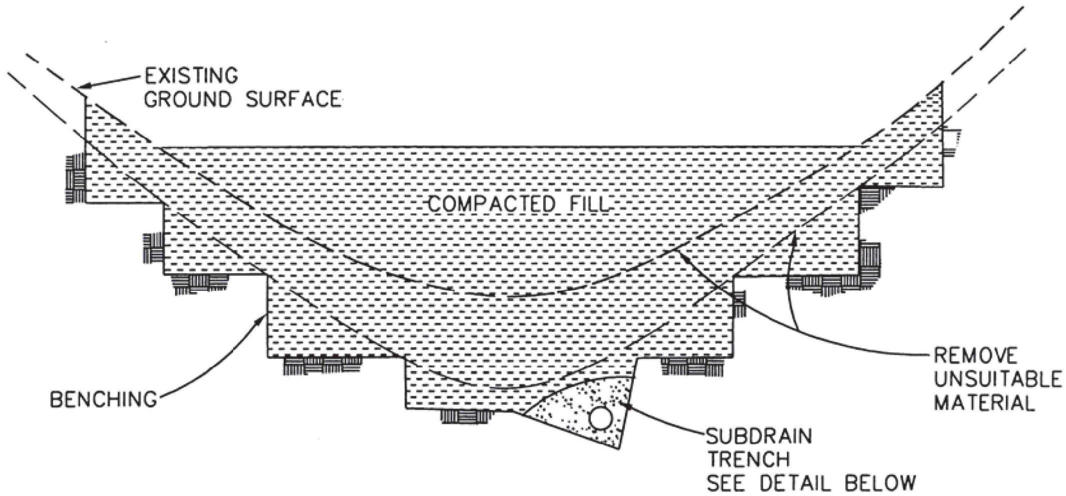
- OVERSIZE ROCK IS LARGER THAN 8 INCHES IN LARGEST DIMENSION.
- EXCAVATE A TRENCH IN THE COMPACTED FILL DEEP ENOUGH TO BURY ALL THE ROCK.
- BACKFILL WITH GRANULAR SOIL JETTED OR FLOODED IN PLACE TO FILL ALL THE VOIDS.
- DO NOT BURY ROCK WITHIN 10 FEET OF FINISH GRADE.
- WINDROW OF BURIED ROCK SHALL BE PARALLEL TO THE FINISHED SLOPE.

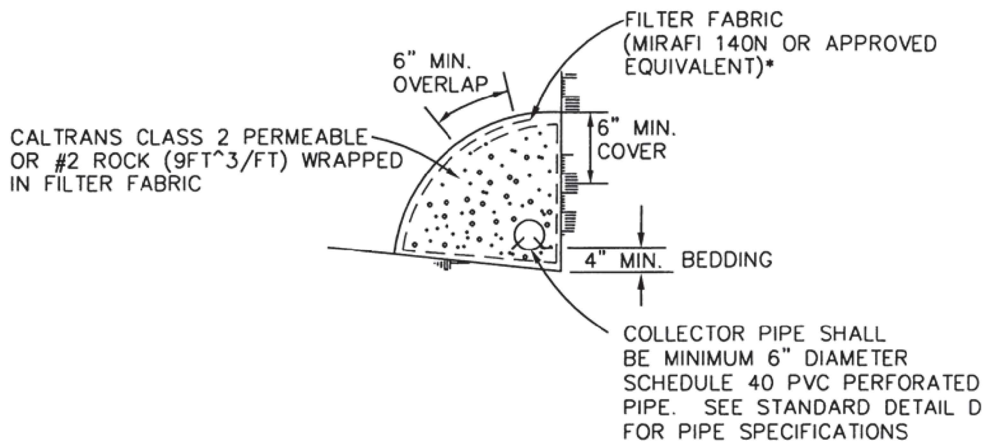


TYPICAL PROFILE ALONG WINDROW

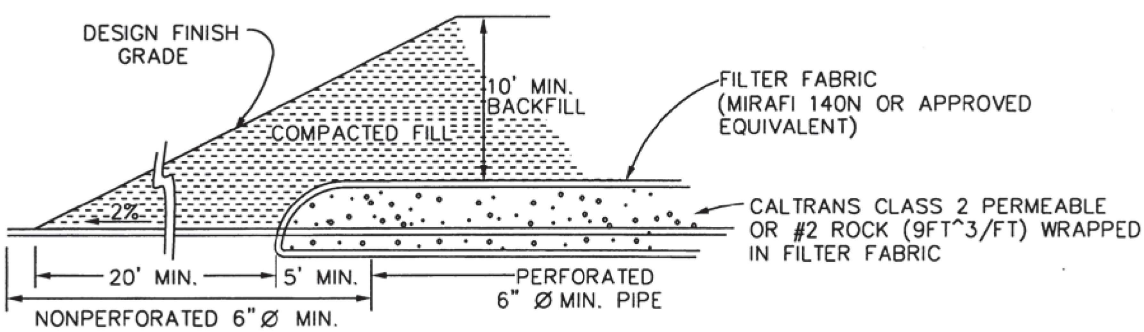
OVERSIZE ROCK DISPOSAL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAIL B





