Environmental Resources Management

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7 January 2016

Mr. Roger Papler
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Off-Site Study Area
Groundwater Characterization Summary Report /Work Plan Addendum #3
Intersil/Siemens Site
Cupertino, California

Dear Mr. Papler:

On behalf of General Electric Company (GE) and SMI Holding LLC (SMI), ERM-West, Inc. (ERM) has prepared this *Off-Site Study Area Groundwater Characterization Summary Report/Work Plan Addendum #3* (Summary Report/ Work Plan Addendum #3) for the Off-Site Study Area (OSA) of the Intersil/Siemens site in Cupertino, California (site). This letter presents the results of the activities described in the *Off-Site Study Area Monitoring Well Installation Work Plan Addendum #2* (Work Plan Addendum #2) submitted on 17 August 2015. The Work Plan Addendum #2 was approved by the California Regional Water Quality Control Board (RWQCB) in a 9 September 2015 letter. This letter also presents the Work Plan Addendum #3 for further Off-Site Study Area characterization activities.

The focus of this investigation was to further characterize the extent and distribution of chlorinated volatile organic compounds (VOCs) in the A1 and A3 depth interval groundwater in the OSA.

OFF-SITE SOIL BORING AND GRAB GROUNDWATER SAMPLING INVESTIGATION

The offsite investigation was performed from 12 through 24 November 2015. Consistent with Work Plan Addendum #2, a membrane interface

probe (MIP) cone penetrometer testing (CPT) boring was advanced at seven locations as presented on Figures 1A and 1B. MIP-OS-16 and MIP-OS-17 were advanced to the A1 depth interval; however, no groundwater was collected at this depth interval due to absence of a water bearing zone, which is likely the result of the current drought. The RWQCB was notified via email on 18 November 2015. The RWQCB response dated 10 December is provided as Attachment 4.

A Hydropunch™ groundwater sample was collected in the A3 depth interval at the following six locations and depths:

- MIP-OS-17 – 75 - 80 feet below ground surface (bgs);
- MIP-OS-18 – 76 – 81 feet bgs;
- MIP-OS-19 – 75 - 80 feet bgs;
- MIP-OS-20 – 70 - 75 feet bgs;
- MIP-OS-21 – 75 – 80 feet bgs; and
- MIP-OS-22 – 75 – 80 feet bgs.

These hydropunch depth intervals were selected based on one of the highest halogen specific detector (XSD) detections, as referenced on their respective MIP logs. The XSD is highly specific to halogenated compounds and typically used for detecting chlorinated solvent plumes or source areas. CPT logs were also referenced to select depth intervals with lithology that were likely water bearing. CPT and MIP reports are included in Attachments 1 and 2.

The groundwater samples were submitted to Test America Laboratories for analysis of volatile organic compounds (VOCs) by Method 8260B. The results are presented on Table 1, and the data have been validated for quality control and assurance and is presented in Attachment 3. TCE concentrations for the MIP boring locations are also presented on Figure 1, together with current available TCE concentrations for monitoring wells and historical MIP or Hydropunch™ boring locations in the A3 depth interval.

CONCLUSION AND RECOMMENDATIONS

The primary objectives of this investigation were to further characterize the extent and distribution of chlorinated VOCs in A1 and A3 depth interval groundwater in the Off-Site Study Area. The scope of work proposed in the Work Plan has been successfully implemented in the A3 depth interval. Based on the findings (Figure 1), further investigation is recommended to characterize the extent and distribution of VOCs in the A3 depth interval groundwater northeast of MIP-OS-17 and MIP-OS-18, which is within the former AMI site's off-site area.

As noted above, due to absence of a water bearing zone, no samples were collected in the A1 depth interval. In a 10 December email, the RWQCB requested that SMI and GE attempt to collect groundwater samples from the A1 depth interval following the rainy season.

WORK PLAN ADDENDUM #3

This Work Plan Addendum #3 proposes to install a total of seven soil borings and collect groundwater samples from three existing AMI monitoring wells. Table 2 presents the rationale for each sample location. Figures 2 and 3 present the A3 and A4 depth interval locations.

Scope of Work

In the event that groundwater levels recover sufficiently in the A1 depth interval, grab groundwater samples will be attempted adjacent to previous locations MIP-OS-16 and 17. This will be based on a review of historical and quarterly water levels to date in existing A1 depth interval monitoring wells, MW-OS-2A1 and MW-OS-3A1, which are located in the vicinity of these MIP borings. During Spring of 2016, the review will be performed and if findings indicate that water levels are declining, then, grab groundwater sampling at this depth interval will not be initiated, and vice versa. If sampling is performed, the investigation will be performed in accordance with the methodology used during the November 2016 investigation and as referenced in Work Plan Addendum #2.

For the A3 and A4 depth intervals, this additional investigation will include soil borings and grab groundwater sampling using the same

methodology used during the November 2015 investigation and as referenced in Work Plan Addendum #2. Specifically, five borings will be in the A3 depth interval (depths of approximately 80 to 85 feet bgs) and two borings will be in the A4 depth interval (depths of approximately 90 to 100 feet bgs), unless MIP refusal is encountered first. Note that two of the borings proposed for the two depth intervals are in the same location. Hence, the boring will first be advanced to the A3 depth interval, and then extended to the A4 depth interval, within the same borehole.

If provided access by AMI, groundwater samples will be collected from the following existing AMI monitoring wells screened in the A4 depth interval to provide additional VOC characterization: E12A, EW4A, and E31A. These A4 depth interval wells were selected because they will provide the extent of VOC impacts, if any, to the east, south, southeast and southwest of the area being delineated. Groundwater samples will be collected using the HydraSleeve™ sampling method, which is consistent with the groundwater sampling procedure used for the annul groundwater sampling events at all SMI and GE monitoring wells.[1]

Groundwater samples will be delivered under proper chain-of-custody protocol to Test America Laboratories, a California-certified analytical laboratory. Consistent with established protocols for the site, samples will be analyzed for VOCs by United States Environmental Protection Agency (USEPA) Method 8260B (8010 compound list).

Data Evaluation and Reporting

After completion of the proposed borings and groundwater sampling, ERM will prepare a summary report. This report will include a description of activities, tabular and graphical presentations of results, and conclusions and recommendations based on these results. Further evaluation will also be performed to assess whether additional groundwater monitoring wells are warranted.

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[1] Note however that concentrations of VOCs in groundwater samples from monitoring wells are generally expected to be lower than concentrations of VOCs in hydropunch samples at depth discrete locations based on the highest MIP detections.

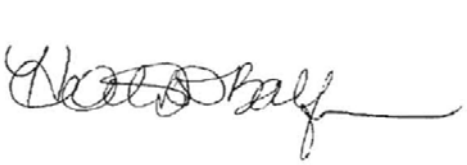
Schedule

As requested by the RWQCB, this investigation will be conducted following the rainy season. The data summary report will be submitted 60 days following the receipt of analytical data but no later than Friday, 1 September 2016.

CLOSING

If you have any questions regarding this submittal, please feel free to contact Heather Balfour at (916) 924-9378 or Kit Soo at (925) 946-0455.

Sincerely,



Heather D. Balfour, P.E.
Partner

Kit Soo, P.G.
Project Manager

HDB/KS/0201040.01SGB

enclosures:

- Figure 1A – TCE Concentrations in the A1 Depth Interval
- Figure 1B – TCE Concentrations in the A3 Depth Interval
- Figure 2 – Proposed Boring and Grab Groundwater Sampling Locations – A3 Depth Interval
- Figure 3 – Proposed Boring, Grab Groundwater and AMI Groundwater Monitoring Well Sampling Locations – A4 Depth Interval
- Table 1 – Summary of Volatile Organic Compounds in Groundwater
- Table 2 – Proposed Boring and Additional Groundwater Monitoring Well Sampling Rationale
- Attachment 1 - MIP Report – Gregg Drilling
- Attachment 2 – CPT Report – Gregg Drilling
- Attachment 3 – QA/QC Memo
- Attachment 4 – RWQCB 10 December 2015 email

cc: Rick Miller, City of Sunnyvale (rmiller@ci.sunnyvale.ca.us)
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Chuck Hunnewell, Siemens Financial Services, Inc. (chuck.hunnewell@siemens.com)
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Figures

M:\Projects\SMI_Cupertino\maps\OffsiteInvestigation\Figure1A_A1_TCESummary.mxd WESAC 12/31/2015

Inverness Way
Kensington Ave
Kerry Ave
Katrine Ct
Kennard Way
Lochinvar Ave
Benton St
Kildare Ave
Lanark Ct
Kintyre Way
Peacock Ave
Redwing Ave
Sparrow Ct
Swift Ct
Benton Ct
Quail Ave
Lochness Ct
Leighton Way
Swallow Dr
Vireo Ave
MIP-OS-14 <0.0005
MIP-OS-15 <0.0005
MIP-OS-6 <0.0005
MIP-OS-7 0.015
MIP-OS-8 <0.0005
MIP-OS-9 <0.0005
MIP-OS-10 0.012
MIP-OS-17 Dry
Lorne Way
MW-OS-3A1 0.025
VM-5S 0.099
MIP-OS-1 0.88
MIP-24 0.035
MIP-26 4.40
MIP-OS-2 0.47
MIP-OS-16 Dry
MIP-OS-11 <0.0005
MW-OS-2A1 1.5
MIP-OS-5 0.0063
MIP-22 0.065
LF-13A NA
2EP 0.26
MIP-OS-4 1.20
Homestead Rd
MIP-20 <0.0005
VM-6S 0.830
MIP-OS-3 1.60
MW-1-RU NA
MIP-28 1.20
MIP-31 0.690
IBM (FORMER AMI BUILDING 700-800)
VM-2S NA
IP-3 <0.00050
UST 2
IP-1 NA
MIP-30 0.620
VM-8S 0.240
IP-2 < 0.0025
4BP 0.420/ NA
UST 4
FORMER SIEMENS FACILITY
UST 1
UST 3
Leonard Ave
IBM (FORMER AMI) PARKING STRUCTURE
Swallow Way
Forge Dr
FORMER TANDEM
FORMER INTERSIL BUILDING
ZOOMSYS SUITE B
Tantau Ave
Melody Ln
Hubbard Ave
Meadow Ave
Shasta Dr
Giannini Dr
Hudson Dr
N
0 125 250
Scale in Feet

Notes:
NA : Not Analyzed because well was dry or insufficient water available for sampling
1.23/0.24 : Primay Result/Duplicate Result
0.12 : Concentration of Trichloroethene (TCE) in milligrams per liter (mg/L)
< : Concentration detected below the Reporting Limit
MIP results are from July and August 2011 - North Side Investigations Report and Off-site Study Area Investigation (PEI and ARCADIS, 2011)

November 2015 MIP Sample Location
Monitoring Well
Groundwater Extraction Well
Injection Point
MIP and/or Depth Discrete Grab Groundwater Sample
Existing Buildings
Groundwater Remediation Facility
City Block
Former Underground Storage Tank (UST; Approximate Location)

Source: ARCADIS, Former Siemens Facility 2006 Annual Report: Figure 3 (dated 1/7/2010).

Intersil/Siemens Site
Cupertino, California

FIGURE 1A
TCE Concentrations in the A1 Depth Interval

ERM

PREPARED BY: mike.appel

JOB NO. 0201040.04SB
FILE: Figure1A_A1_TCESummary

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Kensington Ave
MIP-OS-22
0.0096
Kerry Ave
Katrine Ct
Lochinvar Ave
MIP-OS-21
< 0.00050
Kildare Ave
MIP-OS-20
< 0.00050
Lanark Ct
MW-OS-5A3
0.019/0.015
Swift Ct
Redwing Ave
Sparrow Ct
MW-OS-4A3
< 0.00050
HP-OS-14
0.054
HP-OS-15
< 0.0005
Lochness Ct
Quail Ave
Swallow Dr
MIP-OS-19
0.16
MW-OS-3A3
0.15
MIP-OS-8
<0.0005
MIP-OS-9
0.200
MIP-OS-17
0.14
Lorne Way
MIP-OS-2
0.130
MW-OS-2A3
0.08
MIP-OS-4
0.0047
MIP-OS-18
0.12
MW-03A3
< 0.00050
MW-04A3
0.022
MIP-26
0.130
2EPa
0.059
MIP-OS-5
0.170
Homestead Rd
LF-12A
0.012
VM-5D
0.17
MIP-27
0.160
MW-01A3
0.061
MIP-20
< 0.0005
H-1A
0.093
VM-6D
0.046
MIP-29
0.016
MIP-31
0.150*
VM-3D
0.00068
VM-2D
0.016
VM-4D
0.0039
VM-7D
0.0083
IBM
FORMER AMI
BUILDING 700-800
UST 1
G-1A
0.35
UST 2
VM-8D
0.045
UST 4
Tantau Ave
FORMER
SIEMENS
FACILITY
UST 3
Swallow Way
IBM (FORMER AMI)
PARKING STRUCTURE
SW-7
0.057
EX-1-RL
0.12
SW-5S
0.049
SW-6S
1.4
W19MA
NS
Forge Dr
W18MA
0.1
FORMER TANDEM
FORMER
INTERSIL
BUILDING
ZOOMSYS SUITE B
N
0 50 100 200
Scale in Feet

Notes:
*: Not included in contouring
NS : Not Analyzed because well was dry or insufficient water available for sampling
1.23/0.24 : Primay Result/Duplicate Result
0.12 : Concentration of Trichloroethene (TCE) in milligrams per liter (mg/L)
< : Concentration detected below the Reporting Limit
MIP results are from July and August 2011 - North Side Investigation Report and Off-site Study Area Investigation (PEI and ARCADIS, 2011).

November 2015 MIP Sample Location
Groundwater Extraction Well
Monitoring Well
MIP and/or Depth Discrete Grab Groundwater Sample

Existing Buildings
Groundwater Remediation Facility
City Block
Former Underground Storage Tank (UST; Approximate Location)

TCE Contour (Dashed where Inferred)

Basemap: ARCADIS, Former Siemens Facility 2006 Annual Report: Figure 3 (dated 1/7/2010).

Intersil/Siemens Site
Cupertino, California

FIGURE 1B
TCE Concentrations in the A3 Depth Interval

ERM

PREPARED BY: mike.appel

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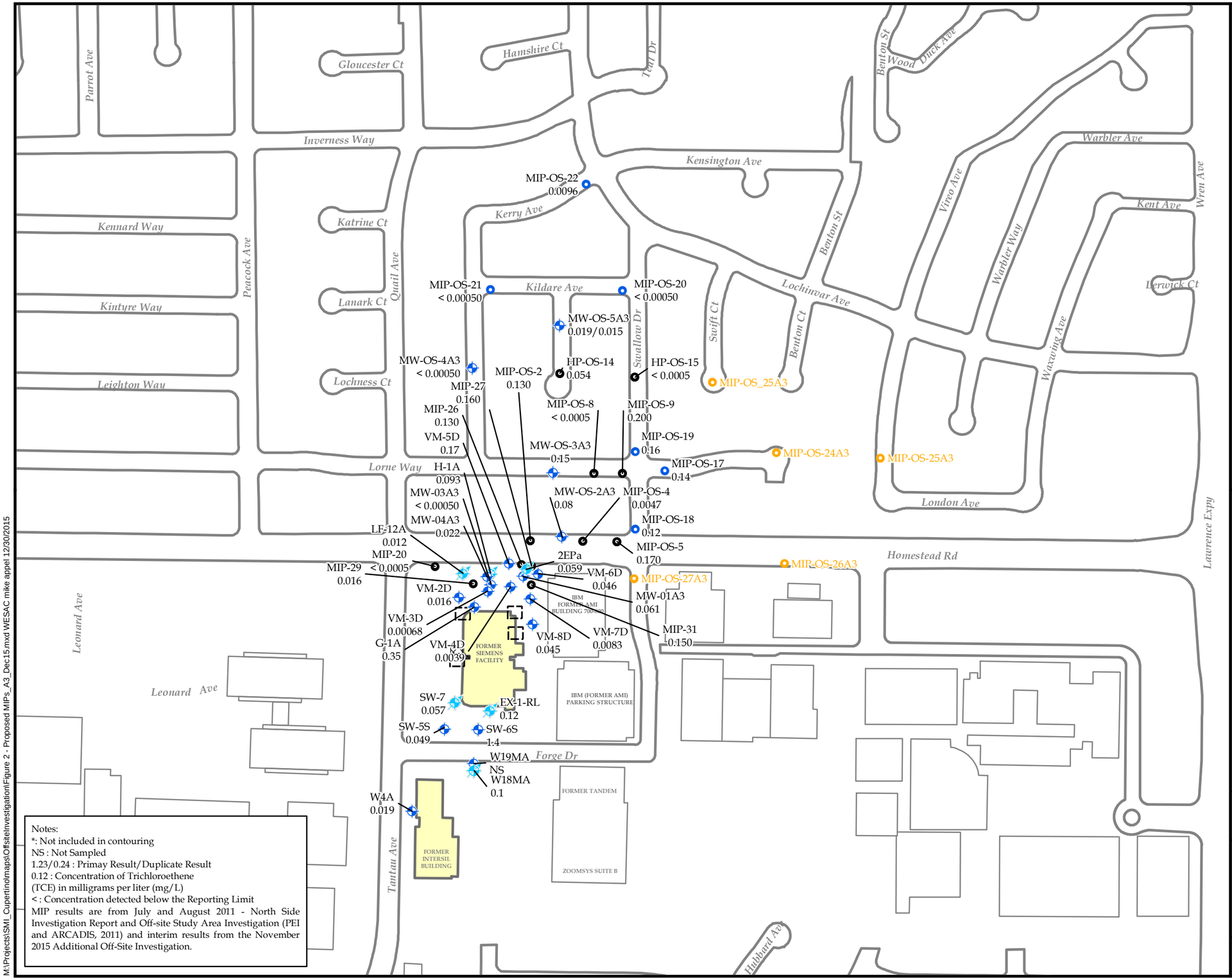

Notes:
*: Not included in contouring
NS : Not Sampled
1.23/0.24 : Primay Result/Duplicate Result
0.12 : Concentration of Trichloroethene
(TCE) in milligrams per liter (mg/L)
< : Concentration detected below the Reporting Limit
MIP results are from July and August 2011 - North Side Investigation Report and Off-site Study Area Investigation (PEI and ARCADIS, 2011) and interim results from the November 2015 Additional Off-Site Investigation.