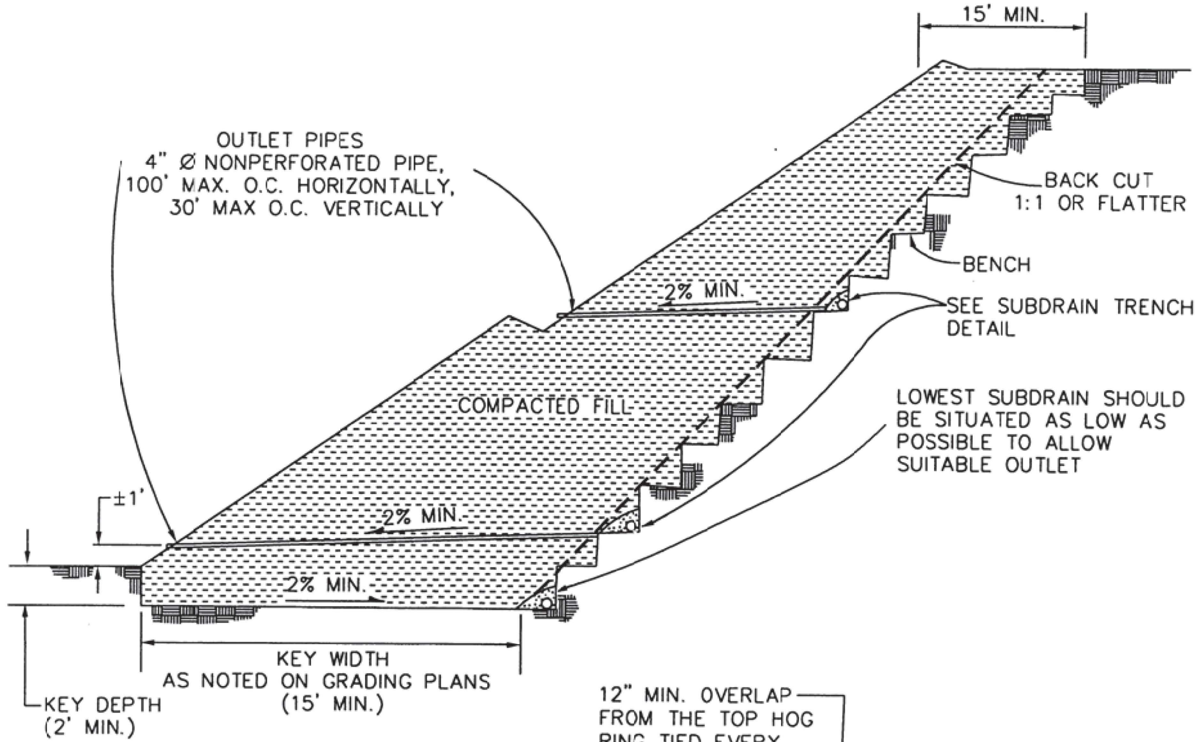
SUBDRAIN DETAIL

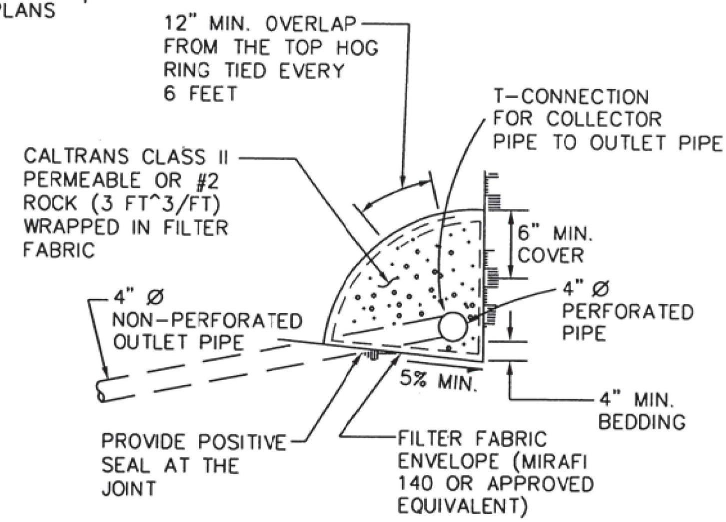


DETAIL OF CANYON SUBDRAIN OUTLET

CANYON SUBDRAINS

GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
STANDARD DETAIL C





SUBDRAIN TRENCH DETAIL

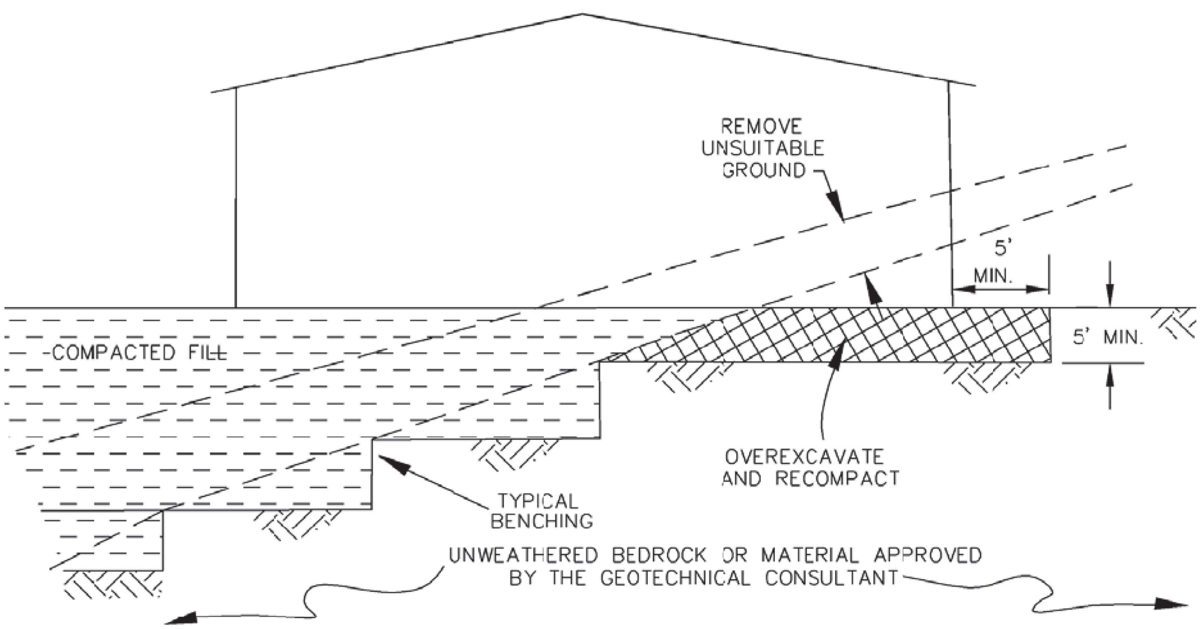
SUBDRAIN INSTALLATION – subdrain collector pipe shall be installed with perforation down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be 1/4" to 1/2" if drill holes are used. All subdrain pipes shall have a gradient of at least 2% towards the outlet.

SUBDRAIN PIPE – Subdrain pipe shall be ASTM D2751, SDR 23.5 or ASTM D1527, Schedule 40, or ASTM D3034, SDR 23.5, Schedule 40 Polyvinyl Chloride Plastic (PVC) pipe.

All outlet pipe shall be placed in a trench no wider than twice the subdrain pipe.

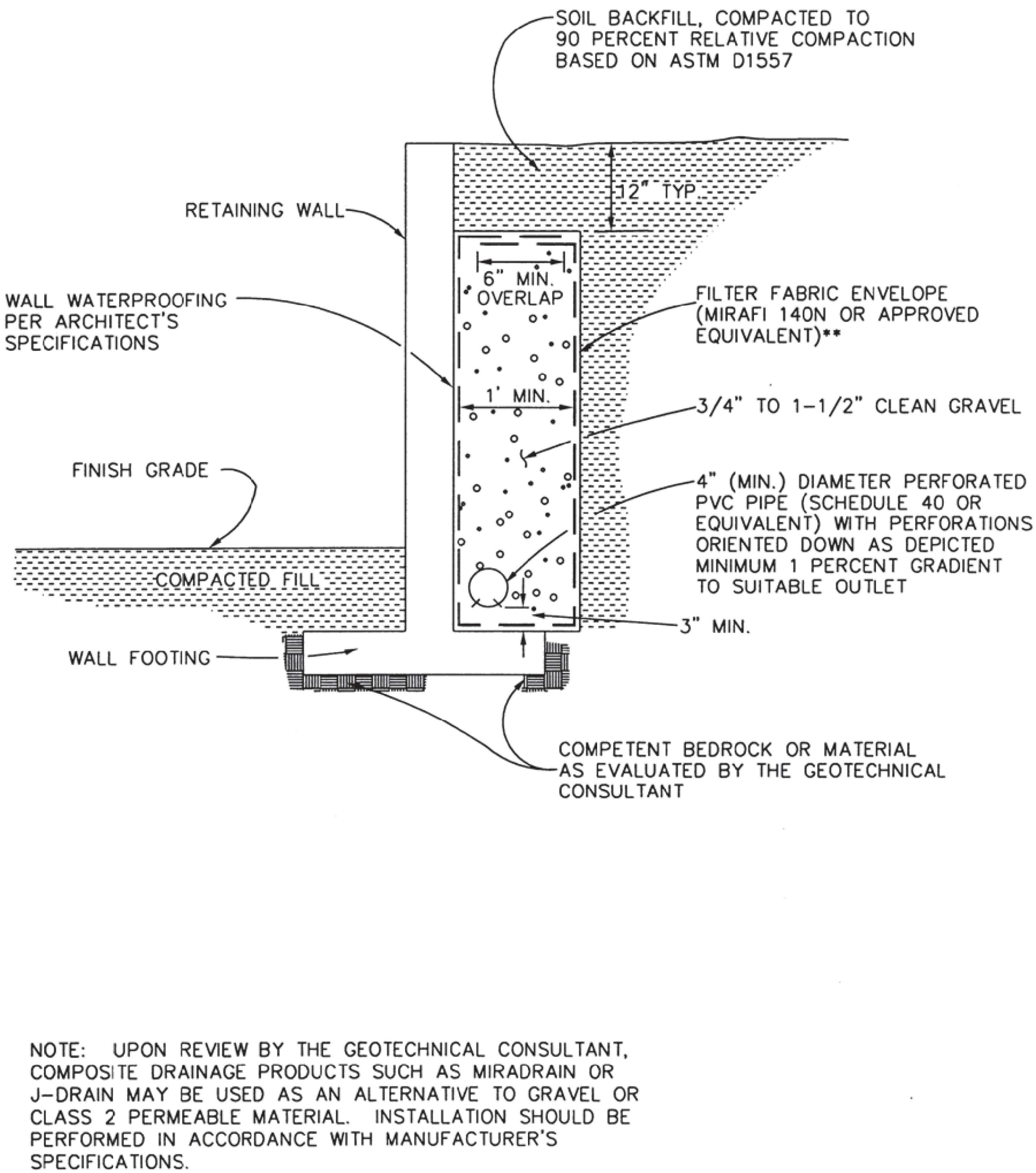
BUTTRESS OR REPLACEMENT FILL SUBDRAINS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAIL D