Legend

- Proposed MIP Locations
- Monitoring Well
- Groundwater Extraction Well
- November 2015 MIP Sample Location
- MIP and/or Depth Discrete Grab Groundwater Sample
- Former Underground Storage Tank (UST; Approximate Location)
- Groundwater Remediation Facility
- Existing Buildings
- City Block

N

0 350 700

Scale in Feet

Intersil/Siemens Site
Cupertino, California

FIGURE 2
Proposed MIP Sampling Locations
A3 Depth Interval

ERM

PREPARED BY: mike appel

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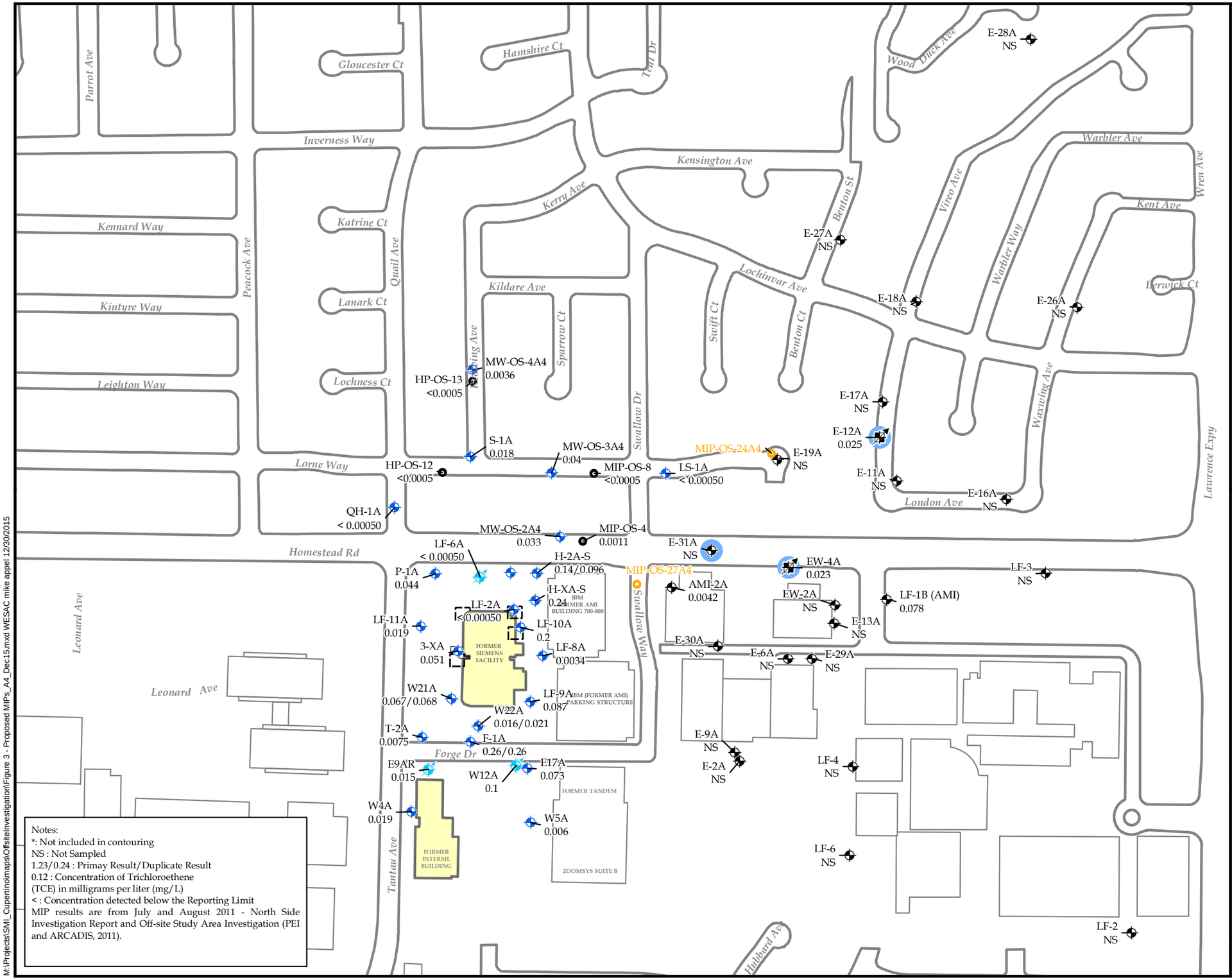

Notes:
*: Not included in contouring
NS : Not Sampled
1.23/0.24 : Primay Result/Duplicate Result
0.12 : Concentration of Trichloroethene (TCE) in milligrams per liter (mg/L)
< : Concentration detected below the Reporting Limit
MIP results are from July and August 2011 - North Side Investigation Report and Off-site Study Area Investigation (PEI and ARCADIS, 2011).

Legend

- Proposed MIP Boring
- Proposed AMI well to Sample
- Monitoring Well
- Groundwater Extraction Well
- MIP and/or Depth Discrete Grab Groundwater Sample
- AMI Monitoring Well
- AMI Extraction Well
- Former Underground Storage Tank (UST; Approximate Location)
- Groundwater Remediation Facility
- Existing Buildings
- City Block

N

0 350 700

Scale in Feet

Intersil/Siemens Site
Cupertino, California

FIGURE 3
Proposed MIP Boring and Groundwater Monitoring Well Sampling Locations
A4 Depth Interval

ERM

PREPARED BY: mike appel

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Tables

Table 1
Summary of Volatile Organic Compounds in Groundwater
SMI/Intersil
Cupertino, California

Location ID	Depth (feet)	Sample Date	1,1,1-Trichloroethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Freon 113	Trichloroethene
Analyte Unit			mg/L	mg/L	mg/L	mg/L	mg/L
CA MCL			0.2	**0.006**	**0.006**	1.2	**0.005**
MIP-OS-17	75-80	11/19/2015	**0.0057**	**0.0089**	**0.0082**	**0.0042**	**0.14**
MIP-OS-18	76-81	11/18/2015	**0.0063**	**0.0073**	**0.0042**	**0.0043**	**0.12**
MIP-OS-19	75-80	11/18/2015	**0.0076**	**0.016**	**0.019**	**0.0056**	**0.16**
MIP-OS-20	70-75	11/19/2015	**0.00070**	< *0.00050*	< *0.00050*	**0.0015**	< *0.00050*
MIP-OS-21	75-80	11/23/2015	**0.00088**	< *0.00050*	< *0.00050*	< *0.00050*	< *0.00050*
MIP-OS-22	75-80	11/24/2015	**0.0021**	< *0.00050*	**0.0017**	**0.0012**	**0.0096**

Notes:
Units are in mg/L = milligrams per liter
Samples with results detected above the Reportable Detection Limit are shown
Bolded values indicate concentrations above the Reportable Detection Limit.
Shaded values indicate concentrations above the CA MCL for drinking water.
< = Compound not detected. Reportable detection limit shown.
SW8260B analyses performed by TestAmerica - Pleasanton (San Francisco) and Irvine, CA.
CA MCL = California Maximum Contaminant Level, updated 1 May 2014 by the California Regional Water Quality Control Board.

Table 2
Proposed Boring and Additional Groundwater Montioring Well Sampling Rationale
Additional Characterization 2016 - Off-Site Study Area
Intersil/Siemens Site
Cupertino, California

Boring/Well Identification	Boring Location	Reference Location	Depth Interval	Rationale
A1 Depth Interval Locations				
MIP-OS-17	On Lorne Way, to the east of Swallow Drive	Adjacent to MIP-OS-17	A1	Attempt to collect A1 depth interval sample following the rainy season
MIP-OS-18	On Swallow Drive, just north of Homestead	Adjacent to MIP-OS-18	A1	Attempt to collect A1 depth interval sample following the rainy season
A3 and A4 Depth Interval Grab Groundwater Locations				
MIP-OS-23	At the end of Swift Court	East of HP-OS-15 and northeast of MIP-OS-19	A3	To characterize the extent and distribution of VOCs in the northern boundary.
MIP-OS-24	Along Lorne Way (in the vicinity of the court)	East of MIP-OS-17 and LS-1A	A3 and A4	To characterize the extent and distribution of VOCs in the eastern boundary.
MIP-OS-25	Along Vireo Avenue, near London.	Further east of MIP-OS-17	A3	To characterize the extent and distribution of VOCs further east.
MIP-OS-26	Along Homestead Road, in front of AMI	Southeast of MIP-OS-17 and east of MIP-OS-18	A3	To characterize the extent and distribution of VOCs to the south/southeast.
MIP-OS-27	On Swallow Way, at Homestead Road	Southeast of MIP-OS-5 (A3) and MIP-OS-4 (A4)	A3 and A4	To characterize the extent and distribution of VOCs south/southwest.
A4 Depth Interval Monitoring Well Locations				
E12A	In the AMI Offsite Area - Along Vireo Avenue, near London.	Co-located with MIP-OS-25	A4	AMI A4 depth interval well that has not been sampled in recent events
EW4A	In the AMI Offsite Area - Along Homestead Road, in front of AMI	Co-located with MIP-OS-26	A4	To characterize the extent and distribution of VOCs to the south/southeast.
E31A	In the AMI Offsite Area - On Swallow Way, at Homestead Road	Betweeen MIP-OS-27 and EW-4A	A4	To characterize the extent and distribution of VOCs south/southwest.

Notes:
bgs = Below ground surface
VOC = Volatile organic compound

Attachment 1
MIP Report – Gregg Drilling

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

Date: 11/25/15

Client: ERM

Attn: Kit Soo

Subject: Membrane Interface Probe (MIP) Site Investigation
Project Name: SMI Cupertino
Project Location: Homestead Rd. and Swallow Dr.
GREGG Project Number: D2150542

Kit:

The following report presents the results of GREGG Drilling & Testing's investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☐
2	Pore Pressure Dissipation Tests	(PPD)	☐
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	Resistivity Cone Penetration Tests	(RCPTU)	☐
5	UVOST Laser Induced Fluorescence	(UVOST)	☐
6	Soil Sampling	(SS)	☐
7	Membrane Interface Probe	(MIP)	☒
8	Membrane Interface Probe with Hydraulic Profiling Tool	(MiHPT)	☐
9	Hydraulic Profiling Tool	(HPT)	☐

Tests using the Membrane Interface Probe (MIP) were carried out in accordance with Geoprobe's Standard Operating Procedure. A list of references providing additional background on the specific device and test is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (562) 427-6899.

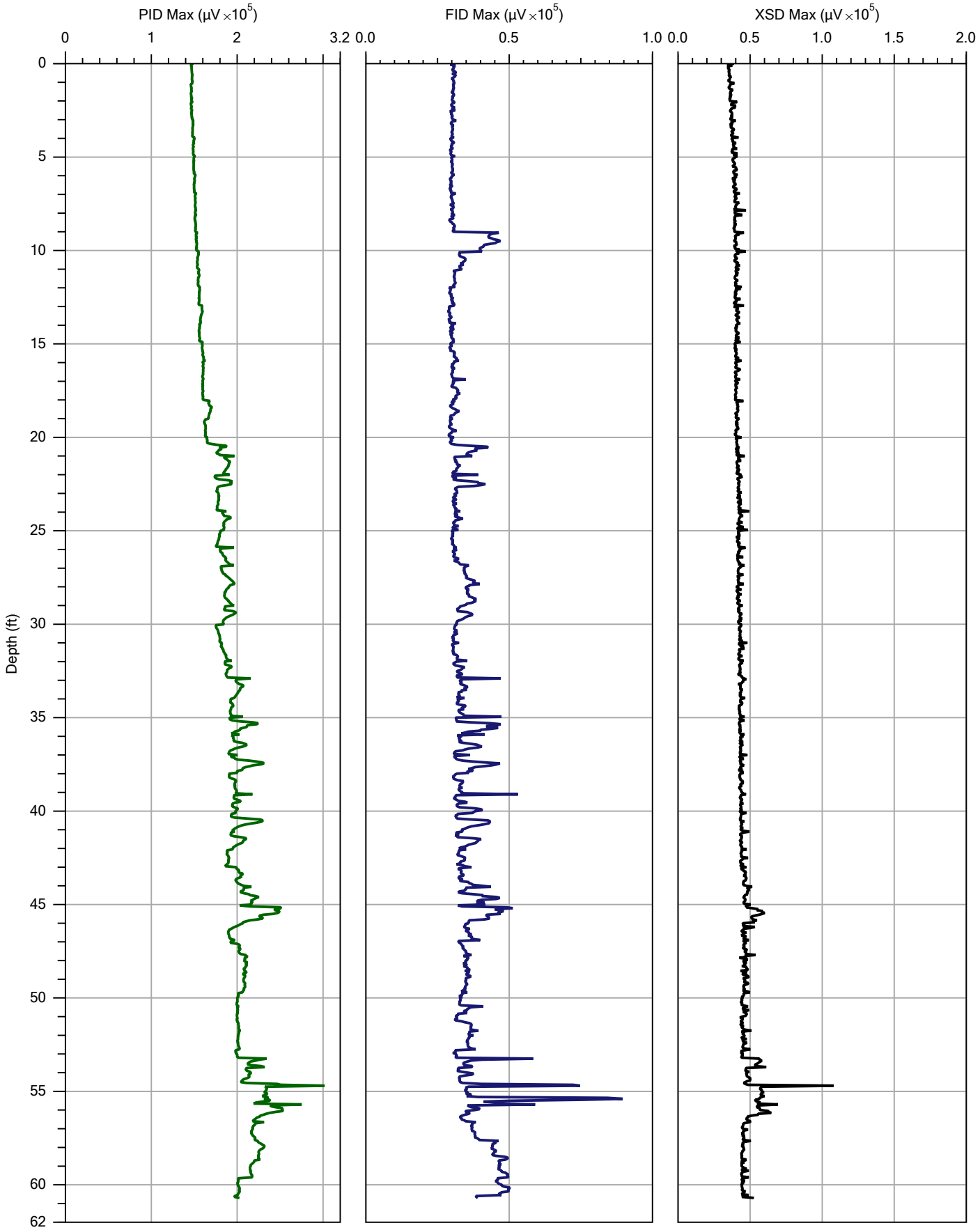
Sincerely,
GREGG Drilling & Testing, Inc.

Peter Robertson
Technical Operations

Bibliography

Geoprobe Hydraulic Profiling Tool (HPT) Standard Operating Procedure. Technical Bulletin No. MK 3137, January 2015.

Geoprobe Membrane Interface Probe (MiHPT) Standard Operating Procedure. Technical Bulletin No. MK 3010, January 2015.



GREGG

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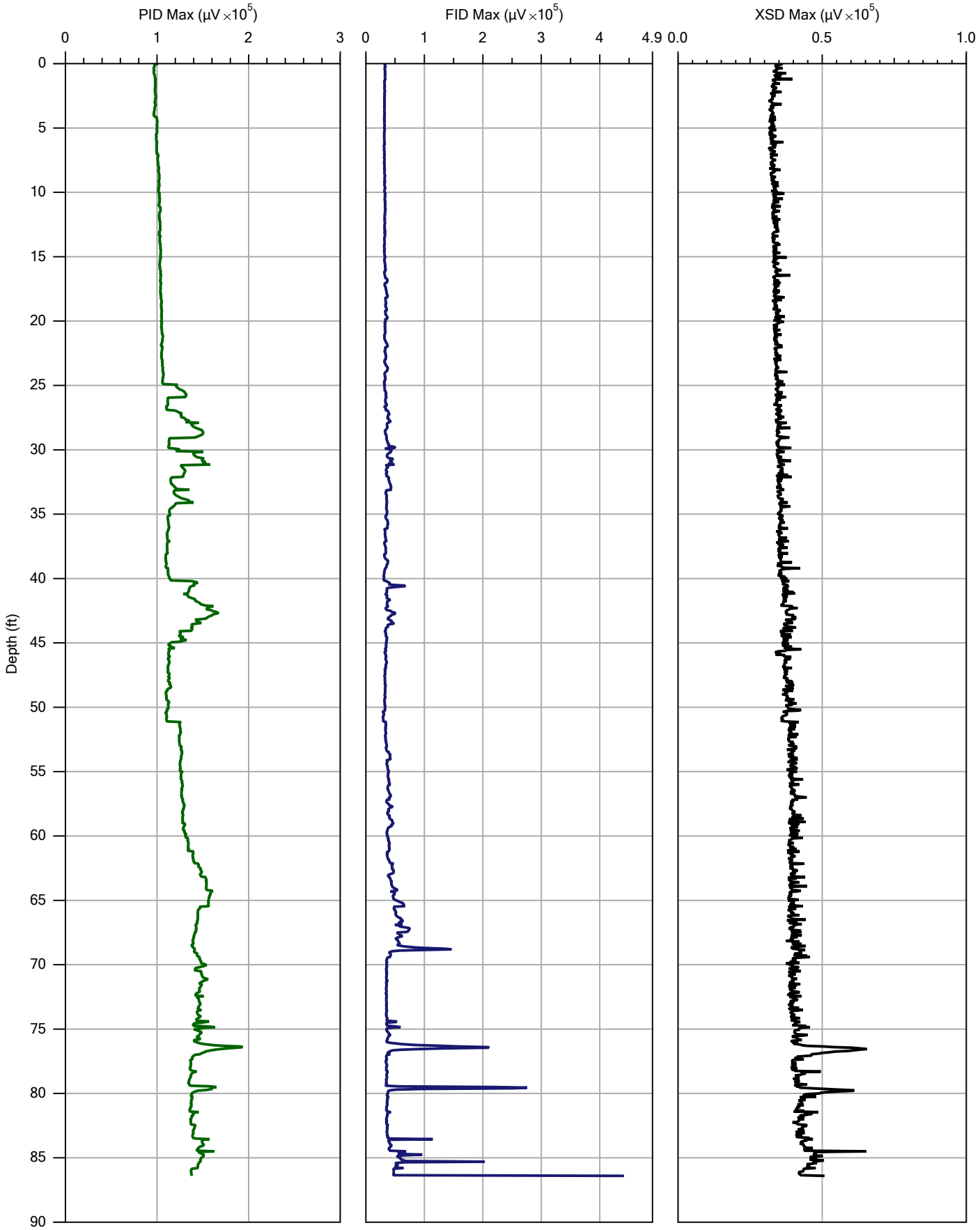
Company: Gregg Drilling and Testing	Operator: C. Hirschy	Date: 11/17/2015
Project ID: SMI Cupertino	Client: ERM	Location:



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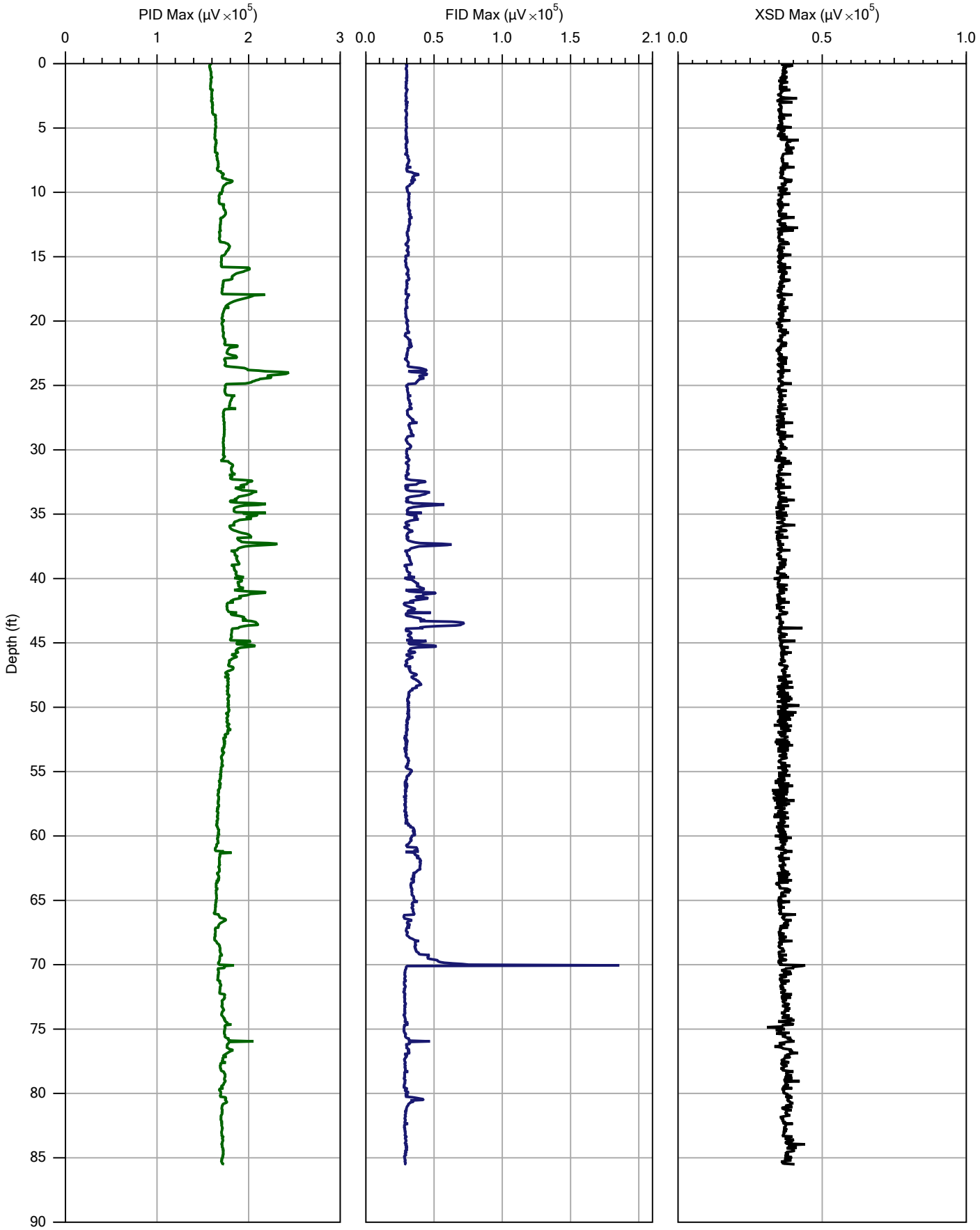
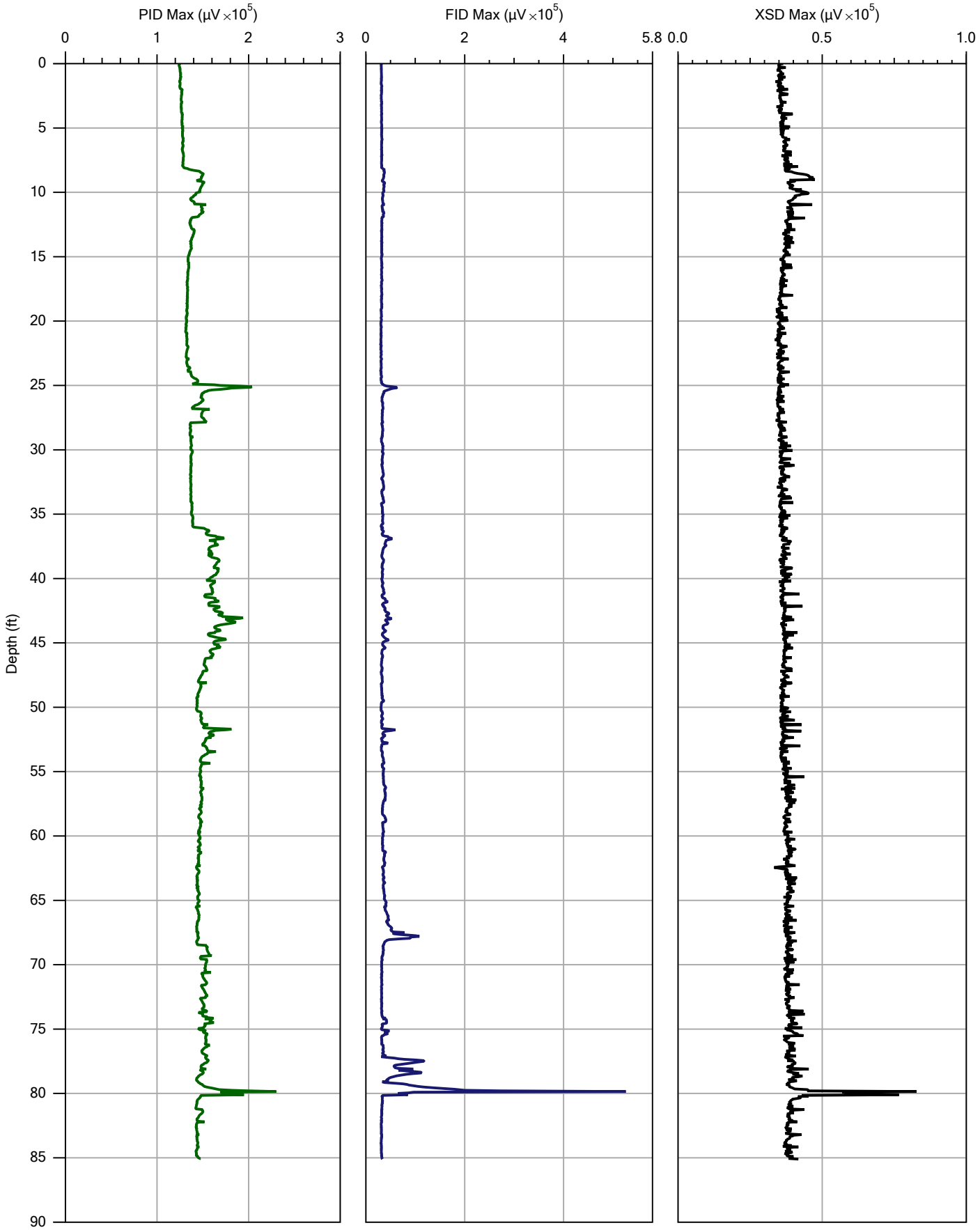
Company: Gregg Drilling and Testing		Operator: C. Hirschy	Date: 11/19/2015
Project ID: SMI Cupertino		Client: ERM	Location:

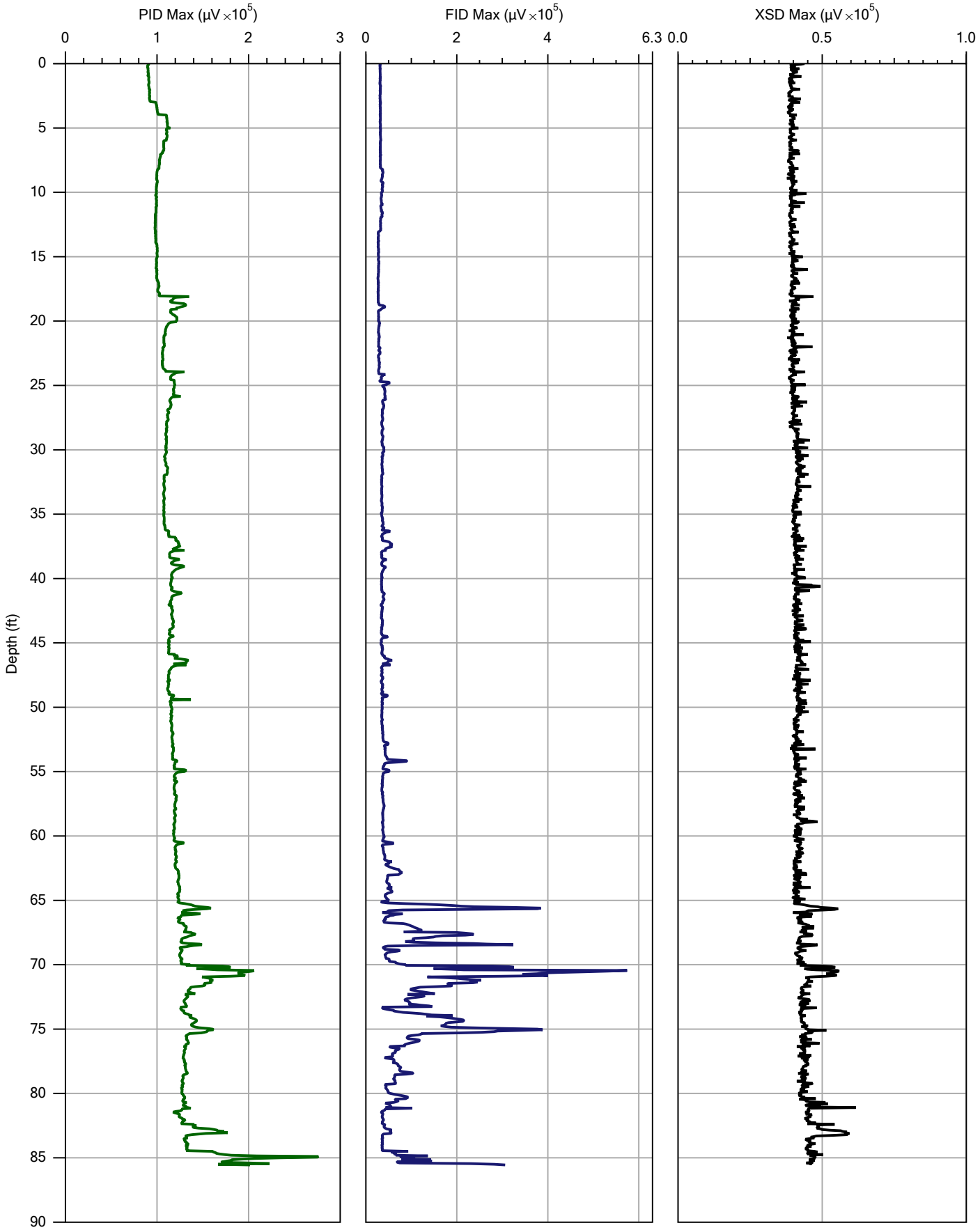


GREGG

		File: MIP-OS-18.MIP
Company: Gregg Drilling and Testing	Operator: C. Hirschy	Date: 11/17/2015
Project ID: SMI Cupertino	Client: ERM	Location:



		File: MIP-OS-19.MIP
Company: Gregg Drilling and Testing	Operator: C. Hirschy	Date: 11/18/2015
Project ID: SMI Cupertino	Client: ERM	Location:



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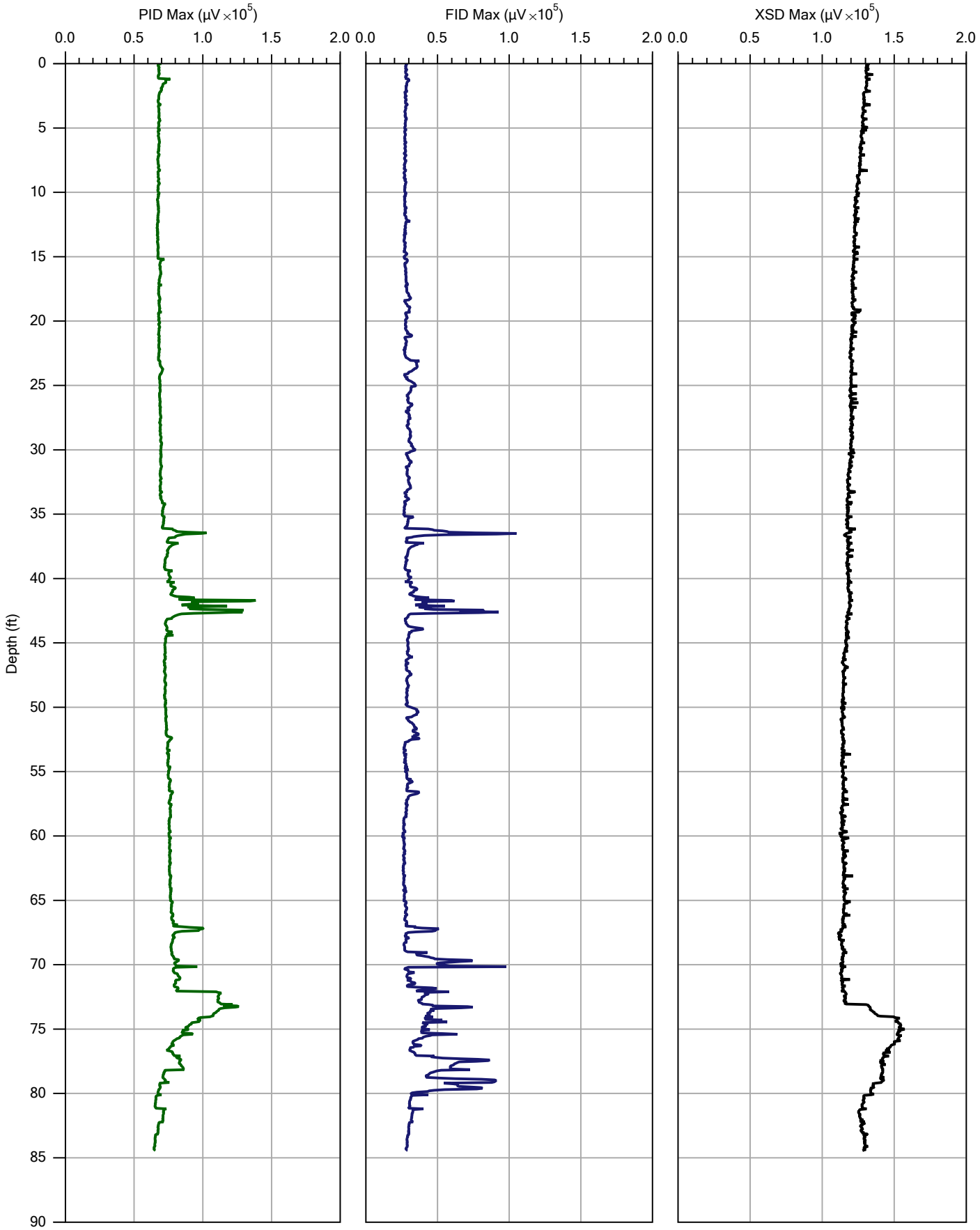
Company: Gregg Drilling and Testing	Operator: C. Hirschy	Date: 11/20/2015
Project ID: SMI Cupertino	Client: ERM	Location:



GREGG

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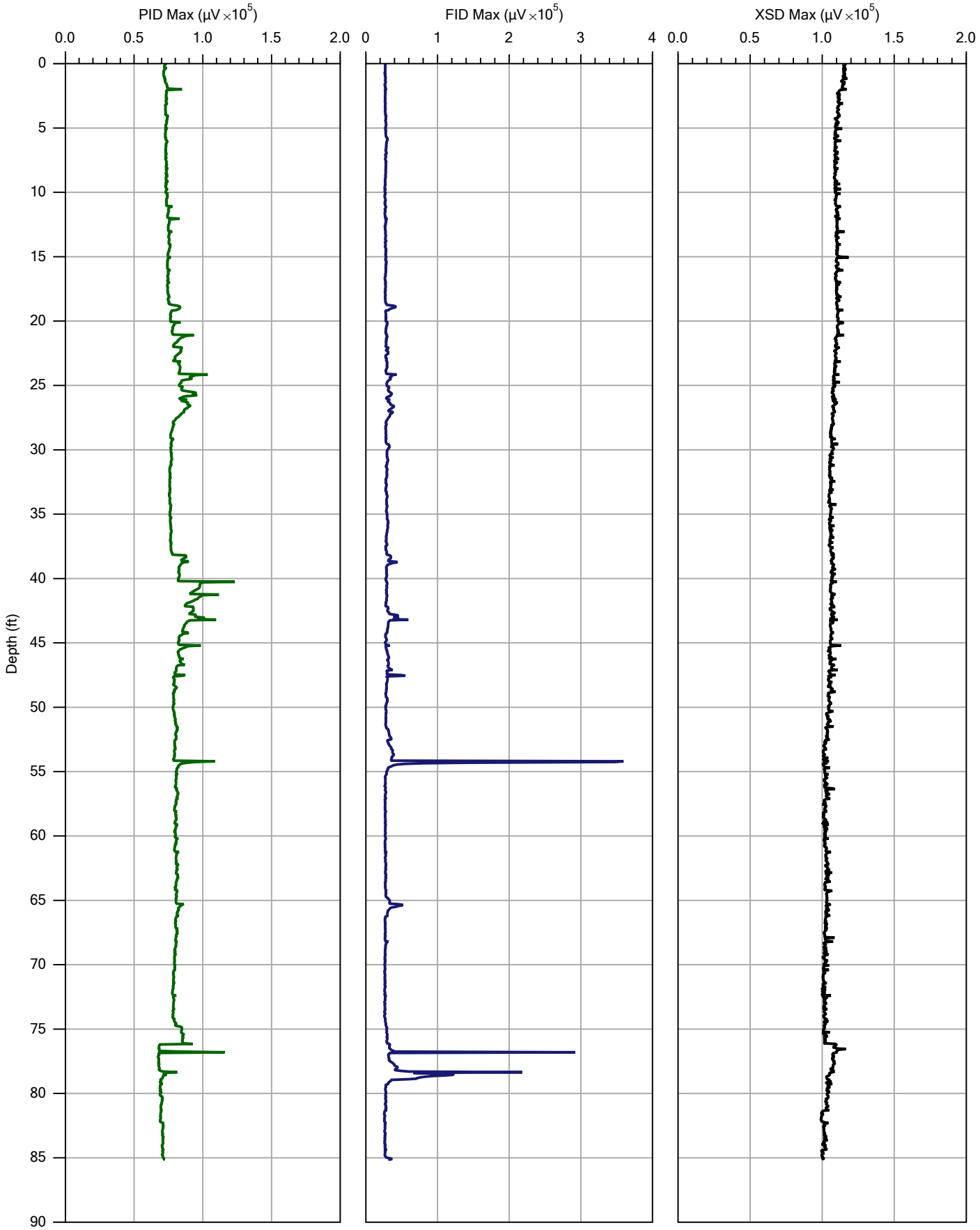
Company: Gregg Drilling and Testing	Operator: C. Hirschy	Date: 11/23/2015
Project ID: SMI Cupertino	Client: ERM	Location:



GREGG

		File: MIP-OS-22.MIP
Company: Gregg Drilling and Testing	Operator: C. Hirschy	Date: 11/23/2015
Project ID: SMI Cupertino	Client: ERM	Location:

Attachment 2
CPT Report – Gregg Drilling

November 25, 2015

ERM
Attn: Kit Soo

Subject: CPT Site Investigation
SMI Cupertino
Sunnyvale, California
GREGG Project Number: 15-207MA

Dear Mr. Soo:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	UVOST Laser Induced Fluorescence	(UVOST)	☐
5	Groundwater Sampling	(GWS)	☒
6	Soil Sampling	(SS)	☐
7	Vapor Sampling	(VS)	☐
8	Pressuremeter Testing	(PMT)	☐
9	Vane Shear Testing	(VST)	☐
10	Dilatometer Testing	(DMT)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (925) 313-5800.

Sincerely,
GREGG Drilling & Testing, Inc.

Mary Walden
Operations Manager

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (feet)	Depth of Groundwater Samples (feet)	Depth of Soil Samples (feet)	Depth of Pore Pressure Dissipation Tests (feet)
MIP-OS-16	11/17/15	63	59	-	-
MIP-OS-17	11/19/15	53	-	-	-
MIP-OS-17A	11/19/15	88	64, 80	-	-
MIP-OS-18	11/17/15	88	59NR, 81	-	-
MIP-OS-19	11/18/15	88	80	-	-
MIP-OS-20	11/20/15	88	75	-	-
MIP-OS-21	11/23/15	88	80	-	-
MIP-OS-22	11/23/15	88	80	-	79.1

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Campanella, R.G. and I. Weemees, "Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies", Canadian Geotechnical Journal, Vol. 27 No. 5, 1990 pp. 557-567.

DeGroot, D.J. and A.J. Lutenegger, "Reliability of Soil Gas Sampling and Characterization Techniques", International Site Characterization Conference - Atlanta, 1998.

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Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

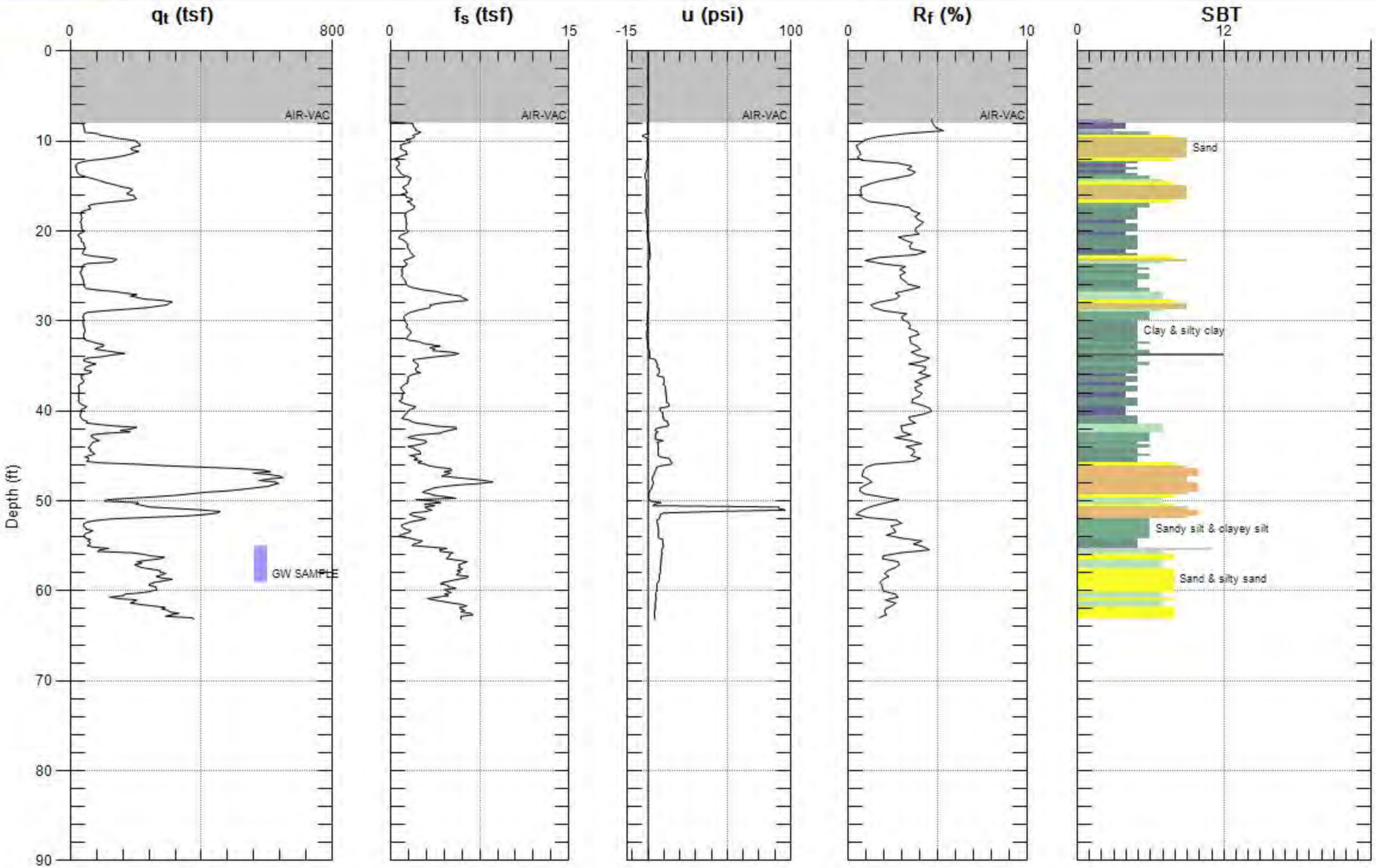
Copies of ASTM Standards are available through www.astm.org

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-16

Engineer: S.MARTIN
Date: 11/17/2015 08:52



Max. Depth: 63.156 (ft)
Avg. Interval: 0.328 (ft)

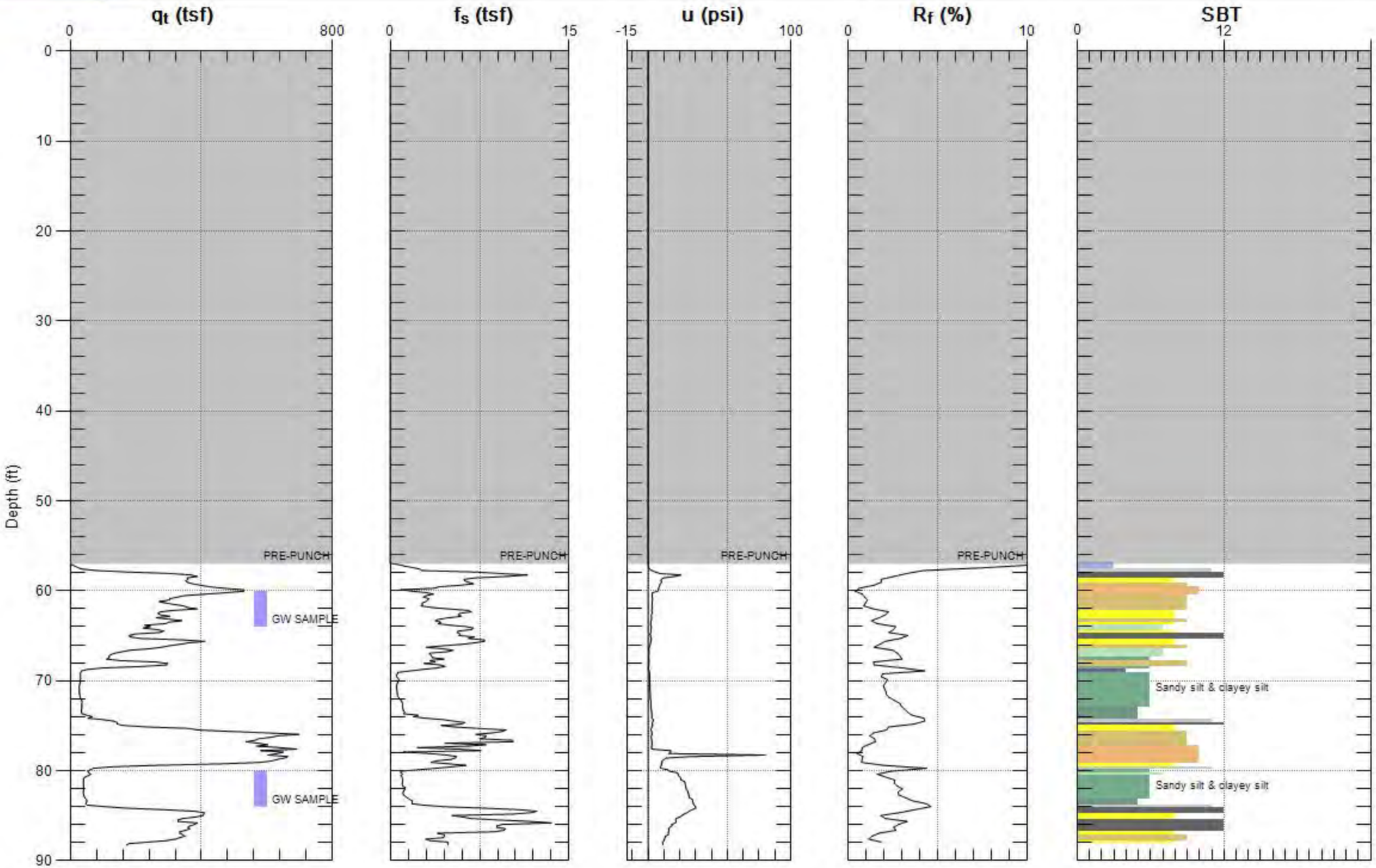
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-17A

Engineer: S.MARTIN
Date: 11/19/2015 10:30



Max. Depth: 88.255 (ft)
Avg. Interval: 0.328 (ft)

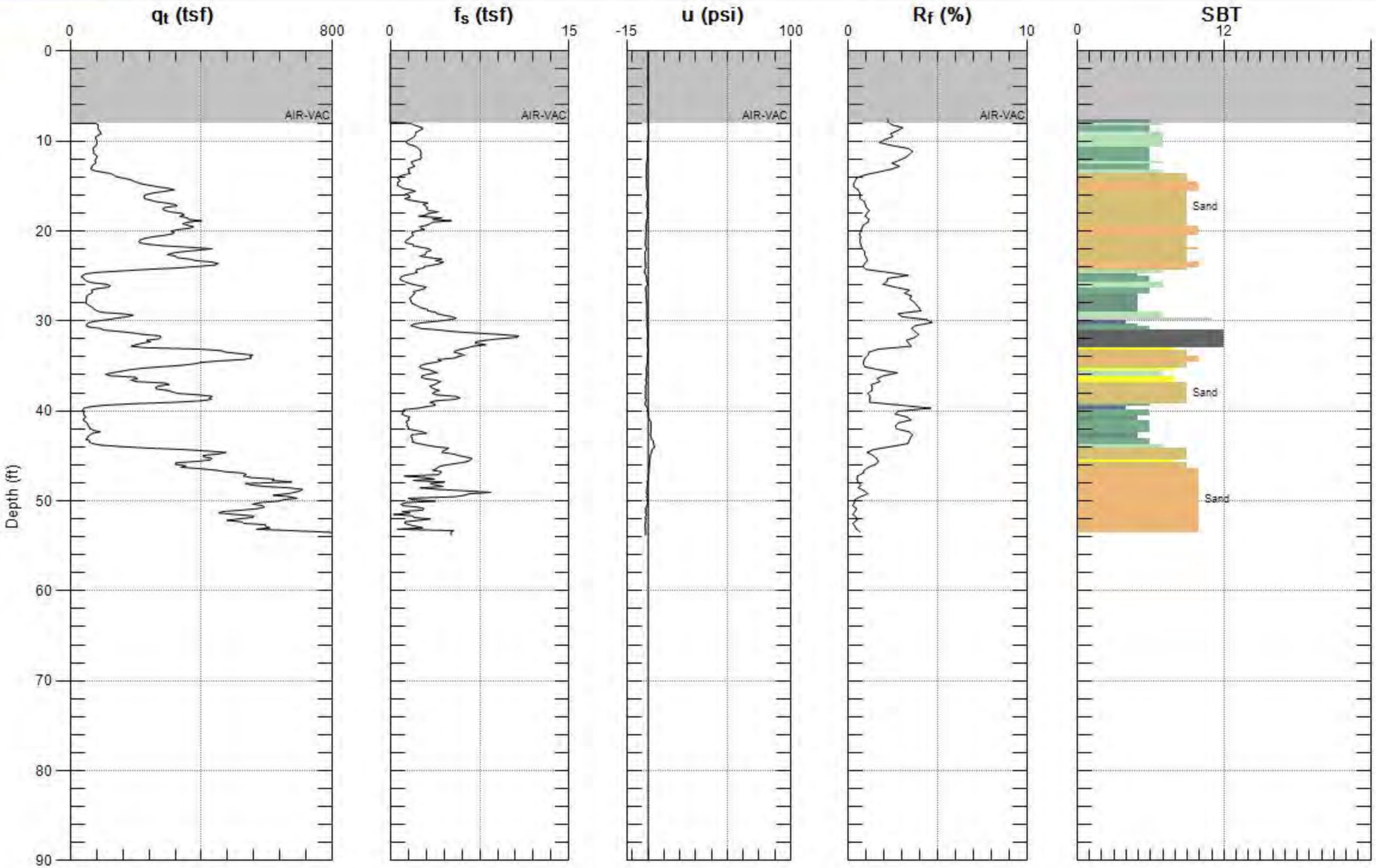
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-17

Engineer: S.MARTIN
Date: 11/19/2015 07:26



Max. Depth: 53.806 (ft)
Avg. Interval: 0.328 (ft)

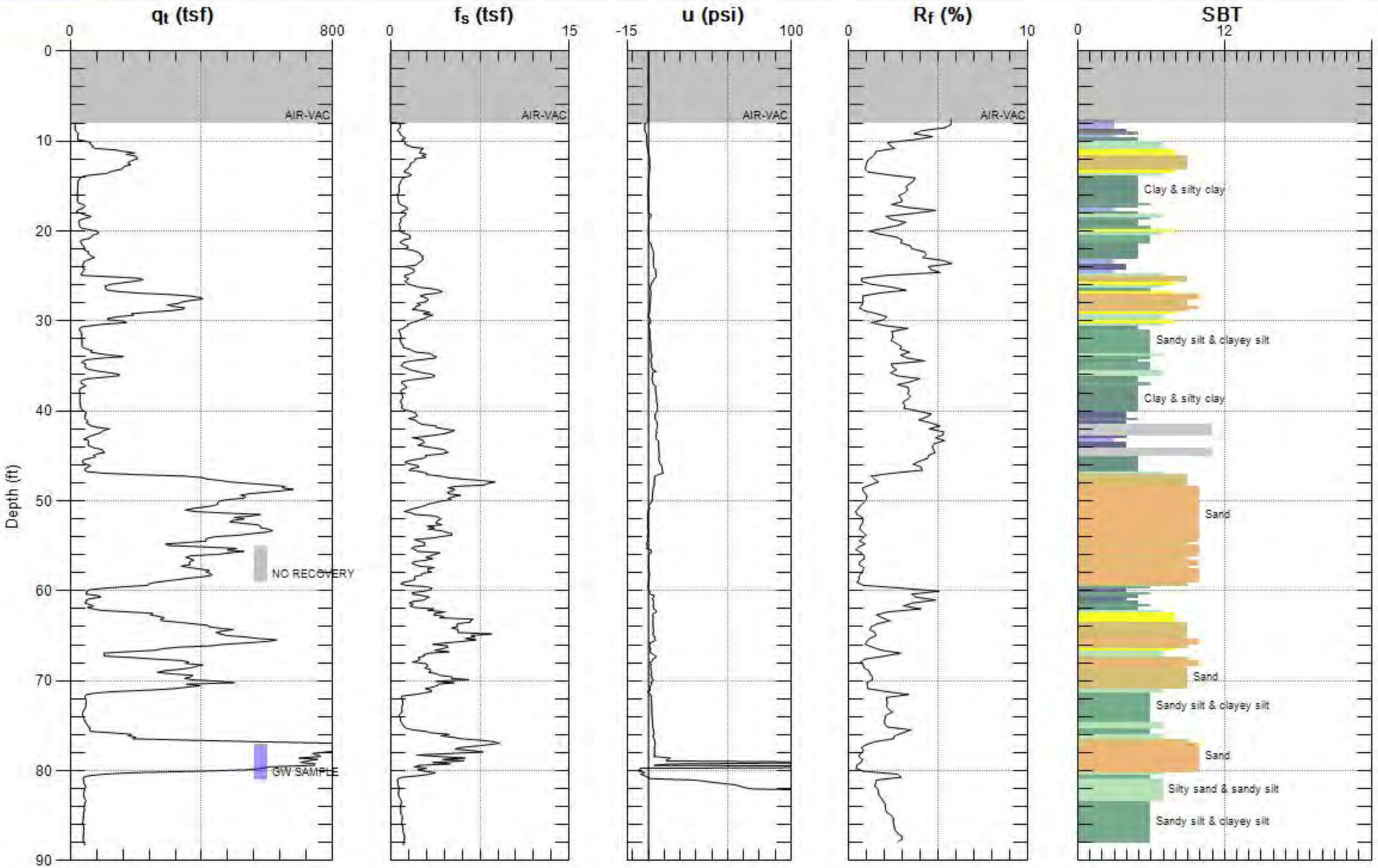
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-18

Engineer: S.MARTIN
Date: 11/17/2015 02:06



Max. Depth: 88.255 (ft)
Avg. Interval: 0.328 (ft)

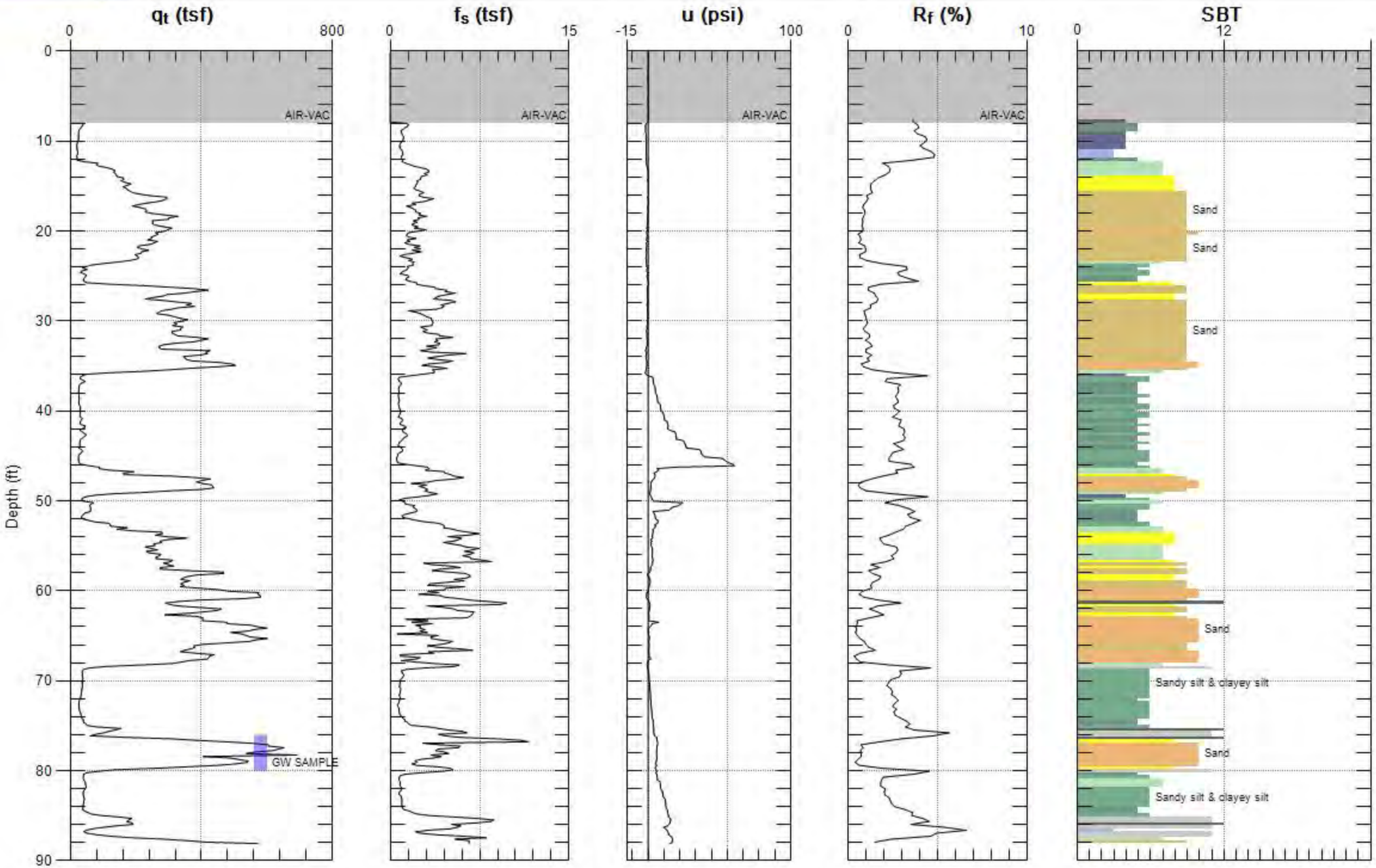
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-19

Engineer: S.MARTIN
Date: 11/18/2015 10:11



Max. Depth: 88.091 (ft)
Avg. Interval: 0.328 (ft)

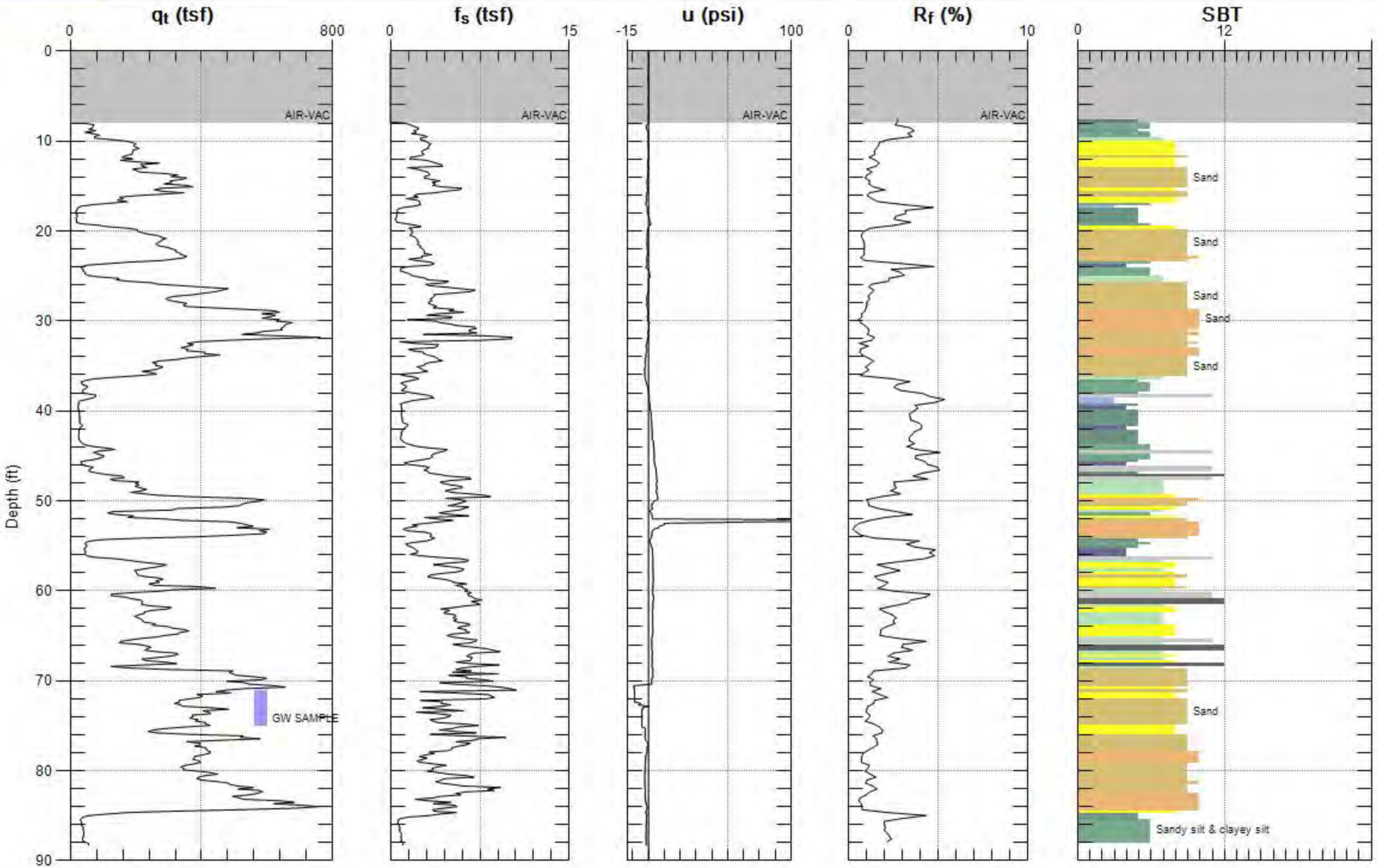
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-20

Engineer: S.MARTIN
Date: 11/20/2015 07:52



Max. Depth: 88.255 (ft)
Avg. Interval: 0.328 (ft)

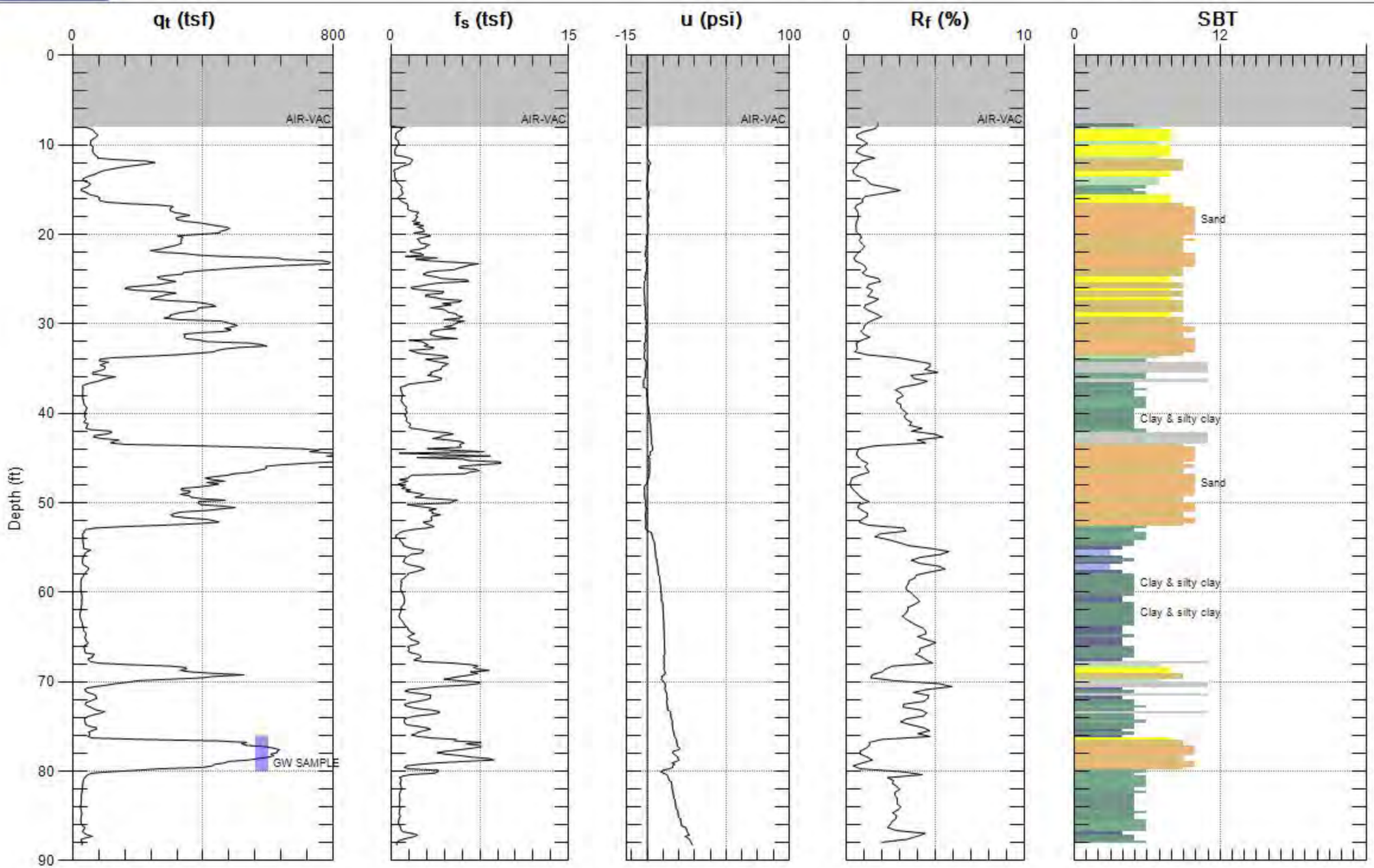
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-21

Engineer: S.MARTIN
Date: 11/23/2015 07:16



Max. Depth: 88.255 (ft)
Avg. Interval: 0.328 (ft)

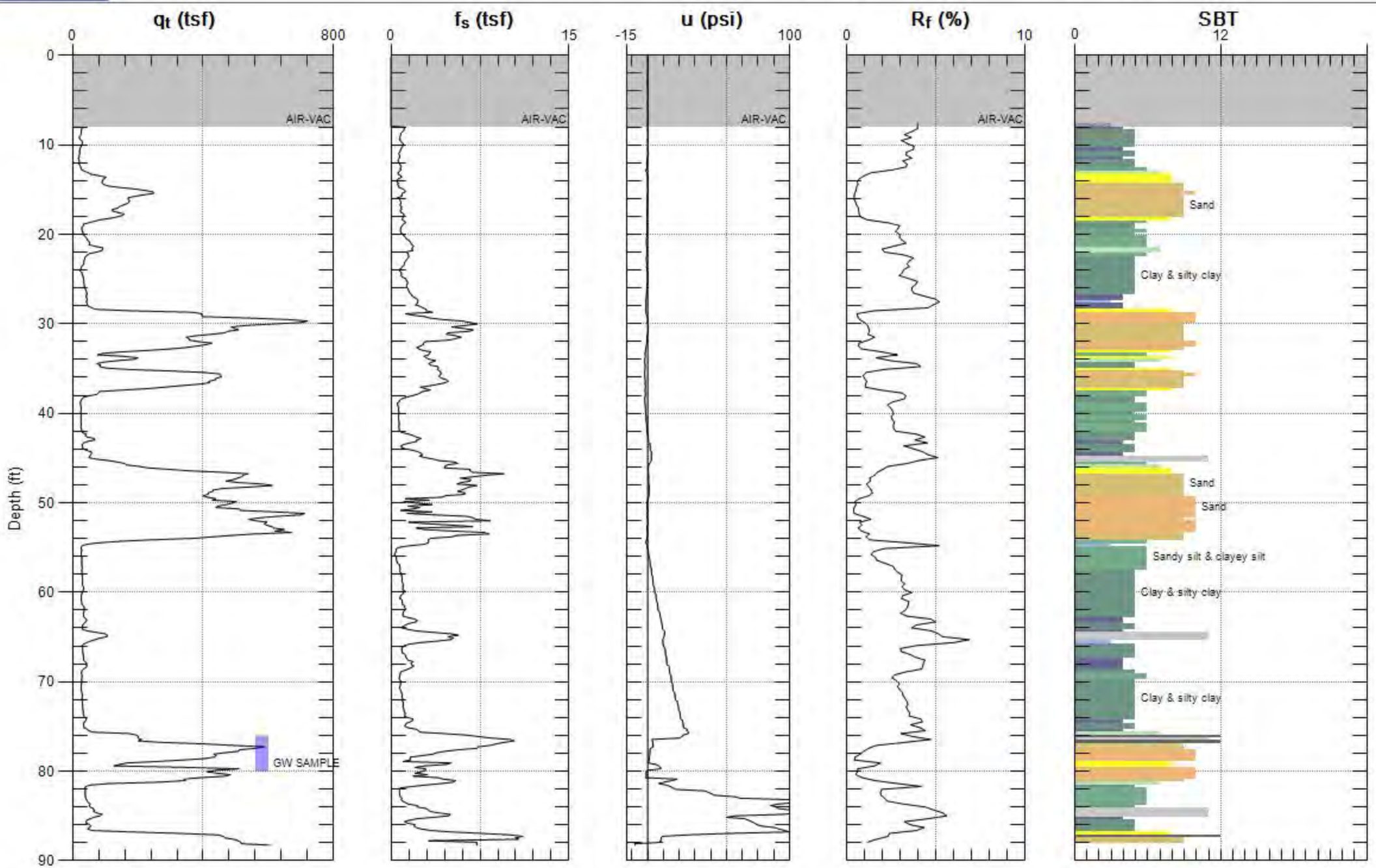
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ERM

Site: SMI CUPERTINO
Sounding: MIP-OS-22

Engineer: S.MARTIN
Date: 11/23/2015 01:15



Max. Depth: 88.255 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*.

The cone takes measurements of tip resistance (q_c), sleeve resistance (f_s), and penetration pore water pressure (u_2). Measurements are taken at either 2.5 or 5 cm intervals during penetration to provide a nearly continuous profile. CPT data reduction and basic interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored electronically for further analysis and reference. All CPT soundings are performed in accordance with revised ASTM standards (D 5778-12).

The 5mm thick porous plastic filter element is located directly behind the cone tip in the u_2 location. A new saturated filter element is used on each sounding to measure both penetration pore pressures as well as measurements during a dissipation test (*PPDT*). Prior to each test, the filter element is fully saturated with oil under vacuum pressure to improve accuracy.

When the sounding is completed, the test hole is backfilled according to client specifications. If grouting is used, the procedure generally consists of pushing a hollow tremie pipe with a "knock out" plug to the termination depth of the CPT hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

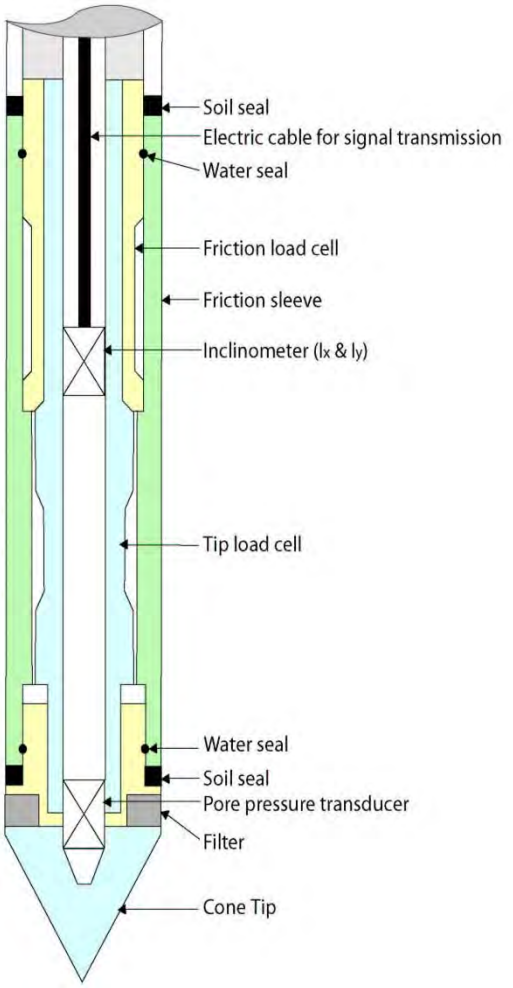


Figure CPT

Gregg 15cm^2 Standard Cone Specifications

Dimensions	
Cone base area	15 cm^2
Sleeve surface area	225 cm^2
Cone net area ratio	0.80
Specifications	
Cone load cell	
Full scale range	180 kN (20 tons)
Overload capacity	150%
Full scale tip stress	120 MPa (1,200 tsf)
Repeatability	120 kPa (1.2 tsf)
Sleeve load cell	
Full scale range	31 kN (3.5 tons)
Overload capacity	150%
Full scale sleeve stress	1,400 kPa (15 tsf)
Repeatability	1.4 kPa (0.015 tsf)
Pore pressure transducer	
Full scale range	7,000 kPa (1,000 psi)
Overload capacity	150%
Repeatability	7 kPa (1 psi)

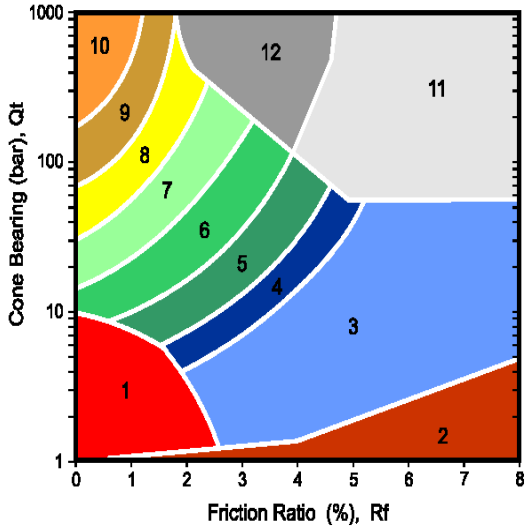
Note: The repeatability during field use will depend somewhat on ground conditions, abrasion, maintenance and zero load stability.

Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected are presented in graphical and electronic form in the report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings deeper than 30m, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson (Guide to Cone Penetration Testing, 2015). The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software. Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



ZONE		SBT
1		Sensitive, fine grained
2		Organic materials
3		Clay
4		Silty clay to clay
5		Clayey silt to silty clay
6		Sandy silt to clayey silt
7		Silty sand to sandy silt
8		Sand to silty sand
9		Sand
10		Gravely sand to sand
11		Very stiff fine grained*
12		Sand to clayey sand*

*over consolidated or cemented

Figure SBT (After Robertson et al., 1986) – Note: Colors may vary slightly compared to plots

Cone Penetration Test (CPT) Interpretation

Gregg uses a proprietary CPT interpretation and plotting software. The software takes the CPT data and performs basic interpretation in terms of soil behavior type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by Lunne, Robertson and Powell (1997). The interpretation is presented in tabular format using MS Excel. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

The following provides a summary of the methods used for the interpretation. Many of the empirical correlations to estimate geotechnical parameters have constants that have a range of values depending on soil type, geologic origin and other factors. The software uses 'default' values that have been selected to provide, in general, conservatively low estimates of the various geotechnical parameters.

Input:

1 Units for display (Imperial or metric) (atm. pressure, p_a = 0.96 tsf or 0.1 MPa)
2 Depth interval to average results (ft or m). Data are collected at either 0.02 or 0.05m and can be averaged every 1, 3 or 5 intervals.
3 Elevation of ground surface (ft or m)
4 Depth to water table, z_w (ft or m) – input required
5 Net area ratio for cone, a (default to 0.80)
6 Relative Density constant, C_{Dr} (default to 350)
7 Young's modulus number for sands, α (default to 5)
8 Small strain shear modulus number
  a. for sands, S_G (default to 180 for SBT_n 5, 6, 7)
  b. for clays, C_G (default to 50 for SBT_n 1, 2, 3 & 4)
9 Undrained shear strength cone factor for clays, N_{kt} (default to 15)
10 Over Consolidation ratio number, k_{ocr} (default to 0.3)
11 Unit weight of water, (default to γ_w = 62.4 lb/ft^3 or 9.81 kN/m^3)

Column

1 Depth, z, (m) – CPT data is collected in meters
2 Depth (ft)
3 Cone resistance, q_c (tsf or MPa)
4 Sleeve resistance, f_s (tsf or MPa)
5 Penetration pore pressure, u (psi or MPa), measured behind the cone (i.e. u_2)
6 Other – any additional data
7 Total cone resistance, q_t (tsf or MPa) $q_t = q_c + u\,(1\text{-}a)$

8	Friction Ratio, R_f (%)	$R_f = (f_s/q_t) \times 100\%$
9	Soil Behavior Type (non-normalized), SBT	see note
10	Unit weight, γ (pcf or kN/m^3)	based on SBT, see note
11	Total overburden stress, σ_v (tsf)	$\sigma_{vo} = \sigma\, z$
12	In-situ pore pressure, u_o (tsf)	$u_o = \gamma_w (z - z_w)$
13	Effective overburden stress, σ'_{vo} (tsf)	$\sigma'_{vo} = \sigma_{vo} - u_o$
14	Normalized cone resistance, Q_{t1}	$Q_{t1} = (q_t - \sigma_{vo}) / \sigma'_{vo}$
15	Normalized friction ratio, F_r (%)	$F_r = f_s / (q_t - \sigma_{vo}) \times 100\%$
16	Normalized Pore Pressure ratio, B_q	$B_q = u - u_o / (q_t - \sigma_{vo})$
17	Soil Behavior Type (normalized), SBT_n	see note
18	SBT_n Index, I_c	see note
19	Normalized Cone resistance, Q_{tn} (n varies with I_c)	see note
20	Estimated permeability, k_{SBT} (cm/sec or ft/sec)	see note
21	Equivalent SPT N_{60}, blows/ft	see note
22	Equivalent SPT $(N_1)_{60}$ blows/ft	see note
23	Estimated Relative Density, D_r, (%)	see note
24	Estimated Friction Angle, ϕ', (degrees)	see note
25	Estimated Young's modulus, E_s (tsf)	see note
26	Estimated small strain Shear modulus, Go (tsf)	see note
27	Estimated Undrained shear strength, s_u (tsf)	see note
28	Estimated Undrained strength ratio	s_u/σ_v'
29	Estimated Over Consolidation ratio, OCR	see note

Notes:

1 Soil Behavior Type (non-normalized), SBT (Lunne et al., 1997 and table below)

2 Unit weight, γ either constant at 119 pcf or based on Non-normalized SBT (Lunne et al., 1997 and table below)

3 Soil Behavior Type (Normalized), SBT_n Lunne et al. (1997)

4 SBT_n Index, I_c $I_c = ((3.47 - \log Q_{t1})^2 + (\log F_r + 1.22)^2)^{0.5}$

5 Normalized Cone resistance, Q_{tn} (n varies with Ic)

$Q_{tn} = ((q_t - \sigma_{vo})/pa)\ (pa/(\sigma'_{vo})^n$ and recalculate I_c, then iterate:

When $I_c < 1.64$, n = 0.5 (clean sand)
When $I_c > 3.30$, n = 1.0 (clays)
When $1.64 < I_c < 3.30$, $n = (I_c - 1.64)0.3 + 0.5$
Iterate until the change in n, $\Delta n < 0.01$

6 Estimated permeability, k_{SBT} based on Normalized SBT_n (Lunne et al., 1997 and table below)

7 Equivalent SPT N_{60}, blows/ft Lunne et al. (1997)

$$\frac{(q_t/p_a)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

8 Equivalent SPT $(N_1)_{60}$ blows/ft $(N_1)_{60} = N_{60}\, C_N$,
where $C_N = (pa/\sigma'_{vo})^{0.5}$

9 Relative Density, D_r, (%) $D_r^2 = Q_{tn} / C_{Dr}$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

10 Friction Angle, ϕ', (degrees) $\tan\phi' = \frac{1}{2.68}\left[\log\left(\frac{q_c}{\sigma'_{vo}}\right) + 0.29\right]$
Only SBT_n 5, 6, 7 & 8 *Show'N/A' in zones 1, 2, 3, 4 & 9*

11 Young's modulus, E_s $E_s = \alpha\, q_t$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

12 Small strain shear modulus, Go

a. $G_o = S_G (q_t\ \sigma'_{vo}\ pa)^{1/3}$ *For SBT_n 5, 6, 7*

b. $G_o = C_G\, q_t$ *For SBT_n 1, 2, 3& 4*

Show 'N/A' in zones 8 & 9

13 Undrained shear strength, s_u $s_u = (q_t - \sigma_{vo}) / N_{kt}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

14 Over Consolidation ratio, OCR $OCR = k_{ocr}\, Q_{t1}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

The following updated and simplified SBT descriptions have been used in the software:

SBT Zones		**SBT_n Zones**	
1	sensitive fine grained	1	sensitive fine grained
2	organic soil	2	organic soil
3	clay	3	clay
4	clay & silty clay	4	clay & silty clay
5	clay & silty clay		
6	sandy silt & clayey silt		

7	silty sand & sandy silt	5	silty sand & sandy silt
8	sand & silty sand	6	sand & silty sand
9	sand		
10	sand	7	sand
11	very dense/stiff soil*	8	very dense/stiff soil*
12	very dense/stiff soil*	9	very dense/stiff soil*

*heavily overconsolidated and/or cemented

Track when soils fall with zones of same description and print that description (i.e. if soils fall only within SBT zones 4 & 5, print 'clays & silty clays')

Estimated Permeability (see Lunne et al., 1997)

SBT_n	Permeability (ft/sec)	(m/sec)
1	$3x\ 10^{-8}$	$1x\ 10^{-8}$
2	$3x\ 10^{-7}$	$1x\ 10^{-7}$
3	$1x\ 10^{-9}$	$3x\ 10^{-10}$
4	$3x\ 10^{-8}$	$1x\ 10^{-8}$
5	$3x\ 10^{-6}$	$1x\ 10^{-6}$
6	$3x\ 10^{-4}$	$1x\ 10^{-4}$
7	$3x\ 10^{-2}$	$1x\ 10^{-2}$
8	$3x\ 10^{-6}$	$1x\ 10^{-6}$
9	$1x\ 10^{-8}$	$3x\ 10^{-9}$

Estimated Unit Weight (see Lunne et al., 1997)

SBT	Approximate Unit Weight (lb/ft^3)	(kN/m^3)
1	111.4	17.5
2	79.6	12.5
3	111.4	17.5
4	114.6	18.0
5	114.6	18.0
6	114.6	18.0
7	117.8	18.5
8	120.9	19.0
9	124.1	19.5
10	127.3	20.0
11	130.5	20.5
12	120.9	19.0

Pore Pressure Dissipation Tests (PPDT)

Pore Pressure Dissipation Tests (PPDT's) conducted at various intervals can be used to measure equilibrium water pressure (at the time of the CPT). If conditions are hydrostatic, the equilibrium water pressure can be used to determine the approximate depth of the ground water table. A PPDT is conducted when penetration is halted at specific intervals determined by the field representative. The variation of the penetration pore pressure (*u)* with time is measured behind the tip of the cone and recorded.

Pore pressure dissipation data can be interpreted to provide estimates of:

- Equilibrium piezometric pressure
- Phreatic Surface
- In situ horizontal coefficient of consolidation (c_h)
- In situ horizontal coefficient of permeability (k_h)

In order to correctly interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until it reaches equilibrium, *Figure PPDT*. This time is commonly referred to as t_{100}, the point at which 100% of the excess pore pressure has dissipated.

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1992 and Lunne et al. 1997.

A summary of the pore pressure dissipation tests are summarized in Table 1.

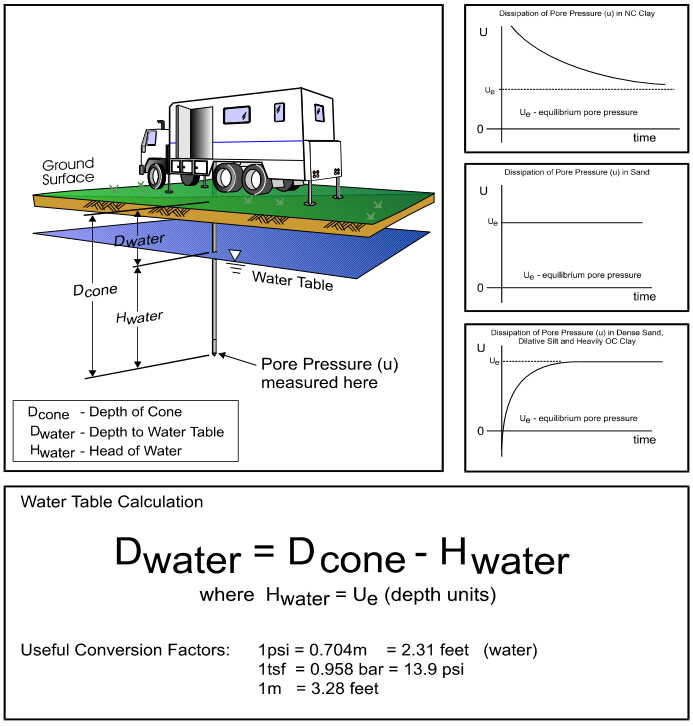


Figure PPDT

Seismic Cone Penetration Testing (SCPT)

Seismic Cone Penetration Testing (SCPT) can be conducted at various intervals during the Cone Penetration Test. Shear wave velocity (Vs) can then be calculated over a specified interval with depth. A small interval for seismic testing, such as 1-1.5m (3-5ft) allows for a detailed look at the shear wave profile with depth. Conversely, a larger interval such as 3-6m (10-20ft) allows for a more average shear wave velocity to be calculated. Gregg's cones have a horizontally active geophone located 0.2m (0.66ft) behind the tip.

To conduct the seismic shear wave test, the penetration of the cone is stopped and the rods are decoupled from the rig. An automatic hammer is triggered to send a shear wave into the soil. The distance from the source to the cone is calculated knowing the total depth of the cone and the horizontal offset distance between the source and the cone. To calculate an interval velocity, a minimum of two tests must be performed at two different depths. The arrival times between the two wave traces are compared to obtain the difference in time (Δt). The difference in depth is calculated (Δd) and velocity can be determined using the simple equation: $v = \Delta d/\Delta t$

Multiple wave traces can be recorded at the same depth to improve quality of the data.

A complete reference on seismic cone penetration tests is presented by Robertson et al. 1986 and Lunne et al. 1997.

A summary the shear wave velocities, arrival times and wave traces are provided with the report.

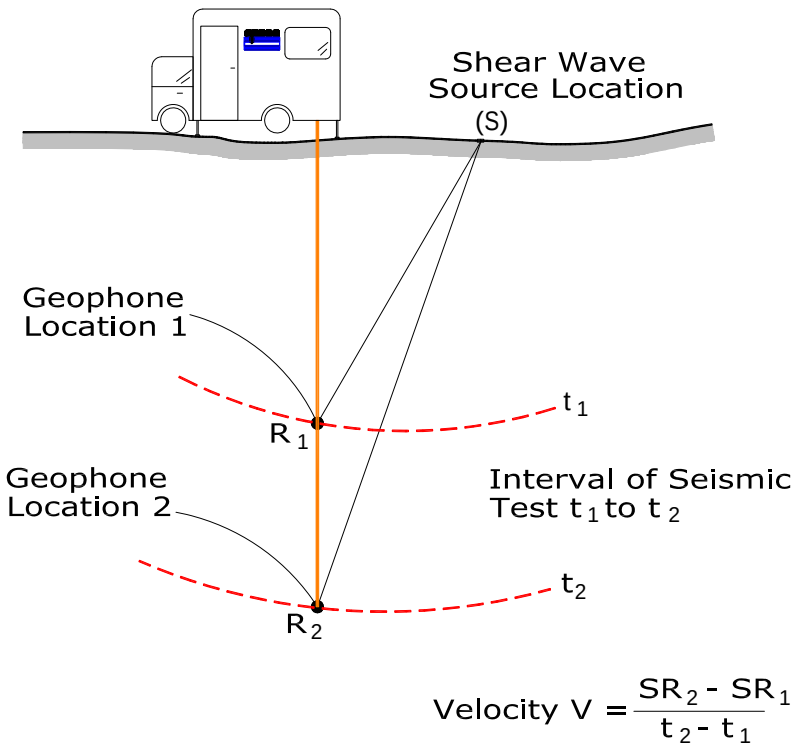


Figure SCPT

Groundwater Sampling

Gregg Drilling & Testing, Inc. conducts groundwater sampling using a sampler as shown in *Figure GWS*. The groundwater sampler has a retrievable stainless steel or disposable PVC screen with steel drop off tip. This allows for samples to be taken at multiple depth intervals within the same sounding location. In areas of slower water recharge, provisions may be made to set temporary PVC well screens during sampling to allow the pushing equipment to advance to the next sample location while the groundwater is allowed to infiltrate.

The groundwater sampler operates by advancing 44.5mm (1¾ inch) hollow push rods with the filter tip in a closed configuration to the base of the desired sampling interval. Once at the desired sample depth, the push rods are retracted; exposing the encased filter screen and allowing groundwater to infiltrate hydrostatically from the formation into the inlet screen. A small diameter bailer (approximately ½ or ¾ inch) is lowered through the push rods into the screen section for sample collection. The number of downhole trips with the bailer and time necessary to complete the sample collection at each depth interval is a function of sampling protocols, volume requirements, and the yield characteristics and storage capacity of the formation. Upon completion of sample collection, the push rods and sampler, with the exception of the PVC screen and steel drop off tip are retrieved to the ground surface, decontaminated and prepared for the next sampling event.

For a detailed reference on direct push groundwater sampling, refer to Zemo et. al., 1992.

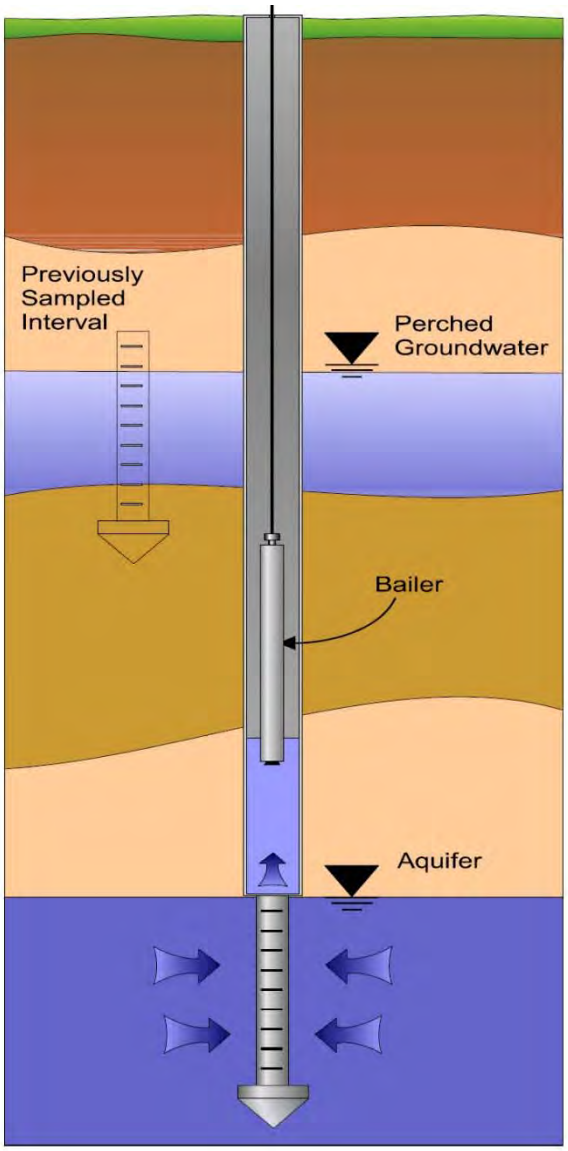


Figure GWS

Soil Sampling

Gregg Drilling & Testing, Inc. uses a piston-type push-in sampler to obtain small soil samples without generating any soil cuttings, *Figure SS*. Two different types of samplers (12 and 18 inch) are used depending on the soil type and density. The soil sampler is initially pushed in a "closed" position to the desired sampling interval using the CPT pushing equipment. Keeping the sampler closed minimizes the potential of cross contamination. The inner tip of the sampler is then retracted leaving a hollow soil sampler with inner 1¼" diameter sample tubes. The hollow sampler is then pushed in a locked "open" position to collect a soil sample. The filled sampler and push rods are then retrieved to the ground surface. Because the soil enters the sampler at a constant rate, the opportunity for 100% recovery is increased. For environmental analysis, the soil sample tube ends are sealed with Teflon and plastic caps. Often, a longer "split tube" can be used for geotechnical sampling.

For a detailed reference on direct push soil sampling, refer to Robertson et al, 1998.

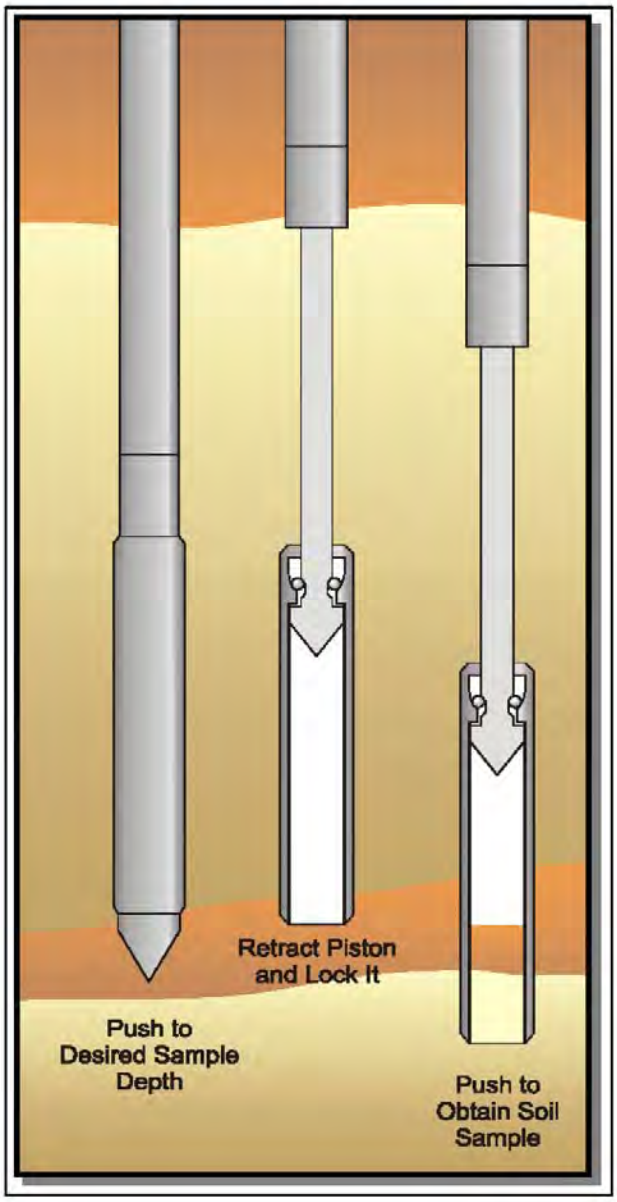


Figure SS

Ultra-Violet Induced Fluorescence (UVOST)

Gregg Drilling conducts Laser Induced Fluorescence (LIF) Cone Penetration Tests using a UVOST module that is located behind the standard piezocone, *Figure UVOST*. The laser induced fluorescence cone works on the principle that polycyclic aromatic hydrocarbons (PAH's), mixed with soil and/or groundwater, fluoresce when irradiated by ultra violet light. Therefore, by measuring the intensity of fluorescence, the lateral and vertical extent of hydrocarbon contamination in the ground can be estimated.

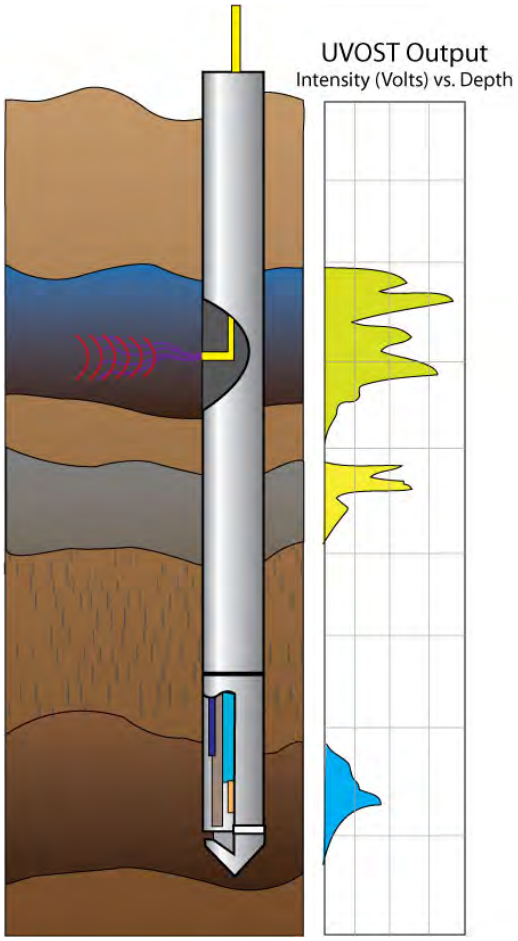


Figure UVOST

The UVOST module uses principles of fluorescence spectrometry by irradiating the soil with ultra violet light produced by a laser and transmitted to the cone through fiber optic cables. The UV light passes through a small window in the side of the cone into the soil. Any hydrocarbon molecules present in the soil absorb the light energy during radiation and immediately re-emit the light at a longer wavelength. This re-emission is termed fluorescence. The UVOST system also measures the emission decay with time at four different wavelengths (350nm, 400nm, 450nm, and 500nm). This allows the software to determine a product "signature" at each data point. This process provides a method to evaluate the type of contaminant. A sample output from the UVOST system is shown in *Figure Output*. In general, the typical detection limit for the UVOST system is <100 ppm and it will operate effectively above and below the saturated zone.

With the capability to push up to 200m (600ft) per day, laser induced fluorescence offers a fast and efficient means for delineating PAH contaminant plumes. Color coded logs offer qualitative information in a quick glance and can be produced in the field for real-time decision making. Coupled with the data provided by the CPT, a complete site assessment can be completed with no samples or cuttings, saving laboratory costs as well as site and environmental impact.

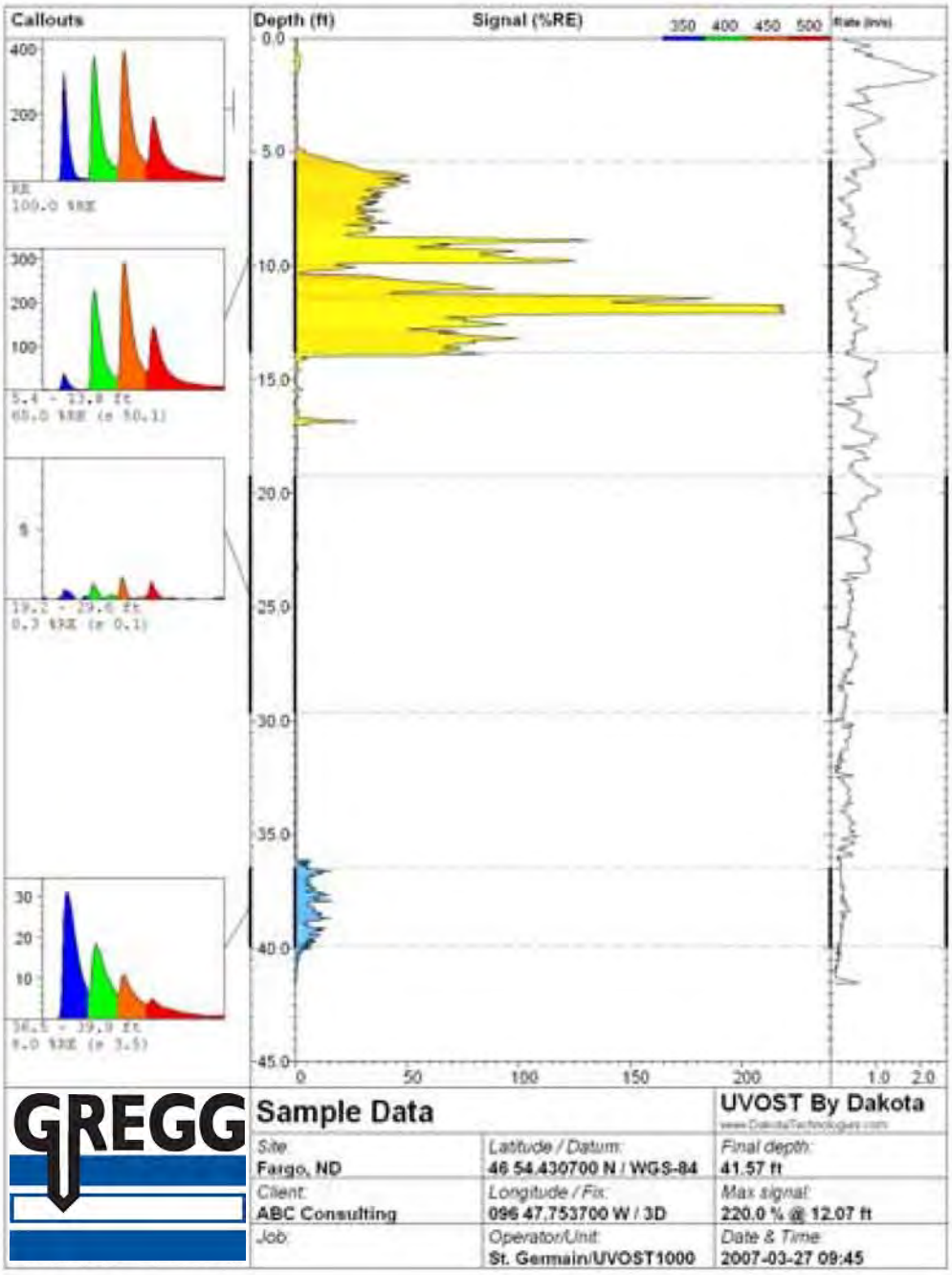


Figure Output

Hydrocarbons detected with UVOST

- Gasoline
- Diesel
- Jet (Kerasene)
- Motor Oil
- Cutting fluids
- Hydraulic fluids
- Crude Oil

Hydrocarbons rarely detected using UVOST

- Extremely weathered gasoline
- Coal tar
- Creosote
- Bunker Oil
- Polychlorinated bi-phenols (PCB's)
- Chlorinated solvent DNAPL
- Dissolved phase (aqueous) PAH's

Potential False Positives (fluorescence observed)

- Sea-shells (weak-medium)
- Paper (medium-strong depending on color)
- Peat/meadow mat (weak)
- Calcite/calcareous sands (weak)
- Tree roots (weak-medium)
- Sewer lines (medium-strong)

Potential False Negatives (do not fluoresce)

- Extremely weathered fuels (especially gasoline)
- Aviation gasoline (weak)
- "Dry" PAHs such as aqueous phase, lamp black, purifier chips
- Creosotes (most)
- Coal tars (most) gasoline (weak)
- Most chlorinated solvents
- Benzene, toluene, zylenes (relatively pure)

Dakota Technologies
UVOST Log Reference

2008-12-12

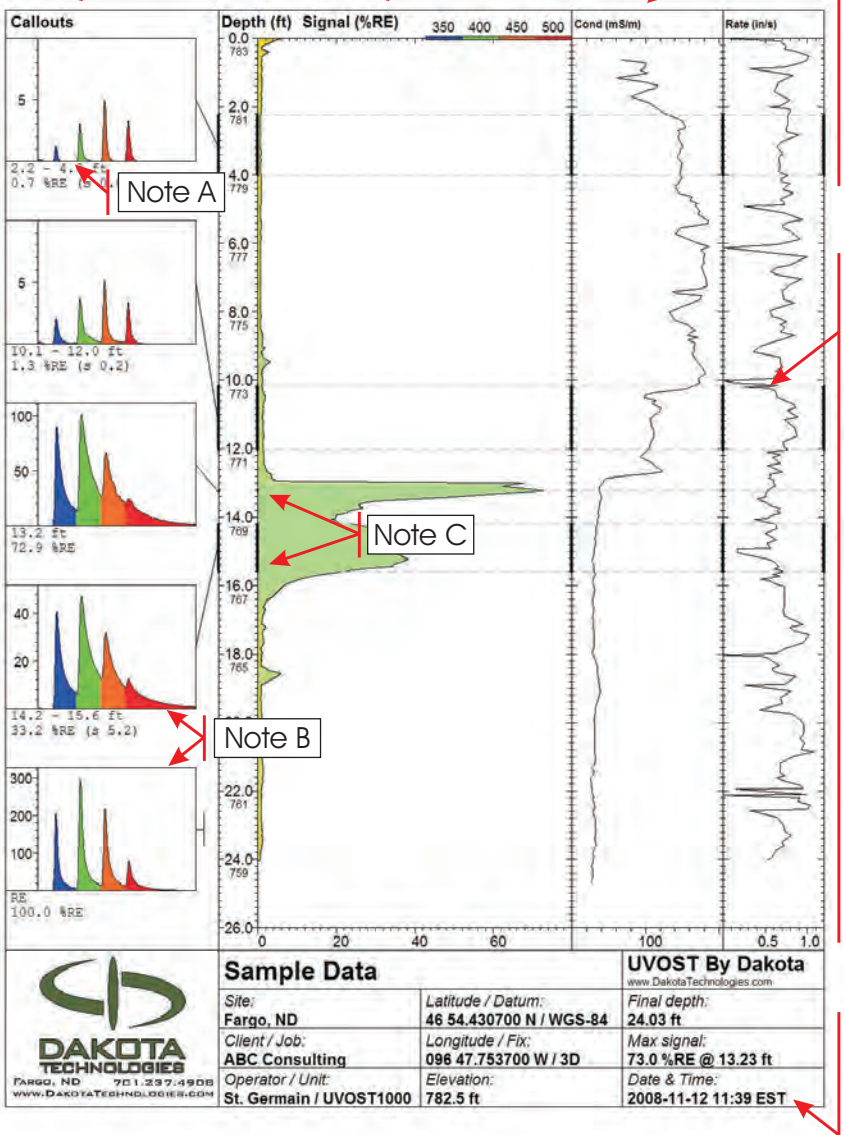
Main Plot :
Signal (total fluorescence) versus depth where signal is relative to the Reference Emitter (RE). The total area of the waveform is divided by the total area of the Reference Emitter yielding the %RE. This %RE scales with the NAPL fluorescence. The fill color is based on relative contribution of each channel's area to the total waveform area (see callout waveform). The channel-to-color relationship and corresponding wavelengths are given in the upper right corner of the main plot.

Callouts :
Waveforms from selected depths or depth ranges showing the multi-wavelength waveform for that depth.

The four peaks are due to fluorescence at four wavelengths and referred to as “channels”. Each channel is assigned a color.

Various NAPLs will have a unique waveform "fingerprint" due to the relative amplitude of the four channels and/or broadening of one or more channels.

Basic waveform statistics and any operator notes are given below the callout.



Conductivity Plot :
The Electrical Conductivity (EC) of the soil can be logged simultaneously with the UVOST data. EC often provides insight into the stratigraphy.
Note the drop in EC from 10 - 13 ft, indicating a shift from consolidated to unconsolidated stratigraphy. This correlates with the observed NAPL distribution.

Rate Plot :
The rate of probe advancement. ~ 0.8in (2cm) per second is preferred.

A noticeable decrease in the rate of advancement may be indicative of difficult probing conditions (gravel, angular sands, etc.) such as that seen here at ~5 ft.

Notice that this log was terminated arbitrarily, not due to "refusal", which would have been indicated by a sudden rate drop at final depth.

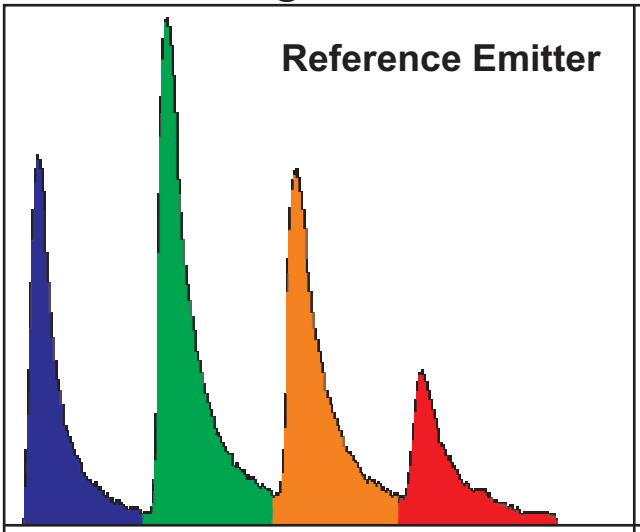
Info Box :
Contains pertinent log info including name and location.

Note A :
Time is along the x axis. No scale is given, but it is a consistent 320ns wide.
The y axis is in mV and directly corresponds to the amount of light striking the photodetector.

Note B :
These two waveforms are clearly different. The first is weathered diesel from the log itself while the second is the Reference Emitter (a blend of NAPLs) always taken before each log for calibration.

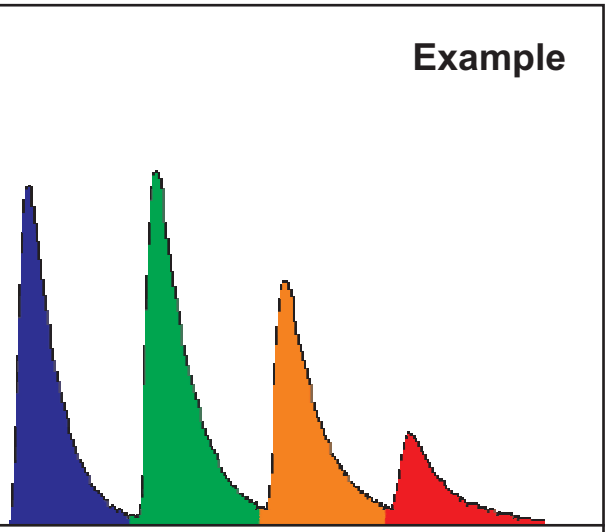
Note C :
Callouts can be a single depth (see 3rd callout) or a range (see 4th callout). The range is noted on the depth axis by a bold line. When the callout is a range, the average and standard deviation in %RE is given below the callout.

Waveform Signal Calculation



CH1		CH2		CH3		CH4		Total
4820	+	8108	+	6249	+	2984	=	**22161**
21.7		36.6		28.2		13.5		**100%**

Channel
Area (pVs)
Percent RE

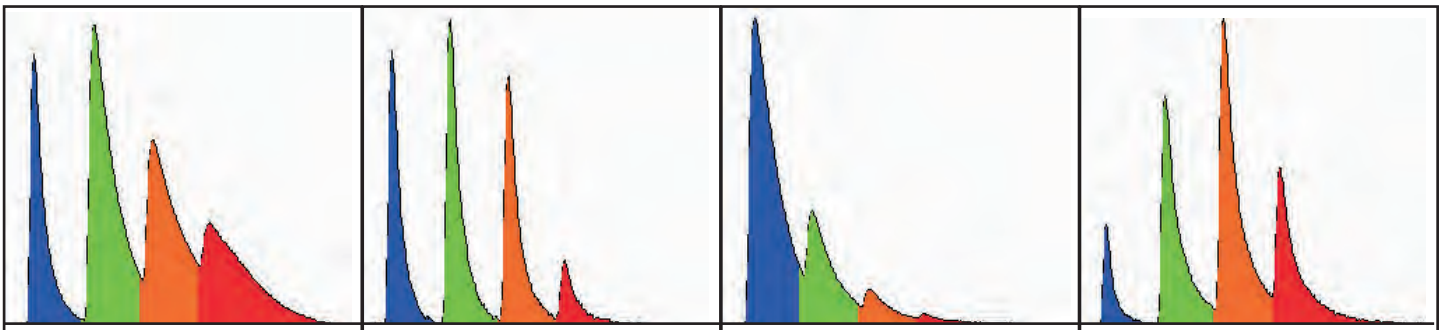


CH1		CH2		CH3		CH4		Total
4923	+	5743	+	4166	+	1735	=	**16587**
22.3		25.9		18.8		7.8		**75%**

Data Files

***.lif.raw.bin**	Raw data file. Header is ASCII format and contains information stored when the file was initially written (e.g. date, total depth, max signal, gps, etc., and any information entered by the operator). All raw waveforms are appended to the bottom of the file in a binary format.
***.lif.plt**	Stores the plot scheme history (e.g. callout depths) for associated Raw file. Transfer along with the Raw file in order to recall previous plots.
***.lif.jpg**	A jpg image of the OST log including the main signal vs. depth plot, callouts, information, etc.
***.lif.dat.txt**	Data export of a single Raw file. ASCII tab delimited format. No string header is provided for the columns (to make importing into other programs easier). Each row is a unique depth reading. The columns are: Depth, Total Signal (%RE), Ch1%, Ch2%, Ch3%, Ch4%, Rate, Conductivity Depth, Conductivity Signal, Hammer Rate. Summing channels 1 to 4 yields the Total Signal.
***.lif.sum.txt**	A summary file for a number of Raw files. ASCII tab delimited format. The file contains a string header. The summary includes one row for each Raw file and contains information for each file including: the file name, gps coordinates, max depth, max signal, and depth at which the max signal occured.
***.lif.log.txt**	An activity log generated automatically located in the OST application directory in the 'log' subfolder. Each OST unit the computer operates will generate a separate log file per month. A log file contains much of the header information contained within each separate Raw file, including: date, total depth, max signal, etc.

Common Waveforms (highly dependent on soil, weathering, etc.)



Diesel	Gas	Kerosene	Motor Oil

Attachment 3
QA/QC Memo

Memorandum

Environmental Resources Management

2875 Michelle Drive
Suite 200
Irvine, CA 92606
(949) 623-4700
(949) 623-4711 (fax)

To: Shannon Martin

From: Irene Lavigne

Date: 14 December 2015

Subject: Data Review of SMI Holdings, Offsite Investigation Samples Collected November 2015

Project Number: 0201040.01SGB

Data Packages: TestAmerica Laboratories Data Packages 720-68720-1, 720-68782-1, 720-68834-1

The quality of the data was assessed and any necessary qualifiers were applied following the *USEPA National Functional Guidelines for Superfund Organic Methods Data Review,* August 2014 and *USEPA National Functional Guidelines for Inorganic Superfund Data Review,* August 2014.

HOLDING TIME AND PRESERVATION EVALUATION

The samples were prepared and analyzed within the method-prescribed time period from the date of collection. None of the data were qualified based on holding time exceedances.

The pH of two samples, MIP-OS-17-75-80 and MIP-OS-20-70-75, were recorded outside of the recommended preservation range for water samples of pH less than two (pH <2) upon receipt at the laboratory. The laboratory noted that no corrective action was taken and the samples were analyzed for volatile organic compounds (VOCs) as directed on the chain of custody. However, the samples were analyzed within the 7-day holding time for unpreserved samples; thus, the data were not qualified based on the preservation exceedance. The unpreserved samples are shown in Table 1.

BLANK EVALUATION

The method blank and trip blank sample results were nondetected for each of the target analytes. Sample data were not qualified based on the blank sample evaluation. The blank results indicate that no contaminants were introduced to the field samples during transportation, preparation, or analysis.

BLANK SPIKE EVALUATION

The laboratory control sample (LCS) and laboratory control sample duplicate recoveries were within the laboratory's limits of acceptance with one exception. Sample data were not qualified based on the LCS outlier because the recoveries were biased high and the associated samples were nondetected for the corresponding compound. The LCS outlier is presented in Table 2. The LCS recoveries indicate acceptable laboratory accuracy and precision.

SURROGATE SPIKE EVALUATION

The surrogate recoveries were within acceptable limits. No qualifications to the data were made. The surrogate recoveries indicate minimal matrix interference in the samples.

OVERALL ASSESSMENT

No data were determined to be unusable or required qualification. All of the data can be used for decision-making purposes. The quality of the data generated during this investigation is acceptable for the preparation of technically-defensible documents.

Table 1
Samples with Exceeded Preservation Requirements
November 2015 Offsite Investigation Samples
SMI Holdings
Cupertino, California

Lab Package	Sample ID	Analysis Method	Sample pH (pH units)	pH Limits	Note	ERM Qualifier
720-68782-1	MIP-OS-17-75-80	VOC	> 2	< 2	HT	--
720-68782-1	MIP-OS-20-70-75	VOC	> 2	< 2	HT	--

Data packages reviewed: 720-68720-1, 720-68782-1, 720-68834-1

Key:
VOC = Volatile organic compound; Method 8260B
HT = Data not qualified; samples analyzed within 7-day holding time for unpreserved samples

Table 2
Laboratory Control Sample Recoveries Outside of Acceptable Limits
November 2015 Offsite Investigation Samples
SMI Holdings
Cupertino, California

Lab Package	Spike Sample ID	Associated Sample	Compound	Recovery (%)	Limit (%)	RPD	RPD Limit	Sample Result	ERM Qualifier
720-68720-1	720-193086/7 LCS/LCSD	NA	Dichlorodifluoromethane	143/145	34-132	1	20	--	--

Data packages reviewed: 720-68720-1, 720-68782-1, 720-68834-1

Key:
RPD = Relative percent difference
LCS/LCSD = Laboratory control sample/laboratory control sample duplicate
NA = Not applicable; associated samples not qualified

Attachment 4
RWQCB 10 December 2015
email

Kit Soo

From: Papler, Roger@Waterboards <Roger.Papler@waterboards.ca.gov>
Sent: Thursday, December 10, 2015 10:27 AM
To: sue.oconnor@siemens.com; lance.hauer@ge.com
Cc: Kit Soo; Heather Balfour; sgcolman@comcast.net; Ben Leslie-Bole; frank.szerdy@amec.com; morash.melanie@epa.gov; Ledbetter.Ray@epa.gov; chuck.hunnewell@siemens.com
Subject: I-S/C - Off-Property: Comments - MIP Investigation Update

Hello Lance and Sue:

Thank you for the 18Nov15 email providing an update on the status of the off-property investigation (Update) that partially implemented the 17Aug15 *Off-Site Study Area - Monitoring Well Installation Work Plan Addendum #2* (Workplan).

The Regional Water Board reviewed the Update with USEPA staff. The following summarizes the Update and provides our comments.

Update Summary

The Update indicates that no groundwater was encountered in the A1 Zone in two membrane interface probe (MIP) borehole locations along Swallow Way, MIP-OS-16 and -18. The lack of negative pore pressure readings on the cone penetrometer test (CPT) logs indicated unsaturated conditions and the unsuccessful attempt to collect a groundwater sample from the A1-Zone interval confirmed the unsaturated conditions. Based on the above, the Update indicated that no further attempted sampling of the A1 Zone would be attempted and invited agency input regarding the path forward.

Agency Comments

The Regional Water Board and USEPA concur with your approach to not attempt further sampling of the A1 Zone based on the current unsaturated A1-Zone conditions. However, meteorological records indicate that rainfall has generally been higher during between December and March and re-attempting to sample the A1 Zone after the rainy season would optimize the probability of collecting A1-Zone samples.

The attached 9Sept15 approval letter (Letter) required you to submit a report documenting implementation of the Workplan by 60 days after collecting the groundwater data but no later than February 29, 2016. However, the report would document partial implementation of the Workplan. So you may defer submitting the report until conducting a followup A1-Zone sampling event in Spring 2016. As per our 9Dec15 discussion with ERM West, we suggest that you gauge water levels in existing A-1 Zone wells during the forthcoming April 2016 sampling event and confer with the Regional Water Board and USEPA to decide whether attempting another A1-Zone re-sampling may produce groundwater samples.

If we decide that a followup sampling effort is likely to be successful, you may submit the report documenting implementation of the Workplan **60 days after the followup A-1 Zone sampling event but no later than COB Friday 1Sept15.** Please submit the tabulated groundwater analytical results within two weeks of receiving the laboratory report. You may include this email in the report appendix to explain the discrepancy between the actual and Letter-required submittal dates.

Please submit the MIP logs for our review and contact this office if you have any questions.

Respectfully,

Roger W. Papler, P.G.
Engineering Geologist
California Environmental Protection Agency

San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Melanie Morash
Remedial Program Manager
U. S. Environmental Protection Agency
Superfund Division
75 Hawthorne Street
San Francisco, CA 94105

Ray Ledbetter, PG
Environmental Scientist
USEPA-OSWER-OSRTI-ERT
4220 South Mayland Parkway, BLDG D, Suite 800
Las Vegas, NV 89119

From: Kit Soo [mailto:Kit.Soo@erm.com]
Sent: Wednesday, November 18, 2015 11:57 AM
To: Papler, Roger@Waterboards
Cc: Heather Balfour; Ben Leslie-Bole; Chuck.Hunnewell@siemens.com; O'Connor, Sue (SRE US); Susan Colman; lance.hauer@ge.com
Subject: SMI/Intersil Facility - Offsite Investigation Update

Hi Roger:

As per our phone conversation today, we began the offsite investigation activities at the SMI/Intersil Facility yesterday. Please see the attached Work Plan which we are working with. Note that the actual locations have been adjusted slightly to facilitate the presence of utilities.

Currently we have completed the following:

1) MIP-OS-16 (Proposed A1 Sampling Location, targeted depth is 55-60'bgs)
- We completed MIP-OS-16 on 11/17
- MIP boring was completed to 61'bgs and the CPT boring was completed to 63'bgs.
- Pore water pressure on CPT log did not show negative numbers indicative of the presence of saturated conditions.
- XSD (formerly known as ECD) detections were noted at ~ 54-58' bgs on the MIP which corresponded to a sandy/clayey silt layer (as shown on the CPT log)
- Hydropunch was attempted at 54-58' bgs and we waited for a few hours and there was no water. Rods were also dry indicating that there is no likely water bearing zone encountered to depth.

As a result of the above findings, we have decided to terminate further sampling at this location and continue to the next location. We do not think the A2-Zone would be appropriate or representative of the groundwater in the A1-Zone. The A2-Zone is a low yielding, semi-confining, water bearing zone that we are not monitoring for groundwater quality and hence, sampling from that zone will not provide suitable data for evaluation.

2) MIP-OS-18 (approximately 100 feet or so south of MIP-OS-16 – this is a proposed A3 sampling location, targeted depth is 80-85' bgs)
- MIP boring was completed to 86' and the CPT boring was completed to 88 feet bgs.
- Pore water pressure on CPT log showed negative numbers AT 80' bgs.
- No elevated XSD detections were noted to depth.

- Although this is a proposed A3 sampling location, we attempted to sample the A1 to see whether the conditions at MIP-OS-16 are prevalent at this location as well. As expected, no water was encountered and a sample could not be collected.
- A sample was collected at the A3 depth interval (~76-81' bgs).

Please let us know if you have any questions or concerns regarding our path forward on MIP-OS-16.

Thanks, Kit

Kit Soo, PG
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