CUT–FILL TRANSITION LOT OVEREXCAVATION

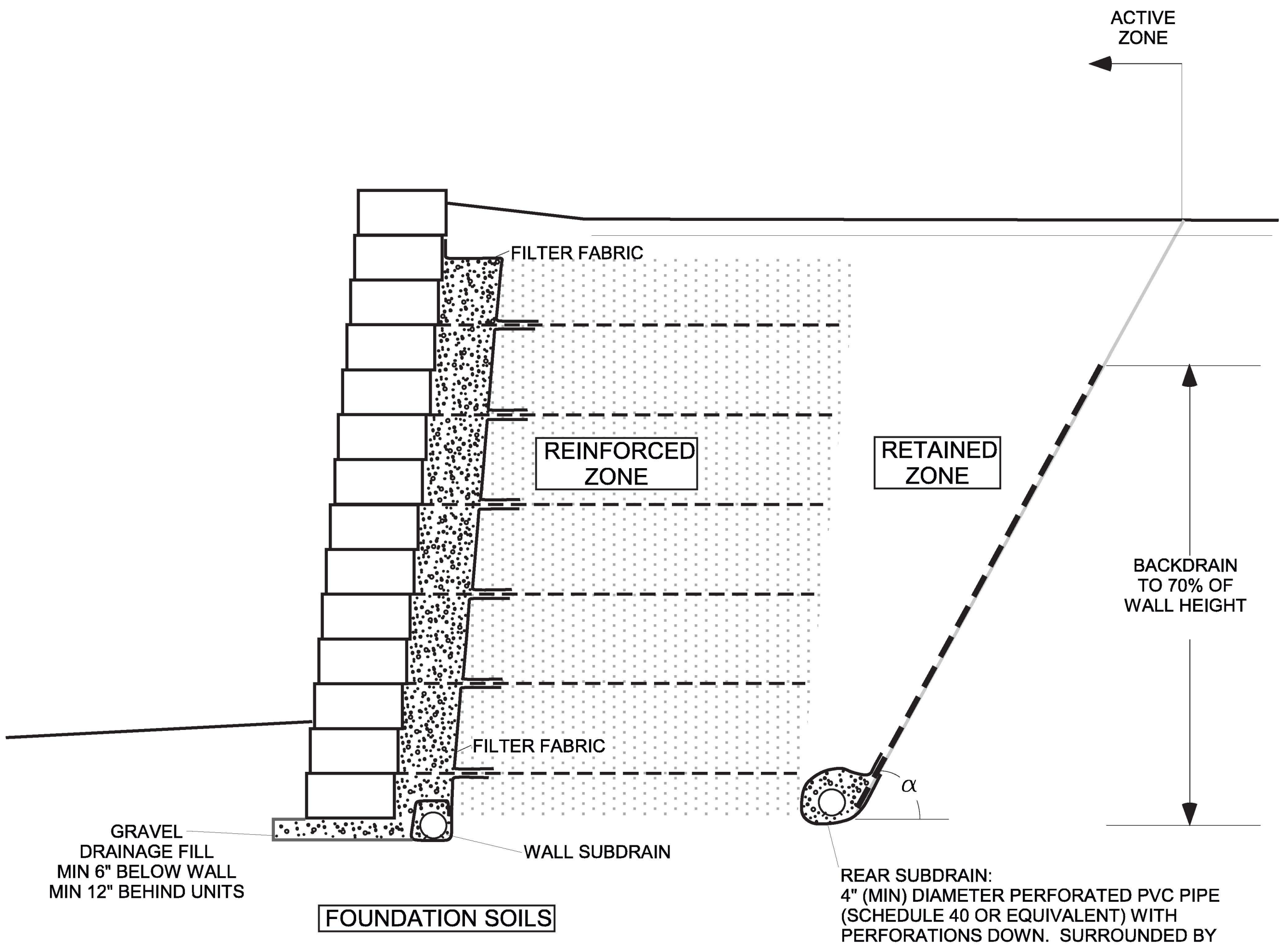


TRANSITION LOT FILLS

GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
STANDARD DETAIL E



RETAINING WALL DRAINAGE	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAIL F



NOTES:

1) MATERIAL GRADATION AND PLASTICITY

REINFORCED ZONE:

SIEVE SIZE	% PASSING
1 INCH	100
NO. 4	20-100
NO. 40	0-60
NO. 200	0-35

FOR WALL HEIGHT < 10 FEET, PLASTICITY INDEX < 20
FOR WALL HEIGHT 10 TO 20 FEET, PLASTICITY INDEX < 10
FOR TIERED WALLS, USE COMBINED WALL HEIGHTS
WALL DESIGNER TO REQUEST SITE-SPECIFIC CRITERIA FOR WALL HEIGHT > 20 FEET

GRAVEL DRAINAGE FILL:

SIEVE SIZE	% PASSING
1 INCH	100
3/4 INCH	75-100
NO. 4	0-60
NO. 40	0-50
NO. 200	0-5

2) CONTRACTOR TO USE SOILS WITHIN THE RETAINED AND REINFORCED ZONES THAT MEET THE STRENGTH REQUIREMENTS OF WALL DESIGN.

3) GEOGRID REINFORCEMENT TO BE DESIGNED BY WALL DESIGNER CONSIDERING INTERNAL, EXTERNAL, AND COMPOUND STABILITY.

3) GEOGRID TO BE PRETENSIONED DURING INSTALLATION.

4) IMPROVEMENTS WITHIN THE ACTIVE ZONE ARE SUSCEPTIBLE TO POST-CONSTRUCTION SETTLEMENT. ANGLE $\alpha = 45 + \phi/2$, WHERE ϕ IS THE FRICTION ANGLE OF THE MATERIAL IN THE RETAINED ZONE.

5) BACKDRAIN SHOULD CONSIST OF J-DRAIN 302 (OR EQUIVALENT) OR 6-INCH THICK DRAINAGE FILL WRAPPED IN FILTER FABRIC. PERCENT COVERAGE OF BACKDRAIN TO BE PER GEOTECHNICAL REVIEW.

SEGMENTAL RETAINING WALLS

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAIL G