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September 29, 2017

Dilan Roe
Land Use and Local Oversight Program Manager
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: Data Gap Investigation and Plume Stability Evaluation Report
1619 1st Street, Livermore, California
Tesoro No. 67076 (Former Beacon 3604); ACEH Case No. RO0434

Dear Ms. Roe:

Enclosed please find a copy of the ***Data Gap Investigation and Plume Stability Evaluation Report*** for the subject site, dated 29 September 2017. This report is submitted by Arctos Environmental at the request of Tesoro Environmental Resources Company.

Based on my inquiry of the person or persons directly responsible for gathering the information contained in this report, I believe the information was prepared by qualified personnel who properly gathered and evaluated the information, and that the information submitted is, to the best of my knowledge and belief, true, correct, and complete. Please feel free to call me at 253/896-8700 or Scott Stromberg of Arctos Environmental at 510/525-2180 with questions.

Sincerely,

Kyle Waldron
Environmental Remediation Administrator

Attachments

CC: Arctos – Scott Stromberg

ARCTOS

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29 September 2017
Project No. 01LV

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Tesoro No. 67076 (Former Beacon 3604); ACEH Case No. RO0434

Dear Ms. Roe:

Arctos Environmental (Arctos), at the request of Tesoro Environmental Resources Company (Tesoro), is submitting this report containing results of a data gap investigation and plume stability evaluation at the subject site (Figure 1).

Executive Summary

In June and July 2017, Arctos conducted field activities to investigate data gaps identified in a draft Remedial Action Plan (RAP) submitted to Alameda County Environmental Health (ACEH) in December 2016, and a meeting with ACEH in February 2017 (Orion, 2016). As part of this effort, Orion assessed the following data gaps:

1. Investigated the downgradient area of the dissolved phase groundwater plume by advancing cone penetration testing (CPT) and grab groundwater sample boring pairs along a transect (Figure 2). Grab groundwater samples were collected at approximately 40 and 60 feet below ground surface (bgs) at each boring pair. Results of grab groundwater sampling indicated that (1) the cross gradient lateral extent of the downgradient portion of the plume has been delineated and (2) the downgradient extent of the plume is not fully delineated based on total petroleum hydrocarbons as gasoline (TPHg) concentrations in grab groundwater samples.

2. Assessed the presence and potential mobility of submerged light non-aqueous phase liquid (LNAPL) in the vicinity of the former underground storage tanks (USTs). Arctos advanced two CPT and Ultra Violet Optical Screening Tool (UVOST) borings and the UVOST response indicated the presence of submerged LNAPL at approximately 55 and 70 feet bgs. Arctos

advanced an additional boring nearby using a hollow-stem auger (HSA) drill rig to collect soil samples for laboratory testing of LNAPL saturation and potential mobility. Results of laboratory testing indicate LNAPL saturation is low and below residual saturation. Therefore, LNAPL present at the site is neither mobile nor recoverable.

3. Evaluated groundwater plume stability by using EarthCon Consultants Inc. (EarthCon) of Memphis, Tennessee, to determine the effectiveness of site remediation using the Ricker Plume Analytics method. Results of the evaluation indicated that average contaminant concentration, estimated contaminant mass, and lateral extent of the contaminant plume are decreasing over time. Onsite contaminant reductions appear to have reached asymptotic levels, indicating onsite remediation is no longer warranted. ACEH approved shutdown of the onsite oxygen injection system in a 12 September 2017 e-mail. Arctos will shut down the system, monitor potential rebound at onsite monitoring wells, and summarize results and recommendations in the next semiannual report submitted to ACEH.

Based on results of the data gap investigation, Arctos recommends installing and sampling a shallow and deep groundwater monitoring well cluster to better delineate the downgradient extent of the plume. Arctos will submit a separate work plan for well installation. No additional LNAPL investigation or remediation is necessary.

Background and Purpose

The remedial objectives in Arctos's 2008 Interim Remedial Action Plan included (1) additional groundwater assessment to investigate deep groundwater quality, and (2) remediation of hydrocarbon-impacted groundwater and vadose soil near the former source areas (Arctos, 2008). Following completion of the deep groundwater investigation and pilot test studies of multiple remedial technologies, Arctos submitted a draft RAP to ACEH in December 2016 (Arctos, 2016).

In the draft RAP and during a February 2017 meeting with ACEH, the following data gaps were identified that may impact remedial decisions:

1. The downgradient lateral extent of the benzene plume has not been fully delineated.

2. There is potential that submerged LNAPL is present in the vicinity of the former USTs based on measurable LNAPL detected once at injection well IP-8 in 2010.

In May 2017, Orion submitted a work plan to investigate these data gaps (Arctos, 2017). Investigation activities were subsequently conducted in June and July 2017. Additionally,

EarthCon performed a plume stability evaluation using historical groundwater elevation and analytical data to assess plume characteristics including whether plume migration is occurring. This report summarizes results of the data gap investigation and plume stability evaluation.

A complete site description and background were included in the draft RAP (Arctos, 2016).

Objectives and Scope of Work

The objectives of the data gap investigation were to assess (1) the downgradient lateral extent of the plume, and (2) the potential presence or mobility of LNAPL in the vicinity of the former USTs. To meet these objectives, Arctos performed the following scope of work:

- Mobilized for field activities including (1) marking for Underground Service Alert, (2) clearing the boring locations with a private utility locator, (3) obtaining boring permits from Zone 7 Water Agency, (4) obtaining an encroachment permit from the City of Livermore, and (5) updating the site-specific Health and Safety Plan

- Air-knifed boring locations to a depth of 5 to 8 feet below grade to clear for subsurface utilities

- Advanced five boring pairs in the offsite, downgradient area of the plume to (1) characterize lithology using CPT and (2) collect grab groundwater samples from shallow and deep intervals for laboratory analysis of TPHg, benzene, toluene, ethylbenzene, xylenes (BTEX), oxygenates, trichloroethylene (TCE), and tetrachloroethylene (PCE)

- Advanced two borings in the vicinity of well DW-8 using a direct-push drill rig equipped to measure CPT and UVOST response

- Advanced a third boring adjacent to well DW-8 using a HSA drill rig and collected two soil samples at the depths of the highest UVOST responses for laboratory analysis of LNAPL saturation and potential mobility.

Field Procedures

Downgradient Plume Delineation

CPT borings were advanced at five locations (DB-11 through DB-15) in approximately 60-foot spacing along a transect at the northernmost accessible extent of the Safeway parking lot, located downgradient of the site (Figure 2). CPT borings were advanced until refusal was encountered at approximately 67 to 125 feet bgs.

Based on lithology characterized by CPT, a second adjacent boring was advanced at each location to collect grab groundwater samples. Grab groundwater samples were collected using a 5-foot-long discrete sampler within the shallow saturated interval (approximately 35 to 40 feet bgs) and the deep interval (approximately 55 to 60 feet bgs). Historical monitoring off site has indicated that the highest impacts are located in the deep interval from approximately 50 to 60 feet bgs (Arctos, 2016). Grab groundwater samples were submitted to Torrent Laboratory, Inc., of Milpitas, California, for analysis of petroleum hydrocarbon compounds and chlorinated solvents. Chlorinated solvents are not chemicals of concern for the site, but were analyzed because of the presence of nearby former dry cleaner release sites.

LNAPL Presence and Mobility

Two CPT/UVOST borings (UVOST-1 and UVOST-2) were advanced adjacent to well DW-8 in P Street (Figure 2). The borings were advanced until refusal was encountered at approximately 91 to 92 feet bgs.

UVOST technology was selected for this assessment because it provides a vertical profile of residual LNAPL regardless of percent saturation in the pore space. Residual submerged LNAPL was identified in the vicinity of well DW-8 in discrete intervals at depths of approximately 55 and 70 feet bgs. The highest UVOST response was observed at boring UVOST-2. Therefore, an additional boring was advanced adjacent to boring UVOST-2 using a HSA rig to collect soil samples for LNAPL saturation and mobility testing. Two soil samples were collected from 55 and 70 feet bgs, correlating with the highest UVOST responses. Soil samples were submitted to PTS Laboratories of Santa Fe Springs, California, for free product mobility testing.

Details of Arctos's field procedures for the data gap investigation are described in Attachment A.

Analytical Program

Grab groundwater samples were analyzed for TPHg, BTEX, and oxygenates including methyl tert-butyl ether (MTBE), di-isopropyl ether, ethyl tert-butyl ether, tert-amyl methyl ether, tert-butyl alcohol, ethanol, as well as chlorinated solvents including TCE and PCE by U.S. Environmental Protection Agency Method 8260B.

Soil samples were analyzed for free product mobility using American Society for Testing and Materials Method D425M. In accordance with this testing method, the samples were first desaturated by centrifuging at 1,000 times the force of gravity for one hour. The centrifuge applies a force much higher than forces operating in real world LNAPL sites, so this analytical method generates conservative residual saturation values. Water and LNAPL production were measured at the completion of the centrifuge run. The post-centrifuged samples were then distilled with a solvent using the Dean-Stark Method to

extract remaining water and LNAPL; fluid extracted post-centrifuge represents residual water and LNAPL saturations. Initial saturations were calculated by adding the centrifuged fluid production to the post-centrifuge residual fluid. The post-centrifuge LNAPL saturation determines the residual saturation for that soil type at the site if the initial saturation is a higher value. (Brady and Kunkel, 2005).

Investigation Results and Discussion

Downgradient Plume Delineation

Concentrations of TPHg at downgradient borings DB-11 through DB-15 collected from the shallow zone at approximately 40 feet bgs ranged from nondetect to 15,000 micrograms per liter (µg/l). Concentrations of benzene in the shallow zone ranged from nondetect to 4.0 µg/l. The highest TPHg and benzene concentrations in the shallow zone were detected at boring DB-13 located along the plume centerline; concentrations at this boring were an order of magnitude higher than concentrations at the edge of the plume. All other contaminant concentrations were nondetect in the shallow zone.

Concentrations of TPHg in the deep zone at approximately 60 feet bgs ranged from 1,470 to 51,000 µg/l. Concentrations of benzene in the deep zone ranged from nondetect to 130 µg/l. The highest concentrations of TPHg and benzene in the deep zone were detected at borings DB-12 through DB-14 located along the plume centerline; concentrations along the plume centerline were an order of magnitude higher than concentrations at the edge of the plume. Toluene, ethylbenzene, total xylenes, and MTBE were detected at low concentrations in the deep zone at borings along the plume centerline, but were not detected at borings DB-11 and DB-12 at the edge of the plume. All other contaminant concentrations were nondetect in the deep zone. Shallow and deep concentrations along the plume centerline and at the edge of the plume are summarized below.

Contaminant	Sample Depth (feet bgs)	Concentration (µg/l)				
		Edge of Plume	Plume Centerline			Edge of Plume
		DB-11	DB-12	DB-13	DB-14	DB-15
TPHg	40	2,280[(a)]	974[(a)]	15,000[(a)]	576[(a)]	ND<59
	60	2,140[(a)]	21,700[(a)]	37,500[(a)]	51,000[(a)]	1,470[(a)]
Benzene	40	ND<21[(b)]	1.0 J[(c)]	4.0 J	1.9	ND<0.59
	60	ND<21	130	130	110	ND<0.5

(a) Result is due to contribution from heavy end hydrocarbons (possibly aged gasoline) and non-fuel light hydrocarbons to the C5-C12 range quantified as Gasoline.
(b) ND - Not detected at the reporting limit listed.
(c) J - An estimated value.

In the downgradient portion of the plume, impacts mostly exist in the deep zone; contaminant concentrations were up to an order magnitude higher in the deep zone relative to the shallow zone. The extent of downgradient TPHg and benzene impacts are

delineated laterally by well DW-4 and borings DB-11 and DB-15; concentrations at these locations were an order of magnitude lower than concentrations along the plume centerline. Concentrations of TPHg are greater than 10,000 µg/l along the plume centerline in the shallow and deep zones. However, these results are due to contribution from heavy end hydrocarbons. Additionally, benzene concentrations are relatively low compared to TPHg concentrations. Therefore, TPHg in the downgradient portion of the plume appears to be weathered.

Site data suggest discrete grab groundwater samples collected from a direct push drill rig may result in petroleum hydrocarbon concentrations biased high compared to concentrations in groundwater samples collected from monitoring wells. The following site data support this conclusion:

1. Monitoring wells DW-7 and DW-9 are located approximately 100 feet upgradient of the transect of borings DB-12 through DB-14 (Figure 2). TPHg and benzene concentrations in groundwater samples collected from wells DW-7 and DW-9 in April were an order of magnitude lower than concentrations in grab groundwater samples collected from borings DB-12 through DB-14 in June. The table below summarizes concentrations in the deep zone from grab groundwater samples and groundwater monitoring wells.

	Concentration (µg/l)				
	Grab Groundwater Samples			**Upgradient Monitoring Well Samples**	
Contaminant	**DB-12 (June 2017)**	**DB-13 (June 2017)**	**DB-14 (June 2017)**	**DW-7 (April 2017)**	**DW-9 (April 2017)**
Screened Interval (feet bgs)	**55 to 60**	**55 to 60**	**55 to 60**	**55 to 65**	**50 to 60**
TPHg	21,700[(a)]	37,500[(a)]	51,000[(a)]	1,120[(b)]	2,130[(b)]
Benzene	130	130	110	18	5.6

(a) Result is due to contribution from heavy end hydrocarbons (possibly aged gasoline) and non-fuel light hydrocarbons to the C5-C12 range quantified as Gasoline.
(b) Result does not match pattern of reference Gasoline standard.

2. In 2012, discrete grab groundwater samples were collected from borings DB-8 and DB-9 using a direct push drill rig (Figure 2). Grab groundwater concentrations at boring DB-9 were up to two orders of magnitude higher than concentrations detected in samples collected from permanent monitoring wells DW-7 and DW-9 located approximately 50 feet upgradient of boring DB-9. The table below summarizes concentrations in the grab groundwater sample collected from boring DB-9 and groundwater samples collected from wells DW-7 and DW-9.

Contaminant	Concentration (µg/l)		
	Grab Groundwater Sample	Upgradient Monitoring Well Samples	
	DB-9 (June 2012)	DW-7 (May 2012)	DW-9 (June 2012)
Screened Interval (feet bgs)	**50 to 55**	**55 to 65**	**50 to 60**
TPHg	18,000	940	8,300
Benzene	610	47	89

Grab groundwater results from the data gap investigation are summarized in Table 1. Figure 2 shows the benzene plume in aerial view. Figures 3A through 3D show the benzene plume in cross section views. The CPT and boring logs are in Attachment B, and laboratory analytical report and chain-of-custody forms are in Attachment C.

LNAPL Presence and Mobility

Initial LNAPL saturation in soil samples collected from UVOST-2 at approximately 55 and 70 feet bgs were 3.1 and 2.1 percent, respectively. Residual LNAPL saturation measured after centrifuging the samples remained the same. Therefore, LNAPL saturation is less than residual saturation. Additionally, the LNAPL saturation values measured in the two soil samples (2.1 to 3.1 percent) were lower than typical LNAPL saturation values for sands (approximately 5 percent; Brady and Kunkel, 2005). Therefore, remaining LNAPL at the site is neither mobile nor recoverable. The table below summarizes results of LNAPL mobility testing.

Sample Depth (feet bgs)	LNAPL Saturation[(a)]	
	Initial	After Centrifuge
54 to 55.5	3.1	3.1
69 to 70.5	2.1	2.1

(a) LNAPL saturation measured in percent.

In addition, during November 2015, groundwater elevations decreased to historical low levels at the site. Depth to water was measured at approximately 57 feet bgs at well DW-8, 2 feet below the top of the well screen and below the depth LNAPL was identified near well DW-8 by UVOST. LNAPL was not measured in well DW-8, indicating residual LNAPL in the vicinity of well DW-8 is not mobile.

Figure 4 shows UVOST boring results. The CPT/UVOST and boring logs are in Attachment B, and laboratory analytical report and chain-of-custody forms are in Attachment C.

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Plume Stability Evaluation

EarthCon performed a plume stability evaluation using historical groundwater elevation and analytical data collected at the site from June 1993 to April 2017. EarthCon evaluated trends in plume characteristics, including area, average concentration, mass, and location of plume center of mass, using visual and statistical methods. The results were presented to ACEH in a 7 September 2017 meeting and the presentation was submitted electronically to ACEH on 11 September 2017.

Between 2003 and 2013, the on- and offsite monitoring well network was expanded significantly. Onsite remediation systems began operation in 2010 and on- and offsite ISCO events occurred in 2011 and 2013. As a result, statistical trends in the plume characteristics stated above were calculated for the periods 1993 to 2003, and 2013 to 2017. The recent trends, from May 2013 to April 2017, are summarized in the following table:

Contaminant	Plume Characteristic	Trend	Statistical Confidence (percent)	
			Mann-Kendall	Regression
TPHg	Area	Decreasing	>99	>99
	Average Concentration	Decreasing	>99	>99
	Mass	Decreasing	99	>99
Benzene	Area	No Trend	55	38
	Average Concentration	Decreasing	>99	>99
	Mass	Decreasing	>99	>99
MTBE	Area	Decreasing	>99	>99
	Average Concentration	Decreasing	>99	>99
	Mass	Decreasing	>99	>99

With the exception of benzene plume area, the area, average concentration, and mass of the TPHg, benzene, and MTBE plumes show decreasing trends with high statistical confidence. Excerpt slides from EarthCon's presentation of the plume stability evaluation are included in this report (Figures 5A through 8). Figures 5A through 6B present graphs of benzene plume characteristic trends for all historical data, graphs of benzene plume characteristic trends for recent data from 2013 to 2017, and plan-view representations of benzene plume characteristics in 2013 and 2017. The benzene plan-view figures show that the average benzene plume concentration decreased from 63 to 12 µg/l and benzene plume mass decreased from 4.4 to 1.2 pounds between 2013 and 2017.

Additional excerpts from the plume stability evaluation include a visual representation of spatial changes in the benzene plume from 2013 to 2017, and a representation of the changes in plume center of mass over time from 2013 to 2017 (Figures 7 and 8). The spatial change evaluation shows that the extent of the benzene plume has decreased up to

100 percent on site as a result of remediation focused in the vicinity of former source areas. Recent statistical trends in plume characteristics show that decreases are approaching asymptotic levels, indicating remediation systems are no longer warranted. Based on these results, groundwater monitoring data from onsite wells, and discussion with ACEH, Arctos and Tesoro requested approval to shut down the onsite oxygen injection system. ACEH approved the request in a 12 September 2017 e-mail (Attachment D).

Additional excerpt slides from EarthCon's presentation showing graphs, plan-view representations, and changes in the center of mass of the TPHg and MTBE plumes are included in Attachment E.

Post-Remedial Rebound Monitoring Plan

Arctos currently conducts groundwater monitoring on a semiannual basis in accordance with ACEH monitoring requirements (ACEH, 2009). In order to monitor potential rebound in dissolved-phase concentrations after shutting down the onsite oxygen injection system, Arctos is proposing to sample selected wells quarterly according to the following monitoring plan:

Well Designation	Location	Sampling Frequency
MW-1, MW-2, MW-11, DW-1, TP-1, TP-2, and VW-2	Former source areas	Quarterly
MW-6, MW-12, DW-2, DW-3, DW-4, DW-5, DW-6, DW-7, DW-8, and DW-9	Downgradient	
VW-3	Upgradient	Semiannually (2nd and 4th quarters)
MW-3, MW-4, MW-5, MW-7, MW-8, and MW-10	Cross gradient	
MW-9	Downgradient	
IP-1 through IP-3, and IP-6 through IP-10	Former source areas	Annually (2nd quarter)
IP-4 and IP-5	Cross gradient	

Arctos will shut down the oxygen injection system in September 2017 and conduct post-remedial monitoring during the fourth quarter 2017. Results, including discussion of potential rebound, and recommendations will be included in the third and fourth quarters 2017 semiannual groundwater monitoring report that will be submitted to ACEH.

In addition, Arctos is proposing to collect monthly dissolved oxygen (DO) readings at former oxygen injection wells and nearby groundwater monitoring wells located on site to monitor changes in DO after shutting down the oxygen injection system. DO readings will be collected only during the fourth quarter 2017 and results will be included in the semiannual report.

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Conclusions and Recommendations

Based on results of the data gap investigation and plume stability evaluation, Arctos has concluded the following:

1. The lateral extent of the downgradient portion of the plume has been delineated. However, the downgradient extent is still not fully delineated based on TPHg concentrations in grab groundwater samples. Although, contaminant concentrations in grab groundwater samples collected during the investigation are likely biased high based on comparison to nearby groundwater monitoring wells and historical grab sampling results.

2. Submerged LNAPL was identified using UVOST technology near well DW-8 in discrete intervals from approximately 55 to 70 feet bgs. Soil core testing determined that LNAPL saturation was low compared to typical values for sands and less than residual saturation. Therefore, LNAPL remaining at the site is neither mobile nor recoverable and no additional LNAPL investigation or remediation is necessary.

3. Based on results of the plume stability evaluation, average contaminant concentration, estimated contaminant mass, and lateral extent of the contaminant plume is decreasing over time; additionally, onsite contaminant reductions due to active remediation appear to have reached asymptotic levels.

4. Continued operation of the onsite remediation systems is no longer anticipated to effectively reduce the groundwater plume. Rather, natural attenuation has been observed and is expected to continue to occur. The ACEH approved shut down of the onsite oxygen injection system via email. Additionally, the onsite soil vapor extraction system has not been operating based on high groundwater levels and the system will remain shut off regardless of future variations in groundwater levels.

Based on the conclusions stated above, Arctos recommends the following:

1. Installing and sampling one shallow and deep groundwater monitoring well cluster in the downgradient portion of the plume to delineate the downgradient extent of the plume. Arctos will submit a separate work plan for the proposed well installation.

2. Performing post-remedial groundwater monitoring and discussing results and recommendations in the upcoming third and fourth quarters 2017 semiannual monitoring report.

If you have questions or comments, please call Mike Purchase or Scott Stromberg at 510/525-2180.

Very truly yours,

ARCTOS ENVIRONMENTAL

Scott Stromberg, P.G.
Project Geologist

Michael P. Purchase, P.E.
Principal Engineer

Copy: Kyle Waldron – Tesoro Companies, Inc.
Colleen Winey – Zone 7 Water Agency

Attachments:
Table 1 – Grab Groundwater Analytical Results
Figure 1 – Site Location Map
Figure 2 – Downgradient Investigation Results and Benzene Concentration Contours
Figure 3A – Cross Section A-A' with Dissolved-Phase Impacts
Figure 3B – Cross Section B-B' with Dissolved-Phase Impacts
Figure 3C – Cross Section C-C' with Dissolved-Phase Impacts
Figure 3D – Cross Section D-D' with Dissolved-Phase Impacts
Figure 4 – UVOST Boring Results and Benzene Concentration Contours
Figure 5A – EarthCon Benzene Plume Area, Average Concentration, and Mass Indicator Graphs
Figure 5B – EarthCon Benzene Plume Area, Average Concentration, and Mass Indicator Graphs with Detail
Figure 6A – EarthCon Benzene Plume, May 2013
Figure 6B – EarthCon Benzene Plume, May 2017
Figure 7 – EarthCon Benzene Plume Differences, May 2013 vs. May 2017
Figure 8 – EarthCon Benzene Center of Mass
Attachment A – Quality Assurance/Quality Control (QA/QC) Procedures
Attachment B – Cone Penetration Testing/Ultra Violet Optical Screening Tool (CPT/UVOST) and Boring Logs
Attachment C – Laboratory Analytical Reports and Chain-of-Custody Forms
Attachment D – Alameda County Environmental Health Correspondence
Attachment E – Excerpts from Ricker Plume Stability Evaluation

References

Alameda County Environmental Health, 2009. "Fuel Leak Case No. RO0000434 and Geotracker Global ID T0600101410, Beacon #3604, 1619 First Street, Livermore, CA – Groundwater Monitoring Requirements," 23 July.

Arctos Environmental, 2008. "Interim Remedial Action Plan for Groundwater, 1619 1st Street, Livermore, California, Tesoro No. 67076 (Former Beacon 3604), ACEH Case No. RO0000434," 21 March.

Arctos Environmental, 2016. "Remedial Action Plan, Tesoro Site No. 67076 (Former Beacon 3604), 1619 1st Street, Livermore, California," 4 December.

Arctos Environmental, 2017. "Monitoring Well Network Analysis and Work Plan for Data Gap Investigation, 1619 1st Street, Livermore, California, Tesoro Site No. 67076 (Former Beacon 3604); ACEH Case No. RO0434," 8 May.

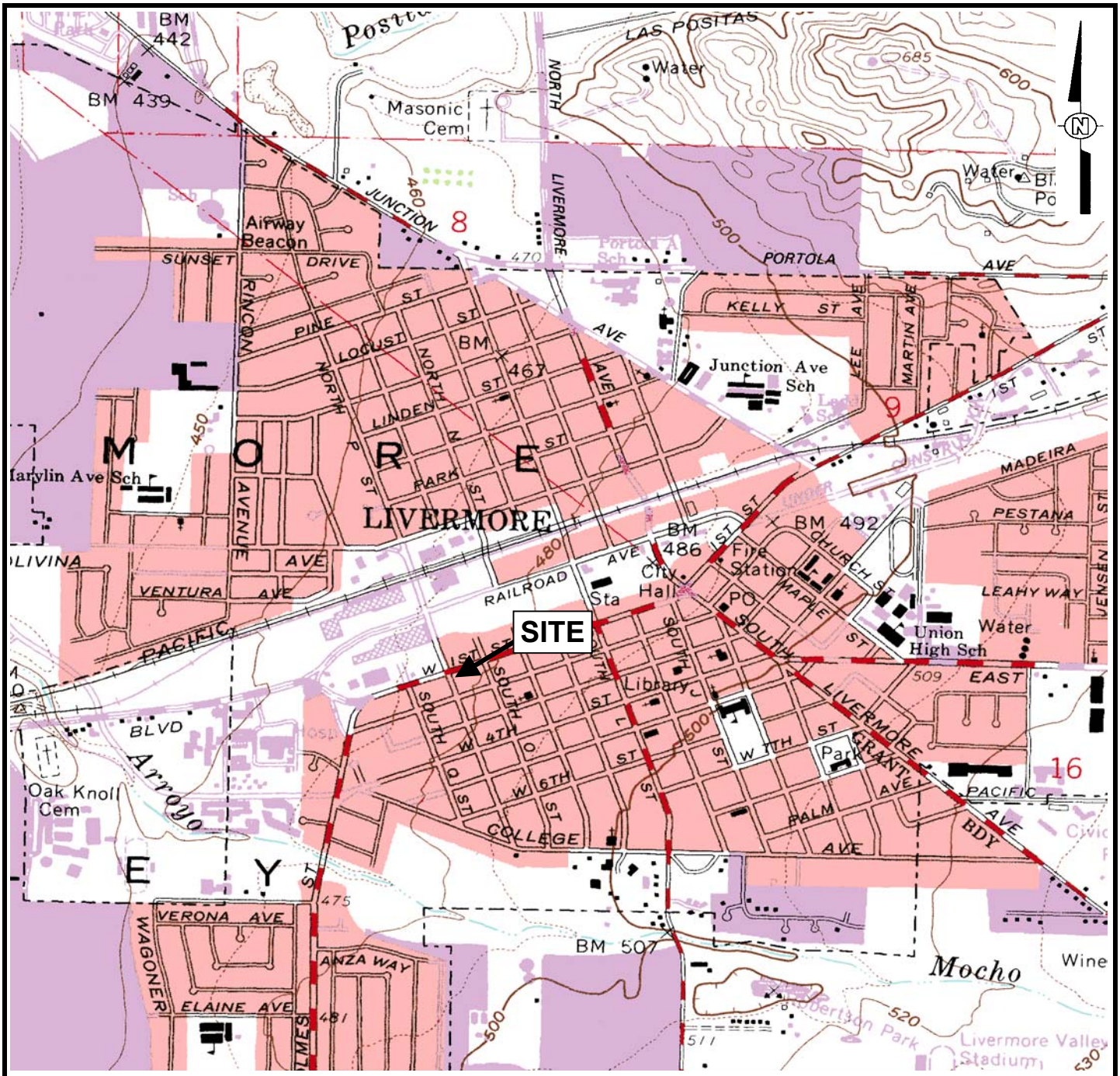
Brady, M.M, and Kunkel, L.A., 2005. "A Screening Method for Determining Free Product Mobility," November.

TABLE 1

GRAB GROUNDWATER ANALYTICAL RESULTS
TESORO - LIVERMORE, 67076

Sample Location	Sample Depth (feet)	Sample Date	TPHg[a] (µg/l)	Benzene[a] (µg/l)	Toluene[a] (µg/l)	Ethyl-benzene[a] (µg/l)	Total Xylenes[a] (µg/l)	MTBE[a] (µg/l)	DIPE[a] (µg/l)	ETBE[a] (µg/l)	TAME[a] (µg/l)	TBA[a] (µg/l)	Ethanol[a] (µg/l)	TCE[a] (µg/l)	PCE[a] (µg/l)
DB-11	40	6/27/17	2,280[b]	ND<21[c]	ND<21	ND<21	ND<63	ND<21	ND<21	ND<21	ND<21	ND<210	ND<210[d]	ND<21	ND<21
	60	6/27/17	2,140[b]	ND<21	ND<21	ND<21	ND<63	ND<21	ND<21	ND<21	ND<21	ND<210	ND<210[d]	ND<21	ND<21
DB-12	40	6/23/17	974[b]	1.0 J[e]	ND<2.1	ND<2.1	ND<6.3	ND<2.1	ND<2.1	ND<2.1	ND<2.1	ND<21	ND<21[d]	ND<2.1	ND<2.1
	60	6/23/17	21,700[b]	130	ND<53	210	74 J	8.4 J	ND<53	ND<53	ND<53	ND<530	ND<530[d]	ND<53	ND<53
DB-13	40	6/23/17	15,000[b]	4.0 J	ND<11[d]	ND<11[e]	ND<32	ND<11	ND<11	ND<11	ND<11	ND<110	ND<110[d]	ND<11	ND<11
	60	6/23/17	37,500[b]	130	ND<53	240	42 J	13 J	ND<53	ND<53	ND<53	ND<530	ND<530[d]	ND<53	ND<53
DB-14	40	6/22/17	576[b]	1.9	ND<0.62	ND<0.62	ND<1.9	ND<0.62	ND<0.62	ND<0.62	ND<0.62	ND<6.2	ND<6.2[d]	ND<0.62	ND<0.62
	60	6/22/17	51,000[b]	110	ND<21	710	230	ND<21	ND<21	ND<21	ND<21	ND<210	ND<210[d]	ND<21	ND<21
DB-15	40	6/22/17	ND<59	ND<0.59	ND<0.59	ND<0.59	ND<1.8	ND<0.59	ND<0.59	ND<0.59	ND<0.59	ND<5.9	ND<5.9[d]	ND<0.59	ND<0.59
	60	6/22/17	1,470[b]	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<5	ND<5[d]	ND<0.5	ND<0.5

(a) Total petroleum hydrocarbons as gasoline (TPHg), benzene, toluene, ethylbenzene, xylenes, methyl tert-butyl ether (MTBE), di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), tert-amyl methyl ether (TAME), tert-butyl alcohol (TBA), ethanol, trichloroethlyene (TCE), tetrachloroethlyene (PCE), analyzed by EPA Method 8260; reported in micrograms per liter (µg/l).
(b) Result is due to contribution from heavy end hydrocarbons (possibly aged gasoline) and non-fuel light hydrocarbons to the C5-C12 range quantified as Gasoline.
(c) ND - Not detected at the reporting limit listed.
(d) Tentatively Identified Compound (TIC)- A compund not contained within the analytical calibration standard but present in the GCMS library of defined compounds
(e) J - A value between the method detection limit and practical quantitation limit and that the reported concentration should be considered as an estimated value.



SCALE

0 2000 4000 FEET

REFERENCE

7.5 MINUTE USGS TOPOGRAPHIC MAP OF
LIVERMORE, CALIFORNIA QUADRANGLE
DATE: 1961, PHOTOREVISED 1980
SCALE = 1:24,000

ARCTOS ENVIRONMENTAL			
TESORO - LIVERMORE			
SITE LOCATION MAP			
PROJECT NO. 01LV	DRAWN BY MP	CHECKED BY MP	APPROVED BY JG
FILE NO. Site Map.xls		FIGURE 1	

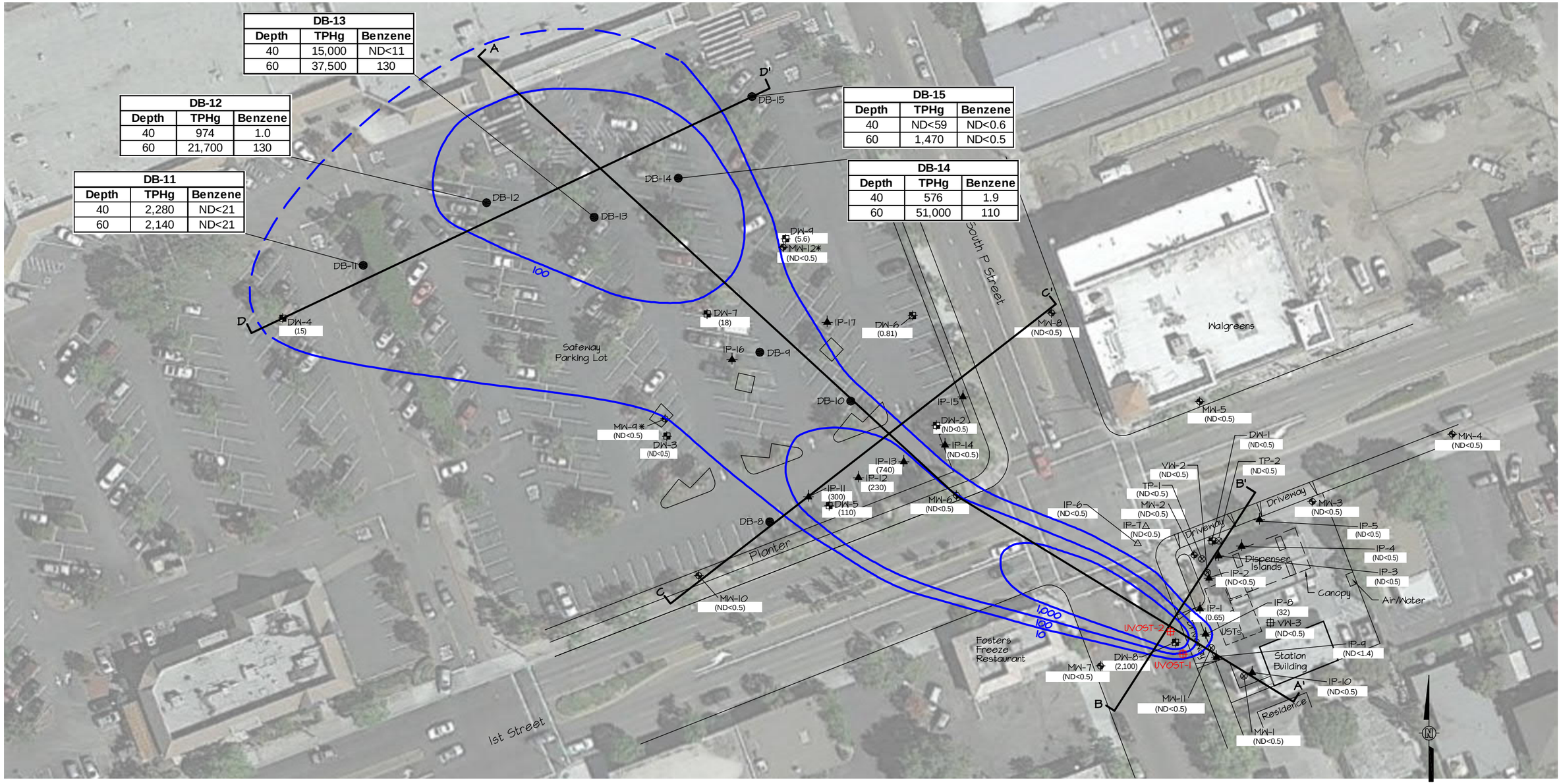
DB-13		
Depth	TPHg	Benzene
40	15,000	ND<11
60	37,500	130

DB-12		
Depth	TPHg	Benzene
40	974	1.0
60	21,700	130

DB-11		
Depth	TPHg	Benzene
40	2,280	ND<21
60	2,140	ND<21

DB-15		
Depth	TPHg	Benzene
40	ND<59	ND<0.6
60	1,470	ND<0.5

DB-14		
Depth	TPHg	Benzene
40	576	1.9
60	51,000	110



Legend

- MW-7 — Groundwater Monitoring Well
- DW-1 — Deep Groundwater Monitoring Well
- IP-1 — Injection Well
- IP-6 △ — Angled Injection Well Screen
- VW-3 — Vapor Extraction Well
- TP-1 — Monitoring Well/Vapor Extraction Well
- UVOST-1 — CPT/UVOST Boring

- (ND<0.5) — Second Quarter 2017 Benzene Results in µg/L
- 1000 — Benzene Concentration Contour (µg/L), Dashed Where Uncertain
- ND — Not Detected at Laboratory Reporting Limit
- NS — Not Sampled
- DB-8 — Soil Boring Advanced in June 2012 (DB-8 to DB-10) or June 2017 (DB-11 to DB-15)
- * — Shallow Well Data Not Used for Contours
- A — A' — Cross Section Line

0 30' 60'
SCALE

REVISION	NO.	BY	DATE	DESCRIPTION
0	0	MY	8/21/17	Data Gap Investigation

ARCTOS ENVIRONMENTAL

TESORO - LIVERMORE

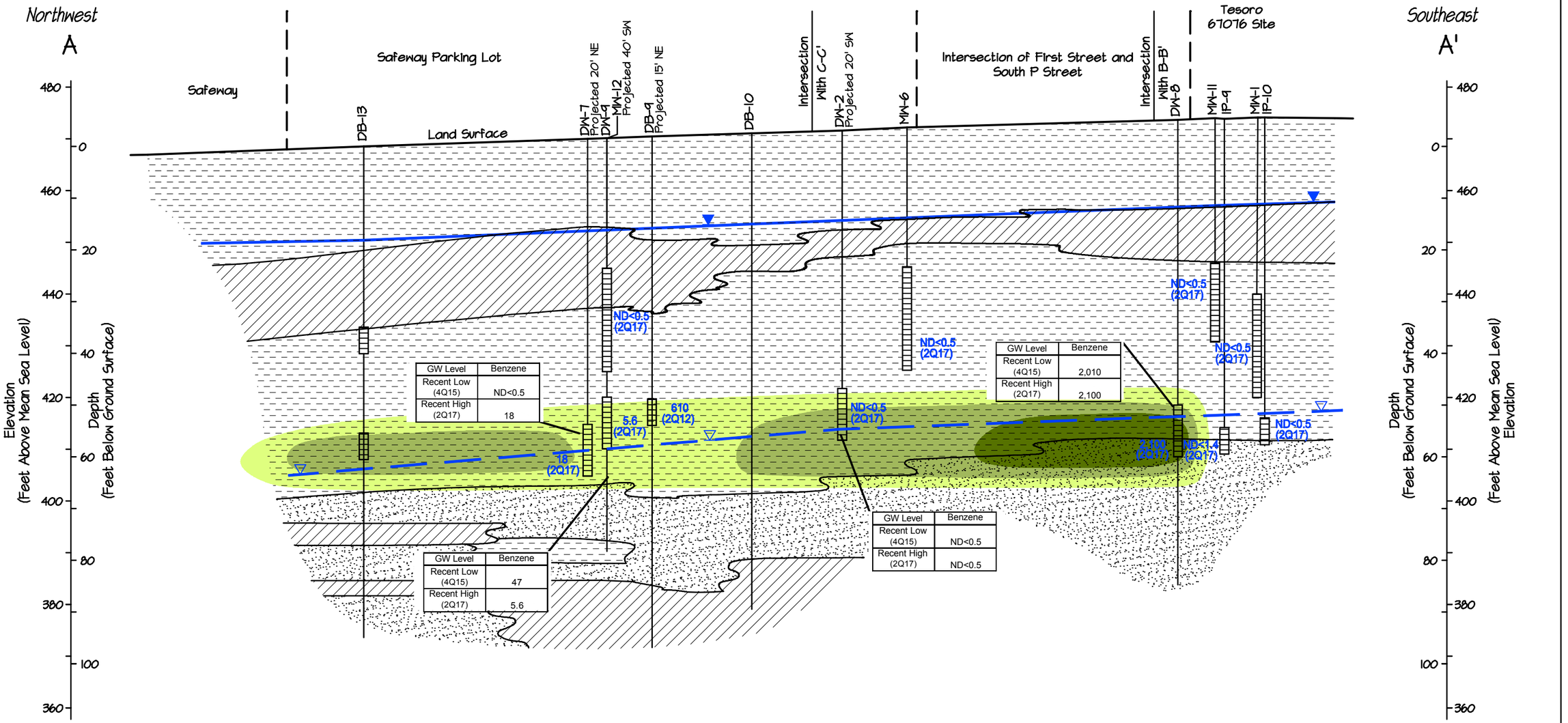
BENZENE CONCENTRATION CONTOURS - 2Q17

PROJECT NO.	DRAWN BY	CHECKED BY	APPROVED BY
01LV	MY	CC	MP

FILE NO. 01LV11A0200.DWG

FIGURE 2

9/13/2017 9:33AM 01LV11A0200.dwg



LEGEND

MW-1 Well or Boring Identification

Screened Interval

Water Level Elevation April 2017 (Historical Maximum Water Level)

Historical Minimum Water Level Elevation November 2015

SOIL CLASSIFICATION

Silts and Clays

Sands and Silty Sands

Cemented Sands or Silts

DISSOLVED-PHASE ISOCONCENTRATION CONTOURS

Benzene > 10 µg/l

Benzene > 100 µg/l

Benzene > 1,000 µg/l

0 — 20' Vertical Scale (feet)

0 — 60' Horizontal Scale (feet)

DISSOLVED-PHASE CONCENTRATIONS

260 Benzene Concentration (µg/l)

(2Q17) Sample Date

GW Level	Benzene
Recent Low (4Q15)	ND<0.5
Recent High (2Q17)	18

Benzene Concentration (µg/l) During Recent Period of Low Groundwater Elevation (4Q15) and High Groundwater Elevation (2Q17)

TESORO

ARCTOS
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TESORO LIVERMORE SITE

CROSS SECTION A–A' WITH DISSOLVED–PHASE IMPACTS

PROJECT 01LV–11B

XS–AA2q17.dwg

FIGURE 3A

August 02, 2017 2:59 pm

Southwest

B

Northeast

B'

South P Street

USTs

Dispenser Islands

Land Surface

MW-7 Projected 15' SE

MIP-8

DW-8 Projected 15' NW Intersection With A-A'

IP-1 Projected 15' NW

IP-2 Projected 10' NW

VW-2 Projected 10' NW

MW-2

TP-1

DW-1

TP-2

IP-5 Projected 15' NW

Elevation (Feet Above Mean Sea Level)

Depth (Feet Below Ground Surface)

480 / 0
460 / 20
440 / 40
420 / 60
400 / 80
380 / 100
360

ND<0.5 (2Q17)

2,100 (2Q17)

0.65 (2Q17)

GW Level	Benzene
Recent Low (4Q15)	2,010
Recent High (2Q17)	2,100

GW Level	Benzene
Recent Low (4Q15)	ND<0.5
Recent High (2Q17)	ND<0.5

LEGEND

MW-1 Well or Boring Identification

Screened Interval

Water Level Elevation April 2017 (Historical Maximum Water Level)

Historical Minimum Water Level Elevation November 2015

SOIL CLASSIFICATION

Silts and Clays

Sands and Silty Sands

Cemented Sands or Silts

0 — 20' Vertical Scale (feet)

DISSOLVED-PHASE ISOCONCENTRATION CONTOURS

Benzene > 10 µg/l

Benzene > 100 µg/l

Benzene > 1,000 µg/l

0 — 20' Horizontal Scale (feet)

DISSOLVED-PHASE CONCENTRATIONS

2,100 (2Q17) Benzene Concentration (µg/l) Sample Date

GW Level	Benzene
Recent Low (4Q15)	ND<0.5
Recent High (2Q17)	18

Benzene Concentration (µg/l) During Recent Period of Low Groundwater Elevation (4Q15) and High Groundwater Elevation (2Q17)

TESORO

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CROSS SECTION B–B' WITH DISSOLVED–PHASE IMPACTS

PROJECT 01LV-11B

XS-BB2q17.dwg

FIGURE 3B

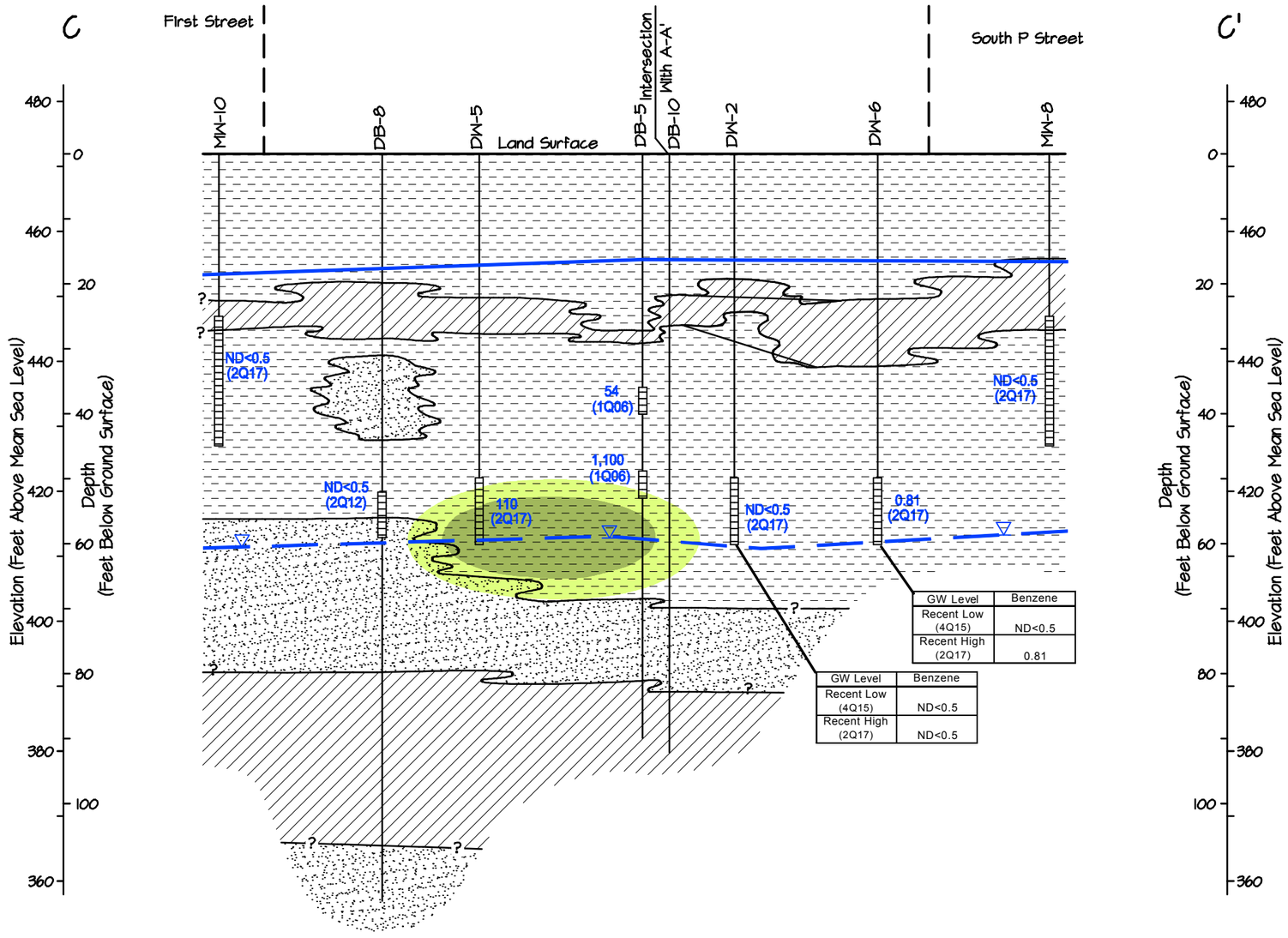
August 02, 2017 3:01 pm

Southwest

C

Northeast

C'



LEGEND

MW-1 Well or Boring Identification

Screened Interval

Water Level Elevation April 2017 (Historical Maximum Water Level)

Historical Minimum Water Level Elevation November 2015

SOIL CLASSIFICATION

Silts and Clays

Sands and Silty Sands

Cemented Sands or Silts

0 20' Vertical Scale (feet)

0 40' Horizontal Scale (feet)

DISSOLVED-PHASE ISOCONCENTRATION CONTOURS

Benzene > 10 µg/l

Benzene > 100 µg/l

DISSOLVED-PHASE CONCENTRATIONS

0.81 (2Q17) Benzene Concentration (µg/l) Sample Date

GW Level	Benzene
Recent Low (4Q15)	ND<0.5
Recent High (2Q17)	ND<0.5

Benzene Concentration (µg/l) During Recent Period of Low Groundwater Elevation (4Q15) and High Groundwater Elevation (2Q17)

TESORO

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TESORO LIVERMORE SITE

CROSS SECTION C–C' WITH DISSOLVED–PHASE IMPACTS

PROJECT 01LV–11B

XS–CC2q17b.dwg

FIGURE 3C

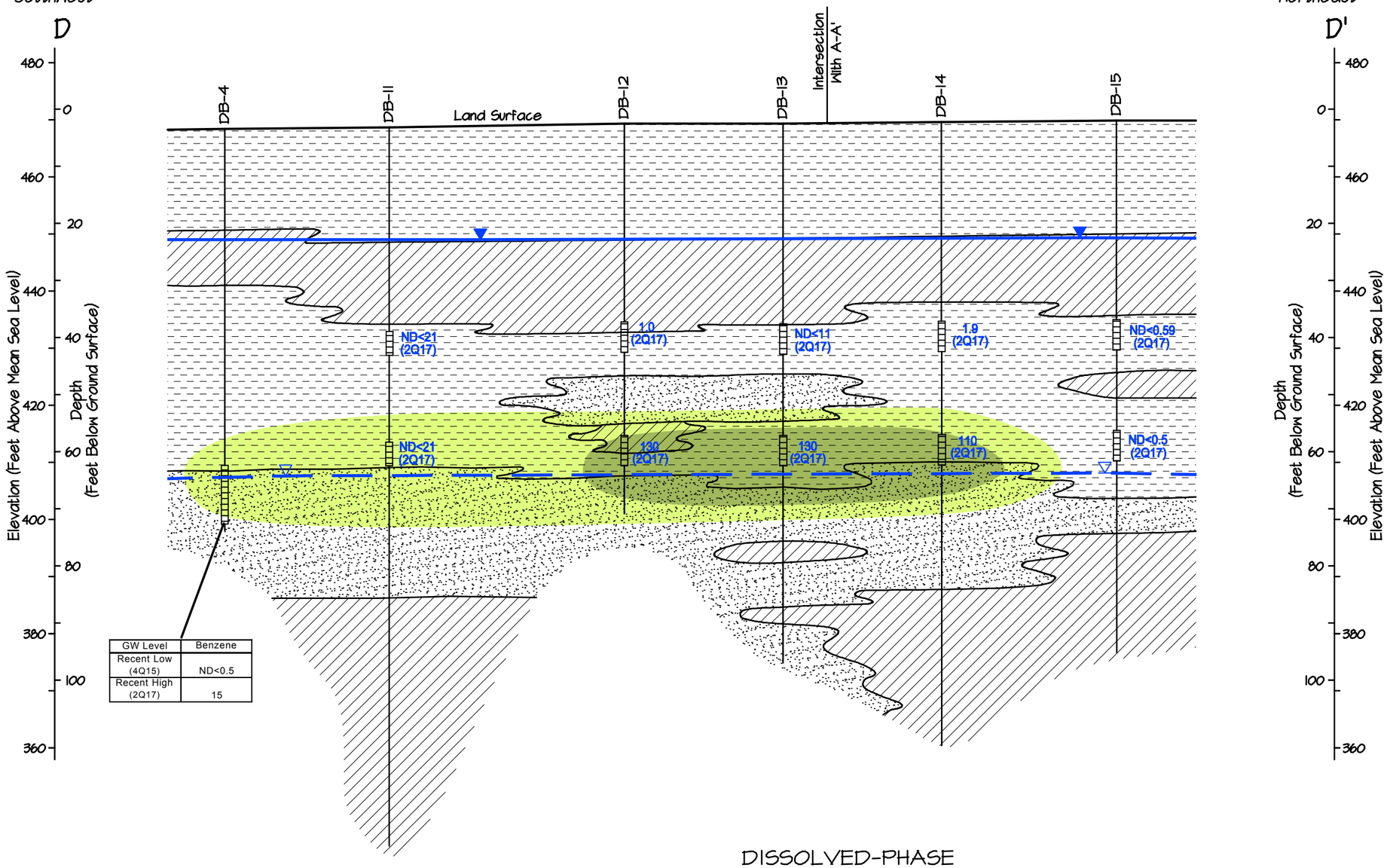
August 16, 2017 1:32 pm

Southwest

D

Northeast

D'



LEGEND

- MW-1 — Well or Boring Identification
- Screened Interval
- Water Level Elevation April 2017 (Historical Maximum Water Level)
- Historical Minimum Water Level Elevation November 2015

SOIL CLASSIFICATION

- Silts and Clays
- Sands and Silty Sands
- Cemented Sands or Silts

DISSOLVED-PHASE ISOCONCENTRATION CONTOURS

- Benzene > 10 µg/l
- Benzene > 100 µg/l

0 — 20' Vertical Scale (feet)

0 — 40' Horizontal Scale (feet)

DISSOLVED-PHASE CONCENTRATIONS

0.81 (2Q17) Benzene Concentration (µg/l) Sample Date

GW Level	Benzene
Recent Low (4Q15)	ND<0.5
Recent High (2Q17)	ND<0.5

Benzene Concentration (µg/l) During Recent Period of Low Groundwater Elevation (4Q15) and High Groundwater Elevation (2Q17)

TESORO

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2332 5th Street, Suite A
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TESORO LIVERMORE SITE

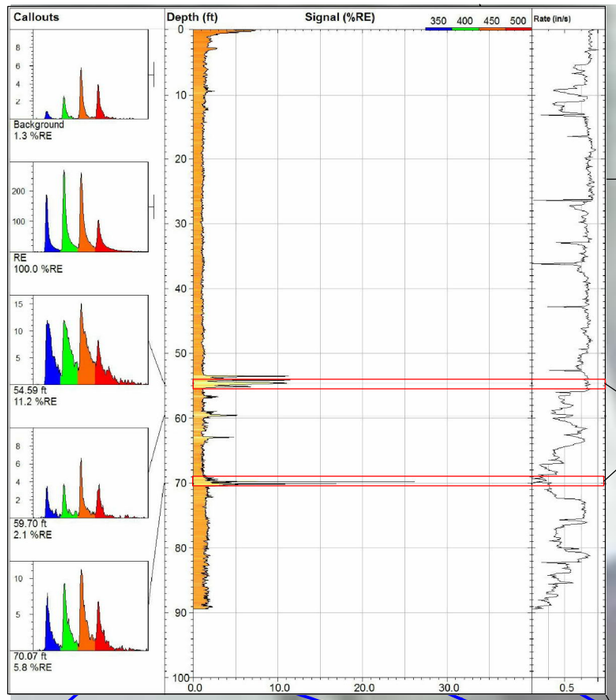
CROSS SECTION D–D' WITH DISSOLVED–PHASE IMPACTS

PROJECT 01LV-11B

XS-DD2q17.dwg

FIGURE 3D

August 16, 2017 1:31 pm



Soil Samples for LNAPL Mobility Testing

MW-5 (ND<0.5)

Driveway

MW-3 (ND<0.5)

IP-5 (ND<0.5)

Canopy

△IP-7 (ND<0.5)

△IP-6 (ND<0.5)

DW-1 (ND<0.5)

⊗TP-2 (ND<0.5)

IP-4 (ND<0.5)

MW-2 (ND<0.5)

IP-3 (ND<0.5)

⊗TP-1 (ND<0.5)

Dispenser Islands

VW-2 (ND<0.5)

IP-2 (ND<0.5)

IP-1 (0.65)

Driveway

USTs

VW-3 (ND<0.5)

UVOST-2

DW-8 (2,100)

IP-8 (32)

1,000

100

10

Fosters Freeze Restaurant

⊗MW-11 (ND<0.5)

UVOST-1

IP-9 (ND<1.4)

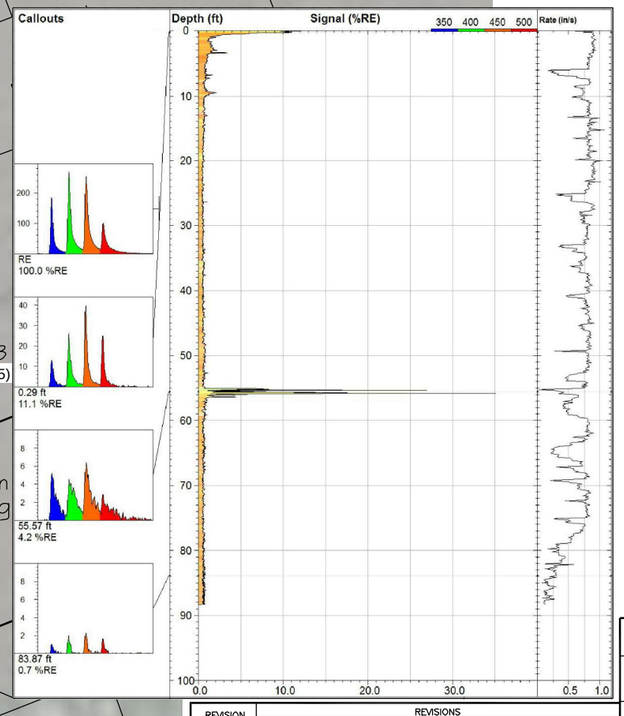
MW-1 (ND<0.5)

IP-10 (ND<0.5)

Station Building

MW-7 (ND<0.5)

Residence



Legend

UVOST-1	June 2017 CPT/UVOST Boring
MW-7	Groundwater Monitoring Well
DW-1	Deep Groundwater Monitoring Well
IP-1	Injection Well
IP-6 △	Angled Injection Well Screen
VW-3	Vapor Extraction Well
TP-1 ⊗	Monitoring Well/Vapor Extraction Well
(ND<0.5)	Second Quarter 2017 Benzene Results in µg/L
1000	Benzene Concentration Contour (µg/L),
ND	Not Detected at Laboratory Reporting Limit

Note:
Inset graphs display Ultra Violet Optical Screening Tool (UVOST) responses for each boring. Vertical axis represents depth in feet and horizontal axis represents UVOST response ranging from 0 to 40 percent.

N

0 10' 20'
Scale

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BENZENE CONCENTRATION CONTOURS WITH UVOST BORING RESULTS

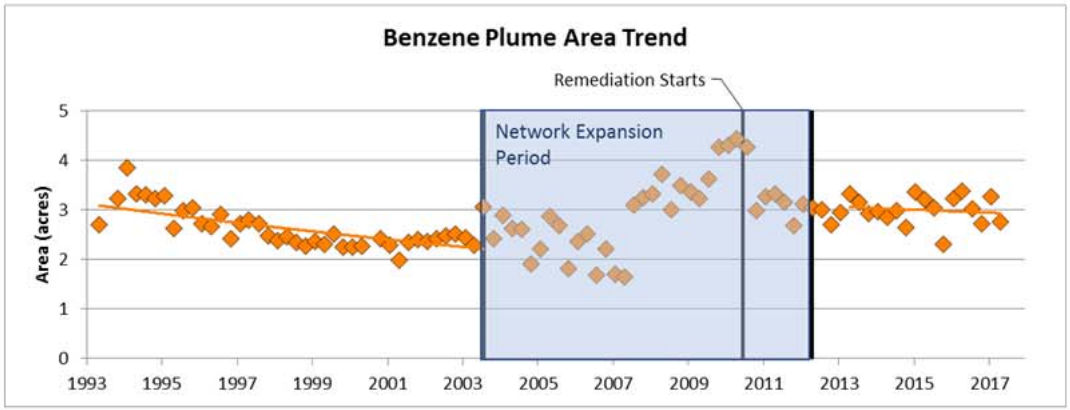
REVISION	NO.	BY	DATE	DESCRIPTION
0	0	MY	10/15/17	Data Gap Investigation Report

PROJECT NO.	DRAWN BY	CHECKED BY	APPROVED BY
01LV	MY	MP	JPG

FILE NO. 01LV11B3400.DWG

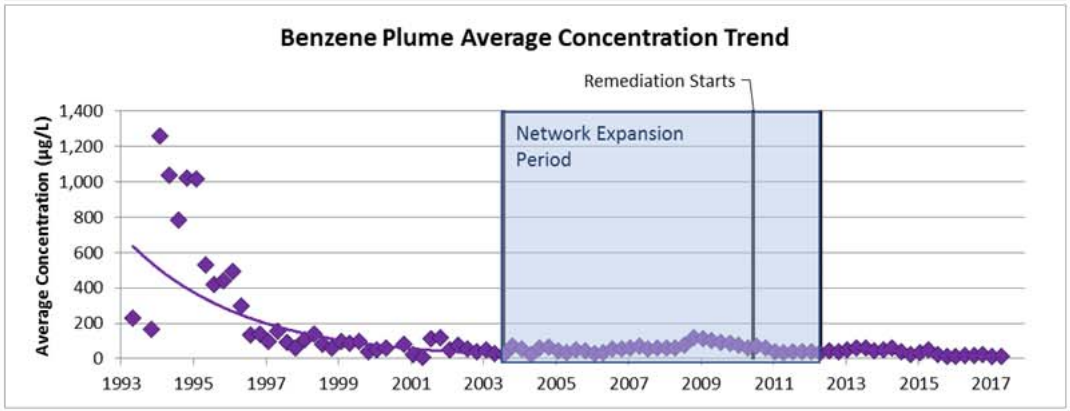
FIGURE 4

9/15/2017 1:28PM 01LV11B3400.dwg



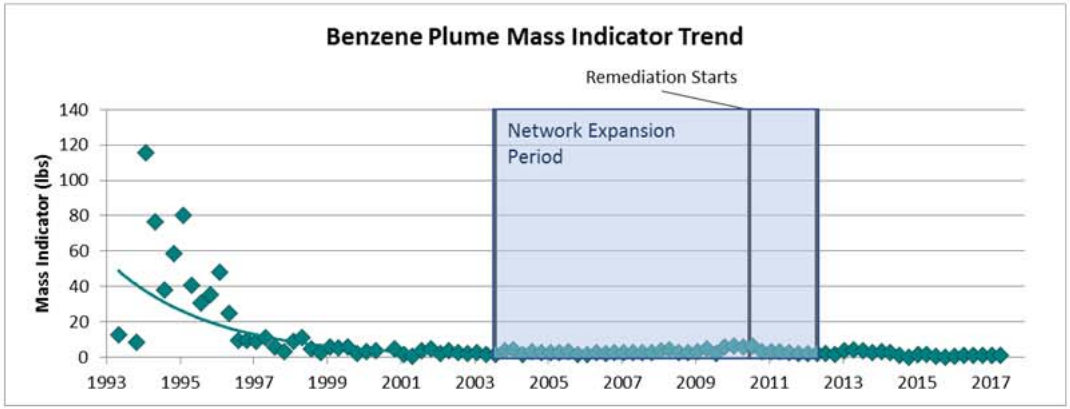
May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
No Trend
Mann-Kendall: 55% Confidence
Regression: 38% Confidence



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: 99% Confidence
Regression: >99% Confidence

Zoom

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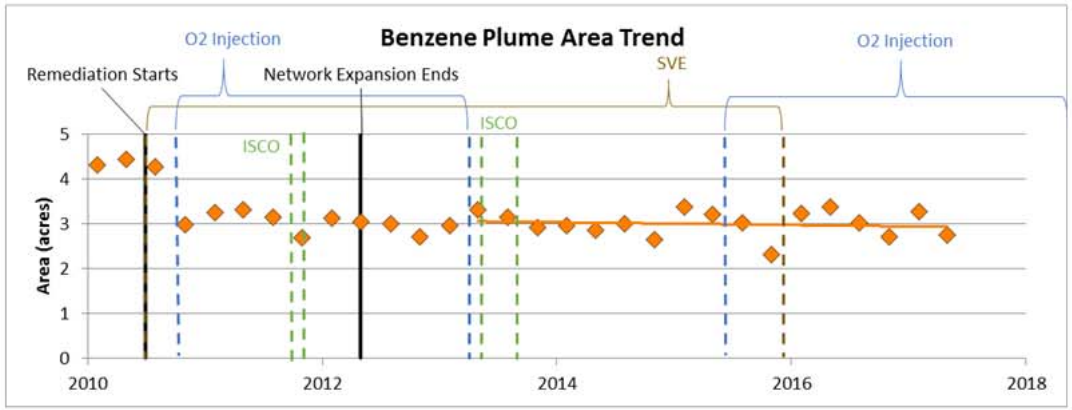
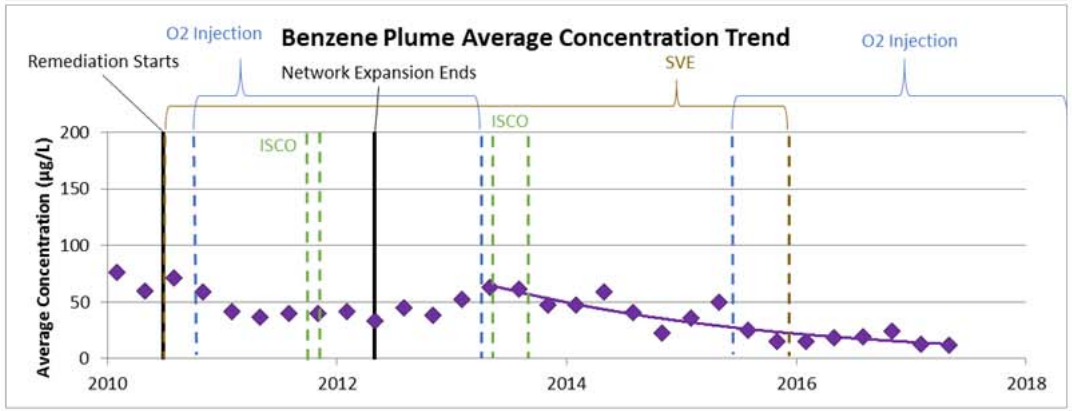
Figure 5A



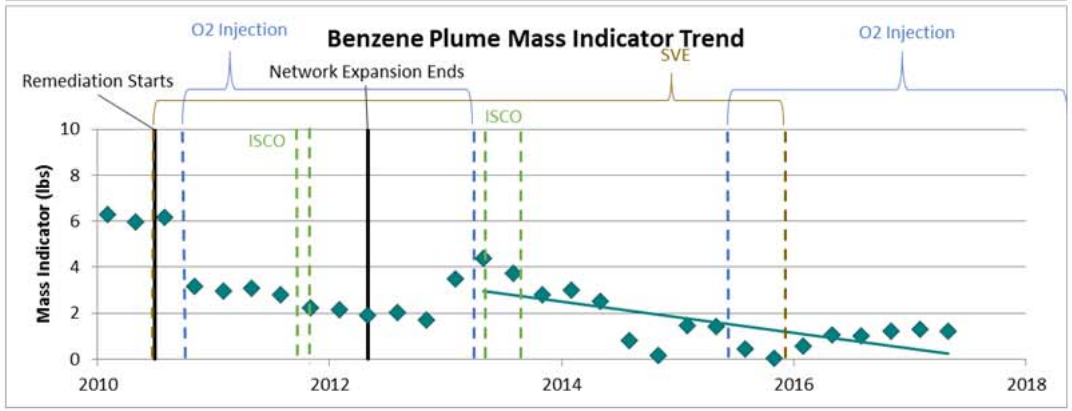
May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
No Trend
Mann-Kendall: 55% Confidence
Regression: 38% Confidence



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: 99% Confidence
Regression: >99% Confidence

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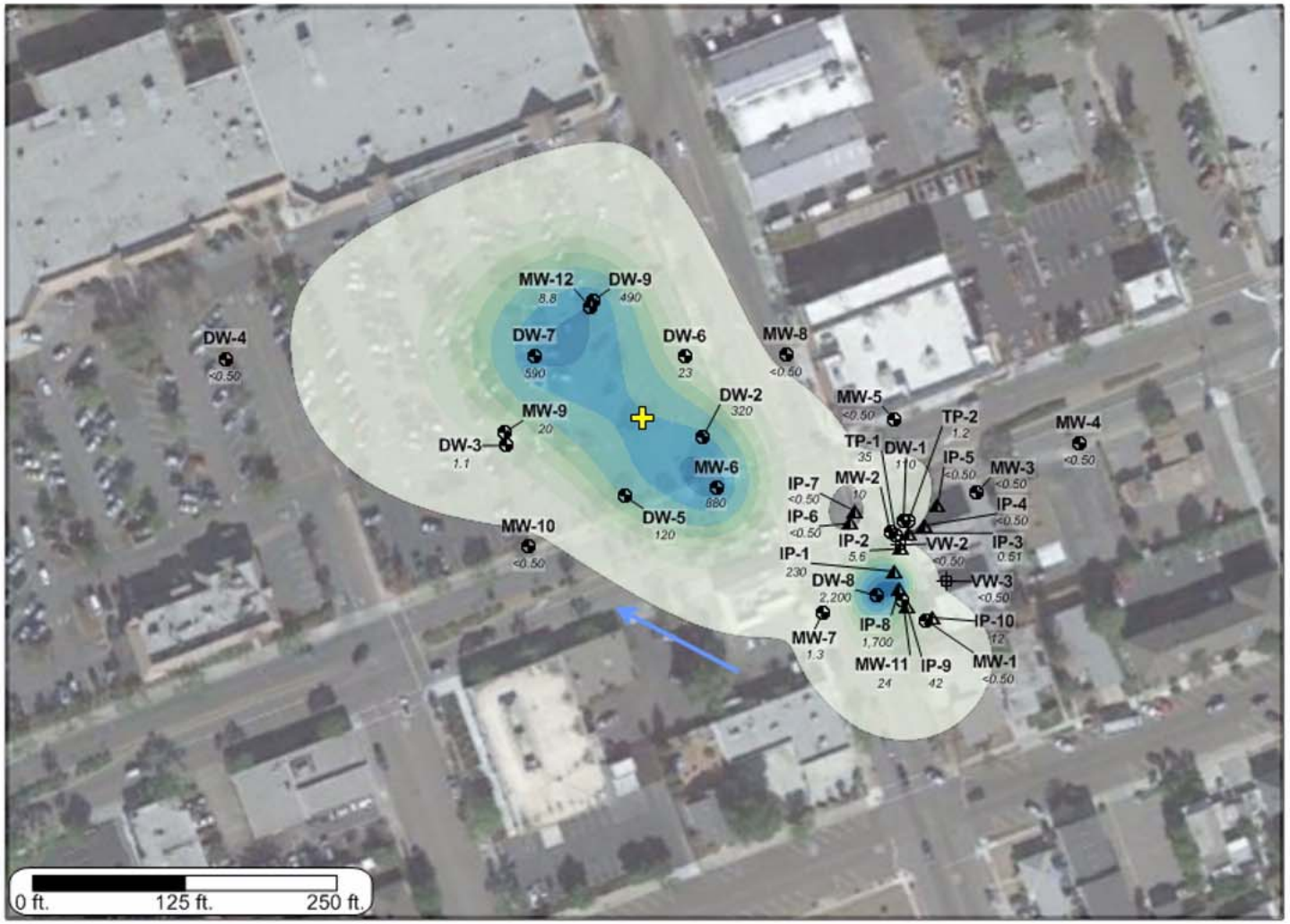
Figure 5B



Benzene
May-2013

Concentration (µg/L)

5,000
2,500
1,000
500
250
100
50
25
10
1

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- 112 — Concentration (µg/L)
- NS (146) — Well Not Sampled (Assigned Value Shown)
- General Groundwater Flow
- Plume Center of Mass

Plume Characteristics

Plume Area: **3.3 acres**
Plume Average Concentration: **63.0 µg/L**
Plume Mass Indicator: **4.4 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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Figure 6A

Benzene
May-2017

Concentration (µg/L)

5,000
2,500
1,000
500
250
100
50
25
10
1

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- 112 — Concentration (µg/L)
- NS (146) — Well Not Sampled (Assigned Value Shown)
- General Groundwater Flow
- Plume Center of Mass

Plume Characteristics

Plume Area: **2.8 acres**
Plume Average Concentration: **12.3 µg/L**
Plume Mass Indicator: **1.2 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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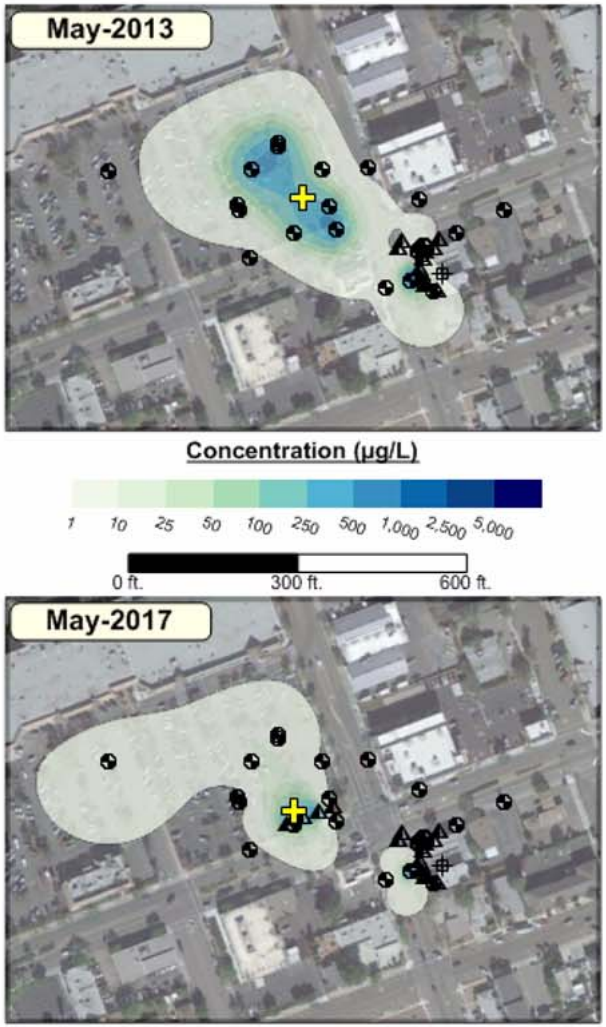
Figure 6B



Plume Differences May-2013 vs May-2017

Benzene

Spatial Change Indicator

-1 0 1

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- General Groundwater Flow
- Plume Center of Mass
- May-2013 Plume Boundary
- May-2017 Plume Boundary

Plume Characteristics

Area: **17% Decrease**
Average Concentration: **80% Decrease**
Mass Indicator: **73% Decrease**
Mass Increase: **0.31 lbs Increase**
Mass Decrease: **3.46 lbs Decrease**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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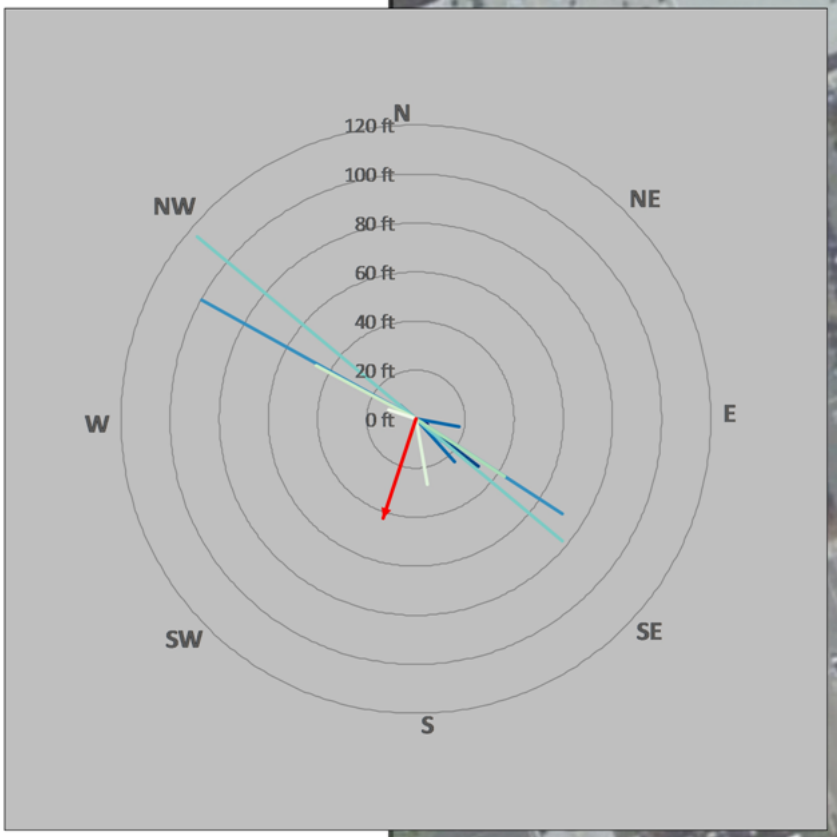
Figure 7

Benzene
Center of Mass



LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- General Groundwater Flow
- Center of Mass Movement
- Net Movement

Center of Mass Scale

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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Figure 8

ATTACHMENT A

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES

ATTACHMENT A
QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES

Health and Safety

Arctos modified the site-specific Health and Safety Plan (HSP) for the data gap investigation field program. The HSP presents procedures for personnel and equipment safety, medical surveillance, personal protection, air-quality monitoring, exposure control, emergency response procedures, and general work practices.

Before beginning work at the site, a site safety meeting was conducted. Field personnel reviewed the HSP and signed the accompanying acknowledgment form. Field personnel complied with the HSP throughout performance of field activities.

Based on the site history and potential chemicals of concern, field activities were initiated in Level D personal protective equipment (PPE). During field activities, the breathing zone of field personnel was monitored using a field photoionization detector (PID). If breathing zone PID readings indicated elevated levels of organic vapors, PPE would be upgraded accordingly. Breathing zone readings were not elevated and were recorded on the field logs.

The following sections provide a description of Arctos's drilling and soil and grab groundwater sampling program.

Utility Locating and Permitting

Before initiating drilling activities, Arctos marked the well locations and contacted Underground Service Alert and met with a private utility locator to clear the area of subsurface lines and utilities. Arctos also obtained boring permits from Zone 7 Water Agency and an encroachment permit from the City of Livermore.

Cone Penetration Testing (CPT) Drilling

Soil borings were advanced using a truck-mounted cone penetration testing (CPT) rig with direct-push technology. The approximately 1.5-inch diameter stainless steel drill rods were advanced into the subsurface with hydraulic pressure. The drill rods were equipped with an electronic cone tip.

The electronic cone tip is capable of taking measurements including resistance, sleeve friction, induced pore pressure, pore pressure dissipation, shear wave velocity, soil resistivity, inclination, and temperature, in accordance with American Society for Testing and Materials Standard D5778. CPT measurements were utilized to produce a nearly

continuous hydrogeologic log, including interpretation of parameters to classify soil using Soil Behavior Type (SBT).

Borings were backfilled after reaching total depth with cement/bentonite grout using the rods as a tremie pipe. In paved areas, borings were capped with concrete to match the surrounding pavement.

Discrete Grab Groundwater Sampling

After completing each CPT boring and identifying potential coarse-grained, saturated intervals, an adjacent boring was advanced using a Hydropunch-type discrete grab groundwater sampling tool. The sampler consists of an approximately 1.75-inch-diameter, 5-foot-long steel casing. The bottom of the steel sleeve has a cone-shaped tip to facilitate soil penetration. Once the sampler reached the desired depth, the steel casing was lifted to expose a 1-inch diameter, 5-foot long polyvinyl chloride (PVC) screen with 0.01- or 0.02-inch slots. The PVC screen and drilling rods were then allowed to fill with groundwater from the discrete exposed interval.

Groundwater sampling was performed with a new disposable PVC or decontaminated stainless steel bailer equipped with a bottom-release device and suspended from new nylon line. Water samples were collected from the bailer in new 40-milliliter glass bottles provided by the analytical laboratory. Sample vials were filled completely so that the water forms a convex meniscus at the top and capped so that no air space or bubbles exist in the vial. The preservatives necessary for the analyses performed were provided in the glass bottles by the analytical laboratory.

The collected water samples were placed in sealable plastic bags or polystyrene holders, and packed on ice in a portable ice chest immediately after collection. Samples were delivered within 24 hours to the analytical laboratory. Additional QA/QC procedures, including the use of sample identification labels and chain-of-custody forms, were followed to track sample collection and delivery.

Hollow-Stem Auger Drilling and Sampling

Soil borings were advanced with 6-inch-diameter, hollow-stem, continuous-flight augers. Soil samples were collected using a split-spoon sampler (California-modified or similar) containing three brass tubes, each 2 inches in diameter and 6 inches in length. The sampler was driven to the sampling depth by dropping a 140-pound hammer approximately 30 inches. Soil samples were collected at 5-foot intervals from approximately 50 to 70 feet bgs.

After the sampler was retrieved from the auger, it was placed on a portable field stand near the boring and the tubes were removed. The ends of one of the tubes was covered with Teflon sheeting, capped with PVC end caps, and placed in a sealable plastic bag. A

portion of the soil from one of the tubes was extruded and placed in a sealable plastic bag, which was closed and allowed to equilibrate for approximately 10 minutes. The organic vapor levels in the headspace were measured using a PID. One of the sealed tubes per sampling run was placed in a portable ice chest and cooled with ice for delivery to a laboratory for analysis. Standard chain-of-custody procedures were used during sample handling, transportation, and delivery.

General Field QA/QC Procedures

Chain-of-Custody Records

Chain-of-custody records were completed before samples were packaged for shipment. One copy of these records was placed in the project file. A second copy accompanied samples during transportation to the laboratory. The individual in the analytical laboratory who accepted responsibility for samples signed and dated the chain-of-custody record.

Equipment Decontamination Procedures

Field equipment was decontaminated between sampling events using the following procedures:

1. Rinse with water using a brush to remove soil and mud.
2. Wash with non-phosphate detergent and water using a brush.
3. Rinse with deionized or distilled water.
4. Rinse again with deionized or distilled water.
5. Air dry.

Personal Decontamination Procedures

At a minimum, field personnel followed the following decontamination procedures:

1. Wear appropriate gloves.
2. Wash hands thoroughly with soap and water.
3. Avoid unnecessary contact with groundwater.

The site health and safety plan was reviewed for site-specific personal decontamination procedures.

Wastewater and Solid Waste Storage and Disposal

Small volumes of used wash and rinse solutions were collected during field work and transported to a central decontamination area. The wastewater was containerized in

labeled 55-gallon DOT drums and stored in a secured area at the site. At the completion of field investigation activities, samples from the 55-gallon drums or holding tanks were collected and analyzed in accordance with the work or sampling plans. Once the analytical results were obtained, the Project Manager determined the appropriate disposal method for this wastewater.

Solid wastes such as used personal protective equipment, paper towels, trash bags, and any other solid debris were collected for disposal.

Field Investigation Documentation Procedures

Field personnel followed documentation procedures developed for site investigation work. The procedures serve to (1) provide a record of the activities performed in the field and (2) permit identification of samples and tracking of their status in the field, during shipment, and at the laboratory. All documentation was recorded with waterproof ink.

Analytical QA/QC Procedures

Laboratory analytical QA/QC procedures included (1) preparing and analyzing laboratory samples to assess the performance of the analytical laboratory and (2) conducting data validation in accordance with the protocols described below. QC samples prepared by the laboratory included method blanks, matrix spike and matrix spike duplicates, and laboratory control samples.

The laboratory results were reviewed in general accordance with EPA guidelines for data validation. The data validation process included reviewing laboratory results for the following parameters:

- ☐ Completeness of the data package
- ☐ Compliance with EPA-required holding times
- ☐ Agreement of dilution factors with reported detection limits
- ☐ Presence or absence of analytes in the method blanks
- ☐ Agreement of duplicate samples
- ☐ Percent recovery and relative percent difference results for matrix spike and matrix spike duplicate analyses
- ☐ Percent recovery results for laboratory control samples.

ATTACHMENT B

CONE PENETRATION TESTING/ULTRA VIOLET OPTICAL SCREENING TOOL (CPT/UVOST) AND BORING LOGS

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Key to Log of Boring

Depth, feet	GEOPHYSICAL LOG: Friction Ratio, Rf, from Cone Penetration Test (percent) 0 2 4 6 8 10	Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
1	2	3	4	5	6	7	8	9

COLUMN DESCRIPTIONS

1 **Depth:** Depth in feet below the ground surface.

2 **Geophysical Log:** **Friction Ratio** (Rf) from Cone Penetration Test sounding; computed as sleeve friction divided by tip resistance, reported as a percent. Generally, finer-grained material has higher friction ratio, coarser-grained material lower.

3 **Water Sample:** Groundwater sampling interval; sampler symbols are explained below.

4 **Graphic Log:** Graphic depiction of subsurface material; typical symbols are explained below. Color bands depict Soil Behavior Type derived from CPT data based on Robertson (1990); SBT colors and soil types are shown below.

5 **USCS Material Description:** Description of material encountered; in addition to soil classification and USCS, may include color, plasticity, dry strength, toughness, and moisture.

6 **Headspace PID:** Photoionization device (PID) field sample headspace reading in parts per million (ppm).

7 **Background PID:** Photoionization device (PID) background (ambient) reading in parts per million (ppm).

8 **Drilling Progress:** Time (in 24-hour clock) at groundwater sampling and other events (such as start and end of geophysical testing) during downhole advance.

9 **Remarks:** Comments and observations regarding drilling or sampling made by driller or field personnel. Also, identification and quantities of groundwater samples retained for analysis.

TYPICAL SOIL GRAPHIC SYMBOLS

- Poorly Graded SAND (SP)
- Well-Graded SAND (SW)
- SAND with SILT (SP-SM)
- SILTY SAND (SM)
- LEAN CLAY (CL)
- FAT CLAY (CH)
- SILTY CLAY (CL)
- CLAYEY SAND (SC)
- SILT (ML)
- CLAYEY SILT (ML)
- Well-Graded GRAVEL (GW)
- Clayey Gravel (GC)

TYPICAL SAMPLER GRAPHIC SYMBOLS

- 2.5-inch-OD split spoon with brass liners (California Modified)
- Portion of sample retained for analysis
- No recovery interval in sampler
- Interval from which grab groundwater sample collected
- Attempted groudwater sampling interval; dry or insufficient water
- Grab soil sample (from augers)

OTHER GRAPHIC SYMBOLS

- First water encountered at time of drilling
- Change in material properties within a stratum
- Inferred contact between strata or gradational change in lithology

COLOR DEPICTION OF SOIL BEHAVIOR TYPE

- Sensitive, fine grained
- Organic materials
- Clay
- Silty clay to clay
- Clayey silt to silty clay
- Sandy silt to clayey silt
- Silty sand to sandy silt
- Sand to silty sand
- Sand
- Gravelly sand to sand
- Very stiff fine grained*
- Sand to clayey sand*

*Overconsolidated or cemented

GENERAL NOTES

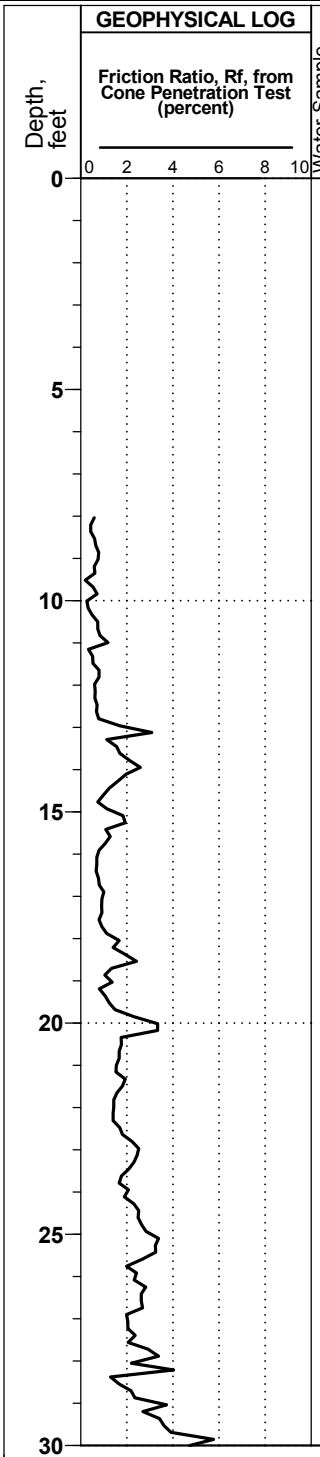
1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-11

Sheet 1 of 4

Date(s) Drilled	6/27/17	Logged By	G. Datt	Checked By	M. Purchase
Drilling Method	Direct Push	Drill Bit Size/Type	1.75-in.-OD CPT tip; 1.75-in.-OD Hydropunch-style cone tip	Borehole Depth	CPT: 125.3 ft GW Sampling: 60 ft
Drill Rig Type	Truck-Mounted CPT	Drilling Contractor	Gregg Drilling & Testing	Surveyed Ground Surface Elevation	468.13 ft
Groundwater Level Observation	Not observed	Sampling Method	Grab GW samples using SS bailer and 3/4-in. PVC with 0.01-in. slots	Borehole Backfill	Cement-bentonite grout capped with 0.5 ft black-dyed concrete
Comments	Two adjacent borings advanced in Safeway parking lot.				

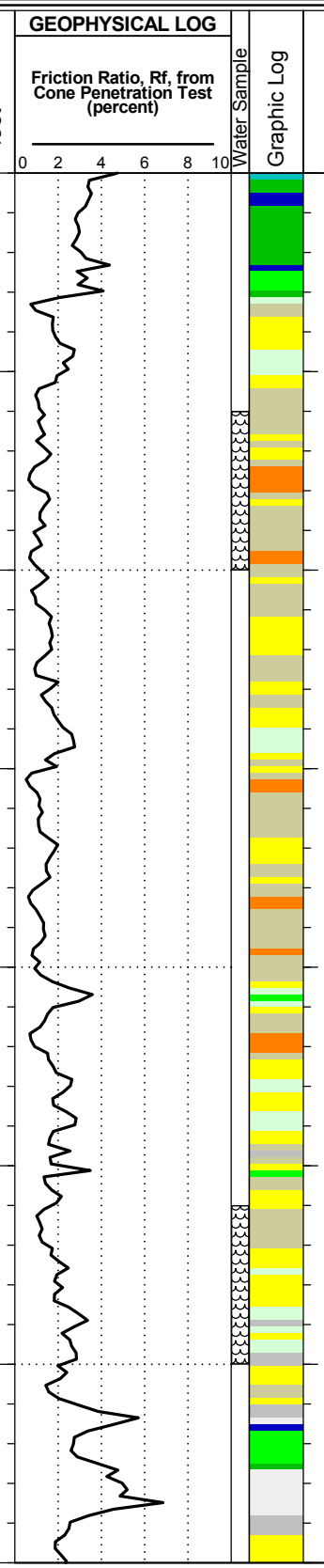


Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Adjacent CPT and GW borings were air-knifed to 5 feet bgs to clear for utilities.		0.0		Air-knife two locations to 5 ft on 6/23/17.
		GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.			0840	Start CPT.
					0930	CPT refusal at 125.3 ft.
					1100	Start driving GW sampler.
						Gregg started CPT interpretation at 8 ft bgs.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-11; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-11

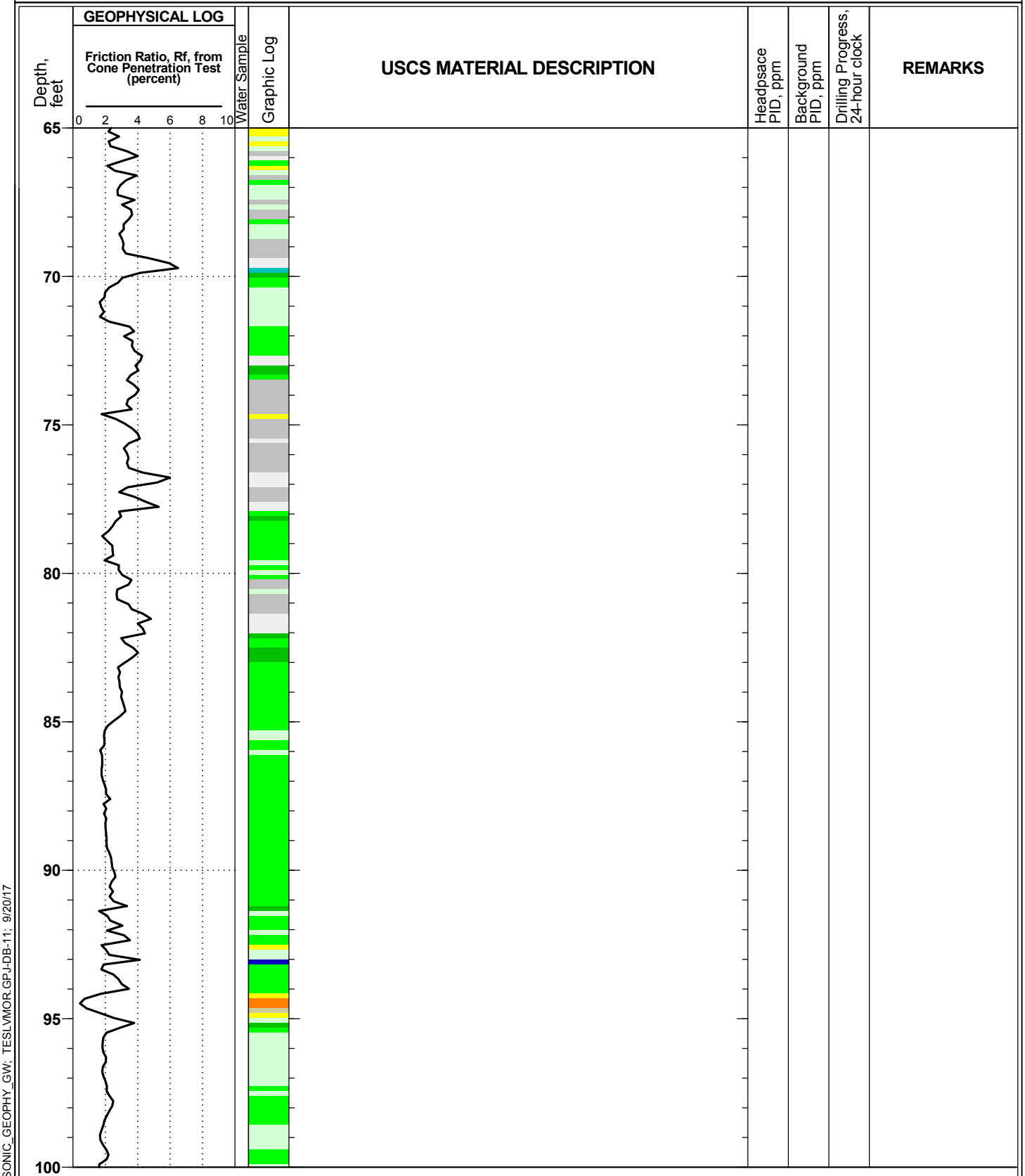


Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.		0.0		
					1130	Collect GW sample DB-11-40W (3 VOAs).
					1203	Collect GW sample DB-11-60W (3 VOAs).

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-11; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

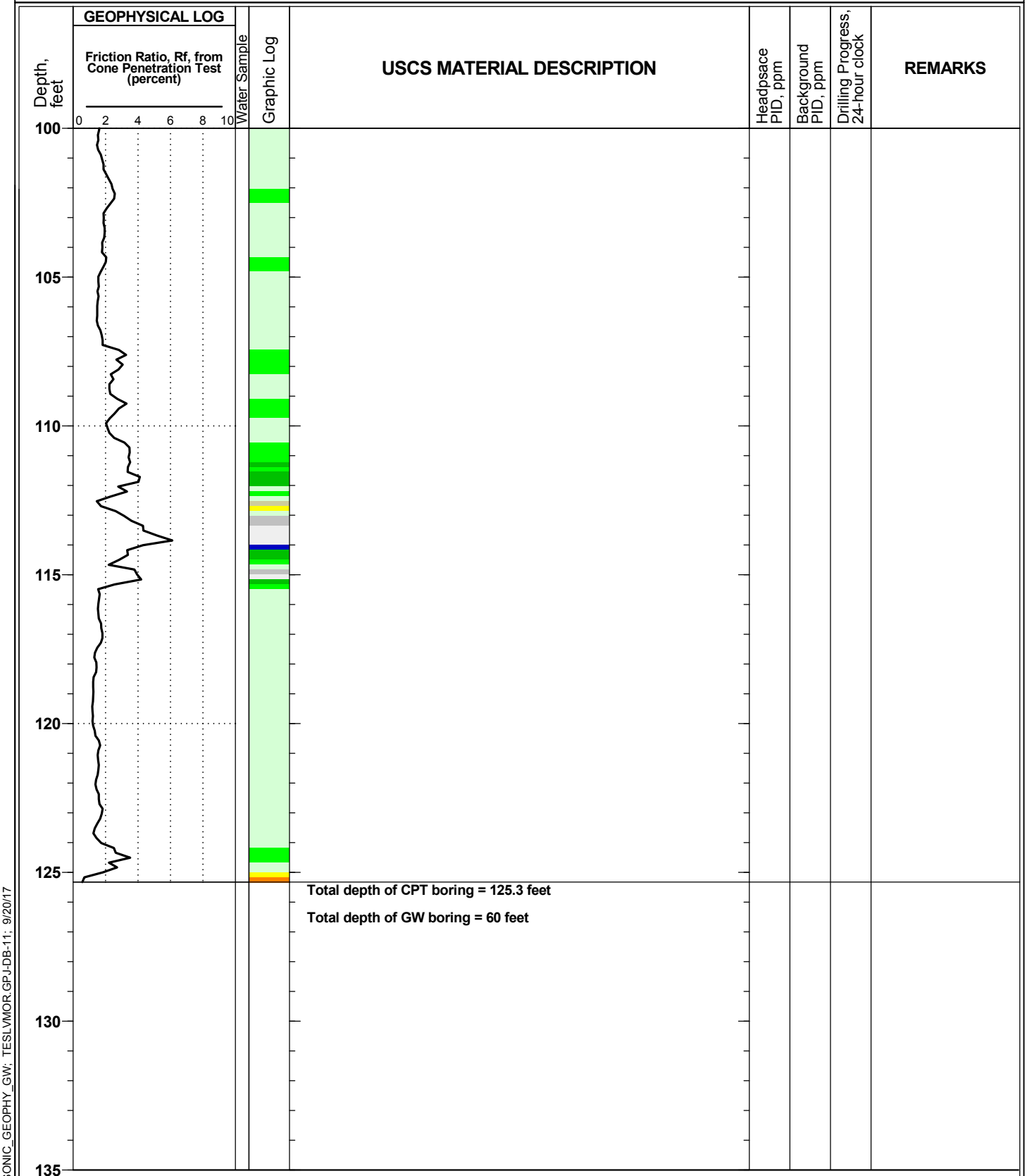
Log of Boring DB-11



ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-11; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-11



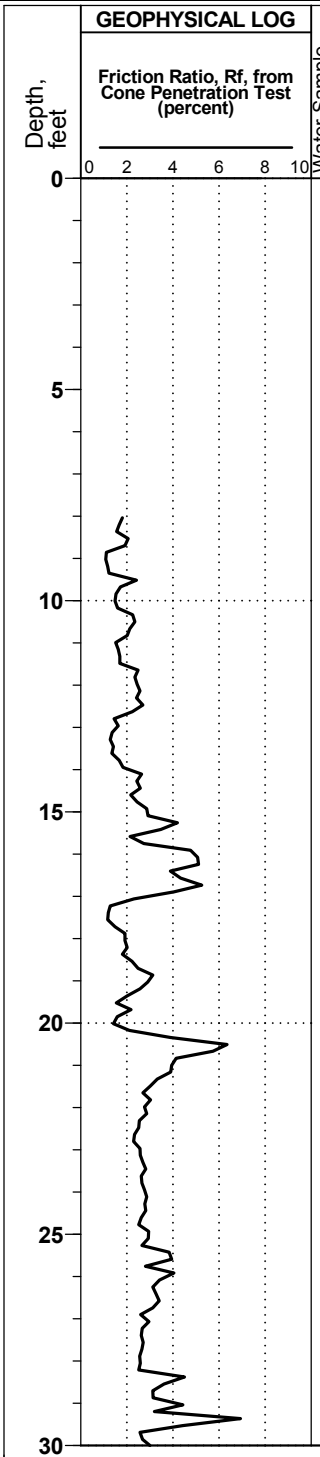
ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-11; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-12

Sheet 1 of 3

Date(s) Drilled	6/23/17	Logged By	G. Datt	Checked By	M. Purchase
Drilling Method	Direct Push	Drill Bit Size/Type	1.75-in.-OD CPT tip; 1.75-in.-OD Hydropunch-style cone tip	Borehole Depth	CPT: 67.6 ft GW Sampling: 60 ft
Drill Rig Type	Truck-Mounted CPT	Drilling Contractor	Gregg Drilling & Testing	Surveyed Ground Surface Elevation	468.40 ft
Groundwater Level Observation	Not observed	Sampling Method	Grab GW samples using SS bailer and 3/4-in. PVC with 0.01-in. slots	Borehole Backfill	Cement-bentonite grout capped with 0.5 ft black-dyed concrete
Comments	Two adjacent borings advanced in Safeway parking lot.				

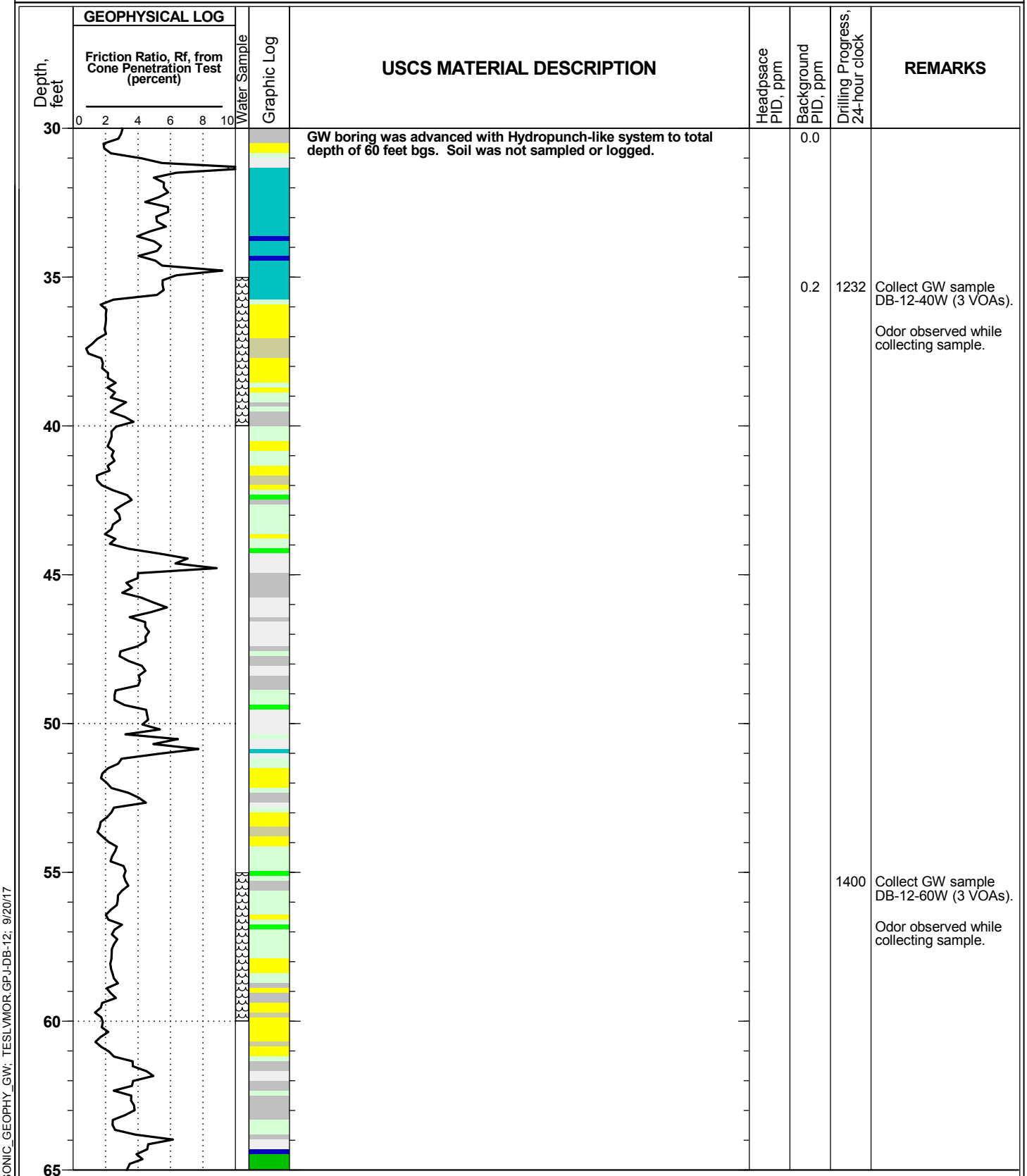


Depth, feet	Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
0			**Adjacent CPT and GW borings were air-knifed to 5 feet bgs to clear for utilities.**		0.0		Air-knife two locations to 5 ft on 6/23/17.
5			**GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.**			1030	Start CPT.
							CPT refusal at 67.6 ft.
						1250	Start driving GW sampler.
							Gregg started CPT interpretation at 8 ft bgs.
10							
15							
20							
25							
30							

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-12; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-12

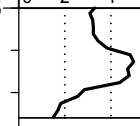


USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.		0.0		
		0.2	1232	Collect GW sample DB-12-40W (3 VOAs). Odor observed while collecting sample.
			1400	Collect GW sample DB-12-60W (3 VOAs). Odor observed while collecting sample.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-12; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-12

Depth, feet	GEOPHYSICAL LOG: Friction Ratio, Rf, from Cone Penetration Test (percent) (0 2 4 6 8 10)	Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
65								
				Total depth of CPT boring = 67.6 feet				
				Total depth of GW boring = 60 feet				
70								
75								
80								
85								
90								
95								
100								

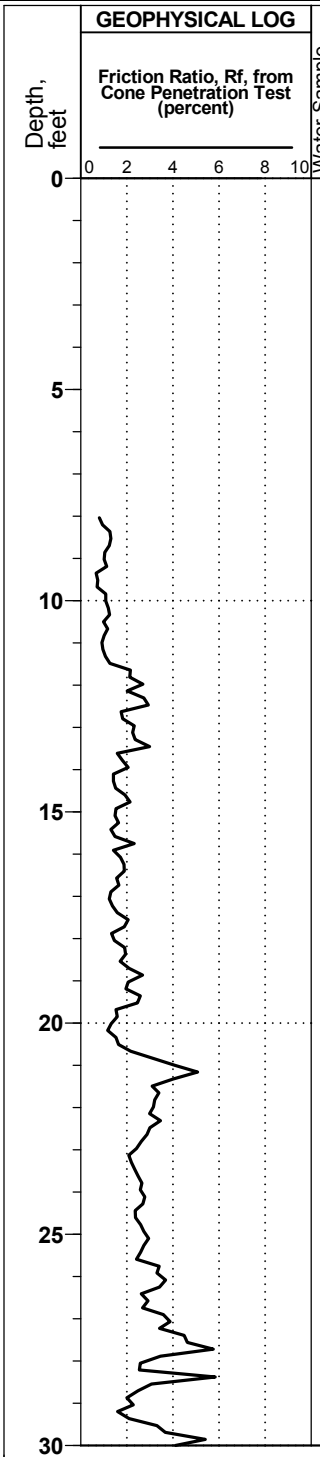
ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-12; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-13

Sheet 1 of 3

Date(s) Drilled	6/23/17	Logged By	G. Datt	Checked By	M. Purchase
Drilling Method	Direct Push	Drill Bit Size/Type	1.75-in.-OD CPT tip; 1.75-in.-OD Hydropunch-style cone tip	Borehole Depth	CPT: 93.8 ft GW Sampling: 60 ft
Drill Rig Type	Truck-Mounted CPT	Drilling Contractor	Gregg Drilling & Testing	Surveyed Ground Surface Elevation	469.59 ft
Groundwater Level Observation	Not observed	Sampling Method	Grab GW samples using SS bailer and 3/4-in. PVC with 0.01-in. slots	Borehole Backfill	Cement-bentonite grout capped with 0.5 ft black-dyed concrete
Comments	Two adjacent borings advanced in Safeway parking lot.				

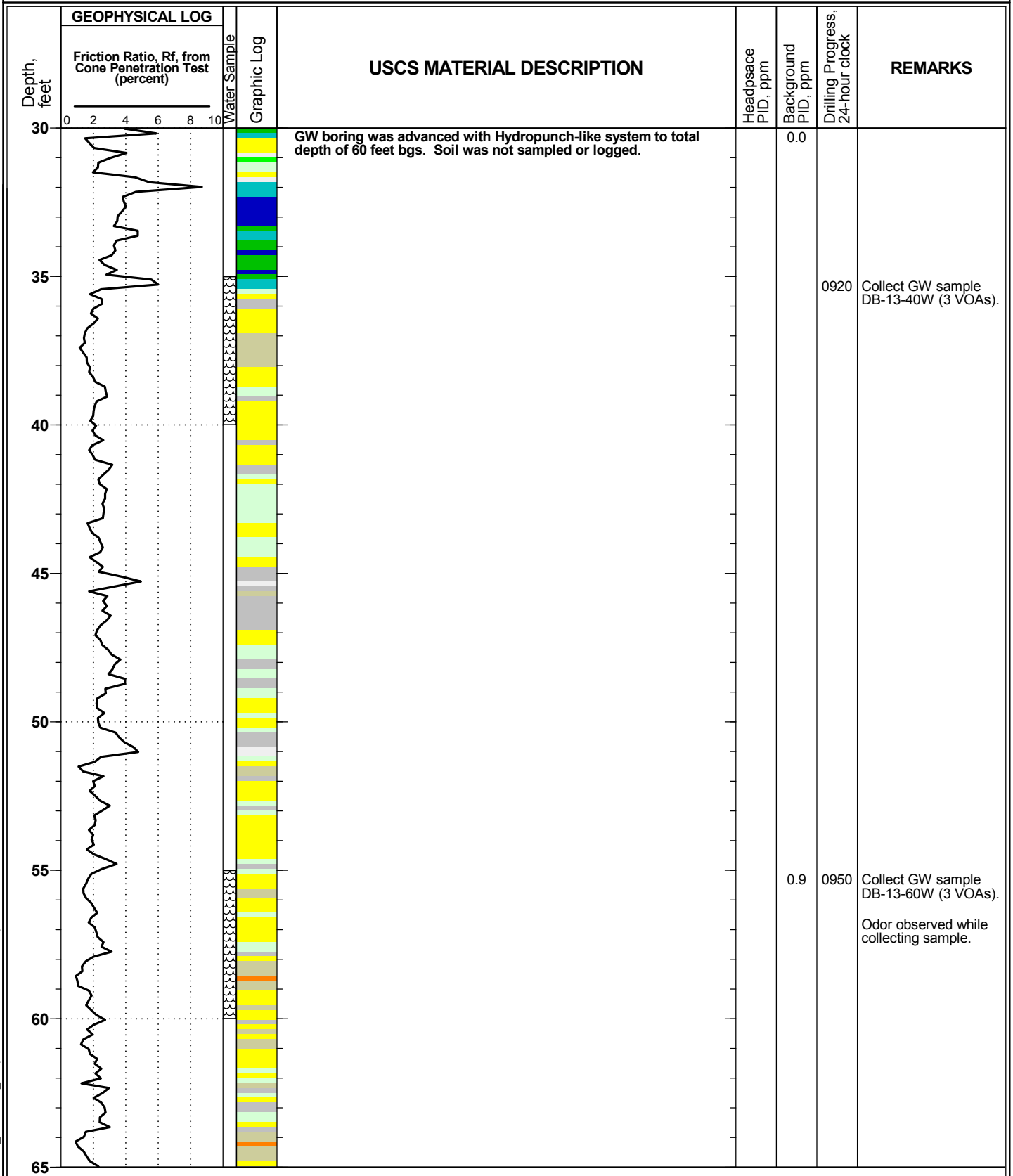


Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Adjacent CPT and GW borings were air-knifed to 5 feet bgs to clear for utilities.		0.0		Air-knife two locations to 5 ft on 6/22/17.
		GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.			0635	Start CPT.
					0715	CPT refusal at 93.8 ft.
					0900	Start driving GW sampler.
						Gregg started CPT interpretation at 8 ft bgs.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-13; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-13

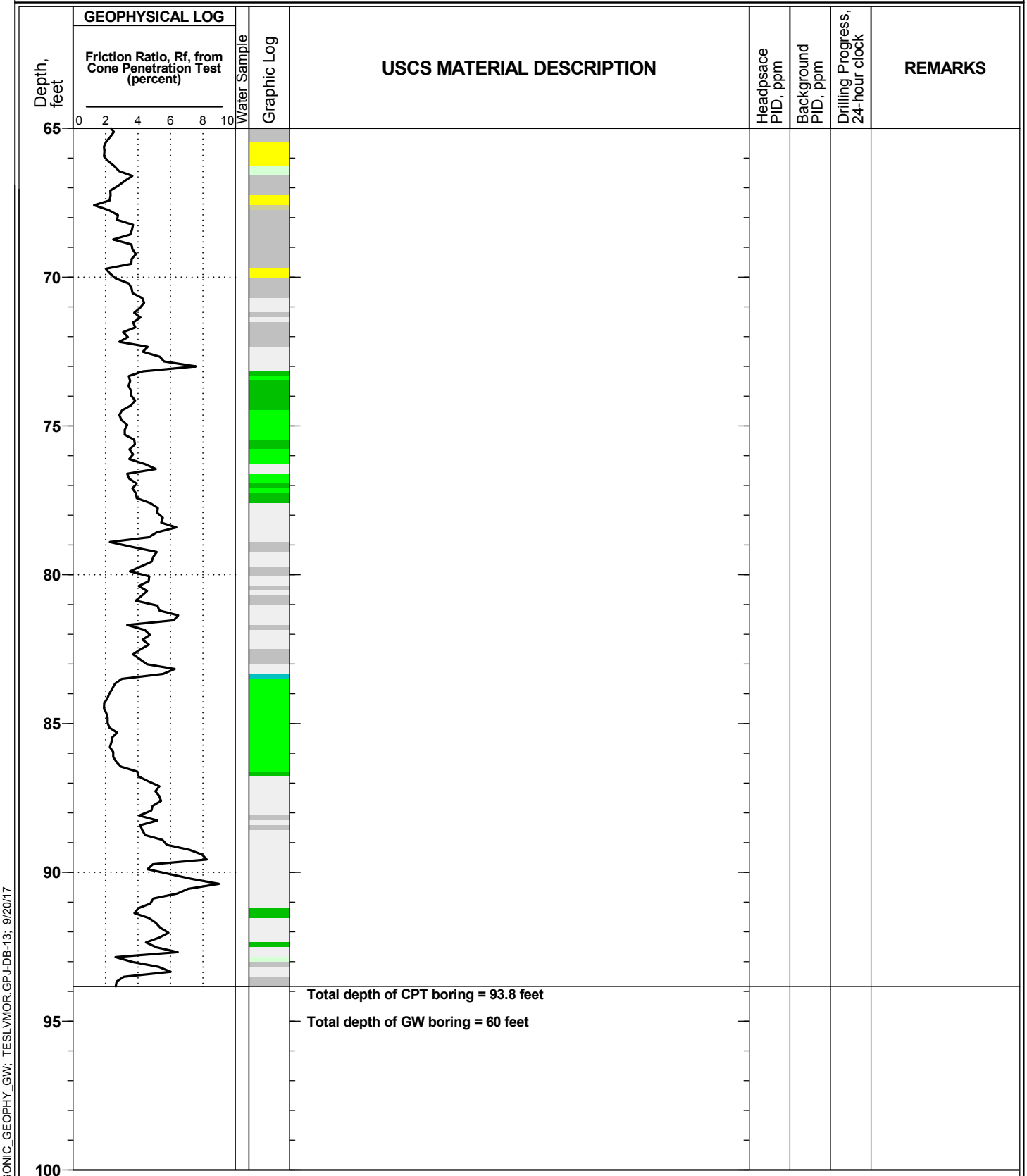


USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.		0.0		
			0920	Collect GW sample DB-13-40W (3 VOAs).
		0.9	0950	Collect GW sample DB-13-60W (3 VOAs). Odor observed while collecting sample.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-13; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-13



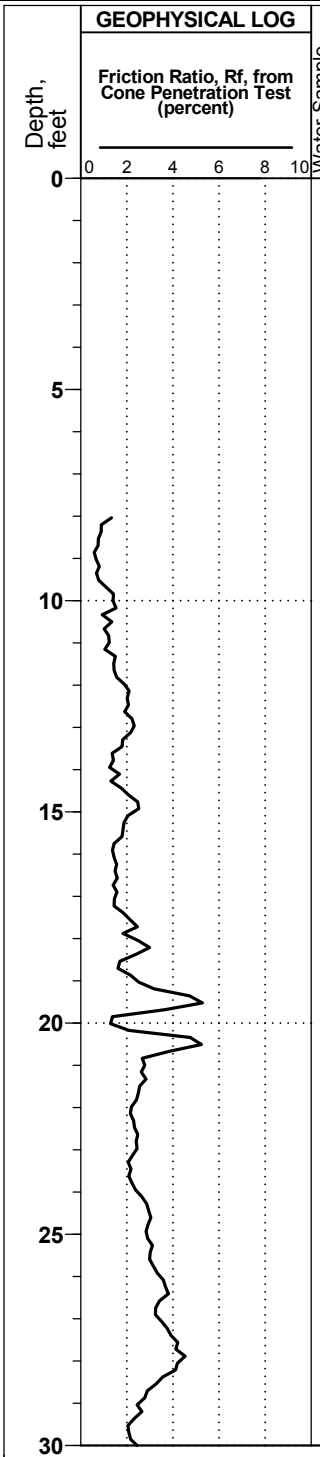
ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-13; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-14

Sheet 1 of 4

Date(s) Drilled	6/22/17	Logged By	G. Datt	Checked By	M. Purchase
Drilling Method	Direct Push	Drill Bit Size/Type	1.75-in.-OD CPT tip; 1.75-in.-OD Hydropunch-style cone tip	Borehole Depth	CPT: 109.3 ft GW Sampling: 60 ft
Drill Rig Type	Truck-Mounted CPT	Drilling Contractor	Gregg Drilling & Testing	Surveyed Ground Surface Elevation	470.02 ft
Groundwater Level Observation	Not observed	Sampling Method	Grab GW samples using SS bailer and 3/4-in. PVC with 0.01-in. slots	Borehole Backfill	Cement-bentonite grout capped with 0.5 ft black-dyed concrete
Comments	Two adjacent borings advanced in Safeway parking lot.				

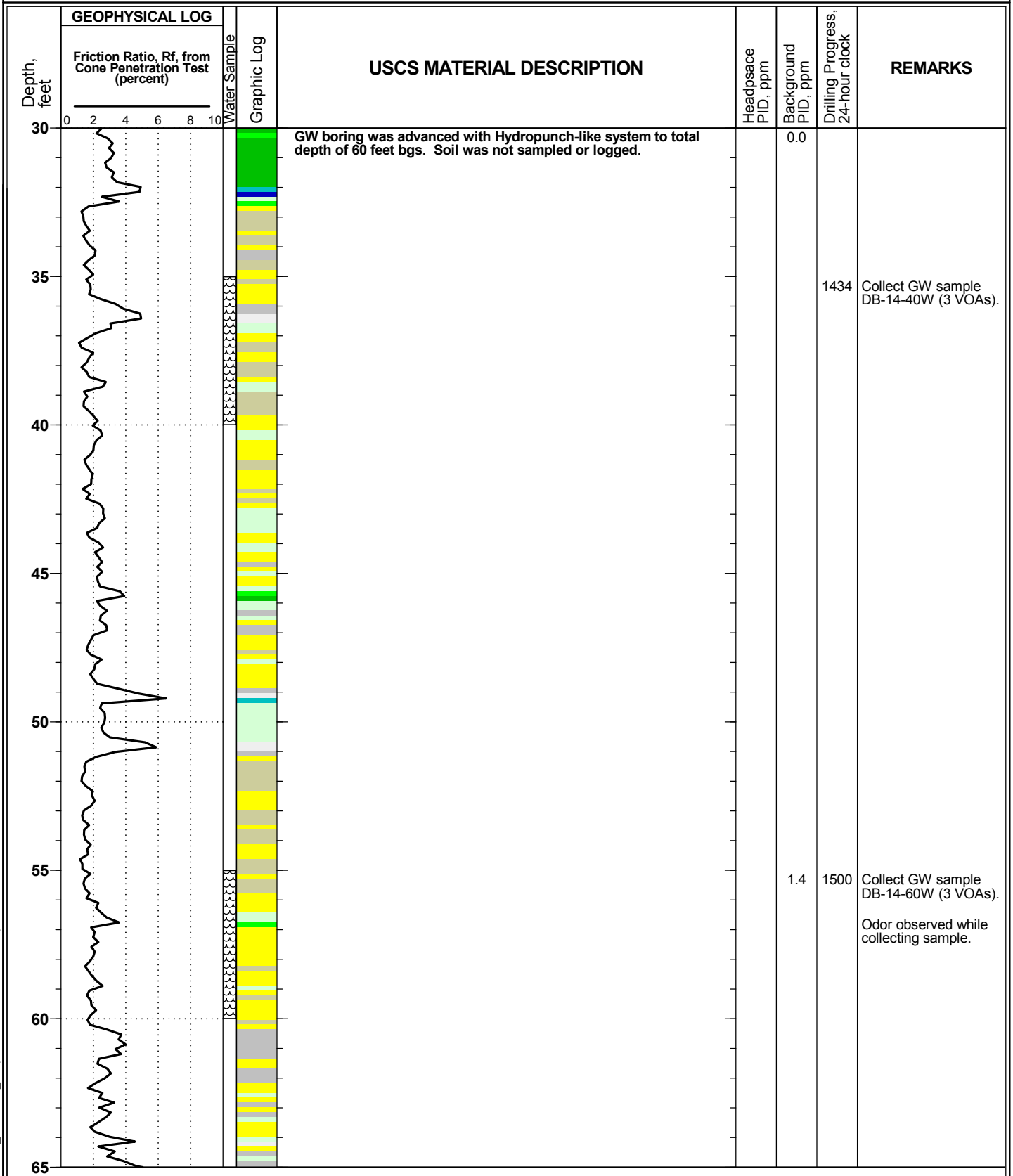


Depth, feet	Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
0			**Adjacent CPT and GW borings were air-knifed to 5 feet bgs to clear for utilities.**		0.0		Air-knife two locations to 5 ft on 6/22/17.
5			**GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.**			1103	Start CPT.
						1210	CPT refusal at 109.3 ft.
							Start driving GW sampler.
10							Gregg started CPT interpretation at 8 ft bgs.
15							
20							
25							
30							

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-14; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-14

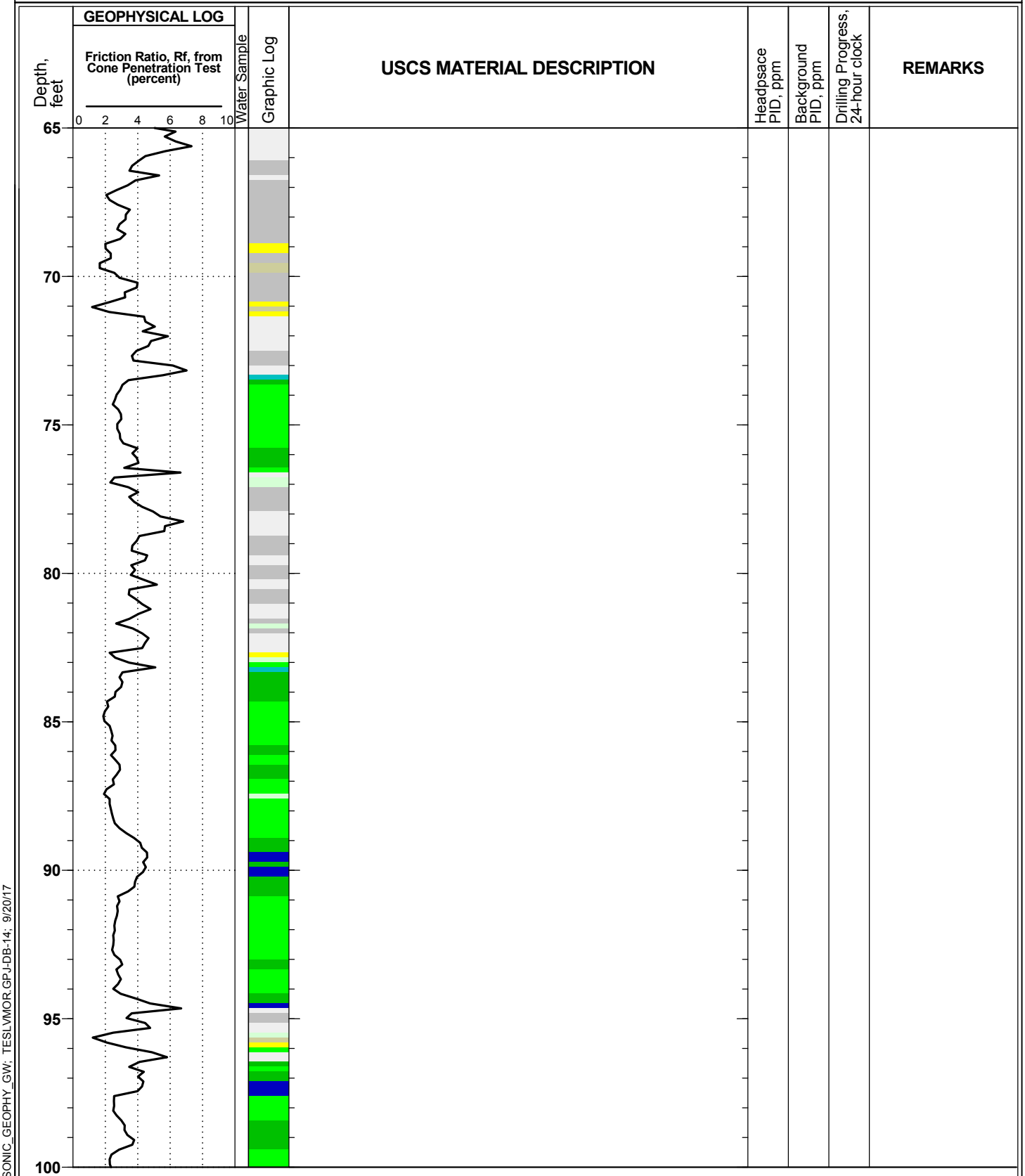


USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.		0.0		
			1434	Collect GW sample DB-14-40W (3 VOAs).
		1.4	1500	Collect GW sample DB-14-60W (3 VOAs). Odor observed while collecting sample.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-14; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

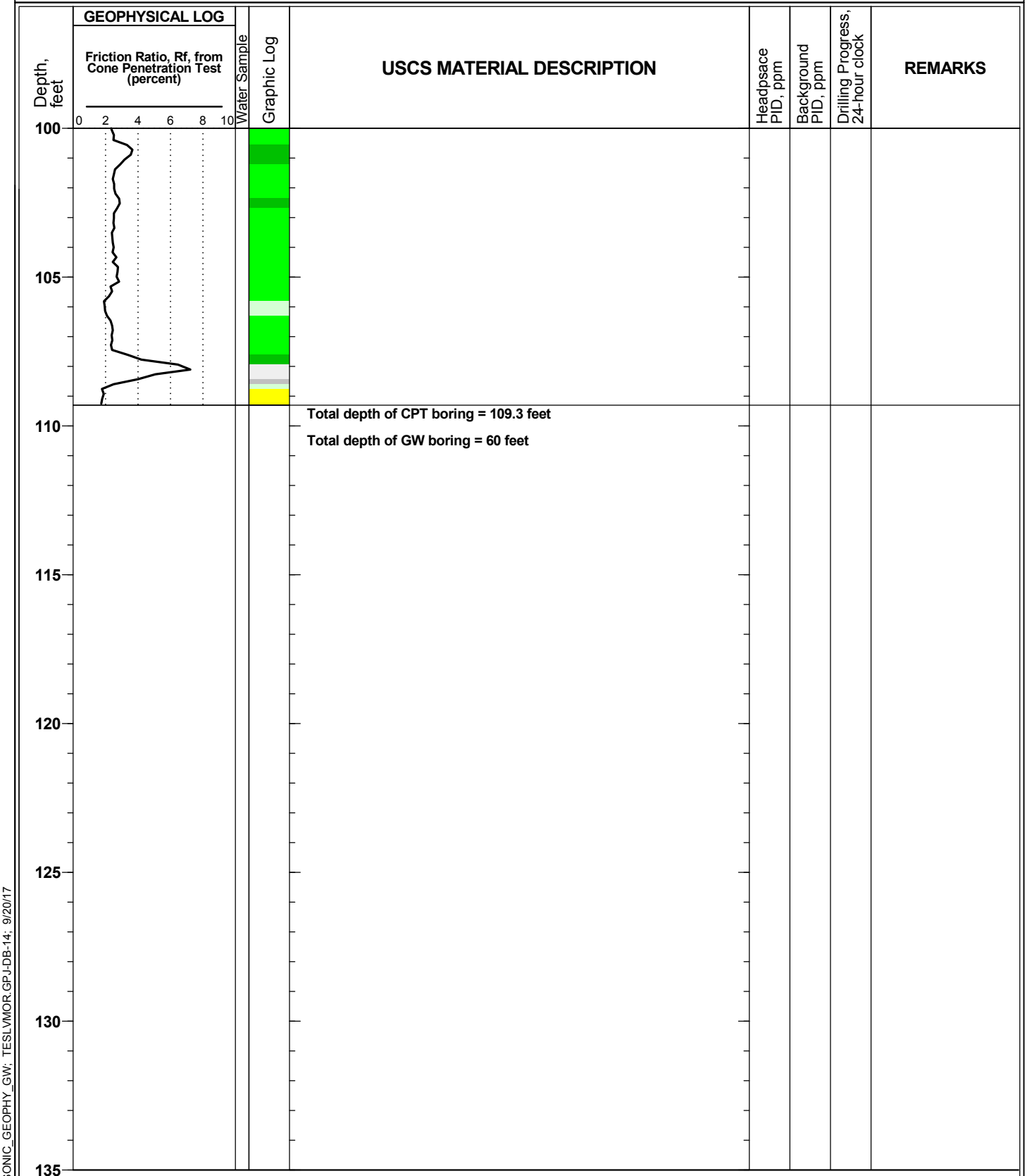
Log of Boring DB-14



ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-14; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-14

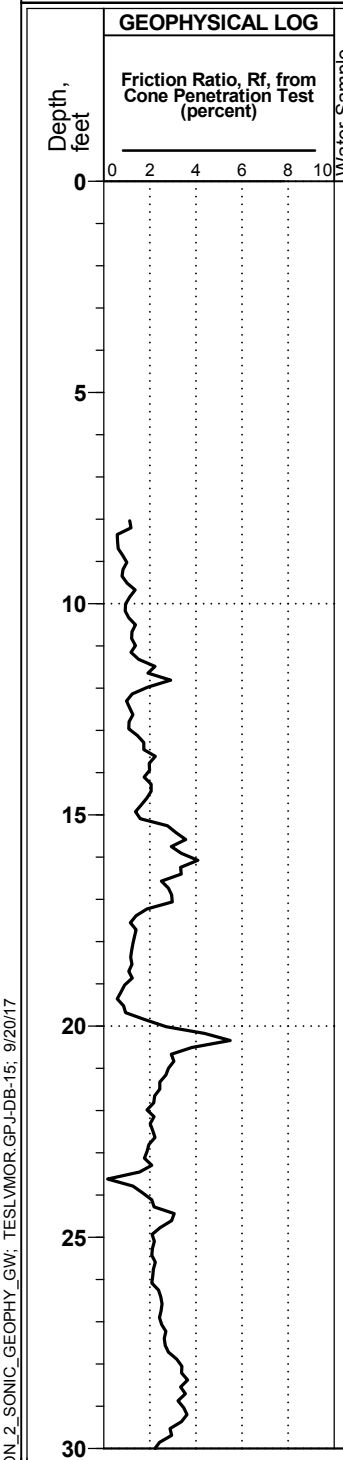


Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-15

Sheet 1 of 3

Date(s) Drilled	6/22/17	Logged By	G. Datt	Checked By	M. Purchase
Drilling Method	Direct Push	Drill Bit Size/Type	1.75-in.-OD CPT tip; 1.75-in.-OD Hydropunch-style cone tip	Borehole Depth	CPT: 92.9 ft GW Sampling: 60 ft
Drill Rig Type	Truck-Mounted CPT	Drilling Contractor	Gregg Drilling & Testing	Surveyed Ground Surface Elevation	470.16 ft
Groundwater Level Observation	Not observed	Sampling Method	Grab GW samples using SS bailer and 3/4-in. PVC with 0.01-in. slots	Borehole Backfill	Cement-bentonite grout capped with 0.5 ft black-dyed concrete
Comments	Two adjacent borings advanced in Safeway parking lot.				

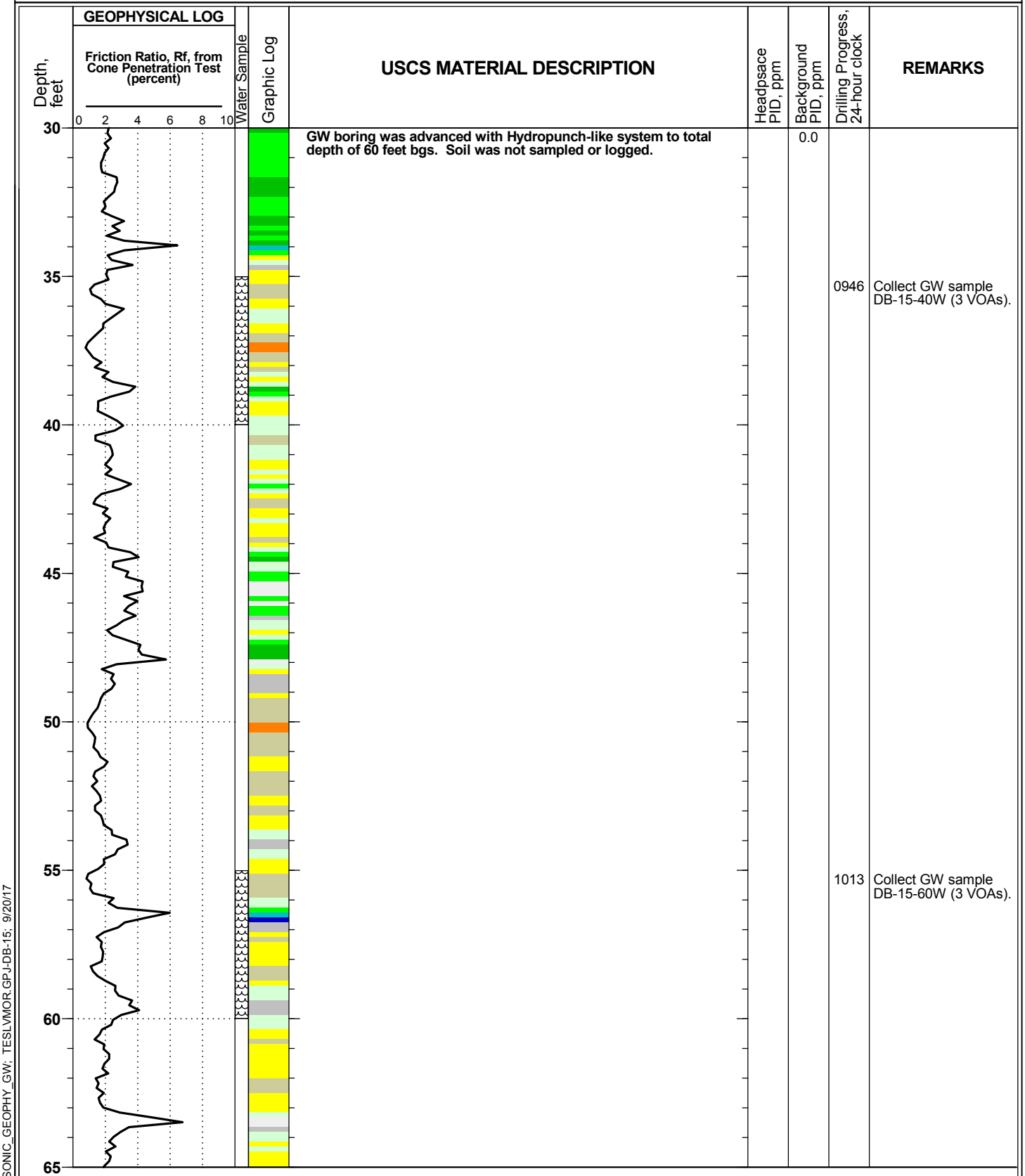


Water Sample	Graphic Log	USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Adjacent CPT and GW borings were air-knifed to 5 feet bgs to clear for utilities.		0.0		Air-knife two locations to 5 ft on 6/21/17.
		GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.			0720	Start CPT.
					0812	CPT refusal at 92.9 ft.
					0927	Start driving GW sampler.
						Gregg started CPT interpretation at 8 ft bgs.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-15; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-15

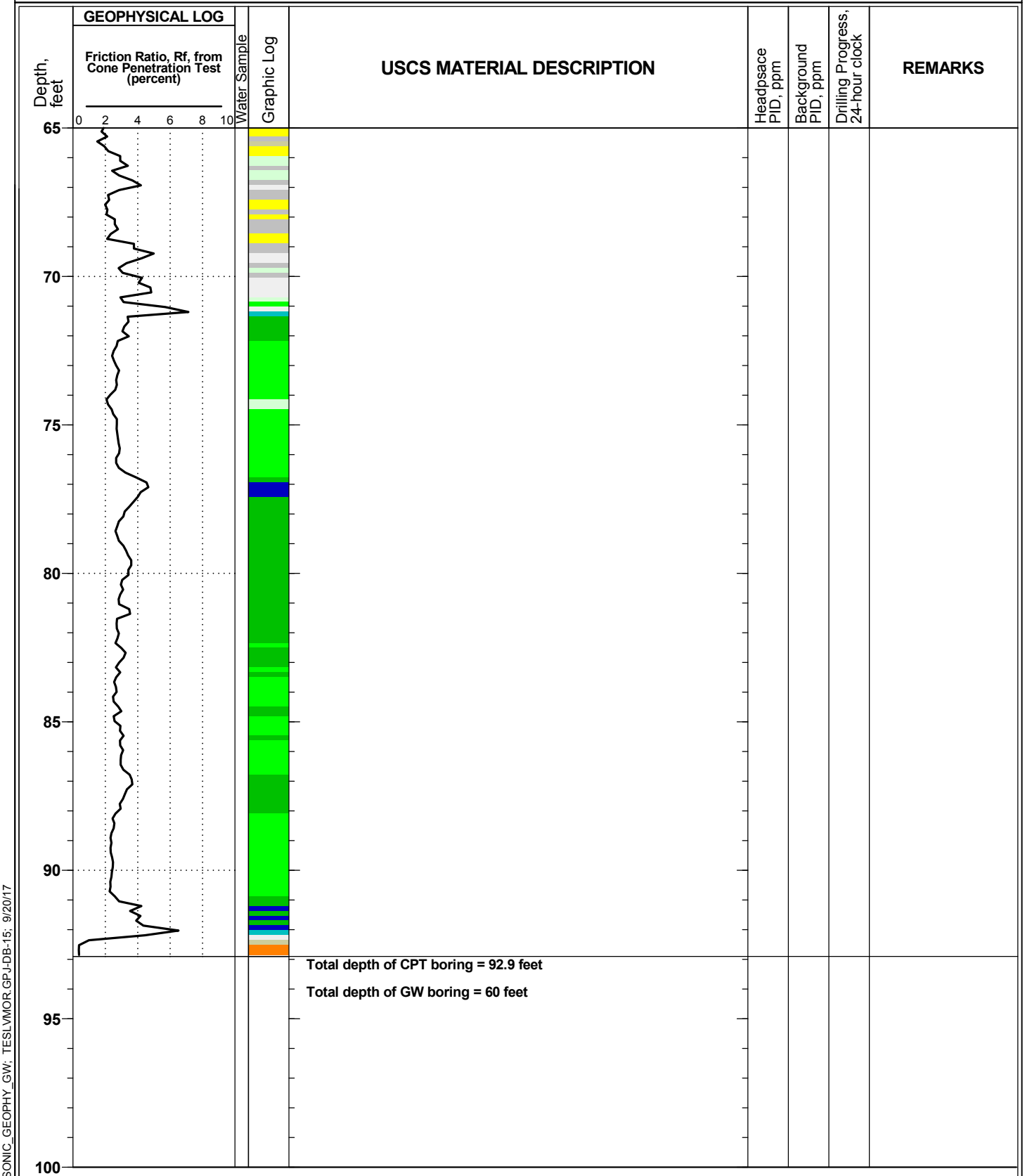


USCS MATERIAL DESCRIPTION	Headspsace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
GW boring was advanced with Hydropunch-like system to total depth of 60 feet bgs. Soil was not sampled or logged.		0.0		
			0946	Collect GW sample DB-15-40W (3 VOAs).
			1013	Collect GW sample DB-15-60W (3 VOAs).

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-15; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring DB-15



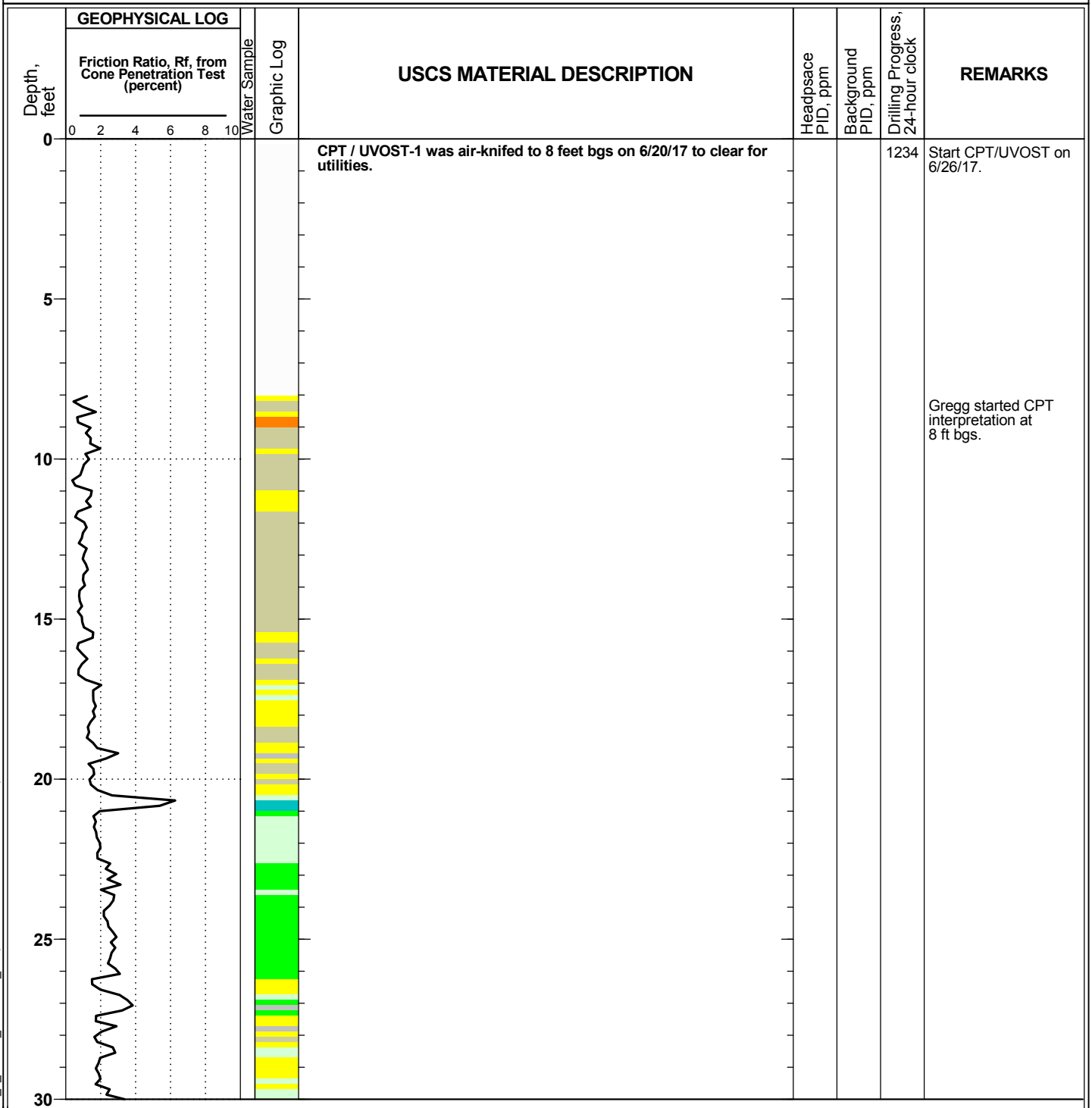
ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-DB-15; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of CPT / UVOST-1

Sheet 1 of 3

Date(s) Drilled	6/26/17	Logged By	G. Datt	Checked By	M. Purchase
Drilling Method	Direct Push	Drill Bit Size/Type	1.75-in.-OD CPT tip	Borehole Depth	91.0 ft
Drill Rig Type	Truck-Mounted CPT	Drilling Contractor	Gregg Drilling & Testing	Surveyed Ground Surface Elevation	Not measured
Groundwater Level Observation	Not observed	Sampling Method	No sampling performed	Borehole Backfill	Cement-bentonite grout capped with 0.5 ft black-dyed concrete
Comments	Two adjacent borings advanced in front of driveway on east side of South P Street.				

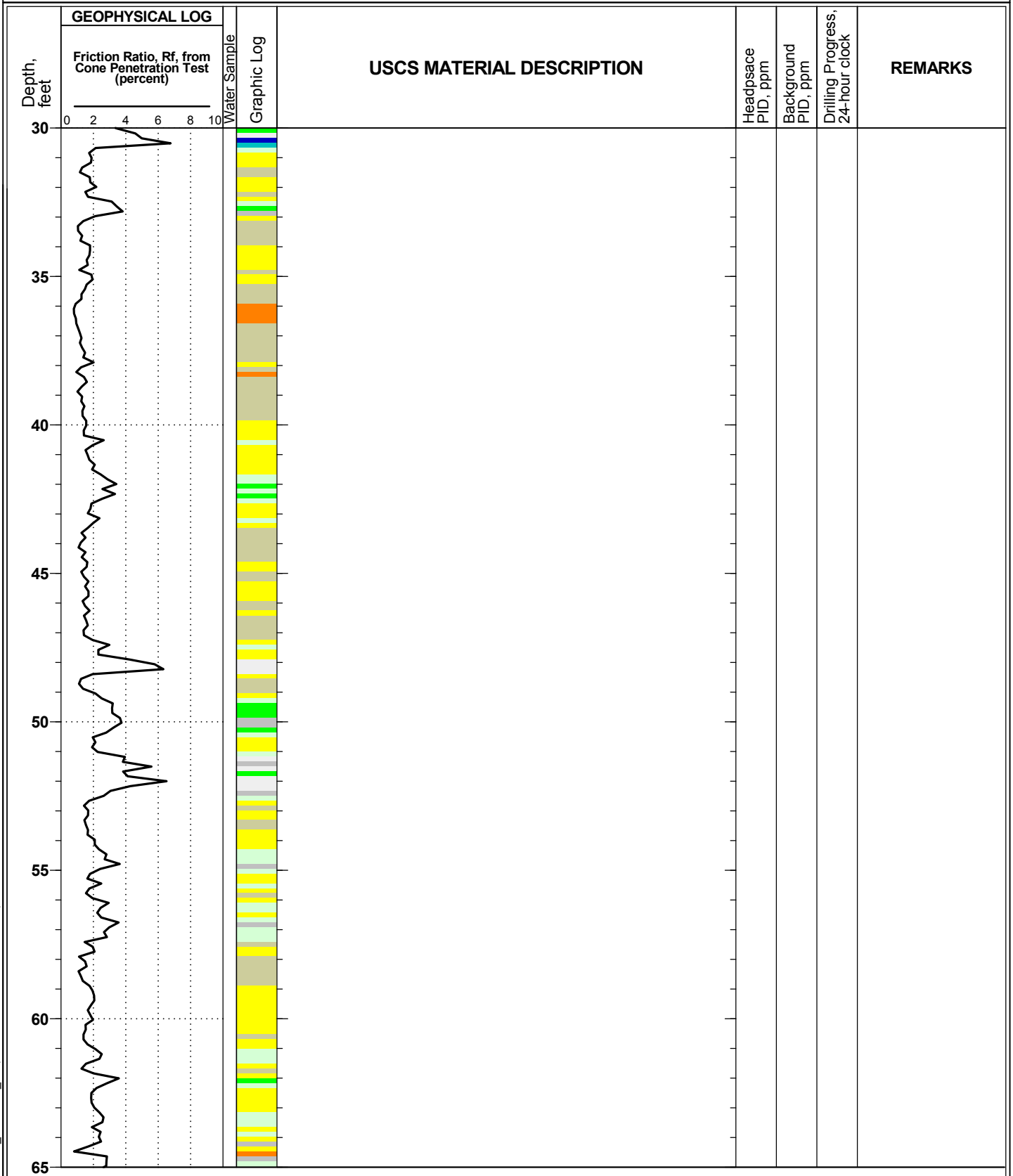


USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
CPT / UVOST-1 was air-knifed to 8 feet bgs on 6/20/17 to clear for utilities.			1234	Start CPT/UVOST on 6/26/17.
				Gregg started CPT interpretation at 8 ft bgs.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-UVOST-01; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

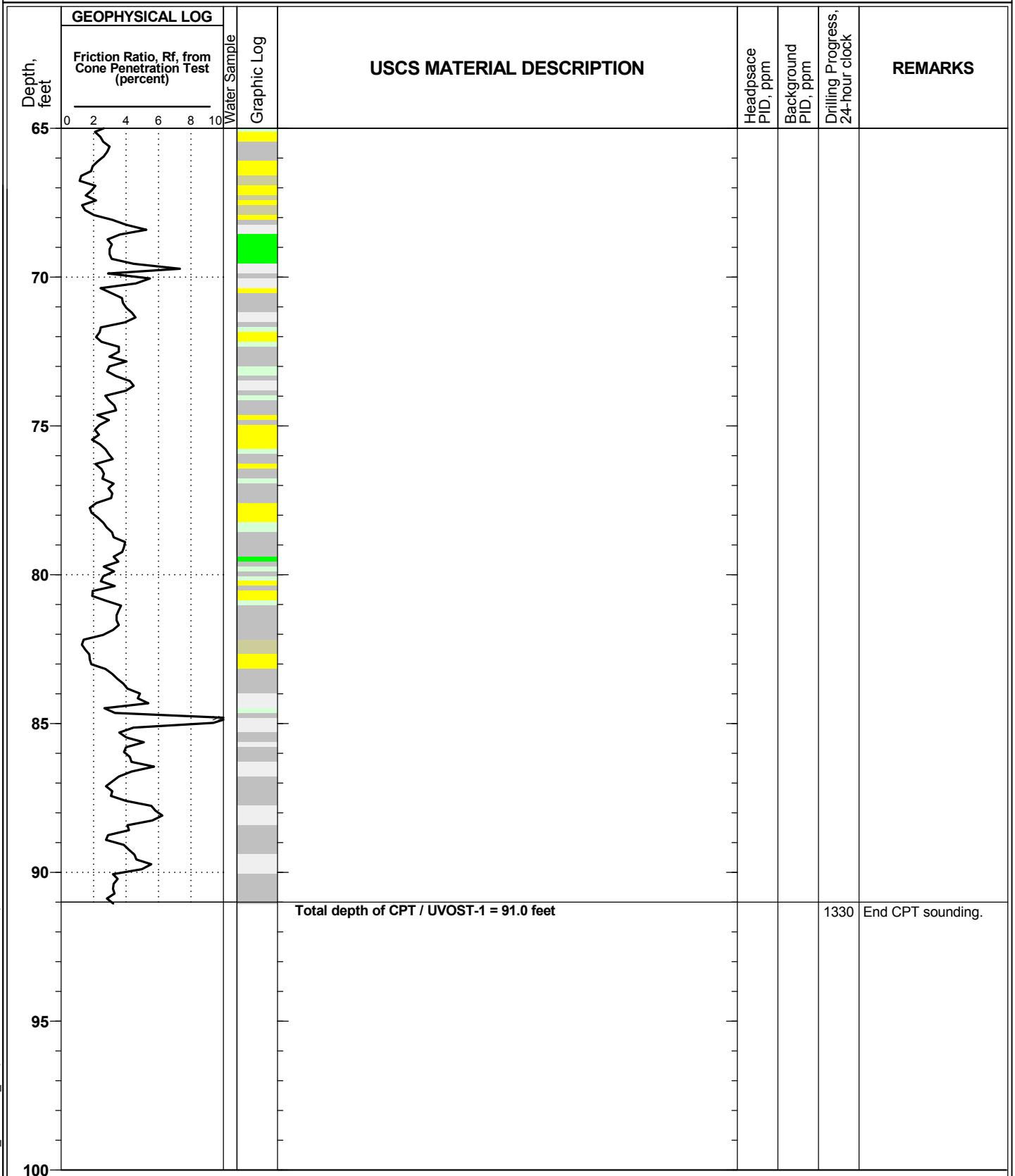
Log of CPT / UVOST-1



ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-UVOST-01; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of CPT / UVOST-1



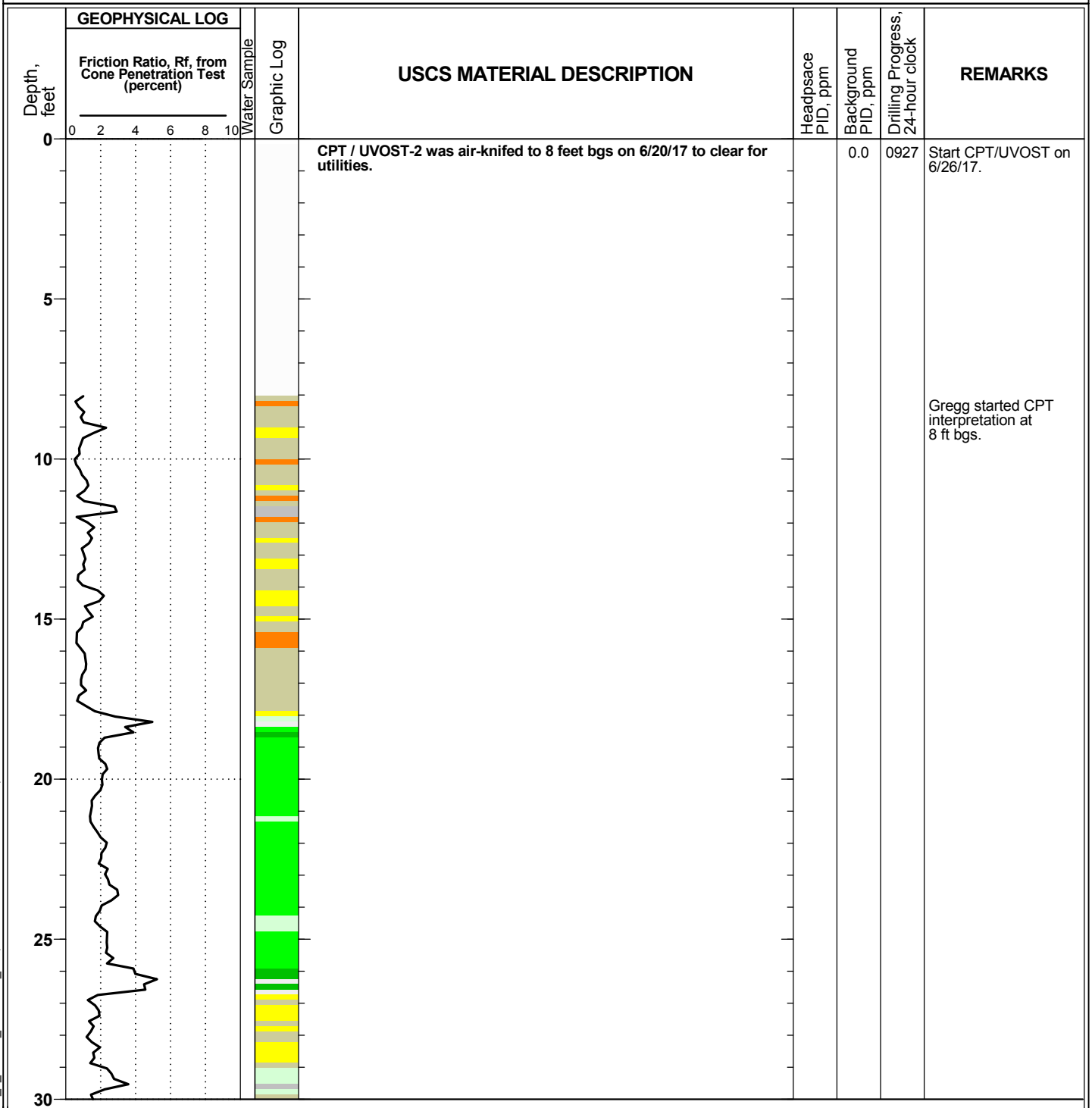
ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-UVOST-01; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of CPT / UVOST-2

Sheet 1 of 3

Date(s) Drilled	6/26/17	Logged By	G. Datt	Checked By	M. Purchase
Drilling Method	Direct Push	Drill Bit Size/Type	1.75-in.-OD CPT tip	Borehole Depth	92.2 ft
Drill Rig Type	Truck-Mounted CPT	Drilling Contractor	Gregg Drilling & Testing	Surveyed Ground Surface Elevation	Not measured
Groundwater Level Observation	Not observed	Sampling Method	No sampling performed	Borehole Backfill	Cement-bentonite grout capped with 0.5 ft black-dyed concrete
Comments	Two adjacent borings advanced in front of driveway on east side of South P Street.				

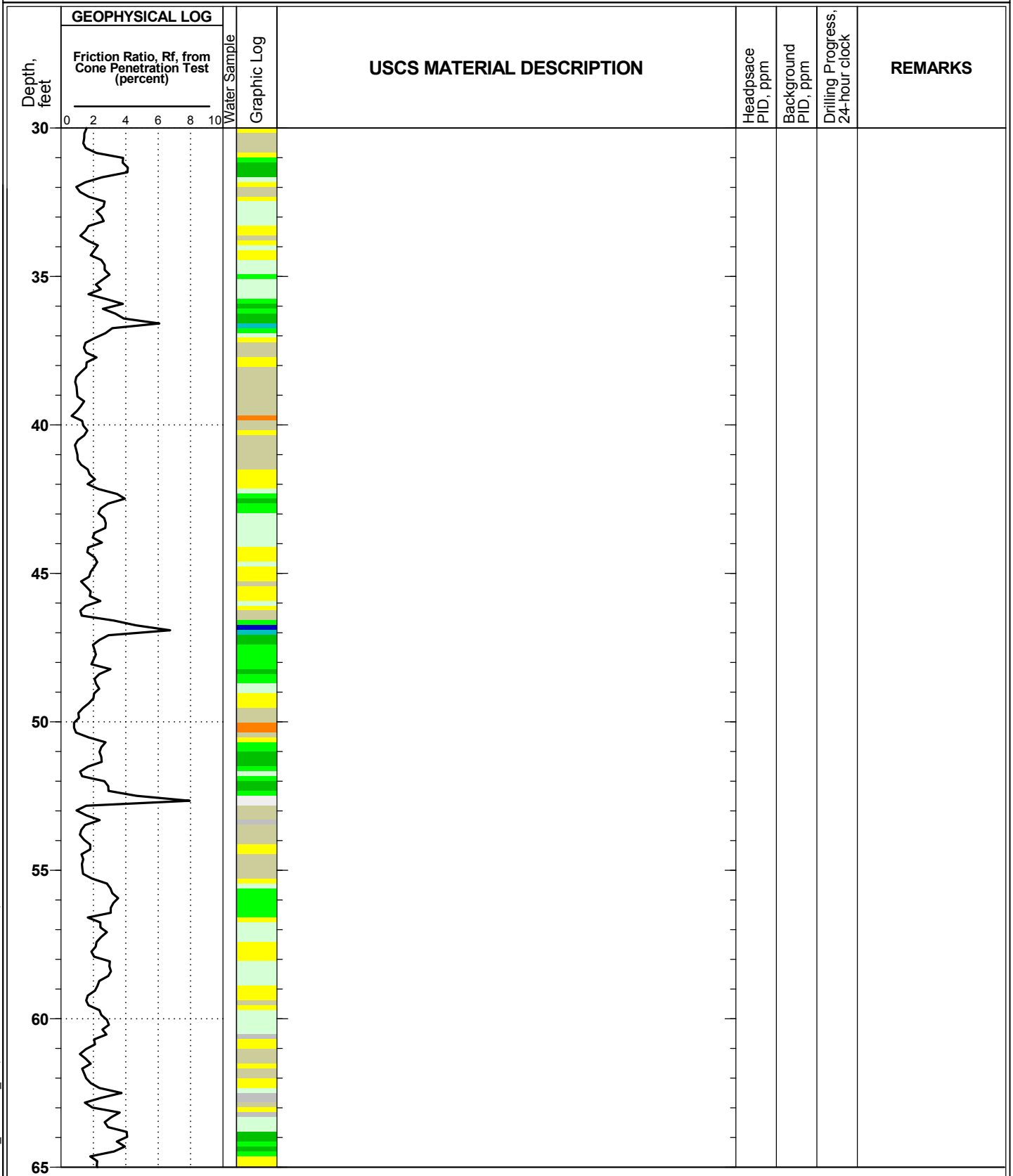


USCS MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
CPT / UVOST-2 was air-knifed to 8 feet bgs on 6/20/17 to clear for utilities.		0.0	0927	Start CPT/UVOST on 6/26/17.
				Gregg started CPT interpretation at 8 ft bgs.

ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-UVOST-02; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

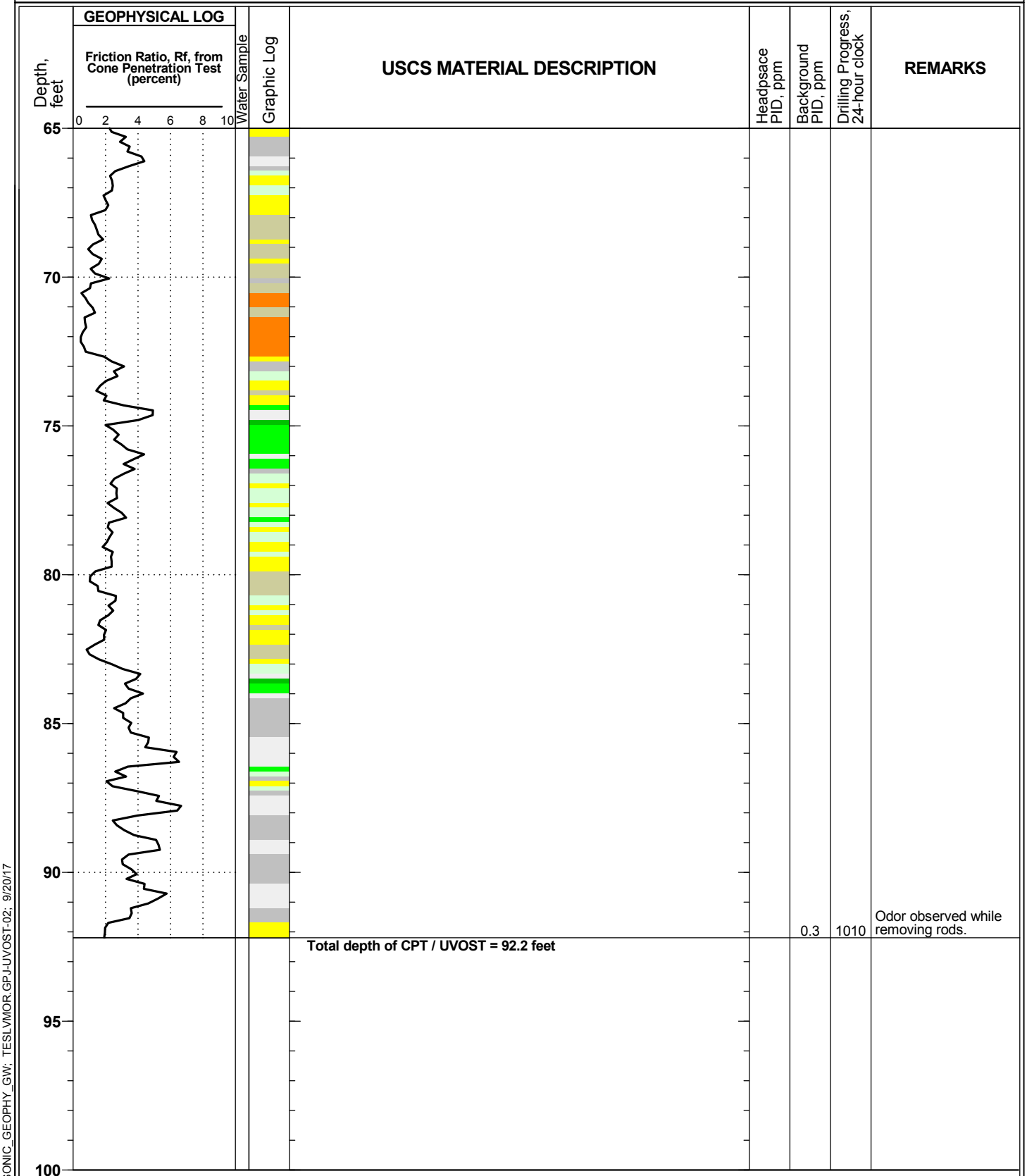
Log of CPT / UVOST-2



ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-UVOST-02; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of CPT / UVOST-2



ORION_2_SONIC_GEOPHY_GW; TESLVMOR.GPJ-UVOST-02; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring UVOST-2

Sheet 1 of 3

Date(s) Drilled	**7/6/17**	Logged By	**E. Chow**	Checked By	**M. Purchase**
Drilling Method	**Hollow-Stem Auger**	Drill Bit Size/Type	**6-inch-OD auger bit**	Total Depth of Borehole	**70.5 feet**
Drill Rig Type	**Limited Access Rig**	Drilling Contractor	**Gregg Drilling & Testing**	Surveyed Ground Surface Elevation	**Not measured**
Groundwater Level and Date Measured	**Not observed**	Sampling Method	**California Modified split spoon**		
Comments	**Located in front of driveway on east side of South P Street.**	Borehole Backfill	**Cement-bentonite grout capped with 0.5 ft black-dyed concrete**		

Elevation, feet / Depth, feet	SAMPLES Type	SAMPLES Number	Graphic Log	MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
0				**Boring UVOST-2 was air-knifed to 8 feet bgs on 6/30/17 to clear for utilities. Soil was not logged.**				
5								
10				**Boring UVOST-2 was drilled near DW-8 The borehole was advanced to 49 feet without collecting samples or observing cuttings. Refer to Log of Boring/Well DW-8 for lithology at this location.**				
15								
20								
25								
30								

ORION_3SA; TESLVMOR.GPJ-UVOST-02HSA; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring UVOST-2

Elevation, feet / Depth, feet	SAMPLES Type	SAMPLES Number	Graphic Log	MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
30				**Boring UVOST-2 was drilled near DW-8 The borehole was advanced to 49 feet without collecting samples or observing cuttings. Refer to Log of Boring/Well DW-8 for lithology at this location.**				
35								
40								
45								
				[Material description from Log of Boring/Well DW-8 is recorded below]				
50	☒	UVOST-2-50S		Moist, brown, well-graded SAND with GRAVEL (SW), fine- to coarse-grained sand, trace silt	0.5	0.0	1029	Sample placed on hold and not analyzed.
				Moist, brown, CLAYEY SILT (ML), medium plasticity				
				Wet, brown, well-graded GRAVEL with SAND (GW), fine to coarse gravel, fine- to coarse-grained sand, trace silt, odor				
55	☒	UVOST-2-55S			294	0.0	1035	
60						0.0	1045	
65	☒	UVOST-2-65S			110	0.0	1054	Sample placed on hold and not analyzed.

ORION_3SA; TESLVMOR.GPJ-UVOST-02HSA; 9/20/17

Project: Tesoro - Livermore
Project Location: 1619 1st Street, Livermore, CA
Project Number: 01LV

Log of Boring UVOST-2

Elevation, feet / Depth, feet	SAMPLES Type	SAMPLES Number	Graphic Log	MATERIAL DESCRIPTION	Headspace PID, ppm	Background PID, ppm	Drilling Progress, 24-hour clock	REMARKS
65				Wet, brown, well-graded GRAVEL with SAND (GW), fine to coarse gravel, fine- to coarse-grained sand, trace silt, odor *(continued)*				
70		UVOST-2-70S		**Total depth = 70.5 feet**	27.5	0.0	1105	
75								
80								
85								
90								
95								
100								

ORION_3SA; TESLVMOR.GPJ-UVOST-02HSA; 9/20/17

6/27/2017

Arctos Environmental
Attn: Scott Stromberg

Subject: CPT Site Investigation
Tesoro - Livermore
Livermore, California
GREGG Project Number: 17-102MA

Dear Mr. Stromberg:

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)
UVOST-1	6/26/17	91	-	-	-
UVOST-2	6/26/17	92	-	-	-

Bibliography

Lunne, T., Robertson, P.K. and Powell, J.J.M., "Cone Penetration Testing in Geotechnical Practice" E & FN Spon. ISBN 0 419 23750, 1997

Roberston, P.K., "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, Vol. 27, 1990 pp. 151-158.

Mayne, P.W., "NHI (2002) Manual on Subsurface Investigations: Geotechnical Site Characterization", available through www.ce.gatech.edu/~geosys/Faculty/Mayne/papers/index.html, Section 5.3, pp. 107-112.

Robertson, P.K., R.G. Campanella, D. Gillespie and A. Rice, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8, 1986 pp. 791-803.

Robertson, P.K., Sully, J., Woeller, D.J., Lunne, T., Powell, J.J.M., and Gillespie, D.J., "Guidelines for Estimating Consolidation Parameters in Soils from Piezocone Tests", Canadian Geotechnical Journal, Vol. 29, No. 4, August 1992, pp. 539-550.

Robertson, P.K., T. Lunne and J.J.M. Powell, "Geo-Environmental Application of Penetration Testing", Geotechnical Site Characterization, Robertson & Mayne (editors), 1998 Balkema, Rotterdam, ISBN 90 5410 939 4 pp 35-47.

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.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, "Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT", 53rd Canadian Geotechnical Conference Montreal, QC October pp. 733-739, 2000.

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

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.

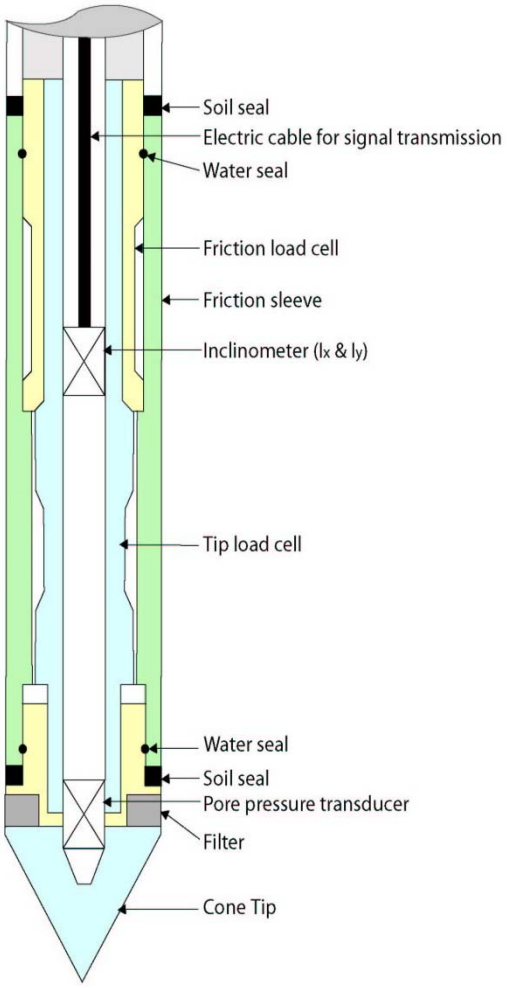


Figure CPT

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)

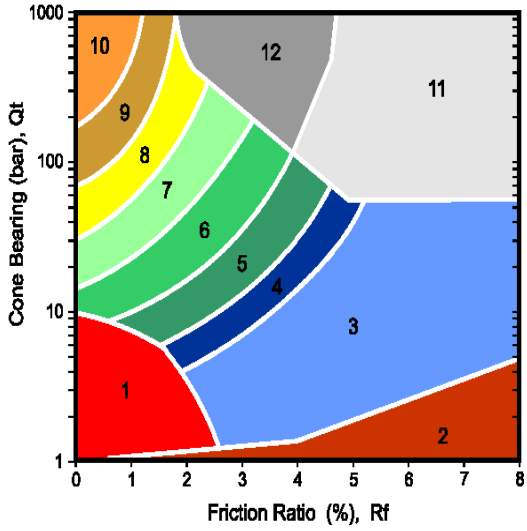
Note: The repeatability during field use will depend somewhat on ground conditions, abrasion, maintenance and zero load stability.

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) $q_t = q_c + u\,(1-a)$

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.

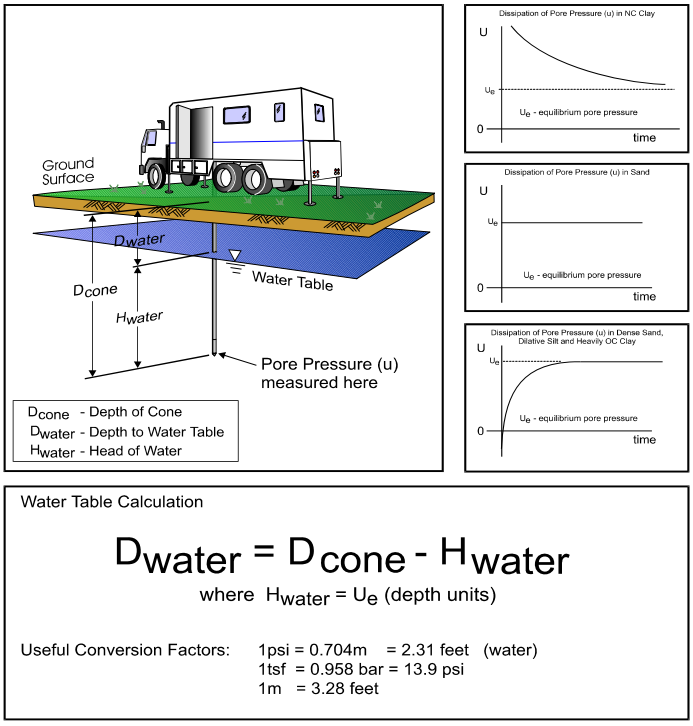
Pore pressure dissipation data can be interpreted to provide estimates of:

- 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.



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors: 1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

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 = Δd/Δt

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.

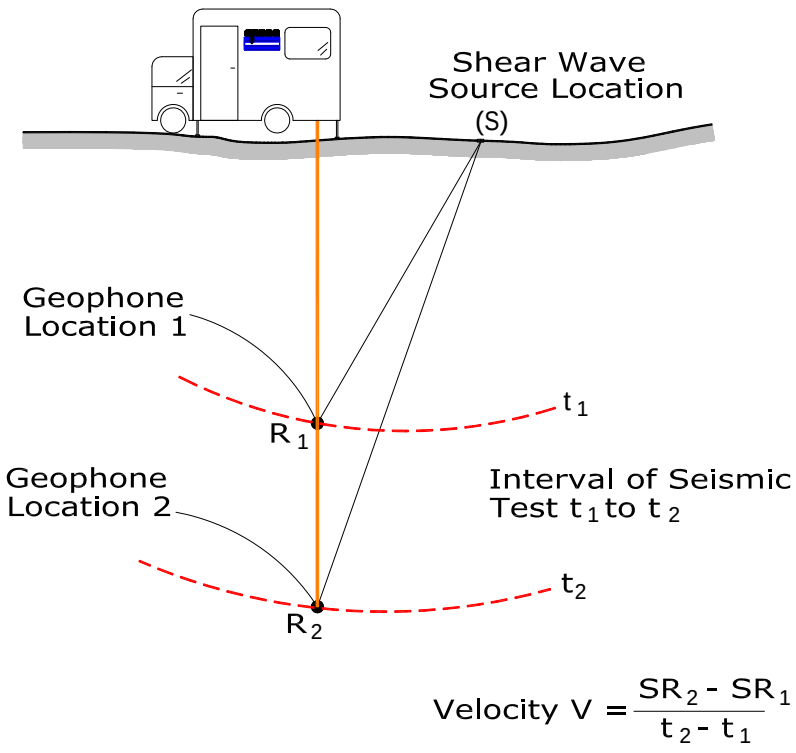


Figure SCPT

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.

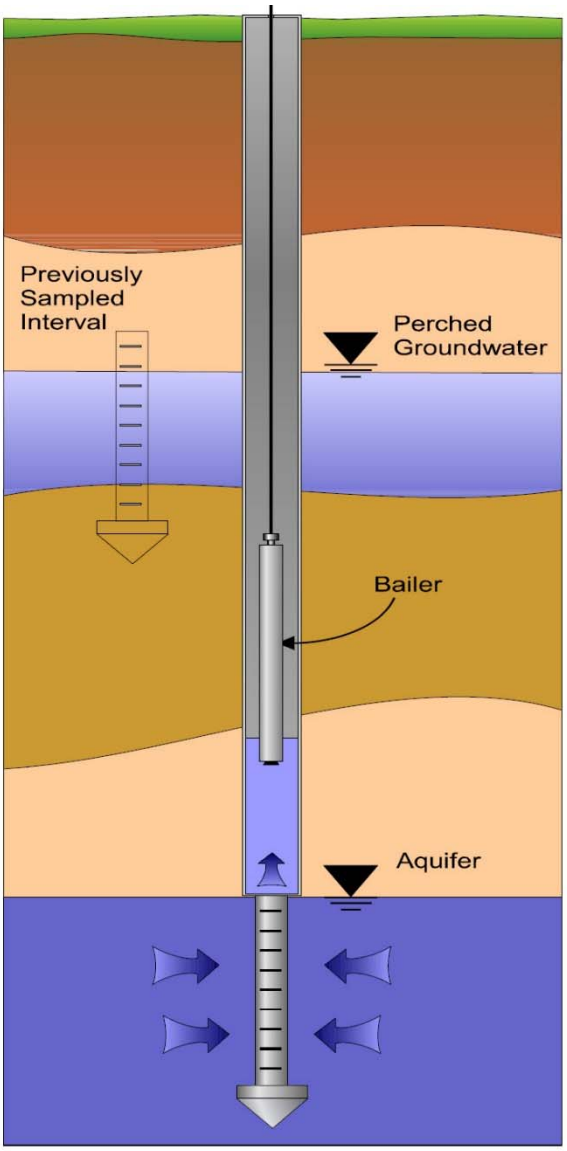


Figure GWS

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.

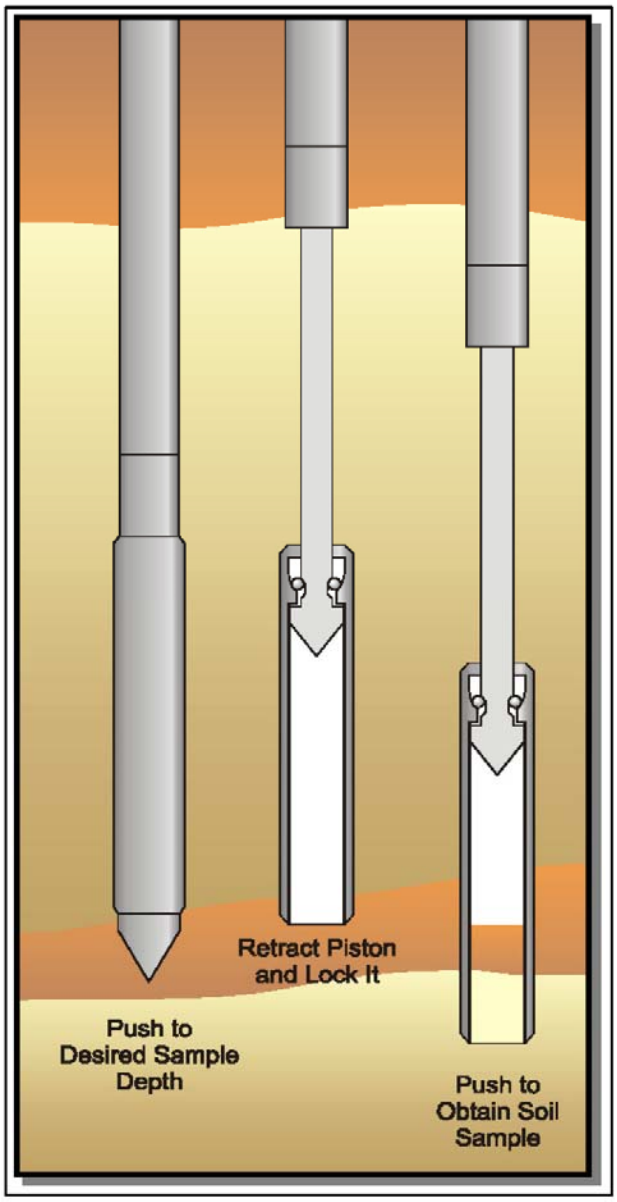


Figure SS

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.

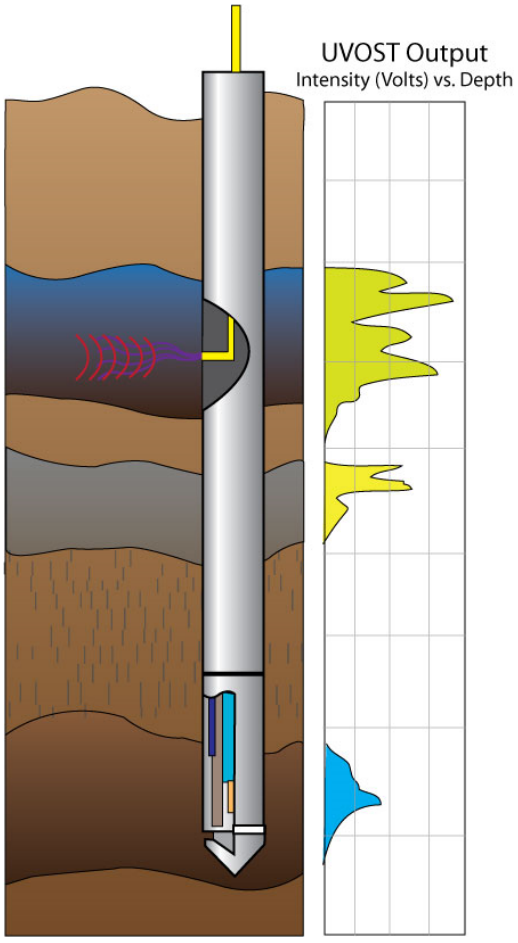


Figure UVOST

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.

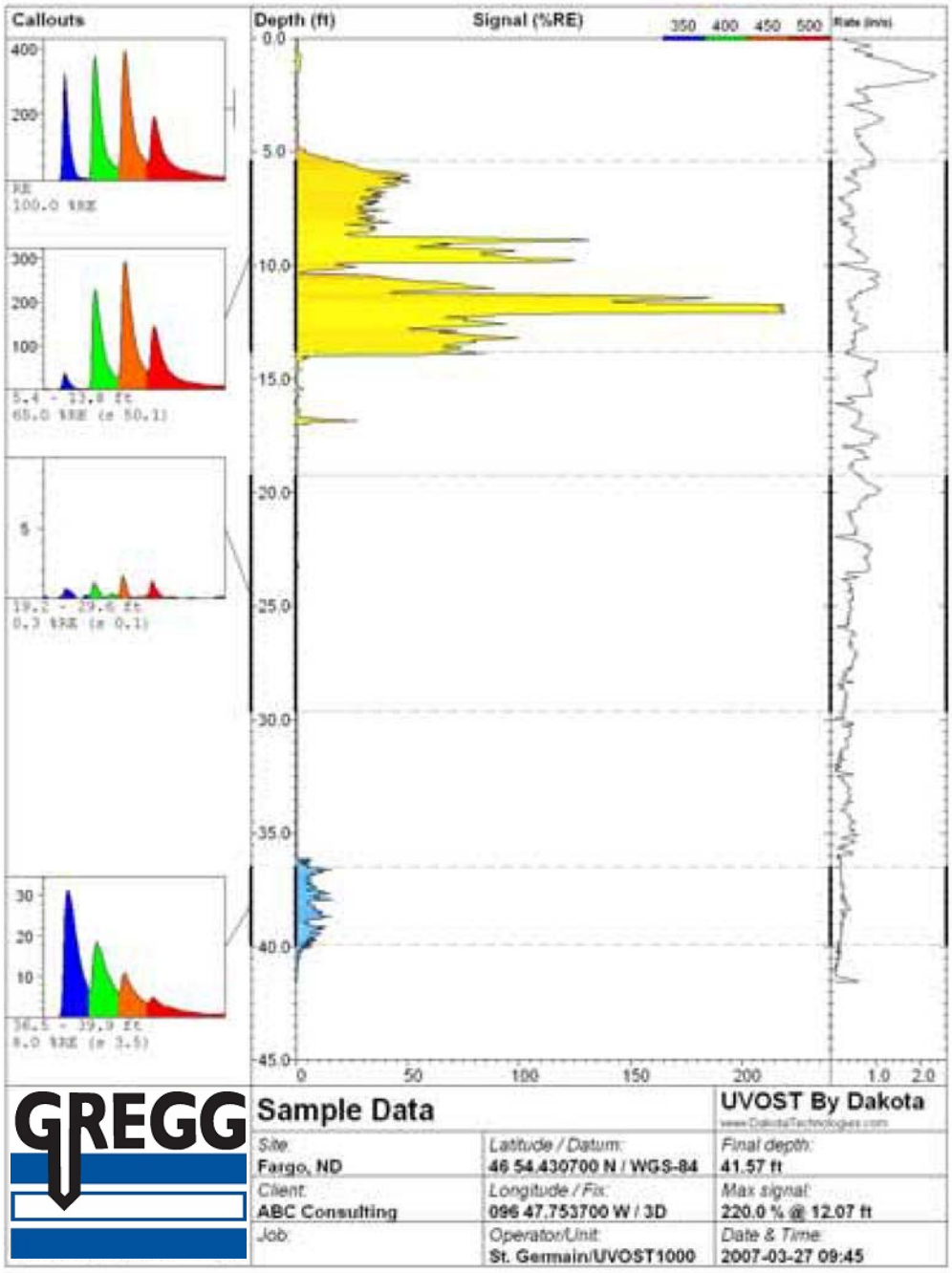


Figure Output

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

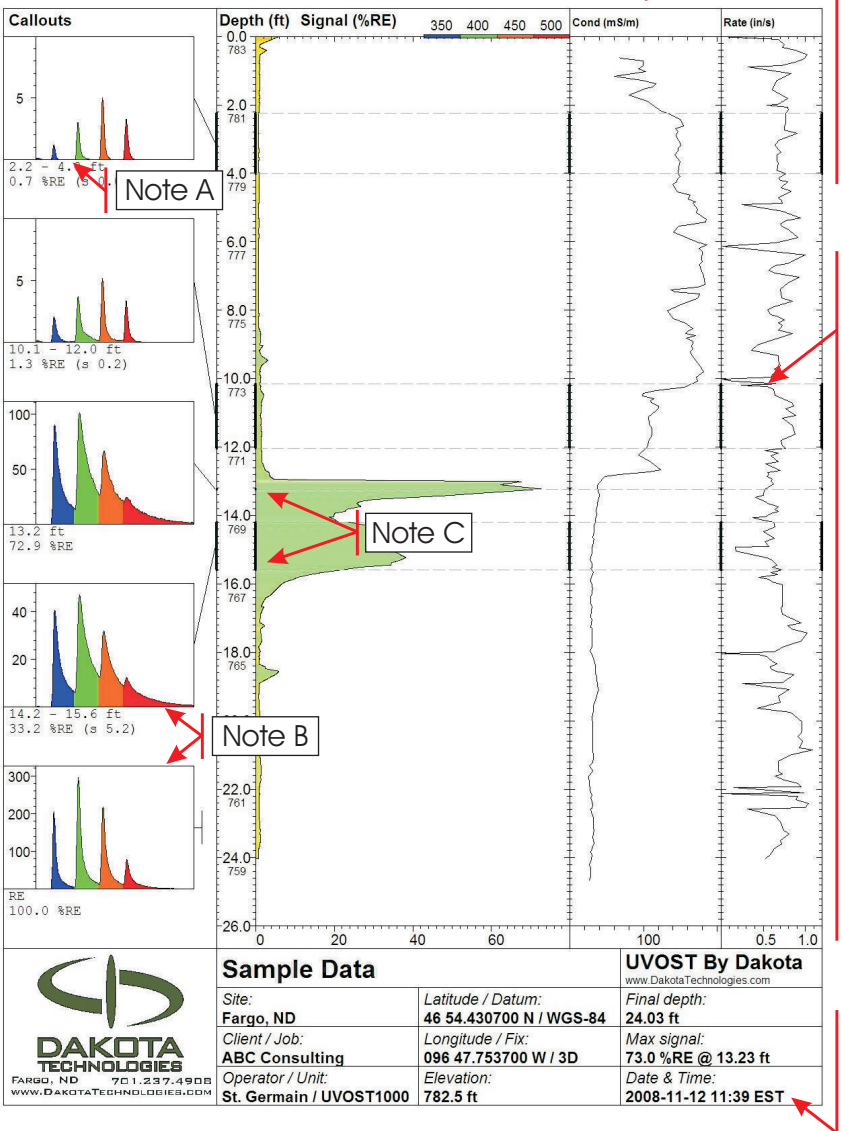
Main Plot :
Signal (total fluorescence) versus depth where signal is relative to the Reference Emitter (RE). The total area of the waveform is divided by the total area of the Reference Emitter yielding the %RE. This %RE scales with the NAPL fluorescence. The fill color is based on relative contribution 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.

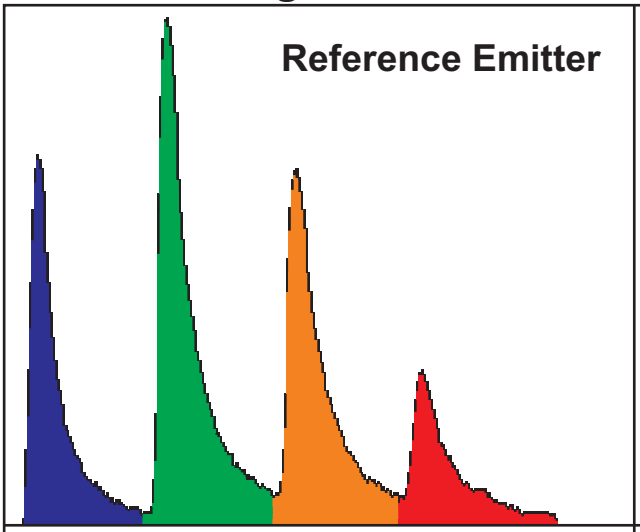
Info Box :
Contains pertinent log info including name and location.

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.

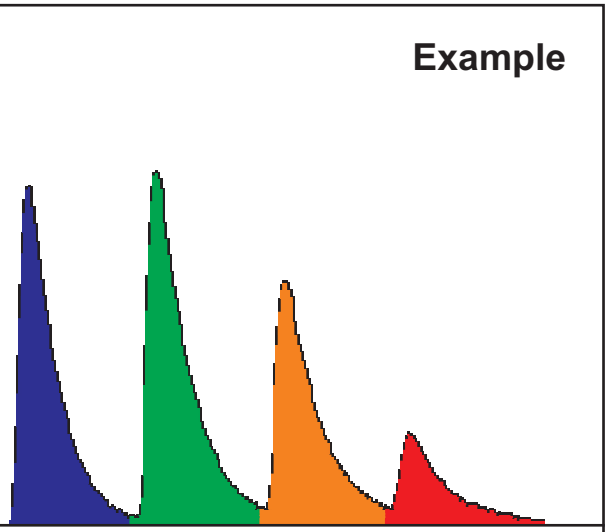
Note C :
Callouts can be a single depth (see 3rd callout) or a range (see 4th callout). The range is noted on the depth axis by a bold line. When the callout is a range, the average and standard deviation in %RE is given below the callout.

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

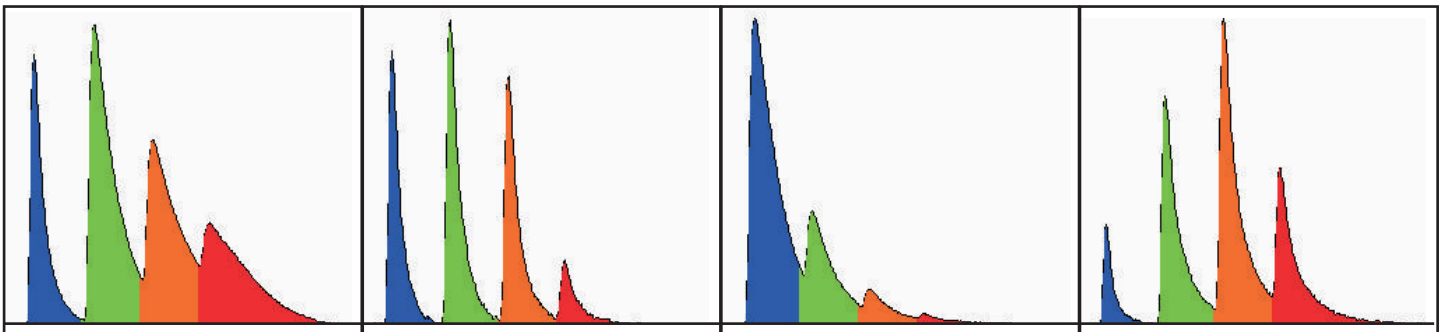


CH1		CH2		CH3		CH4		Total
4923	+	5743	+	4166	+	1735	=	**16587**
22.3		25.9		18.8		7.8		**75%**

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.

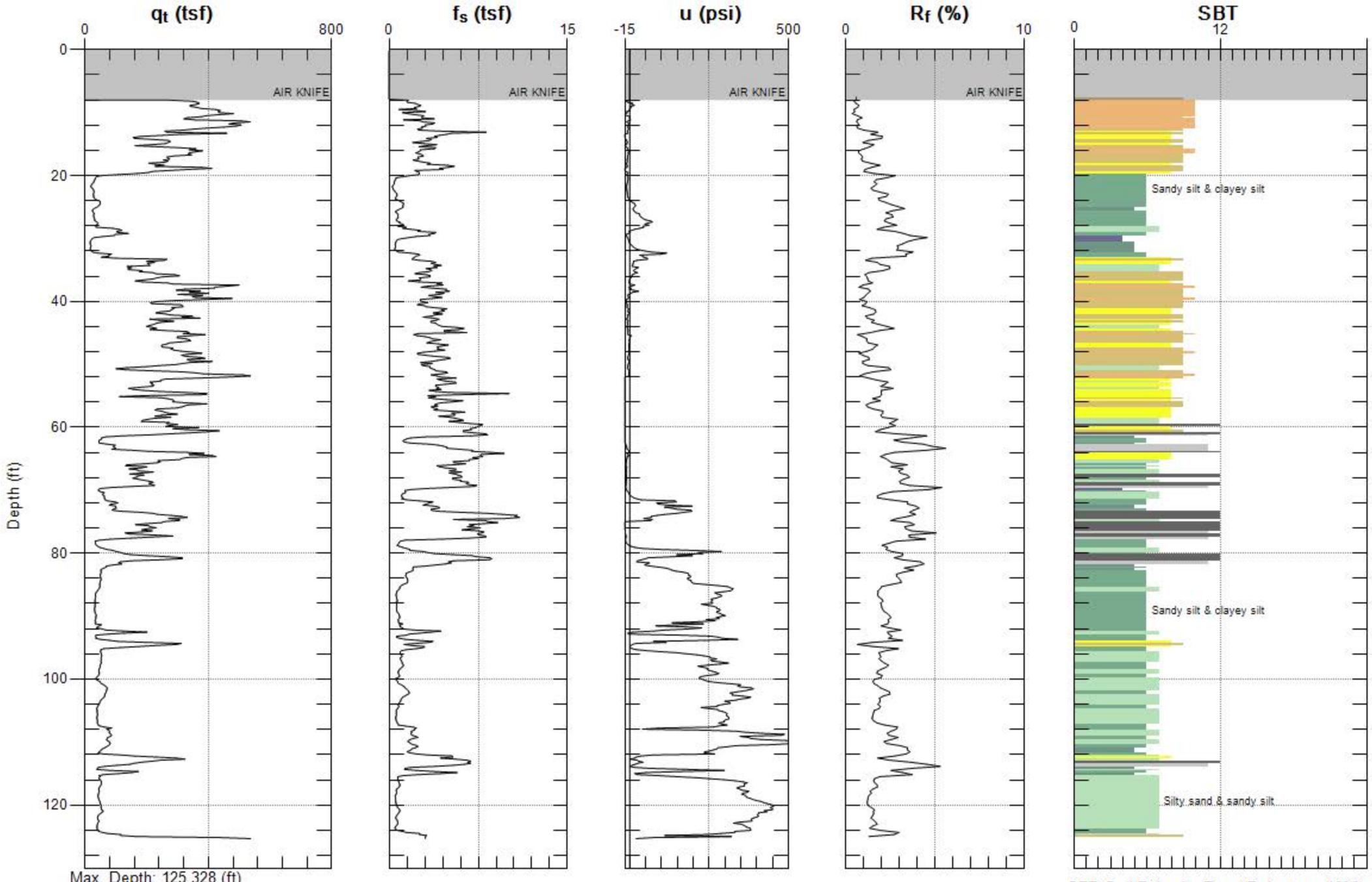
Common Waveforms (highly dependent on soil, weathering, etc.)



Diesel	Gas	Kerosene	Motor Oil

ARCTOS ENVIRONMENTAL

Site: SHELL GAS STATION
Sounding: CPT-DB11
Engineer: G.DATT
Date: 6/27/2017 08:23



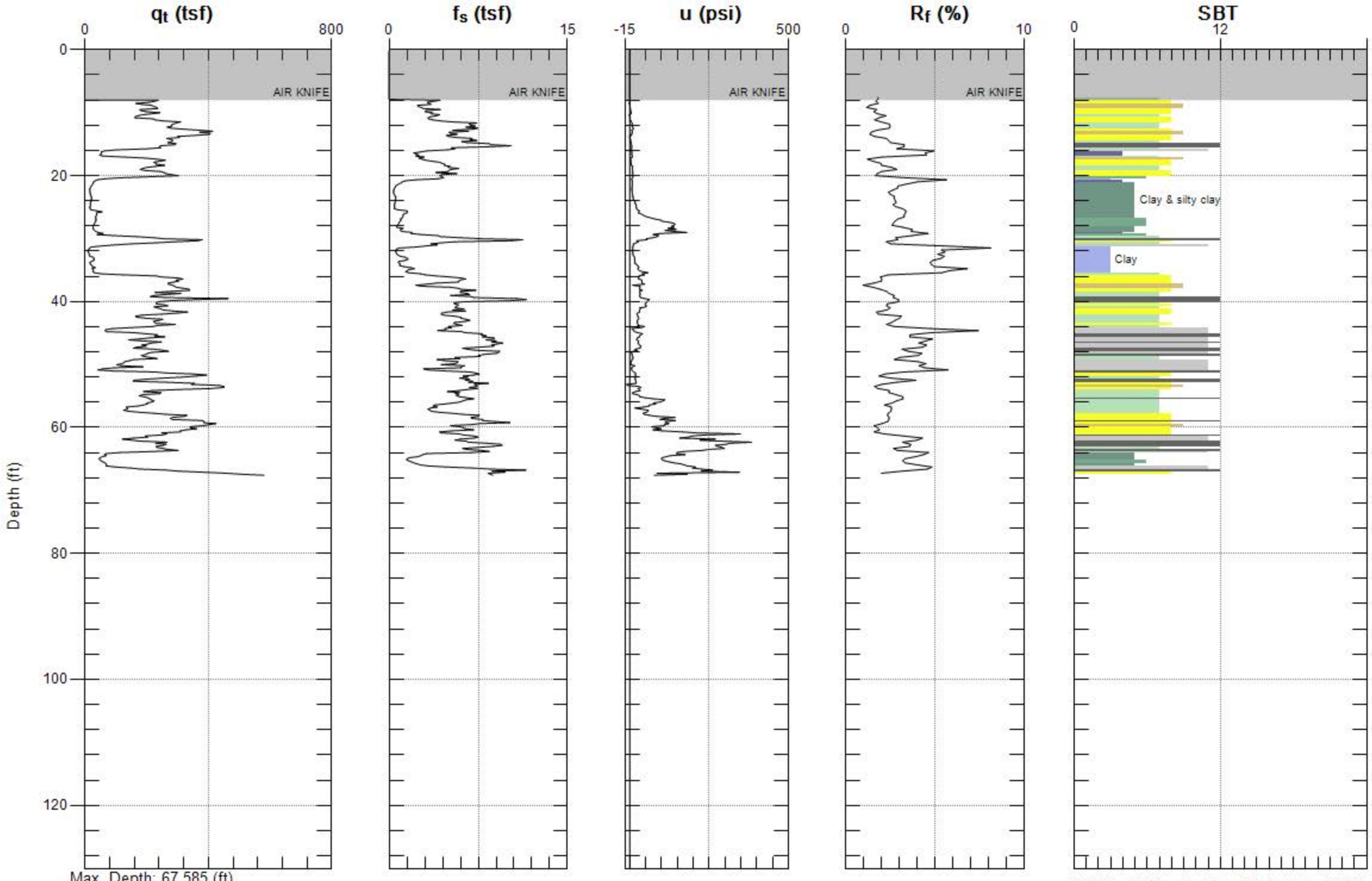
Max. Depth: 125.328 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: SHELL GAS STATION
Sounding: CPT-DB12

Engineer: G.DATT
Date: 6/23/2017 10:35



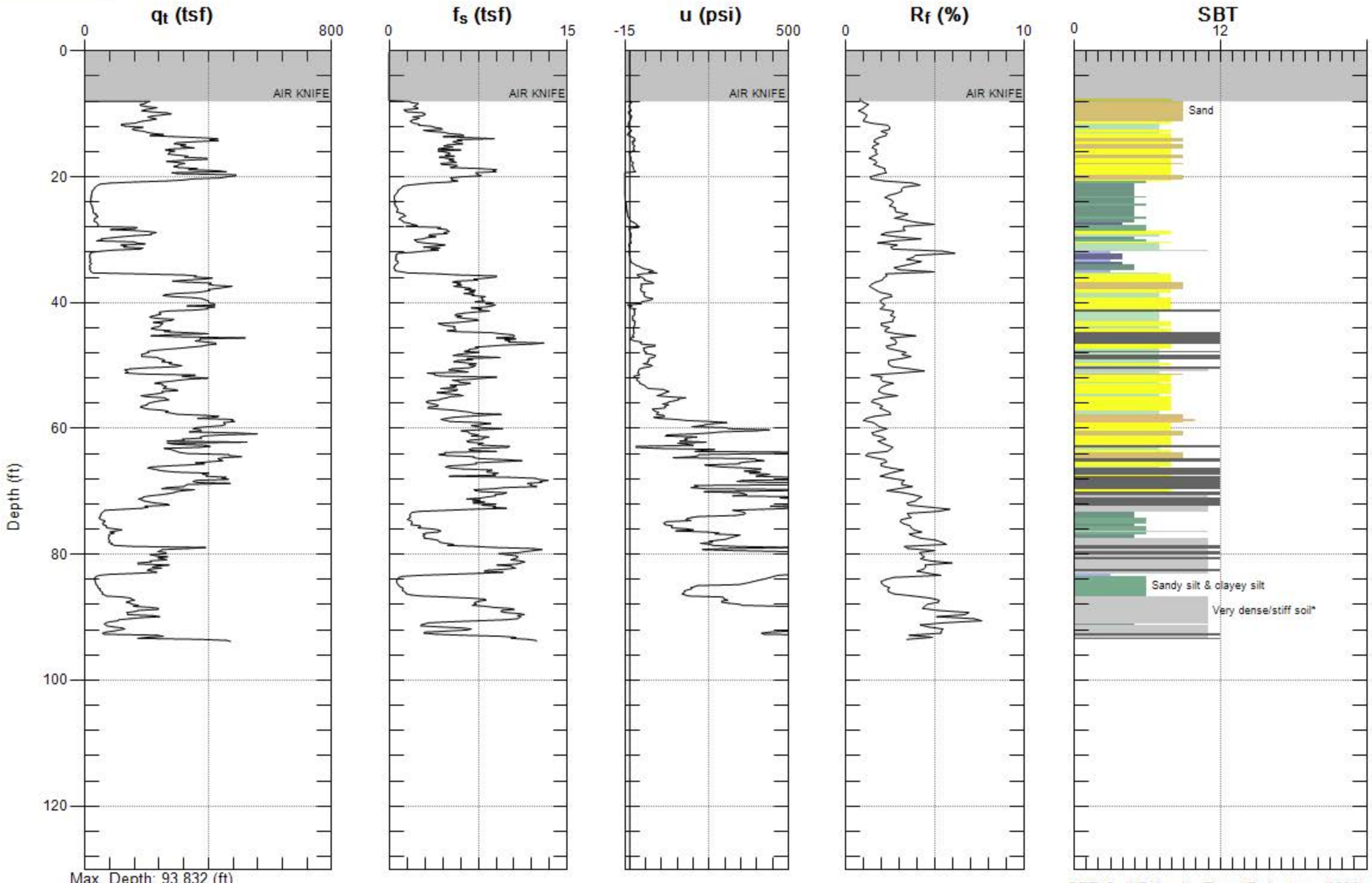
Max. Depth: 67.585 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: SHELL GAS STATION
Sounding: CPT-DB13

Engineer: G.DATT
Date: 6/23/2017 06:38

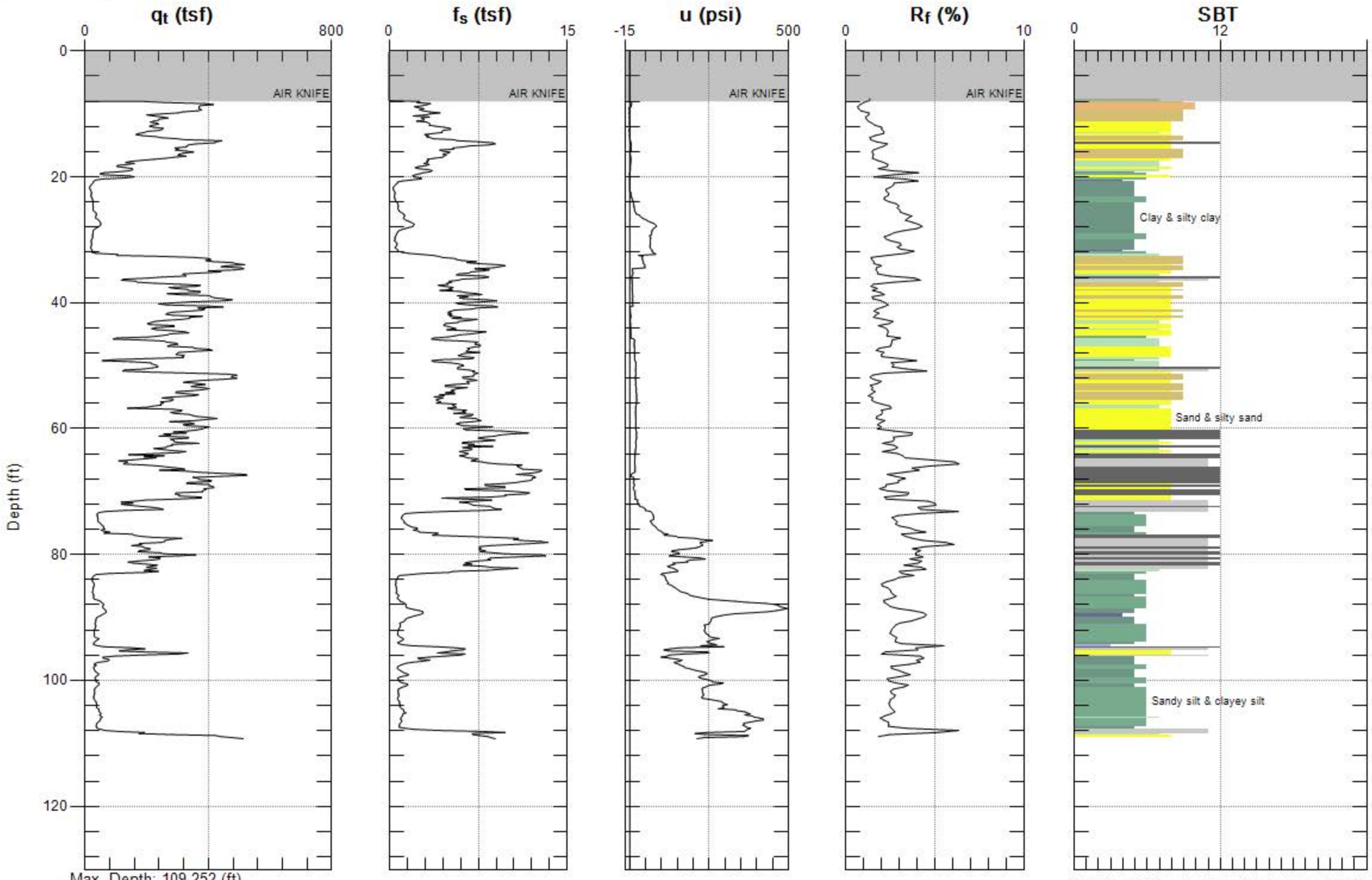


Max. Depth: 93.832 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: SHELL GAS STATION
Sounding: CPT-DB14
Engineer: G.DATT
Date: 6/15/2017 11:03

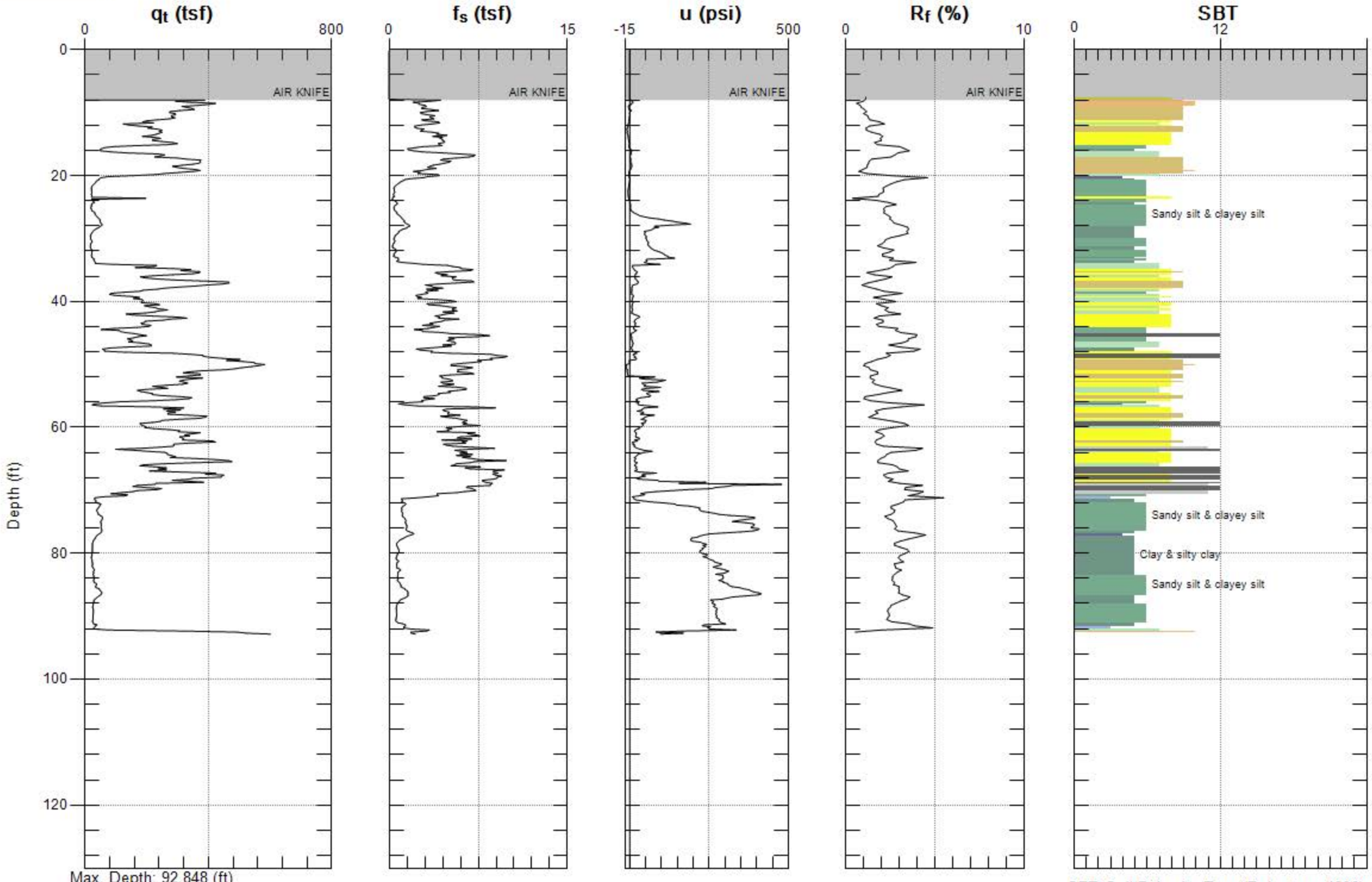


Max. Depth: 109.252 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: SHELL GAS STATION
Sounding: CPT-Db15
Engineer: G.DATT
Date: 6/22/2017 07:14

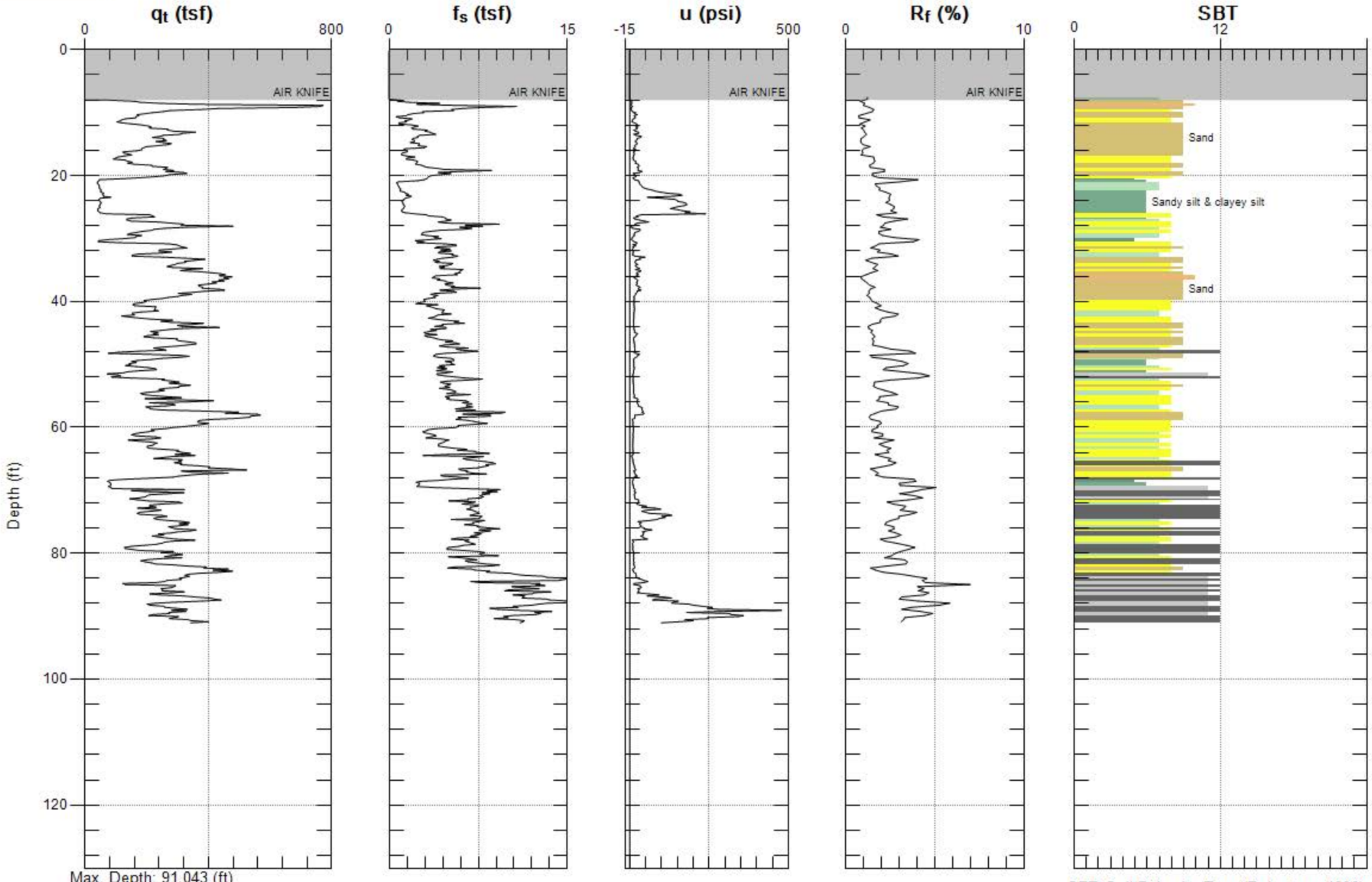


Max. Depth: 92.848 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: SHELL GAS STATION
Sounding: UVOST-1
Engineer: G.DATT
Date: 6/26/2017 12:38



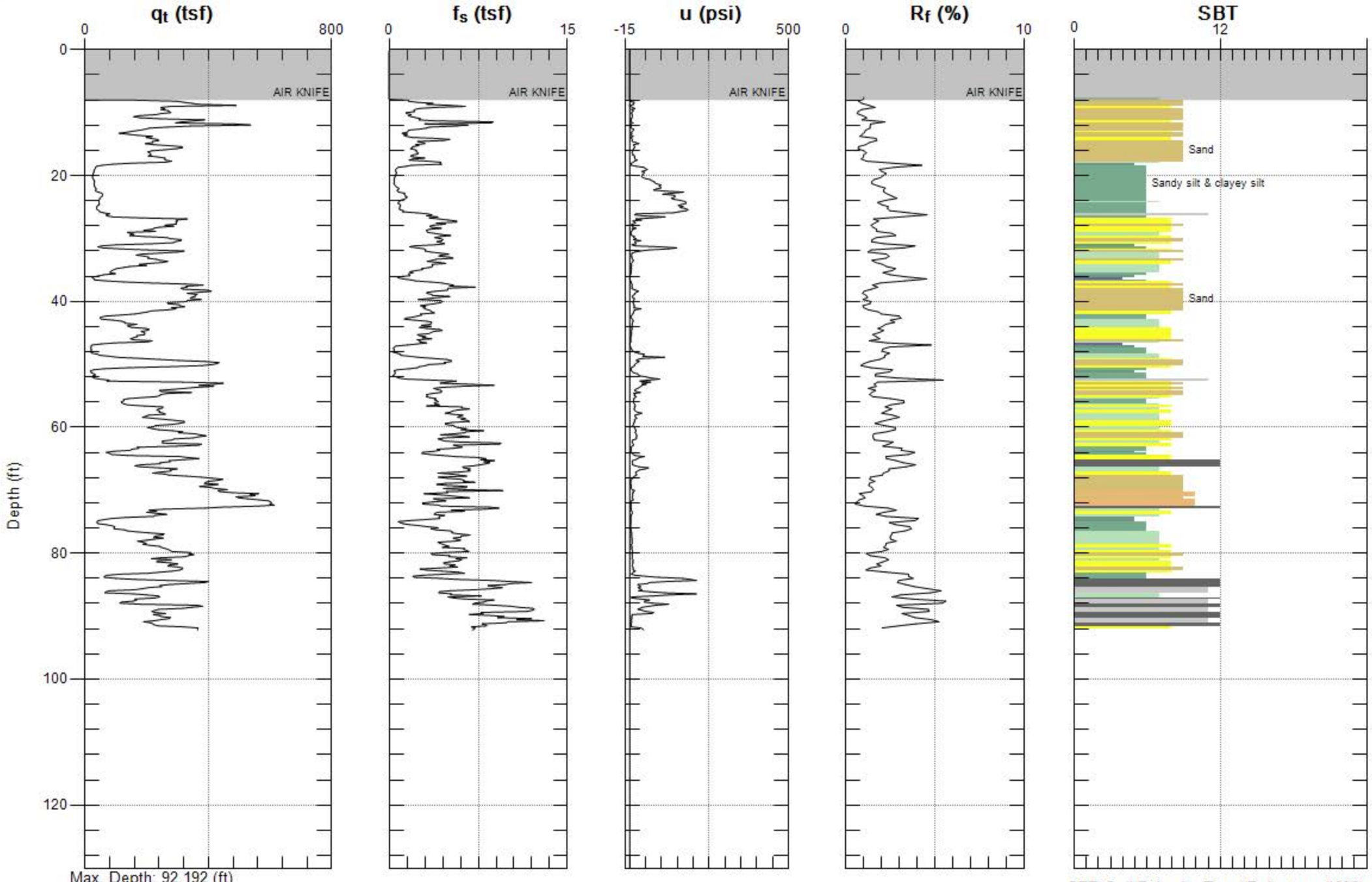
Max. Depth: 91.043 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

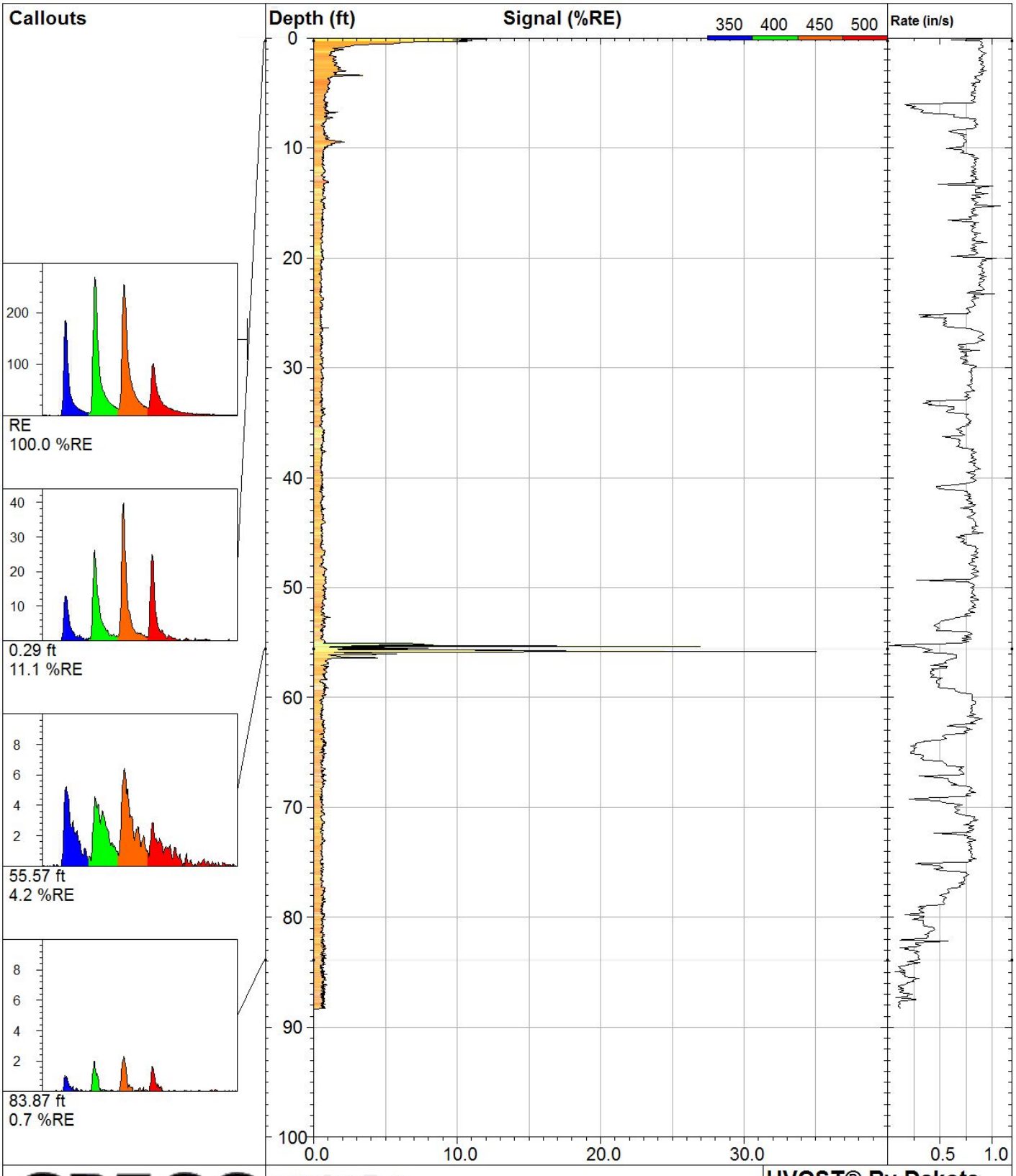
Site: SHELL GAS STATION
Sounding: UVOST-2

Engineer: G.DATT
Date: 6/26/2017 09:27



Max. Depth: 92.192 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

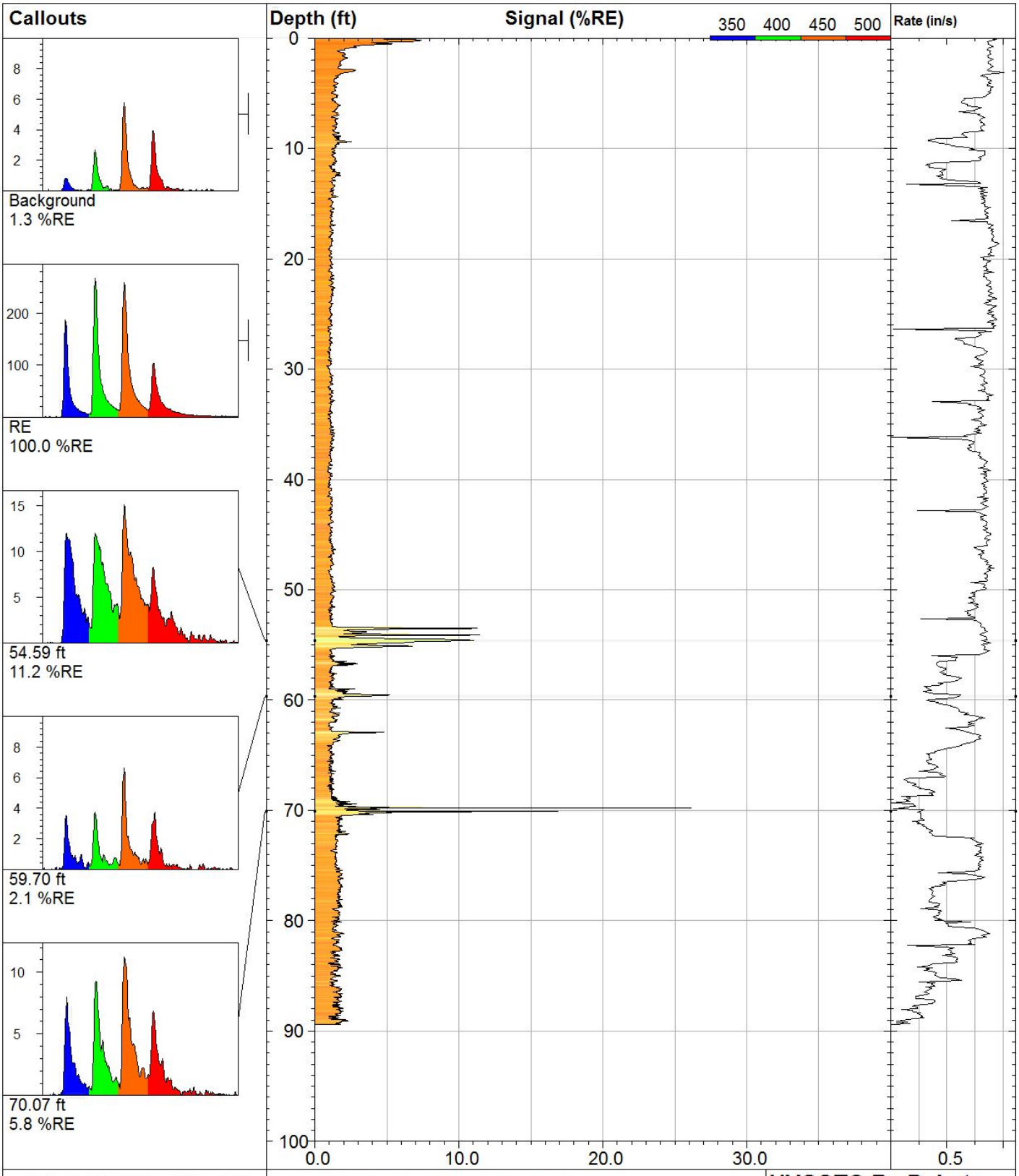


GREGG

UVOST-1

UVOST® By Dakota
www.DakotaTechnologies.com

Site: **TESORO-Livermore**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **88.31 ft**
Client / Job: **ARCTOS Env. / 17-102MA**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **35.2 %RE @ 55.81 ft**
Operator / Unit: **D. Tidwell / UVOST1009**	*Elevation:* **Unavailable**	*Date & Time:* **2017-06-26 12:42 PDT**



UVOST-2_UVOST-2b

UVOST® By Dakota
www.DakotaTechnologies.com

Site: **TESORO-Livermore**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **89.43 ft**
Client / Job: **ARCTOS Env. / 17-102MA**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **27.8 %RE @ 69.78 ft**
Operator / Unit: **D. Tidwell / UVOST1009**	*Elevation:* **Unavailable**	*Date & Time:* **2017-06-26 09:32 PDT**

ATTACHMENT C

LABORATORY ANALYTICAL REPORTS AND CHAIN-OF-CUSTODY FORMS

Scott Stromberg, PG
Arctos Environmental
2332 Fifth Street
Berkeley, California 94710
Fax: 510]525]2180
Email: sstromberg@orionenv.com

RE: Tesoro - Livermore

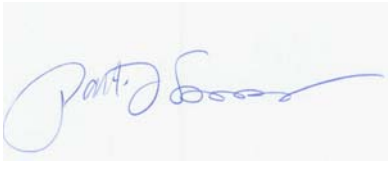
Work Order No.: 1706221

Dear Scott Stromberg:

Torrent Laboratory, Inc. received 2 sample(s) on June 27, 2017 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991 If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.



Patti L Sandrock
QA Officer

July 06, 2017
Date

Date: 7/6/2017

Client: Arctos Environmental

Project: Tesoro - Livermore

Work Order: 1706221

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Unless otherwise indicated in the following narrative, no results have been method and/or field blank corrected.

Reported results relate only to the items/samples tested by the laboratory.

This report shall not be reproduced, except in full, without the written approval of Torrent Analytical, Inc.

Sample Result Summary

Report prepared for: Scott Stromberg
Arctos Environmental

Date Received: 06/27/17
Date Reported: 07/06/17

DB-11-40W 1706221-001

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	42	1200	2100	2280	ug/L

DB-11-60W 1706221-002

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	42	1200	2100	2140	ug/L

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/27/17, 3:50 pm
Date Reported: 07/06/17

Client Sample ID:	DB-11-40W	**Lab Sample ID:**	1706221-001A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/27/17 / 11:30		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method: 5030VOC **Prep Batch Date/Time:** 6/29/17 9:50:00AM
Prep Batch ID: 7903 **Prep Analyst:** BPATEL

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
MTBE	SW8260B	42	3.2	21	ND		ug/L	06/29/17	16:13	BP	425175
tert-Butanol	SW8260B	42	120	210	ND		ug/L	06/29/17	16:13	BP	425175
Diisopropyl ether (DIPE)	SW8260B	42	5.1	21	ND		ug/L	06/29/17	16:13	BP	425175
ETBE	SW8260B	42	2.7	21	ND		ug/L	06/29/17	16:13	BP	425175
Benzene	SW8260B	42	6.6	21	ND		ug/L	06/29/17	16:13	BP	425175
TAME	SW8260B	42	3.0	21	ND		ug/L	06/29/17	16:13	BP	425175
Toluene	SW8260B	42	6.0	21	ND		ug/L	06/29/17	16:13	BP	425175
Ethyl Benzene	SW8260B	42	8.2	21	ND		ug/L	06/29/17	16:13	BP	425175
Total Xylenes	SW8260B	42	17	63	ND		ug/L	06/29/17	16:13	BP	425175
Ethanol	SW8260B	42	210	210	ND	TIC	ug/L	06/29/17	16:13	BP	425175
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/29/17	16:13	BP	425175
(S) Toluene-d8	SW8260B		75.1 - 127		**98**		%	06/29/17	16:13	BP	425175
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**90**		%	06/29/17	16:13	BP	425175

NOTE: Reporting limits were raised due to matrix nature (Oil layer on Top).

Prep Method: 5030GRO **Prep Batch Date/Time:** 6/29/17 9:50:00AM
Prep Batch ID: 7904 **Prep Analyst:** BPATEL

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	42	1200	2100	**2280**	x	ug/L	06/29/17	16:13	BP	425175
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**106**		%	06/29/17	16:13	BP	425175

NOTE: x – Reported TPH value due to non-target heavy hydrocarbons within range of C5-C12 quantified as gasoline
Raised reporting limit - see comment for 8260B analysis..

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/27/17, 3:50 pm
Date Reported: 07/06/17

Client Sample ID:	DB-11-40W	**Lab Sample ID:**	1706221-001B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/27/17 / 11:30		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/29/17 9:50:00AM
Prep Batch ID:	7903	**Prep Analyst:**	BPATEL

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	42	6.1	21	ND		ug/L	06/29/17	16:13	BP	425175
Tetrachloroethylene	SW8260B	42	10.	21	ND		ug/L	06/29/17	16:13	BP	425175
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/29/17	16:13	BP	425175
(S) Toluene-d8	SW8260B		75.1 - 127		**98**		%	06/29/17	16:13	BP	425175
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**90**		%	06/29/17	16:13	BP	425175

NOTE: Reporting limits were raised due to matrix nature (Oil layer on Top).

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/27/17, 3:50 pm
Date Reported: 07/06/17

Client Sample ID:	DB-11-60W	**Lab Sample ID:**	1706221-002A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/27/17 / 12:03		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method: 5030VOC **Prep Batch Date/Time:** 6/29/17 9:50:00AM
Prep Batch ID: 7903 **Prep Analyst:** BPATEL

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
MTBE	SW8260B	42	3.2	21	ND		ug/L	06/29/17	16:41	BP	425175
tert-Butanol	SW8260B	42	120	210	ND		ug/L	06/29/17	16:41	BP	425175
Diisopropyl ether (DIPE)	SW8260B	42	5.1	21	ND		ug/L	06/29/17	16:41	BP	425175
ETBE	SW8260B	42	2.7	21	ND		ug/L	06/29/17	16:41	BP	425175
Benzene	SW8260B	42	6.6	21	ND		ug/L	06/29/17	16:41	BP	425175
TAME	SW8260B	42	3.0	21	ND		ug/L	06/29/17	16:41	BP	425175
Toluene	SW8260B	42	6.0	21	ND		ug/L	06/29/17	16:41	BP	425175
Ethyl Benzene	SW8260B	42	8.2	21	ND		ug/L	06/29/17	16:41	BP	425175
Total Xylenes	SW8260B	42	17	63	ND		ug/L	06/29/17	16:41	BP	425175
Ethanol	SW8260B	42	210	210	ND	TIC	ug/L	06/29/17	16:41	BP	425175
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/29/17	16:41	BP	425175
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/29/17	16:41	BP	425175
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**88**		%	06/29/17	16:41	BP	425175

NOTE: Reporting limits were raised due to matrix nature (Oil layer on Top).

Prep Method: 5030GRO **Prep Batch Date/Time:** 6/29/17 9:50:00AM
Prep Batch ID: 7904 **Prep Analyst:** BPATEL

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
TPH(Gasoline)	8260TPH	42	1200	2100	**2140**	x	ug/L	06/29/17	16:41	BP	425175
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**92.5**		%	06/29/17	16:41	BP	425175

NOTE: x – Reported TPH value due to non-target heavy hydrocarbons within range of C5-C12 quantified as gasoline
Raised reporting limit - see comment for 8260B analysis..

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/27/17, 3:50 pm
Date Reported: 07/06/17

Client Sample ID:	DB-11-60W	**Lab Sample ID:**	1706221-002B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/27/17 / 12:03		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/29/17 9:50:00AM
Prep Batch ID:	7903	**Prep Analyst:**	BPATEL

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	42	6.1	21	ND		ug/L	06/29/17	16:41	BP	425175
Tetrachloroethylene	SW8260B	42	10.	21	ND		ug/L	06/29/17	16:41	BP	425175
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/29/17	16:41	BP	425175
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/29/17	16:41	BP	425175
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**88**		%	06/29/17	16:41	BP	425175

NOTE: Reporting limits were raised due to matrix nature (Oil layer on Top).

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706221	**Prep Method:**	5030VOC	**Prep Date:**	06/29/17	**Prep Batch:**	7903
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/29/2017	**Analytical Batch:**	425175
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier	
Dichlorodifluoromethane	0.26	0.50	ND		
Chloromethane	0.17	0.50	ND		
Vinyl Chloride	0.21	0.50	ND		
Bromomethane	0.21	0.50	0.26		
Chloroethane	0.11	0.50	ND		
Trichlorofluoromethane	0.19	0.50	ND		
1,1-Dichloroethene	0.14	0.50	ND		
Freon 113	0.34	0.50	ND		
Methylene Chloride	0.13	0.50	ND		
trans-1,2-Dichloroethene	0.16	0.50	ND		
MTBE	0.077	0.50	ND		
tert-Butanol	7.4	10	ND		
Diisopropyl ether (DIPE)	0.12	0.50	ND		
1,1-Dichloroethane	0.12	0.50	ND		
ETBE	0.064	0.50	ND		
cis-1,2-Dichloroethene	0.15	0.50	ND		
2,2-Dichloropropane	0.094	0.50	ND		
Bromochloromethane	0.15	0.50	ND		
Chloroform	0.12	0.50	ND		
Carbon Tetrachloride	0.16	0.50	ND		
1,1,1-Trichloroethane	0.16	0.50	ND		
1,1-Dichloropropene	0.19	0.50	ND		
Benzene	0.16	0.50	ND		
TAME	0.072	0.50	ND		
1,2-Dichloroethane	0.11	0.50	ND		
Trichloroethylene	0.15	0.50	ND		
Dibromomethane	0.11	0.50	ND		
1,2-Dichloropropane	0.089	0.50	ND		
Bromodichloromethane	0.076	0.50	ND		
cis-1,3-Dichloropropene	0.078	0.50	ND		
Toluene	0.14	0.50	ND		
Tetrachloroethylene	0.24	0.50	ND		
trans-1,3-Dichloropropene	0.22	0.50	ND		
1,1,2-Trichloroethane	0.076	0.50	ND		
Dibromochloromethane	0.18	0.50	ND		
1,3-Dichloropropane	0.22	0.50	ND		
1,2-Dibromoethane	0.079	0.50	ND		
Chlorobenzene	0.16	0.50	ND		
Ethyl Benzene	0.20	0.50	ND		
1,1,1,2-Tetrachloroethane	0.087	0.50	ND		
m,p-Xylene	0.39	1.0	ND		
o-Xylene	0.15	0.50	ND		

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706221	**Prep Method:**	5030VOC	**Prep Date:**	06/29/17	**Prep Batch:**	7903
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/29/2017	**Analytical Batch:**	425175
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Styrene	0.11	0.50	ND	
Bromoform	0.076	0.50	ND	
Isopropyl Benzene	0.22	0.50	ND	
n-Propylbenzene	0.30	0.50	ND	
Bromobenzene	0.15	0.50	ND	
1,1,2,2-Tetrachloroethane	0.079	0.50	ND	
2-Chlorotoluene	0.25	0.50	ND	
1,3,5-Trimethylbenzene	0.24	0.50	ND	
1,2,3-Trichloropropane	0.15	0.50	ND	
4-Chlorotoluene	0.22	0.50	ND	
tert-Butylbenzene	0.26	0.50	ND	
1,2,4-Trimethylbenzene	0.23	0.50	ND	
sec-Butyl Benzene	0.30	0.50	ND	
p-Isopropyltoluene	0.27	0.50	ND	
1,3-Dichlorobenzene	0.17	0.50	ND	
1,4-Dichlorobenzene	0.18	0.50	ND	
n-Butylbenzene	0.27	0.50	ND	
1,2-Dichlorobenzene	0.16	0.50	ND	
1,2-Dibromo-3-Chloropropane	0.76	2.0	ND	
Hexachlorobutadiene	0.62	2.0	ND	
1,2,4-Trichlorobenzene	0.93	2.0	ND	
Naphthalene	1.2	2.0	ND	
1,2,3-Trichlorobenzene	1.2	2.0	ND	
(S) Dibromofluoromethane			116	
(S) Toluene-d8			96.0	
(S) 4-Bromofluorobenzene			88.1	

Work Order:	1706221	**Prep Method:**	5030GRO	**Prep Date:**	06/29/17	**Prep Batch:**	7904
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/29/2017	**Analytical Batch:**	425175
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH(Gasoline)	29	50	41	
(S) 4-Bromofluorobenzene			84.8	

Torrent LABORATORY, INC.

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1706221	**Prep Method:**	5030VOC	**Prep Date:**	06/29/17	**Prep Batch:**	7903
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/29/2017	**Analytical Batch:**	425175
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	0.14	0.50	ND	17.9	94.5	106	11.7	61.4 - 129	30	
Benzene	0.16	0.50	ND	17.9	101	106	4.32	66.9 - 140	30	
Trichloroethylene	0.15	0.50	ND	17.9	90.6	98.6	8.28	69.3 - 144	30	
Toluene	0.14	0.50	0.26	17.9	97.9	99.7	1.70	76.6 - 123	30	
Chlorobenzene	0.16	0.50	ND	17.9	90.2	93.9	4.26	73.9 - 137	30	
(S) Dibromofluoromethane				17.9	103	108		61.2 - 131		
(S) Toluene-d8				17.9	95.1	96.2		75.1 - 127		
(S) 4-Bromofluorobenzene				17.9	91.0	93.7		64.1 - 120		

Work Order:	1706221	**Prep Method:**	5030GRO	**Prep Date:**	06/29/17	**Prep Batch:**	7904
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/29/2017	**Analytical Batch:**	425175
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	29	50	41	238	120	123	2.76	52.4 - 127	30	
(S) 4-Bromofluorobenzene				11.9	121	109		41.5 - 125		

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit/Reporting Limit/Limit of Quantitation (PQL/RL/LOQ) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs/RLs/LODs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg/m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the analyte is found in the associated method or preparation blank

D - Surrogate is not recoverable due to the necessary dilution of the sample

E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.

H- Indicates that the recommended holding time for the analyte or compound has been exceeded

J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative

NA - Not Analyzed

N/A - Not Applicable

ND - Not Detected at a concentration greater than the PQL/RL or, if reported to the MDL, at greater than the MDL.

NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added

R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts

S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative

X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: Arctos Environmental

Project Name: Tesoro - Livermore

Work Order No.: 1706221

Date and Time Received: 6/27/2017 3:50:00PM

Received By: KE

Physically Logged By: Helena Ueng

Checklist Completed By:

Carrier Name: First Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	8.0	°C
Water-VOA vials have zero headspace?	Yes			
Water-pH acceptable upon receipt?				

pH Checked by: N/A

pH Adjusted by: N/A

Comments:

Login Summary Report

Client ID: TL6226 Arctos Environmental
Project Name: Tesoro - Livermore
Project # : GW Investigation
Report Due Date: 7/6/2017

QC Level: II
TAT Requested: 5+ day:5
Date Received: 6/27/2017
Time Received: 3:50 pm

Comments:

Work Order # : ***1706221***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1706221-001A	DB-11-40W	06/27/17 11:30	Water	08/11/17			VOC_W_GRO VOC_OrionList	
Sample Note:	8260: BTEX, Oxys, TPHg (Report Total Xylenes), and PCE & TCE (report on "B" fraction)							
1706221-001B	DB-11-40W	06/27/17 11:30	Water	08/11/17			VOC_W_PetE/PCE+	
Sample Note:	8260: BTEX, Oxys, TPHg (Report Total Xylenes), and PCE & TCE (report on "B" fraction)							
1706221-002A	DB-11-60W	06/27/17 12:03	Water	08/11/17			VOC_W_GRO VOC_OrionList	
1706221-002B	DB-11-60W	06/27/17 12:03	Water	08/11/17			VOC_W_PetE/PCE+	

Torrent LABORATORY, INC.

Torrent LABORATORY, INC. 483 Sinclair Frontage Road Milpitas, CA 95035 Phone: 408.263.5258 FAX: 408.263.8293 www.torrentlab.com RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1706221

Company Name: Arctos Environmental	Location of Sampling: Tesoro - Livermore
Address: 2332 5th Street	Purpose: GW Investigation
City: Berkeley State: CA Zip Code: 94710	Special Instructions / Comments: Report Total Xylenes
Telephone: 510-525-2180 FAX: 510-525-2392	
REPORT TO: sstromberg@orionenv.com SAMPLER: Gita Datt	P.O. #: 01LV-7A EMAIL: sstromberg@orionenv.com

TURNAROUND TIME: ☐ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☑ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☑ Ground Water ☐ Soil

REPORT FORMAT: ☐ QC Level IV ☑ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	TPHg (8260B)	BTEX (8260B)	7 Oxys (8260B)	Lead Scavengers (82	8260 (TCE & PCE)					REMARKS
001A	DB-11-40 W	6/27/17 1130	W	3	voas	✓	✓	✓		✓					
002A	DB-11-60 W	6/27/17 1207	W	3	voas	✓	✓	✓		✓					

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1	[signature]	Gita Datt	6/27/17	1350	[signature]		6/27/17	1350
2	[signature]		6/27/17	15:50	Katrina [signature]		6-27	1550

Were Samples Received in Good Condition? ☑ Yes ☐ NO Samples on Ice? ☑ Yes ☐ NO Method of Shipment FCS Sample seals intact? ☐ Yes ☐ NO ☑ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange-ments are made. 8°C #1 Page ____ of ____

Log In By: ____ Date: ____ Log In Reviewed By: ____ Date: ____ PE

483 Sinclair Frontage Rd., Milpitas, CA 95035 | tel: 408.263.5258 | fax: 408.263.8293 | www.torrentlab.com

Scott Stromberg, PG
Arctos Environmental
2332 Fifth Street
Berkeley, California 94710
Fax: 510]525]2180
Email: sstromberg@orionenv.com

RE: Tesoro - Livermore

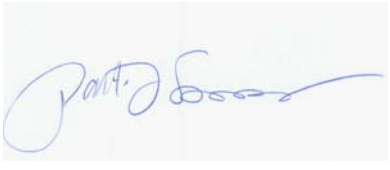
Work Order No.: 1706203

Dear Scott Stromberg:

Torrent Laboratory, Inc. received 4 sample(s) on June 23, 2017 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991 If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.



Patti L Sandrock
QA Officer

July 06, 2017
Date

Date: 7/6/2017

Client: Arctos Environmental

Project: Tesoro - Livermore

Work Order: 1706203

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Unless otherwise indicated in the following narrative, no results have been method and/or field blank corrected.

Reported results relate only to the items/samples tested by the laboratory.

This report shall not be reproduced, except in full, without the written approval of Torrent Analytical, Inc.

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: Scott Stromberg
Arctos Environmental

Date Received: 06/23/17
Date Reported: 07/06/17

DB-13-40W 1706203-001

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	105	3100	5300	15000	ug/L
Benzene	SW8260B	21	3.3	11	4.0	ug/L

DB-13-60W 1706203-002

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	105	3100	5300	37500	ug/L
MTBE	SW8260B	105	8.1	53	13	ug/L
Benzene	SW8260B	105	16	53	130	ug/L
Ethyl Benzene	SW8260B	105	20	53	240	ug/L
Total Xylenes	SW8260B	105	41	160	42	ug/L

DB-12-40W 1706203-003

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	8.4	250	420	974	ug/L
Benzene	SW8260B	4.2	0.66	2.1	1.0	ug/L

DB-12-60W 1706203-004

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	105	3100	5300	21700	ug/L
MTBE	SW8260B	105	8.1	53	8.4	ug/L
Benzene	SW8260B	105	16	53	130	ug/L
Ethyl Benzene	SW8260B	105	20	53	210	ug/L
Total Xylenes	SW8260B	105	41	160	74	ug/L

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-13-40W	**Lab Sample ID:**	1706203-001A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 9:20		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method: 5030VOC **Prep Batch Date/Time:** 6/27/17 10:00:00AM
Prep Batch ID: 7794 **Prep Analyst:** BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
MTBE	SW8260B	21	1.6	11	ND		ug/L	06/27/17	16:13	BP	425062
tert-Butanol	SW8260B	21	62	110	ND		ug/L	06/27/17	16:13	BP	425062
Diisopropyl ether (DIPE)	SW8260B	21	2.5	11	ND		ug/L	06/27/17	16:13	BP	425062
ETBE	SW8260B	21	1.3	11	ND		ug/L	06/27/17	16:13	BP	425062
Benzene	SW8260B	21	3.3	11	**4.0**	J	ug/L	06/27/17	16:13	BP	425062
TAME	SW8260B	21	1.5	11	ND		ug/L	06/27/17	16:13	BP	425062
Toluene	SW8260B	21	3.0	11	ND		ug/L	06/27/17	16:13	BP	425062
Ethyl Benzene	SW8260B	21	4.1	11	ND		ug/L	06/27/17	16:13	BP	425062
Total Xylenes	SW8260B	21	8.3	32	ND		ug/L	06/27/17	16:13	BP	425062
Ethanol	SW8260B	21	110	110	ND	TIC	ug/L	06/27/17	16:13	BP	425062
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/27/17	16:13	BP	425062
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/27/17	16:13	BP	425062
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**98**		%	06/27/17	16:13	BP	425062

NOTE: Reporting limits were raised due to high level of non-target hydrocarbons.

Prep Method: 5030GRO **Prep Batch Date/Time:** 6/26/17 8:30:00AM
Prep Batch ID: 7754 **Prep Analyst:** BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	105	3100	5300	**15000**	x	ug/L	06/26/17	16:32	BP	425024
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**112**		%	06/26/17	16:32	BP	425024

NOTE: x – Result is due to significant contribution from non-target hydrocarbons in C5-C12 range quantified as Gasoline.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-13-40W	**Lab Sample ID:**	1706203-001B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 9:20		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/27/17 10:00:00AM
Prep Batch ID:	7794	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
Trichloroethylene	SW8260B	21	3.1	11	ND		ug/L	06/27/17	16:13	BP	425062
Tetrachloroethylene	SW8260B	21	5.0	11	ND		ug/L	06/27/17	16:13	BP	425062
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/27/17	16:13	BP	425062
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/27/17	16:13	BP	425062
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**98**		%	06/27/17	16:13	BP	425062

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-13-60W	**Lab Sample ID:**	1706203-002A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 9:50		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method: 5030VOC **Prep Batch Date/Time:** 6/26/17 8:30:00AM
Prep Batch ID: 7749 **Prep Analyst:** BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
MTBE	SW8260B	105	8.1	53	**13**	J	ug/L	06/26/17	18:54	BP	425024
tert-Butanol	SW8260B	105	310	530	ND		ug/L	06/26/17	18:54	BP	425024
Diisopropyl ether (DIPE)	SW8260B	105	13	53	ND		ug/L	06/26/17	18:54	BP	425024
ETBE	SW8260B	105	6.7	53	ND		ug/L	06/26/17	18:54	BP	425024
Benzene	SW8260B	105	16	53	**130**		ug/L	06/26/17	18:54	BP	425024
TAME	SW8260B	105	7.6	53	ND		ug/L	06/26/17	18:54	BP	425024
Toluene	SW8260B	105	15	53	ND		ug/L	06/26/17	18:54	BP	425024
Ethyl Benzene	SW8260B	105	20	53	**240**		ug/L	06/26/17	18:54	BP	425024
Total Xylenes	SW8260B	105	41	160	**42**	J	ug/L	06/26/17	18:54	BP	425024
Ethanol	SW8260B	105	530	530	ND	TIC	ug/L	06/26/17	18:54	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	18:54	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**98**		%	06/26/17	18:54	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	18:54	BP	425024

NOTE: Reporting limits were raised due to high level of non-target hydrocarbons.

Prep Method: 5030GRO **Prep Batch Date/Time:** 6/26/17 8:30:00AM
Prep Batch ID: 7754 **Prep Analyst:** BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	105	3100	5300	**37500**	x	ug/L	06/26/17	18:54	BP	425024
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**140**	S	%	06/26/17	18:54	BP	425024

NOTE: x – Result is due to significant contribution from non-target hydrocarbons in C5-C12 range quantified as Gasoline.
S - High surrogate recovery attributed to TPH interference .

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-13-60W	**Lab Sample ID:**	1706203-002B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 9:50		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	105	15	53	ND		ug/L	06/26/17	18:54	BP	425024
Tetrachloroethylene	SW8260B	105	25	53	ND		ug/L	06/26/17	18:54	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	18:54	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**98**		%	06/26/17	18:54	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	18:54	BP	425024

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-12-40W	**Lab Sample ID:**	1706203-003A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 12:32		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method: 5030VOC **Prep Batch Date/Time:** 6/27/17 10:00:00AM
Prep Batch ID: 7794 **Prep Analyst:** BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
MTBE	SW8260B	4.2	0.32	2.1	ND		ug/L	06/27/17	16:42	BP	425062
tert-Butanol	SW8260B	4.2	12	21	ND		ug/L	06/27/17	16:42	BP	425062
Diisopropyl ether (DIPE)	SW8260B	4.2	0.51	2.1	ND		ug/L	06/27/17	16:42	BP	425062
ETBE	SW8260B	4.2	0.27	2.1	ND		ug/L	06/27/17	16:42	BP	425062
Benzene	SW8260B	4.2	0.66	2.1	**1.0**	J	ug/L	06/27/17	16:42	BP	425062
TAME	SW8260B	4.2	0.30	2.1	ND		ug/L	06/27/17	16:42	BP	425062
Toluene	SW8260B	4.2	0.60	2.1	ND		ug/L	06/27/17	16:42	BP	425062
Ethyl Benzene	SW8260B	4.2	0.82	2.1	ND		ug/L	06/27/17	16:42	BP	425062
Total Xylenes	SW8260B	4.2	1.7	6.3	ND		ug/L	06/27/17	16:42	BP	425062
Ethanol	SW8260B	4.2	21	21	ND	TIC	ug/L	06/27/17	16:42	BP	425062
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**100**		%	06/27/17	16:42	BP	425062
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/27/17	16:42	BP	425062
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/27/17	16:42	BP	425062

NOTE: Reporting limits were raised due to high level of non-target hydrocarbons.

Prep Method: 5030GRO **Prep Batch Date/Time:** 7/5/17 9:11:00AM
Prep Batch ID: 7894 **Prep Analyst:** BPATEL

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	8.4	250	420	**974**	x	ug/L	07/05/17	15:34	BP	425159
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**91.9**		%	07/05/17	15:34	BP	425159

NOTE: x – Does not match pattern of reference Gasoline standard. Reported value due to contribution from non-target heavy hydrocarbons into range of C5-C12 quantified as gasoline.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-12-40W	**Lab Sample ID:**	1706203-003B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 12:32		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/27/17 10:00:00AM
Prep Batch ID:	7794	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	4.2	0.61	2.1	ND		ug/L	06/27/17	16:42	BP	425062
Tetrachloroethylene	SW8260B	4.2	1.00	2.1	ND		ug/L	06/27/17	16:42	BP	425062
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**100**		%	06/27/17	16:42	BP	425062
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/27/17	16:42	BP	425062
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/27/17	16:42	BP	425062

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-12-60W	**Lab Sample ID:**	1706203-004A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 14:00		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method: 5030VOC **Prep Batch Date/Time:** 6/26/17 8:30:00AM
Prep Batch ID: 7749 **Prep Analyst:** BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
MTBE	SW8260B	105	8.1	53	**8.4**	J	ug/L	06/26/17	17:29	BP	425024
tert-Butanol	SW8260B	105	310	530	ND		ug/L	06/26/17	17:29	BP	425024
Diisopropyl ether (DIPE)	SW8260B	105	13	53	ND		ug/L	06/26/17	17:29	BP	425024
ETBE	SW8260B	105	6.7	53	ND		ug/L	06/26/17	17:29	BP	425024
Benzene	SW8260B	105	16	53	**130**		ug/L	06/26/17	17:29	BP	425024
TAME	SW8260B	105	7.6	53	ND		ug/L	06/26/17	17:29	BP	425024
Toluene	SW8260B	105	15	53	ND		ug/L	06/26/17	17:29	BP	425024
Ethyl Benzene	SW8260B	105	20	53	**210**		ug/L	06/26/17	17:29	BP	425024
Total Xylenes	SW8260B	105	41	160	**74**	J	ug/L	06/26/17	17:29	BP	425024
Ethanol	SW8260B	105	530	530	ND	TIC	ug/L	06/26/17	17:29	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**120**		%	06/26/17	17:29	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/26/17	17:29	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**98**		%	06/26/17	17:29	BP	425024

NOTE: Reporting limits were raised due to high level of non-target hydrocarbons.
No Ethanol was found by TIC (Tentatively identified compounds).

Prep Method: 5030GRO **Prep Batch Date/Time:** 6/26/17 8:30:00AM
Prep Batch ID: 7754 **Prep Analyst:** BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	105	3100	5300	**21700**	x	ug/L	06/26/17	17:29	BP	425024
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**102**		%	06/26/17	17:29	BP	425024

NOTE: x – Result is due to significant contribution from non-target hydrocarbons in C5-C12 range quantified as Gasoline.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/23/17, 4:40 pm
Date Reported: 07/06/17

Client Sample ID:	DB-12-60W	**Lab Sample ID:**	1706203-004B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/23/17 / 14:00		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	105	15	53	ND		ug/L	06/26/17	17:29	BP	425024
Tetrachloroethylene	SW8260B	105	25	53	ND		ug/L	06/26/17	17:29	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**120**		%	06/26/17	17:29	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**97**		%	06/26/17	17:29	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**98**		%	06/26/17	17:29	BP	425024

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706203	**Prep Method:**	5030VOC	**Prep Date:**	06/26/17	**Prep Batch:**	7749
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier	
Dichlorodifluoromethane	0.26	0.50	ND		
Chloromethane	0.17	0.50	ND		
Vinyl Chloride	0.21	0.50	ND		
Bromomethane	0.21	0.50	0.26		
Chloroethane	0.11	0.50	ND		
Trichlorofluoromethane	0.19	0.50	ND		
1,1-Dichloroethene	0.14	0.50	ND		
Freon 113	0.34	0.50	ND		
Methylene Chloride	0.13	0.50	ND		
trans-1,2-Dichloroethene	0.16	0.50	ND		
MTBE	0.077	0.50	ND		
tert-Butanol	7.4	10	ND		
Diisopropyl ether (DIPE)	0.12	0.50	ND		
1,1-Dichloroethane	0.12	0.50	ND		
ETBE	0.064	0.50	ND		
cis-1,2-Dichloroethene	0.15	0.50	ND		
2,2-Dichloropropane	0.094	0.50	ND		
Bromochloromethane	0.15	0.50	ND		
Chloroform	0.12	0.50	ND		
Carbon Tetrachloride	0.16	0.50	ND		
1,1,1-Trichloroethane	0.16	0.50	ND		
1,1-Dichloropropene	0.19	0.50	0.26		
Benzene	0.16	0.50	ND		
TAME	0.072	0.50	ND		
1,2-Dichloroethane	0.11	0.50	0.11		
Trichloroethylene	0.15	0.50	ND		
Dibromomethane	0.11	0.50	ND		
1,2-Dichloropropane	0.089	0.50	ND		
Bromodichloromethane	0.076	0.50	ND		
cis-1,3-Dichloropropene	0.078	0.50	ND		
Toluene	0.14	0.50	ND		
Tetrachloroethylene	0.24	0.50	ND		
trans-1,3-Dichloropropene	0.22	0.50	ND		
1,1,2-Trichloroethane	0.076	0.50	ND		
Dibromochloromethane	0.18	0.50	ND		
1,3-Dichloropropane	0.22	0.50	ND		
1,2-Dibromoethane	0.079	0.50	ND		
Chlorobenzene	0.16	0.50	ND		
Ethyl Benzene	0.20	0.50	ND		
1,1,1,2-Tetrachloroethane	0.087	0.50	ND		
m,p-Xylene	0.39	1.0	ND		
o-Xylene	0.15	0.50	ND		

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706203	**Prep Method:**	5030VOC	**Prep Date:**	06/26/17	**Prep Batch:**	7749
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Styrene	0.11	0.50	ND	
Bromoform	0.076	0.50	ND	
Isopropyl Benzene	0.22	0.50	ND	
n-Propylbenzene	0.30	0.50	ND	
Bromobenzene	0.15	0.50	ND	
1,1,2,2-Tetrachloroethane	0.079	0.50	ND	
2-Chlorotoluene	0.25	0.50	ND	
1,3,5-Trimethylbenzene	0.24	0.50	ND	
1,2,3-Trichloropropane	0.15	0.50	ND	
4-Chlorotoluene	0.22	0.50	ND	
tert-Butylbenzene	0.26	0.50	ND	
1,2,4-Trimethylbenzene	0.23	0.50	ND	
sec-Butyl Benzene	0.30	0.50	ND	
p-Isopropyltoluene	0.27	0.50	ND	
1,3-Dichlorobenzene	0.17	0.50	ND	
1,4-Dichlorobenzene	0.18	0.50	ND	
n-Butylbenzene	0.27	0.50	ND	
1,2-Dichlorobenzene	0.16	0.50	ND	
1,2-Dibromo-3-Chloropropane	0.76	2.0	ND	
Hexachlorobutadiene	0.62	2.0	ND	
1,2,4-Trichlorobenzene	0.93	2.0	ND	
Naphthalene	1.2	2.0	ND	
1,2,3-Trichlorobenzene	1.2	2.0	ND	
(S) Dibromofluoromethane			111	
(S) Toluene-d8			96.7	
(S) 4-Bromofluorobenzene			101	

Work Order:	1706203	**Prep Method:**	5030GRO	**Prep Date:**	06/26/17	**Prep Batch:**	7754
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH(Gasoline)	29	50	42	
(S) 4-Bromofluorobenzene			98.3	

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706203	**Prep Method:**	5030VOC	**Prep Date:**	06/27/17	**Prep Batch:**	7794
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/27/2017	**Analytical Batch:**	425062
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier	
Dichlorodifluoromethane	0.26	0.50	ND		
Chloromethane	0.17	0.50	ND		
Vinyl Chloride	0.21	0.50	ND		
Bromomethane	0.21	0.50	ND		
Chloroethane	0.11	0.50	ND		
Trichlorofluoromethane	0.19	0.50	ND		
1,1-Dichloroethene	0.14	0.50	ND		
Freon 113	0.34	0.50	ND		
Methylene Chloride	0.13	0.50	ND		
trans-1,2-Dichloroethene	0.16	0.50	ND		
MTBE	0.077	0.50	ND		
tert-Butanol	7.4	10	ND		
Diisopropyl ether (DIPE)	0.12	0.50	ND		
1,1-Dichloroethane	0.12	0.50	ND		
ETBE	0.064	0.50	ND		
cis-1,2-Dichloroethene	0.15	0.50	ND		
2,2-Dichloropropane	0.094	0.50	ND		
Bromochloromethane	0.15	0.50	ND		
Chloroform	0.12	0.50	ND		
Carbon Tetrachloride	0.16	0.50	ND		
1,1,1-Trichloroethane	0.16	0.50	ND		
1,1-Dichloropropene	0.19	0.50	0.27		
Benzene	0.16	0.50	ND		
TAME	0.072	0.50	ND		
1,2-Dichloroethane	0.11	0.50	0.12		
Trichloroethylene	0.15	0.50	ND		
Dibromomethane	0.11	0.50	ND		
1,2-Dichloropropane	0.089	0.50	ND		
Bromodichloromethane	0.076	0.50	ND		
cis-1,3-Dichloropropene	0.078	0.50	ND		
Toluene	0.14	0.50	ND		
Tetrachloroethylene	0.24	0.50	ND		
trans-1,3-Dichloropropene	0.22	0.50	ND		
1,1,2-Trichloroethane	0.076	0.50	ND		
Dibromochloromethane	0.18	0.50	ND		
1,3-Dichloropropane	0.22	0.50	ND		
1,2-Dibromoethane	0.079	0.50	ND		
Chlorobenzene	0.16	0.50	ND		
Ethyl Benzene	0.20	0.50	ND		
1,1,1,2-Tetrachloroethane	0.087	0.50	ND		
m,p-Xylene	0.39	1.0	ND		
o-Xylene	0.15	0.50	ND		

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706203	**Prep Method:**	5030VOC	**Prep Date:**	06/27/17	**Prep Batch:**	7794
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/27/2017	**Analytical Batch:**	425062
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Styrene	0.11	0.50	ND	
Bromoform	0.076	0.50	ND	
Isopropyl Benzene	0.22	0.50	ND	
n-Propylbenzene	0.30	0.50	ND	
Bromobenzene	0.15	0.50	ND	
1,1,2,2-Tetrachloroethane	0.079	0.50	ND	
2-Chlorotoluene	0.25	0.50	ND	
1,3,5-Trimethylbenzene	0.24	0.50	ND	
1,2,3-Trichloropropane	0.15	0.50	ND	
4-Chlorotoluene	0.22	0.50	ND	
tert-Butylbenzene	0.26	0.50	ND	
1,2,4-Trimethylbenzene	0.23	0.50	ND	
sec-Butyl Benzene	0.30	0.50	ND	
p-Isopropyltoluene	0.27	0.50	ND	
1,3-Dichlorobenzene	0.17	0.50	ND	
1,4-Dichlorobenzene	0.18	0.50	ND	
n-Butylbenzene	0.27	0.50	0.27	
1,2-Dichlorobenzene	0.16	0.50	ND	
1,2-Dibromo-3-Chloropropane	0.76	2.0	ND	
Hexachlorobutadiene	0.62	2.0	ND	
1,2,4-Trichlorobenzene	0.93	2.0	ND	
Naphthalene	1.2	2.0	ND	
1,2,3-Trichlorobenzene	1.2	2.0	ND	
(S) Dibromofluoromethane			114	
(S) Toluene-d8			94.8	
(S) 4-Bromofluorobenzene			97.8	

Work Order:	1706203	**Prep Method:**	5030GRO	**Prep Date:**	07/05/17	**Prep Batch:**	7894
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	7/5/2017	**Analytical Batch:**	425159
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH(Gasoline)	29	50	49	
(S) 4-Bromofluorobenzene			72.2	

Torrent LABORATORY, INC.

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1706203	**Prep Method:**	5030VOC	**Prep Date:**	06/26/17	**Prep Batch:**	7749
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	0.14	0.50	ND	17.9	95.2	93.3	1.78	61.4 - 129	30	
Benzene	0.16	0.50	ND	17.9	112	111	1.00	66.9 - 140	30	
Trichloroethylene	0.15	0.50	ND	17.9	103	104	1.08	69.3 - 144	30	
Toluene	0.14	0.50	0.26	17.9	108	106	2.09	76.6 - 123	30	
Chlorobenzene	0.16	0.50	ND	17.9	107	104	3.17	73.9 - 137	30	
(S) Dibromofluoromethane				17.9	123	120		61.2 - 131		
(S) Toluene-d8				17.9	114	112		75.1 - 127		
(S) 4-Bromofluorobenzene				17.9	117	118		64.1 - 120		

Work Order:	1706203	**Prep Method:**	5030GRO	**Prep Date:**	06/26/17	**Prep Batch:**	7754
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/27/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	29	50	42	238	115	117	1.81	52.4 - 127	30	
(S) 4-Bromofluorobenzene				11.9	113	119		41.5 - 125		

Work Order:	1706203	**Prep Method:**	5030VOC	**Prep Date:**	06/27/17	**Prep Batch:**	7794
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/27/2017	**Analytical Batch:**	425062
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	0.14	0.50	ND	17.9	74.0	77.8	5.17	61.4 - 129	30	
Benzene	0.16	0.50	ND	17.9	87.0	96.3	10.4	66.9 - 140	30	
Trichloroethylene	0.15	0.50	ND	17.9	86.3	87.1	1.29	69.3 - 144	30	
Toluene	0.14	0.50	ND	17.9	91.5	93.1	1.82	76.6 - 123	30	
Chlorobenzene	0.16	0.50	ND	17.9	88.1	93.0	5.57	73.9 - 137	30	
(S) Dibromofluoromethane				17.9	96.8	103		61.2 - 131		
(S) Toluene-d8				17.9	95.5	98.8		75.1 - 127		
(S) 4-Bromofluorobenzene				17.9	97.8	102		64.1 - 120		

Torrent LABORATORY, INC.

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1706203	**Prep Method:**	5030GRO	**Prep Date:**	07/05/17	**Prep Batch:**	7894
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	7/5/2017	**Analytical Batch:**	425159
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	29	50	49	238	113	104	8.49	52.4 - 127	30	
(S) 4-Bromofluorobenzene				11.9	114	99.4		41.5 - 125		

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit/Reporting Limit/Limit of Quantitation (PQL/RL/LOQ) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs/RLs/LODs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg/m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the analyte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
ND - Not Detected at a concentration greater than the PQL/RL or, if reported to the MDL, at greater than the MDL.
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: Arctos Environmental

Project Name: Tesoro - Livermore

Work Order No.: 1706203

Date and Time Received: 6/23/2017 4:40:00PM

Received By: NG

Physically Logged By: Helena Ueng

Checklist Completed By:

Carrier Name: First Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	8.0	°C
Water-VOA vials have zero headspace?	Yes			
Water-pH acceptable upon receipt?	N/A			

pH Checked by: N/A

pH Adjusted by: N/A

Comments:

Login Summary Report

Client ID: TL6226 Arctos Environmental
Project Name: Tesoro - Livermore
Project # : GW Investigation
Report Due Date: 7/6/2017

QC Level: II
TAT Requested: 5+ day:5
Date Received: 6/23/2017
Time Received: 4:40 pm

Comments:

Work Order # : ***1706203***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1706203-001A	DB-13-40W	06/23/17 9:20	Water	08/07/17			EDF VOC_W_GRO VOC_OrionList VOC_W_PetE/PCE+	
Sample Note:	8260: BTEX, Oxys, TPHg (Report Total Xylenes), and PCE & TCE (report on "B" fraction)							
1706203-001B	DB-13-40W	06/23/17 9:20	Water	08/07/17			VOC_W_PetE/PCE+	
Sample Note:	"B" fraction for reporting PCE& TCE							
1706203-002A	DB-13-60W	06/23/17 9:50	Water	08/07/17			VOC_OrionList VOC_W_GRO VOC_W_PetE/PCE+	
1706203-002B	DB-13-60W	06/23/17 9:50	Water	08/07/17			VOC_W_PetE/PCE+	
1706203-003A	DB-12-40W	06/23/17 12:32	Water	08/07/17			VOC_OrionList VOC_W_PetE/PCE+ VOC_W_GRO	
1706203-003B	DB-12-40W	06/23/17 12:32	Water	08/07/17			VOC_W_PetE/PCE+	
1706203-004A	DB-12-60W	06/23/17 14:00	Water	08/07/17			VOC_OrionList VOC_W_GRO VOC_W_PetE/PCE+	
1706203-004B	DB-12-60W	06/23/17 14:00	Water	08/07/17			VOC_W_PetE/PCE+	

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1706203

Company Name: Arctos Environmental	Location of Sampling: Tesoro - Livermore
Address: 2332 5th Street	Purpose: GW Investigation
City: Berkeley / State: CA / Zip Code: 94710	Special Instructions / Comments: Report Total Xylenes
Telephone: 510-525-2180 FAX: 510-525-2392	
REPORT TO: sstromberg@orionenv.com SAMPLER: Gita Datt	P.O. #: 01LV-7A EMAIL: sstromberg@orionenv.com

TURNAROUND TIME:
- ☐ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day
- ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours
- ☑ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE:
- ☐ Storm Water ☐ Air
- ☐ Waste Water ☐ Other
- ☑ Ground Water
- ☐ Soil

REPORT FORMAT:
- ☐ QC Level IV
- ☑ EDF
- ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	TPHg (8260B)	BTEX (8260B)	7 Oxys (8260B)	Lead Scavengers (82	8260 (PCE & TCE)					REMARKS
001A	DB-13-40W	6/23/17 0920	W	3	VOAs	✓	✓	✓		✓					
002A	DB-13-60W	6/23/17 0950	W	3	VOAs	✓	✓	✓		✓					
003A	DB-12-40W	6/23/17 1232	W	3	VOAs	✓	✓	✓		✓					
004A	DB-12-60W	6/23/17 1400	W	3	VOAs	✓	✓	✓		✓					
															Temp 8°C #1

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		Gita Datt	6/23/17	1500			6/23/17	3:00
2	Relinquished By:	Print:	Date: 6/23/17	Time: 4:40	Received By:	Print: NAVIN G	Date: 6-23-17	Time: 4:40 P.M.

Were Samples Received in Good Condition? ☒ Yes ☐ NO Samples on Ice? ☒ Yes ☐ NO Method of Shipment FC Sample seals intact? ☐ Yes ☐ NO ☒ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 1

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Scott Stromberg, PG
Arctos Environmental
2332 Fifth Street
Berkeley, California 94710
Fax: 510]525]2180
Email: sstromberg@orionenv.com

RE: Tesoro - Livermore

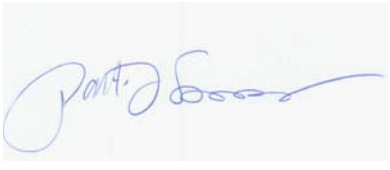
Work Order No.: 1706187

Dear Scott Stromberg:

Torrent Laboratory, Inc. received 4 sample(s) on June 22, 2017 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991 If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.



Patti L Sandrock
QA Officer

June 29, 2017
Date

Date: 6/29/2017

Client: Arctos Environmental

Project: Tesoro - Livermore

Work Order: 1706187

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Unless otherwise indicated in the following narrative, no results have been method and/or field blank corrected.

Reported results relate only to the items/samples tested by the laboratory.

This report shall not be reproduced, except in full, without the written approval of Torrent Analytical, Inc.

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: Scott Stromberg
Arctos Environmental

Date Received: 06/22/17
Date Reported: 06/29/17

DB-15-40W 1706187-001

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit

All compounds were non-detectable for this sample.

DB-15-60W 1706187-002

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	1	29	50	1470	ug/L

DB-14-40W 1706187-003

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	1.24	36	62	576	ug/L
Benzene	SW8260B	1.24	0.19	0.62	1.9	ug/L

DB-14-60W 1706187-004

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH(Gasoline)	8260TPH	42	1200	2100	51000	ug/L
Benzene	SW8260B	42	6.6	21	110	ug/L
Ethyl Benzene	SW8260B	42	8.2	21	710	ug/L
Total Xylenes	SW8260B	42	17	63	230	ug/L

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-15-40W	**Lab Sample ID:**	1706187-001A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 9:46		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
MTBE	SW8260B	1.17	0.090	0.59	ND		ug/L	06/26/17	13:12	BP	425024
tert-Butanol	SW8260B	1.17	3.4	5.9	ND		ug/L	06/26/17	13:12	BP	425024
Diisopropyl ether (DIPE)	SW8260B	1.17	0.14	0.59	ND		ug/L	06/26/17	13:12	BP	425024
ETBE	SW8260B	1.17	0.075	0.59	ND		ug/L	06/26/17	13:12	BP	425024
Benzene	SW8260B	1.17	0.18	0.59	ND		ug/L	06/26/17	13:12	BP	425024
TAME	SW8260B	1.17	0.084	0.59	ND		ug/L	06/26/17	13:12	BP	425024
Toluene	SW8260B	1.17	0.17	0.59	ND		ug/L	06/26/17	13:12	BP	425024
Ethyl Benzene	SW8260B	1.17	0.23	0.59	ND		ug/L	06/26/17	13:12	BP	425024
Total Xylenes	SW8260B	1.17	0.46	1.8	ND		ug/L	06/26/17	13:12	BP	425024
Ethanol	SW8260B	1.17	5.9	5.9	ND	TIC	ug/L	06/26/17	13:12	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	13:12	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**96**		%	06/26/17	13:12	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**98**		%	06/26/17	13:12	BP	425024

NOTE: Reporting limits were raised due to sediment in all VOAs.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-15-40W	**Lab Sample ID:**	1706187-001A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 9:46		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030GRO	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7754	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	1.17	34	59	ND		ug/L	06/26/17	13:12	BP	425024
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**113**		%	06/26/17	13:12	BP	425024

NOTE: Raised reporting limit - see comment for 8260B analysis.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-15-40W	**Lab Sample ID:**	1706187-001B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 9:46		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	1.17	0.17	0.59	ND		ug/L	06/26/17	13:12	BP	425024
Tetrachloroethylene	SW8260B	1.17	0.28	0.59	ND		ug/L	06/26/17	13:12	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	13:12	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**96**		%	06/26/17	13:12	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**98**		%	06/26/17	13:12	BP	425024

NOTE: Reporting limits were raised due to sediment in all VOAs.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-15-60W	**Lab Sample ID:**	1706187-002A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 10:13		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
MTBE	SW8260B	1	0.077	0.50	ND		ug/L	06/26/17	13:41	BP	425024
tert-Butanol	SW8260B	1	2.9	5.0	ND		ug/L	06/26/17	13:41	BP	425024
Diisopropyl ether (DIPE)	SW8260B	1	0.12	0.50	ND		ug/L	06/26/17	13:41	BP	425024
ETBE	SW8260B	1	0.064	0.50	ND		ug/L	06/26/17	13:41	BP	425024
Benzene	SW8260B	1	0.16	0.50	ND		ug/L	06/26/17	13:41	BP	425024
TAME	SW8260B	1	0.072	0.50	ND		ug/L	06/26/17	13:41	BP	425024
Toluene	SW8260B	1	0.14	0.50	ND		ug/L	06/26/17	13:41	BP	425024
Ethyl Benzene	SW8260B	1	0.20	0.50	ND		ug/L	06/26/17	13:41	BP	425024
Total Xylenes	SW8260B	1	0.39	1.5	ND		ug/L	06/26/17	13:41	BP	425024
Ethanol	SW8260B	1	5.0	5.0	ND	TIC	ug/L	06/26/17	13:41	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**98**		%	06/26/17	13:41	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**100**		%	06/26/17	13:41	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	13:41	BP	425024

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-15-60W	**Lab Sample ID:**	1706187-002A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 10:13		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030GRO	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7754	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	1	29	50	**1470**	x	ug/L	06/26/17	13:41	BP	425024
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**101**		%	06/26/17	13:41	BP	425024

NOTE: x – Reported TPH value due to significant amount of non-target hydrocarbons within range of C5-C12 quantified as gasoline.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-15-60W	**Lab Sample ID:**	1706187-002B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 10:13		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
Trichloroethylene	SW8260B	1	0.15	0.50	ND		ug/L	06/26/17	13:41	BP	425024
Tetrachloroethylene	SW8260B	1	0.24	0.50	ND		ug/L	06/26/17	13:41	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**98**		%	06/26/17	13:41	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**100**		%	06/26/17	13:41	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	13:41	BP	425024

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-14-40W	**Lab Sample ID:**	1706187-003A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 14:34		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
MTBE	SW8260B	1.24	0.095	0.62	ND		ug/L	06/26/17	14:09	BP	425024
tert-Butanol	SW8260B	1.24	3.7	6.2	ND		ug/L	06/26/17	14:09	BP	425024
Diisopropyl ether (DIPE)	SW8260B	1.24	0.15	0.62	ND		ug/L	06/26/17	14:09	BP	425024
ETBE	SW8260B	1.24	0.079	0.62	ND		ug/L	06/26/17	14:09	BP	425024
Benzene	SW8260B	1.24	0.19	0.62	**1.9**		ug/L	06/26/17	14:09	BP	425024
TAME	SW8260B	1.24	0.089	0.62	ND		ug/L	06/26/17	14:09	BP	425024
Toluene	SW8260B	1.24	0.18	0.62	ND		ug/L	06/26/17	14:09	BP	425024
Ethyl Benzene	SW8260B	1.24	0.24	0.62	ND		ug/L	06/26/17	14:09	BP	425024
Total Xylenes	SW8260B	1.24	0.49	1.9	ND		ug/L	06/26/17	14:09	BP	425024
Ethanol	SW8260B	1.24	6.2	6.2	ND	TIC	ug/L	06/26/17	14:09	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	14:09	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**100**		%	06/26/17	14:09	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	14:09	BP	425024

NOTE: Reporting limits were raised due to sediment in all VOAs.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-14-40W	**Lab Sample ID:**	1706187-003A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 14:34		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030GRO	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7754	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	1.24	36	62	**576**	x	ug/L	06/26/17	14:09	BP	425024
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**101**		%	06/26/17	14:09	BP	425024

NOTE: Raised reporting limit - see comment for 8260B analysis..

x – Reported TPH value due to significant amount of non-target hydrocarbons within range of C5-C12 quantified as gasoline.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-14-40W	**Lab Sample ID:**	1706187-003B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 14:34		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	1.24	0.18	0.62	ND		ug/L	06/26/17	14:09	BP	425024
Tetrachloroethylene	SW8260B	1.24	0.29	0.62	ND		ug/L	06/26/17	14:09	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	14:09	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**100**		%	06/26/17	14:09	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	14:09	BP	425024

NOTE: Reporting limits were raised due to sediment in all VOAs.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-14-60W	**Lab Sample ID:**	1706187-004A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 15:00		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
MTBE	SW8260B	42	3.2	21	ND		ug/L	06/26/17	17:57	BP	425024
tert-Butanol	SW8260B	42	120	210	ND		ug/L	06/26/17	17:57	BP	425024
Diisopropyl ether (DIPE)	SW8260B	42	5.1	21	ND		ug/L	06/26/17	17:57	BP	425024
ETBE	SW8260B	42	2.7	21	ND		ug/L	06/26/17	17:57	BP	425024
Benzene	SW8260B	42	6.6	21	**110**		ug/L	06/26/17	17:57	BP	425024
TAME	SW8260B	42	3.0	21	ND		ug/L	06/26/17	17:57	BP	425024
Toluene	SW8260B	42	6.0	21	ND		ug/L	06/26/17	17:57	BP	425024
Ethyl Benzene	SW8260B	42	8.2	21	**710**		ug/L	06/26/17	17:57	BP	425024
Total Xylenes	SW8260B	42	17	63	**230**		ug/L	06/26/17	17:57	BP	425024
Ethanol	SW8260B	42	210	210	ND	TIC	ug/L	06/26/17	17:57	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	17:57	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**100**		%	06/26/17	17:57	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	17:57	BP	425024

NOTE: Reporting limits were raised due to high level of non-target hydrocarbons.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-14-60W	**Lab Sample ID:**	1706187-004A
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 15:00		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030GRO	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7754	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
TPH(Gasoline)	8260TPH	42	1200	2100	**51000**	x	ug/L	06/26/17	17:57	BP	425024
(S) 4-Bromofluorobenzene	8260TPH		41.5 - 125		**99.7**		%	06/26/17	17:57	BP	425024

NOTE: x – Reported TPH value due to significant amount of non-target hydrocarbons within range of C5-C12 quantified as gasoline.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Scott Stromberg
Arctos Environmental

Date/Time Received: 06/22/17, 5:35 pm
Date Reported: 06/29/17

Client Sample ID:	DB-14-60W	**Lab Sample ID:**	1706187-004B
Project Name/Location:	Tesoro - Livermore	**Sample Matrix:**	Water
Project Number:	GW Investigation		
Date/Time Sampled:	06/22/17 / 15:00		
SDG:			
Tag Number:	Tesoro Livermore		

Prep Method:	5030VOC	**Prep Batch Date/Time:**	6/26/17 8:30:00AM
Prep Batch ID:	7749	**Prep Analyst:**	BALI

Parameters:	Analysis Method	DF	MDL	PQL	Results	Q	Units	Analyzed	Time	By	Analytical Batch
The results shown below are reported using their MDL.											
Trichloroethylene	SW8260B	42	6.1	21	ND		ug/L	06/26/17	17:57	BP	425024
Tetrachloroethylene	SW8260B	42	10.	21	ND		ug/L	06/26/17	17:57	BP	425024
(S) Dibromofluoromethane	SW8260B		61.2 - 131		**110**		%	06/26/17	17:57	BP	425024
(S) Toluene-d8	SW8260B		75.1 - 127		**100**		%	06/26/17	17:57	BP	425024
(S) 4-Bromofluorobenzene	SW8260B		64.1 - 120		**100**		%	06/26/17	17:57	BP	425024

NOTE: Reporting limits were raised due to high level of non-target hydrocarbons.

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706187	**Prep Method:**	5030VOC	**Prep Date:**	06/26/17	**Prep Batch:**	7749
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier	
Dichlorodifluoromethane	0.26	0.50	ND		
Chloromethane	0.17	0.50	ND		
Vinyl Chloride	0.21	0.50	ND		
Bromomethane	0.21	0.50	0.26		
Chloroethane	0.11	0.50	ND		
Trichlorofluoromethane	0.19	0.50	ND		
1,1-Dichloroethene	0.14	0.50	ND		
Freon 113	0.34	0.50	ND		
Methylene Chloride	0.13	0.50	ND		
trans-1,2-Dichloroethene	0.16	0.50	ND		
MTBE	0.077	0.50	ND		
tert-Butanol	7.4	10	ND		
Diisopropyl ether (DIPE)	0.12	0.50	ND		
1,1-Dichloroethane	0.12	0.50	ND		
ETBE	0.064	0.50	ND		
cis-1,2-Dichloroethene	0.15	0.50	ND		
2,2-Dichloropropane	0.094	0.50	ND		
Bromochloromethane	0.15	0.50	ND		
Chloroform	0.12	0.50	ND		
Carbon Tetrachloride	0.16	0.50	ND		
1,1,1-Trichloroethane	0.16	0.50	ND		
1,1-Dichloropropene	0.19	0.50	0.26		
Benzene	0.16	0.50	ND		
TAME	0.072	0.50	ND		
1,2-Dichloroethane	0.11	0.50	0.11		
Trichloroethylene	0.15	0.50	ND		
Dibromomethane	0.11	0.50	ND		
1,2-Dichloropropane	0.089	0.50	ND		
Bromodichloromethane	0.076	0.50	ND		
cis-1,3-Dichloropropene	0.078	0.50	ND		
Toluene	0.14	0.50	ND		
Tetrachloroethylene	0.24	0.50	ND		
trans-1,3-Dichloropropene	0.22	0.50	ND		
1,1,2-Trichloroethane	0.076	0.50	ND		
Dibromochloromethane	0.18	0.50	ND		
1,3-Dichloropropane	0.22	0.50	ND		
1,2-Dibromoethane	0.079	0.50	ND		
Chlorobenzene	0.16	0.50	ND		
Ethyl Benzene	0.20	0.50	ND		
1,1,1,2-Tetrachloroethane	0.087	0.50	ND		
m,p-Xylene	0.39	1.0	ND		

Torrent LABORATORY, INC.

MB Summary Report

Work Order:	1706187	**Prep Method:**	5030VOC	**Prep Date:**	06/26/17	**Prep Batch:**	7749
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
o-Xylene	0.15	0.50	ND	
Styrene	0.11	0.50	ND	
Bromoform	0.076	0.50	ND	
Isopropyl Benzene	0.22	0.50	ND	
n-Propylbenzene	0.30	0.50	ND	
Bromobenzene	0.15	0.50	ND	
1,1,2,2-Tetrachloroethane	0.079	0.50	ND	
2-Chlorotoluene	0.25	0.50	ND	
1,3,5-Trimethylbenzene	0.24	0.50	ND	
1,2,3-Trichloropropane	0.15	0.50	ND	
4-Chlorotoluene	0.22	0.50	ND	
tert-Butylbenzene	0.26	0.50	ND	
1,2,4-Trimethylbenzene	0.23	0.50	ND	
sec-Butyl Benzene	0.30	0.50	ND	
p-Isopropyltoluene	0.27	0.50	ND	
1,3-Dichlorobenzene	0.17	0.50	ND	
1,4-Dichlorobenzene	0.18	0.50	ND	
n-Butylbenzene	0.27	0.50	ND	
1,2-Dichlorobenzene	0.16	0.50	ND	
1,2-Dibromo-3-Chloropropane	0.76	2.0	ND	
Hexachlorobutadiene	0.62	2.0	ND	
1,2,4-Trichlorobenzene	0.93	2.0	ND	
Naphthalene	1.2	2.0	ND	
1,2,3-Trichlorobenzene	1.2	2.0	ND	
(S) Dibromofluoromethane			111	
(S) Toluene-d8			96.7	
(S) 4-Bromofluorobenzene			101	

Work Order:	1706187	**Prep Method:**	5030GRO	**Prep Date:**	06/26/17	**Prep Batch:**	7754
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH(Gasoline)	29	50	42	
(S) 4-Bromofluorobenzene			98.3	

Torrent LABORATORY, INC.

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1706187	**Prep Method:**	5030VOC	**Prep Date:**	06/26/17	**Prep Batch:**	7749
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/26/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	0.14	0.50	ND	17.9	95.2	93.3	1.78	61.4 - 129	30	
Benzene	0.16	0.50	ND	17.9	112	111	1.00	66.9 - 140	30	
Trichloroethylene	0.15	0.50	ND	17.9	103	104	1.08	69.3 - 144	30	
Toluene	0.14	0.50	0.26	17.9	108	106	2.09	76.6 - 123	30	
Chlorobenzene	0.16	0.50	ND	17.9	107	104	3.17	73.9 - 137	30	
(S) Dibromofluoromethane				17.9	123	120		61.2 - 131		
(S) Toluene-d8				17.9	114	112		75.1 - 127		
(S) 4-Bromofluorobenzene				17.9	117	118		64.1 - 120		

Work Order:	1706187	**Prep Method:**	5030GRO	**Prep Date:**	06/26/17	**Prep Batch:**	7754
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	6/27/2017	**Analytical Batch:**	425024
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	29	50	42	238	115	117	1.81	52.4 - 127	30	
(S) 4-Bromofluorobenzene				11.9	113	119		41.5 - 125		

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit/Reporting Limit/Limit of Quantitation (PQL/RL/LOQ) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs/RLs/LODs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg/m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the analyte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
ND - Not Detected at a concentration greater than the PQL/RL or, if reported to the MDL, at greater than the MDL.
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: Arctos Environmental

Project Name: Tesoro - Livermore

Work Order No.: 1706187

Date and Time Received: 6/22/2017 5:35:00PM

Received By: Helena Ueng

Physically Logged By: Helena Ueng

Checklist Completed By:

Carrier Name: First Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	6.0	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by: N/A

pH Adjusted by: N/A

Comments:

Login Summary Report

Client ID: TL6226 Arctos Environmental
Project Name: Tesoro - Livermore
Project # : GW Investigation
Report Due Date: 6/29/2017

QC Level: II
TAT Requested: 5+ day:5
Date Received: 6/22/2017
Time Received: 5:35 pm

Comments:

Work Order # : ***1706187***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1706187-001A	DB-15-40W	06/22/17 9:46	Water	08/06/17			EDF VOC_W_GRO VOC_OrionList	
1706187-001B	DB-15-40W	06/22/17 9:46	Water	08/06/17			VOC_W_PetE/PCE+	
Sample Note:	Same sample as 001A; fraction logged for TCE/PCE							
1706187-002A	DB-15-60W	06/22/17 10:13	Water	08/06/17			VOC_OrionList VOC_W_GRO	
1706187-002B	DB-15-60W	06/22/17 10:13	Water	08/06/17			VOC_W_PetE/PCE+	
1706187-003A	DB-14-40W	06/22/17 14:34	Water	08/06/17			VOC_OrionList VOC_W_GRO	
1706187-003B	DB-14-40W	06/22/17 14:34	Water	08/06/17			VOC_W_PetE/PCE+	
1706187-004A	DB-14-60W	06/22/17 15:00	Water	08/06/17			VOC_OrionList VOC_W_GRO	
1706187-004B	DB-14-60W	06/22/17 15:00	Water	08/06/17			VOC_W_PetE/PCE+	

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1706187

Company Name: Arctos Environmental	Location of Sampling: Tesoro - Livermore
Address: 2332 5th Street	Purpose: GW Investigation
City: Berkeley State: CA Zip Code: 94710	Special Instructions / Comments: Report Total Xylenes
Telephone: 510-525-2180 FAX: 510-525-2392	
REPORT TO: sstromberg@orionenv.com SAMPLER: Gita Datt	P.O. #: 01LV-7A EMAIL: sstromberg@orionenv.com

TURNAROUND TIME:
- ☐ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day
- ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours
- ☑ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE:
- ☐ Storm Water ☐ Air
- ☐ Waste Water ☐ Other
- ☑ Ground Water
- ☐ Soil

REPORT FORMAT:
- ☐ QC Level IV
- ☑ EDF
- ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	TPHg (8260B)	BTEX (8260B)	7 Oxys (8260B)	Lead Scavengers (82 +)	8260C PCE & TCE					REMARKS
001A	DB-15-40W	6/22/17 0946	water	3	VOAs	✓	✓	✓		✓					
002A	DB-15-60W	6/22/17 1013	water	3	VOAs	✓	✓	✓		✓					
003A	DB-14-40W	6/22/17 1434	W	3	VOAs	✓	✓	✓		✓					
004A	DB-14-60W	6/22/17 1500	W	3	VOAs	✓	✓	✓		✓					
															Temp. 6°C #1

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1	[signature]	Gita Datt	6/22/17	1305	[signature]		6/22/17	305
2	[signature]		6/22/17	1535	[signature]	NAVIN G.	6/22/17	5:35 P.M

Were Samples Received in Good Condition? ☒ Yes ☐ NO Samples on Ice? ☒ Yes ☐ NO Method of Shipment: FC Sample seals intact? ☐ Yes ☐ NO ☒ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 1 of 1

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

ATTACHMENT D

ALAMEDA COUNTY ENVIRONMENTAL HEALTH CORRESPONDENCE

Scott Stromberg

From: Roe, Dilan, Env. Health <Dilan.Roe@acgov.org>
Sent: Tuesday, September 12, 2017 11:34 AM
To: Scott Stromberg; Waldron, Kyle (Kyle.A.Waldron@andeavor.com)
Cc: Emily Chow; French, Tamami, Env. Health
Subject: Fuel Leak Case No. RO0000434, Geotracker Global ID No. T0600101410, Beacon # 3604,1619 1ST, Livermore, CA

Good Morning Scott and Kyle:

Thank you for meeting with Alameda County Department of Environmental (ACDEH) on September 11, 2017 and providing the meeting notes and presentation slides.

Your request for continued non-operation of the soil vapor extraction system and shut down of the oxygen injection system is approved. Please ensure that these systems are protected until authorization is given by ACDEH to decommission them. It seems appropriate to conduct rebound testing through the collection of groundwater samples from site monitoring wells to monitor/evaluate the effect of the oxygen injection system shut down. Please include a scope of work for groundwater monitoring to evaluate rebound in the work plan for installation of a downgradient monitoring well to delineate the plume extent.

TECHNICAL REPORT REQUEST

Please submit technical reports to ACDEH (Attention: Dilan Roe), according to the following naming convention and schedule:

- **November 9, 2017 –** Groundwater Monitoring Well Installation & Rebound Testing Work Plan (RO0000434_WP_R_yyyy-mm-dd)
- **November 9, 2017 –** Soil and Groundwater Investigation Report (RO0000434_SWI_R_yyyy-mm-dd)

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline the responsibilities of a responsible party in response to an unauthorized release from a petroleum UST system, and require your compliance with this request.

Dilan Roe, PE, C73703
Chief – Land Water Division
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, CA
510.567.6767; Ext. 36767
QIC: 30440
dilan.roe@acgov.org

From: Scott Stromberg [mailto:sstromberg@orionenv.com]
Sent: Monday, September 11, 2017 2:16 PM
To: Roe, Dilan, Env. Health <Dilan.Roe@acgov.org>; French, Tamami, Env. Health <Tamami.French@acgov.org>
Cc: Waldron, Kyle (Kyle.A.Waldron@andeavor.com) <Kyle.A.Waldron@andeavor.com>; Emily Chow <echow@orionenv.com>
Subject: Tesoro Livermore - ACEH RO0434 - 9/7 meeting summary and O2 system shutdown request

Dilan and Tamami,

Thanks for taking the time to meet with us last Thursday. As we discussed in the meeting, attached are the presentation slides with some additional notes added, plus summary notes for the meeting.

In the meeting notes we summarized the upcoming deliverables and action items, which are as follows:

---

1. Arctos/Tesoro will submit a report summarizing the data gap investigation activities conducted in June and July 2017. The report will include a summary of the plume stability analysis conducted by Joe Ricker with EarthCon. Joe has uploaded the plume stability analysis presentation to a file transfer site and you can download the presentation here: https://we.tl/52TO4R76IJ. The link is active for 1 week from today.

2. Based on significant decreases in mass and lateral extent of the plume and decreasing trends in COCs, the onsite oxygen injection system is no longer warranted for former source area remediation. **Arctos and Tesoro are requesting approval to shut down the oxygen injection system**. In addition, Arctos and Tesoro are requesting continued non-operation of the SVE system on site. The systems will remain on site until final decommissioning.

3. As requested by ACEH, Arctos and Tesoro will submit a work plan for installation of one groundwater monitoring well in the downgradient area of the plume.

4. Arctos will upload missing Geotracker data for the site.

Please respond to this email to (1) approve shut down of the oxygen injection system, and (2) confirm the request for one downgradient monitoring well.

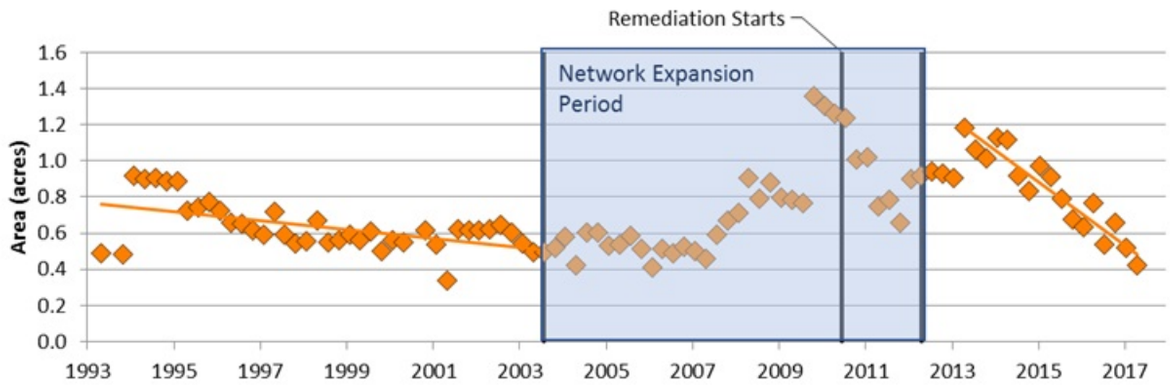
Thanks -

Scott Stromberg
Orion Environmental Inc.

ATTACHMENT E

EXCERPTS FROM RICKER PLUME STABILITY EVALUATION

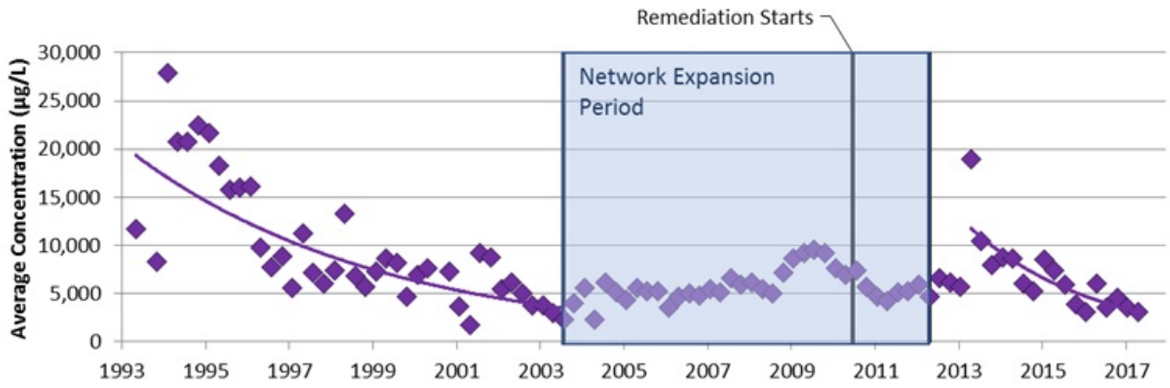
TPHg Plume Area Trend



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

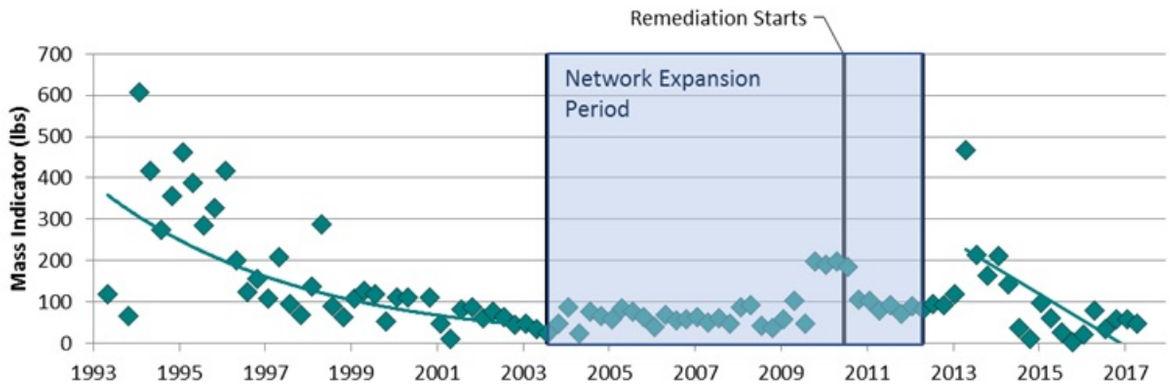
TPHg Plume Average Concentration Trend



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

TPHg Plume Mass Indicator Trend



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: 99% Confidence
Regression: >99% Confidence

Zoom

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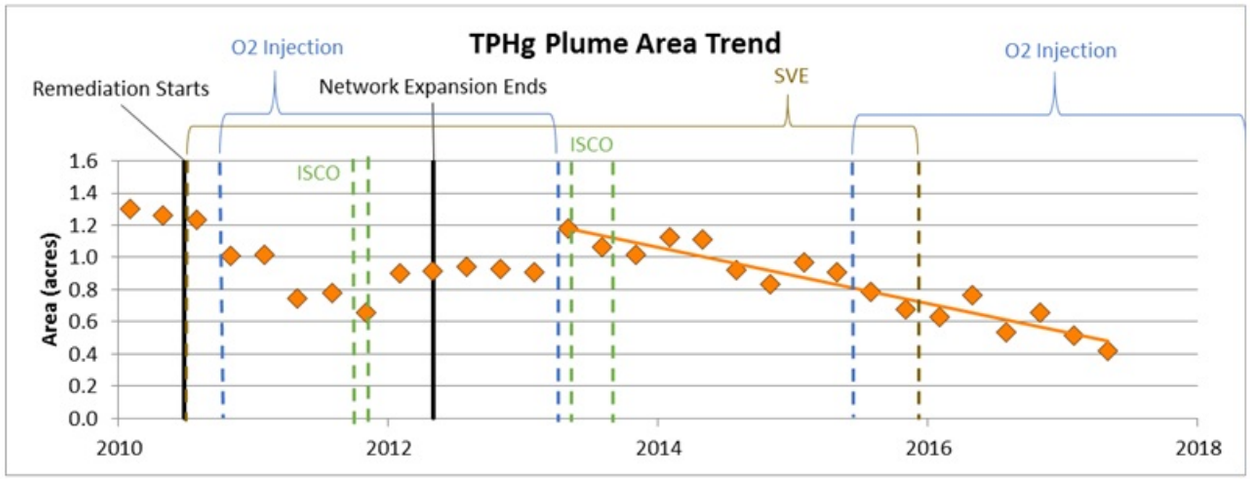
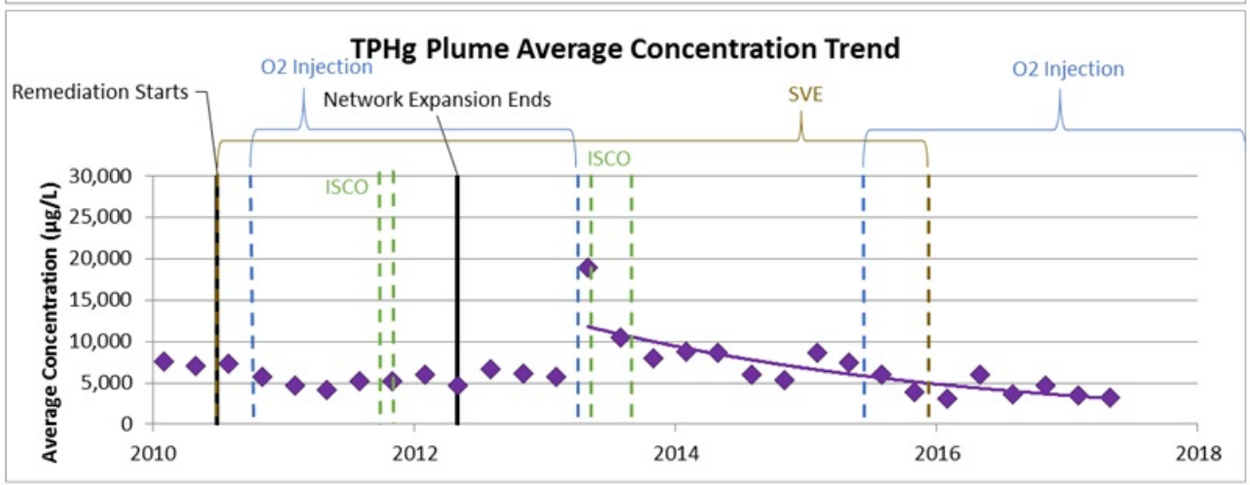


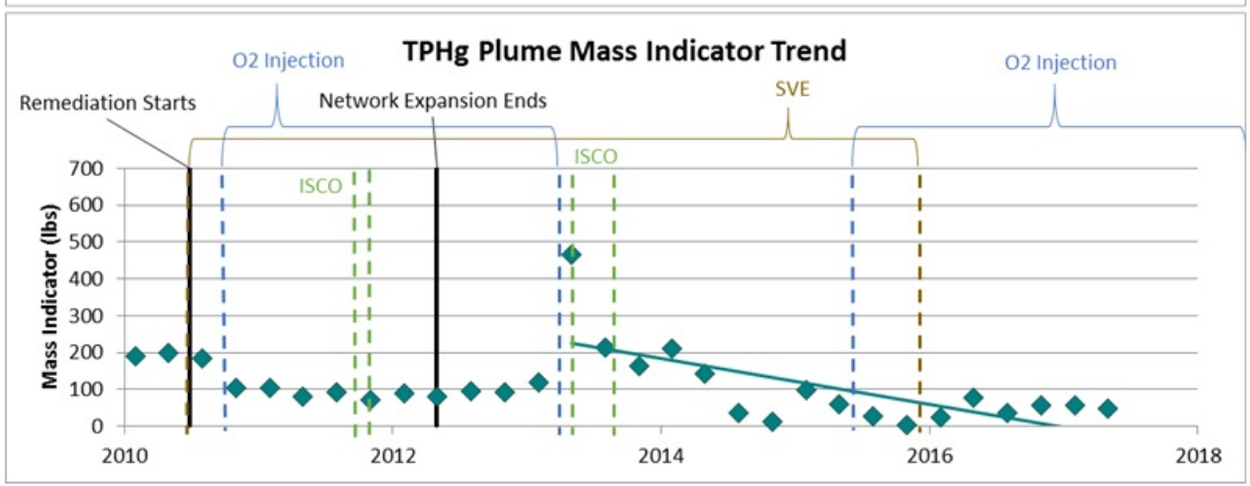
May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence



May-1993 to Aug-2003
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: 99% Confidence
Regression: >99% Confidence

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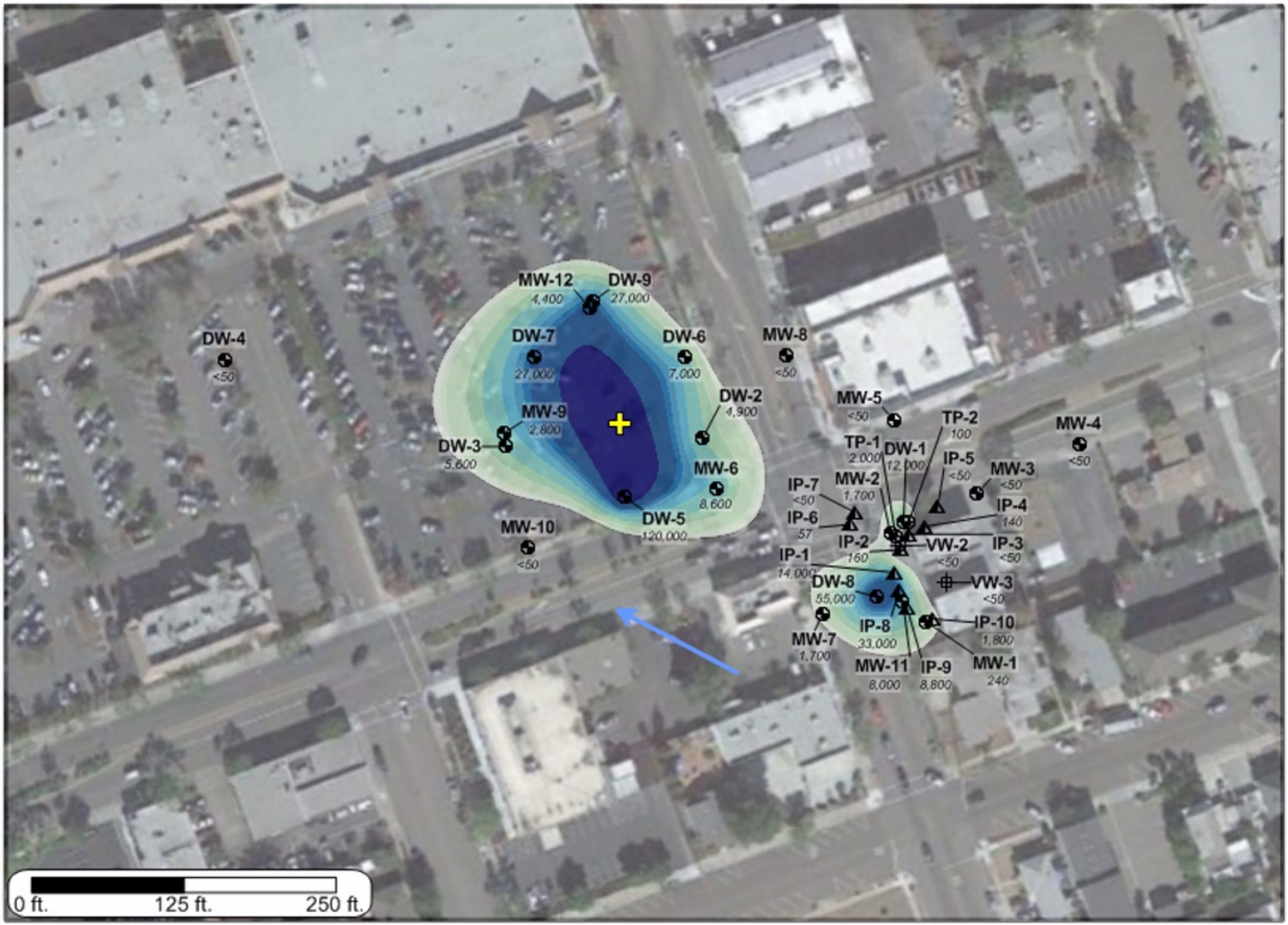

TPHg
May-2013

Concentration (µg/L)

50,000
25,000
20,000
15,000
10,000
5,000
3,000
1,500
1,250
1,000

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- 112 — Concentration (µg/L)
- NS (146) — Well Not Sampled (Assigned Value Shown)
- General Groundwater Flow
- Plume Center of Mass

Plume Characteristics

Plume Area: **1.2 acres**
Plume Average Concentration: **18,910 µg/L**
Plume Mass Indicator: **467 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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TPHg
May-2017

Concentration (µg/L)

50,000
25,000
20,000
15,000
10,000
5,000
3,000
1,500
1,250
1,000

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- 112 — Concentration (µg/L)
- NS (146) — Well Not Sampled (Assigned Value Shown)
- General Groundwater Flow
- Plume Center of Mass

Plume Characteristics

Plume Area: **0.42 acres**
Plume Average Concentration: **3,162 µg/L**
Plume Mass Indicator: **47.1 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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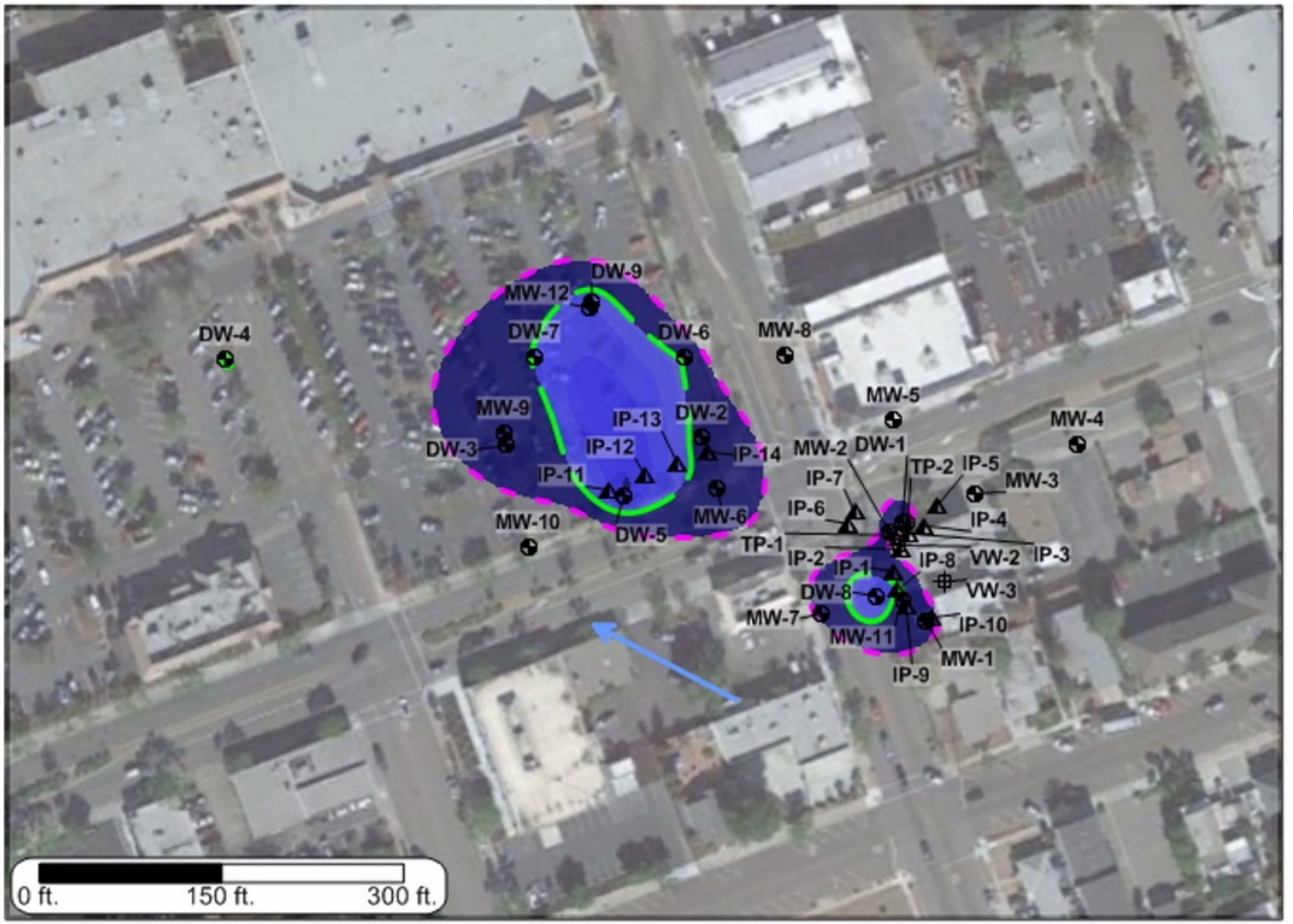
Concentration (µg/L)

1,000 1,250 1,500 3,000 5,000 10,000 15,000 20,000 25,000 50,000

0 ft. 300 ft. 600 ft.

Plume Differences May-2013 vs May-2017

TPHg



Spatial Change Indicator

-1 0 1

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- General Groundwater Flow
- Plume Center of Mass
- May-2013 Plume Boundary
- May-2017 Plume Boundary

Plume Characteristics

Area: **64% Decrease**
Average Concentration: **83% Decrease**
Mass Indicator: **90% Decrease**
Mass Increase: **0.04 lbs Increase**
Mass Decrease: **412 lbs Decrease**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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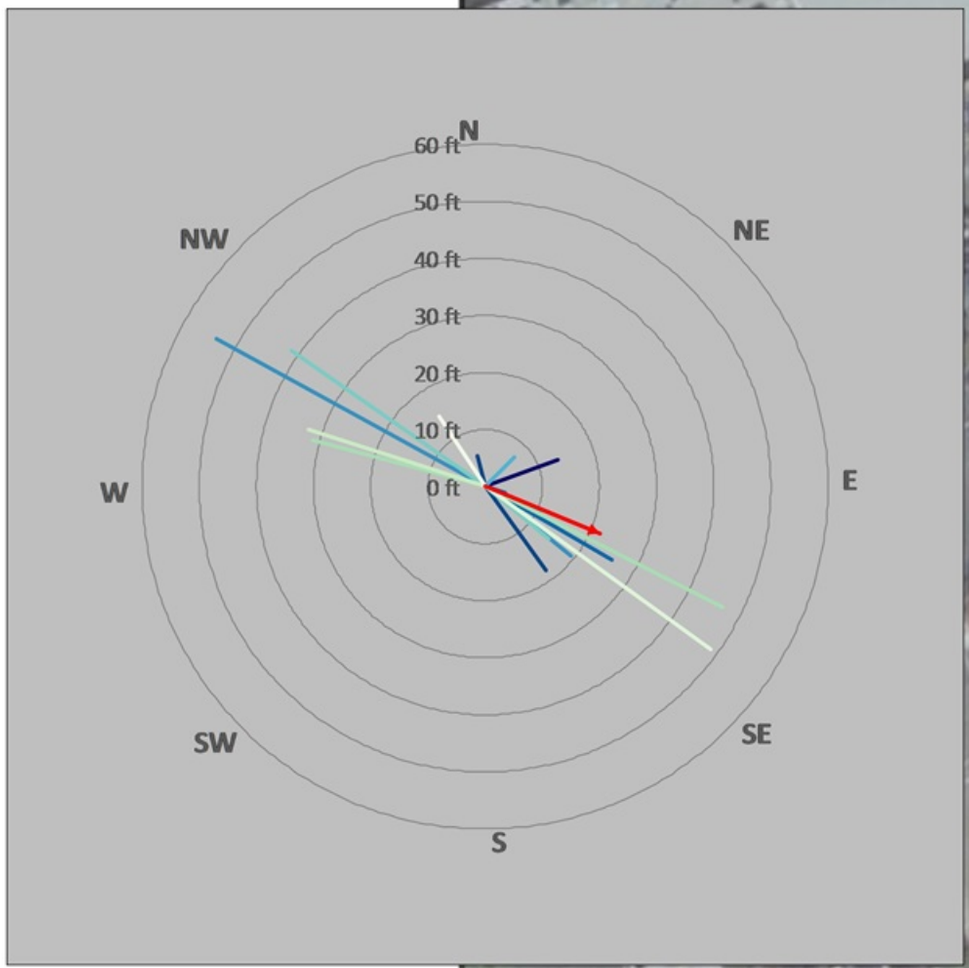
TPHg
Center of Mass



LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- General Groundwater Flow
- Center of Mass Movement
- Net Movement

N

Center of Mass Scale

2013 — 2015 — 2017

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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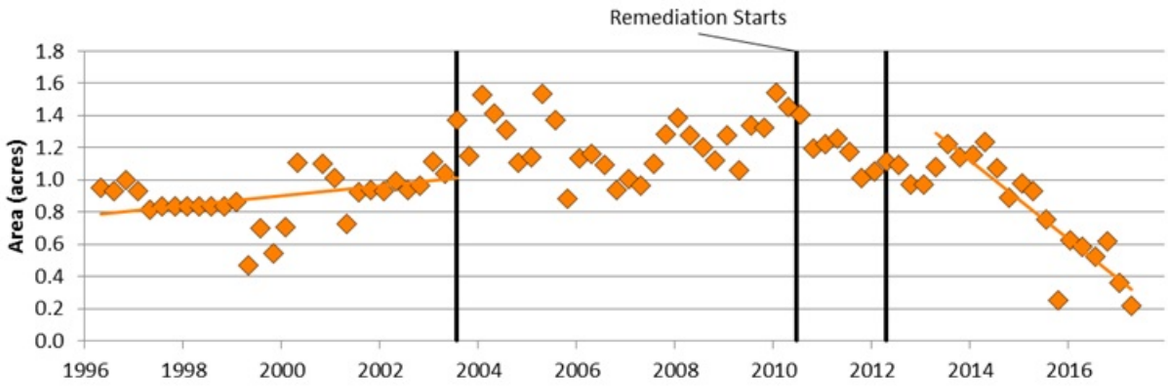
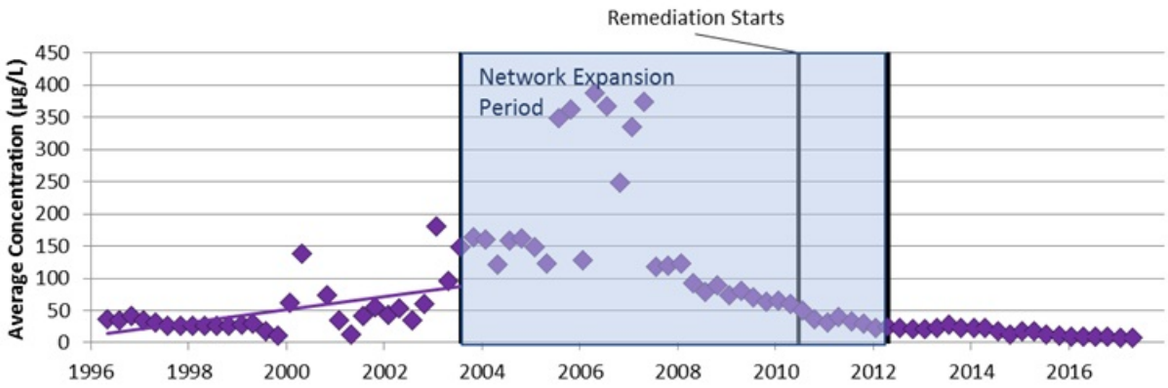
MTBE Plume Area Trend



May-1996 to Aug-2003
Increasing Trend
Mann-Kendall: 98% Confidence
Regression: 96% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

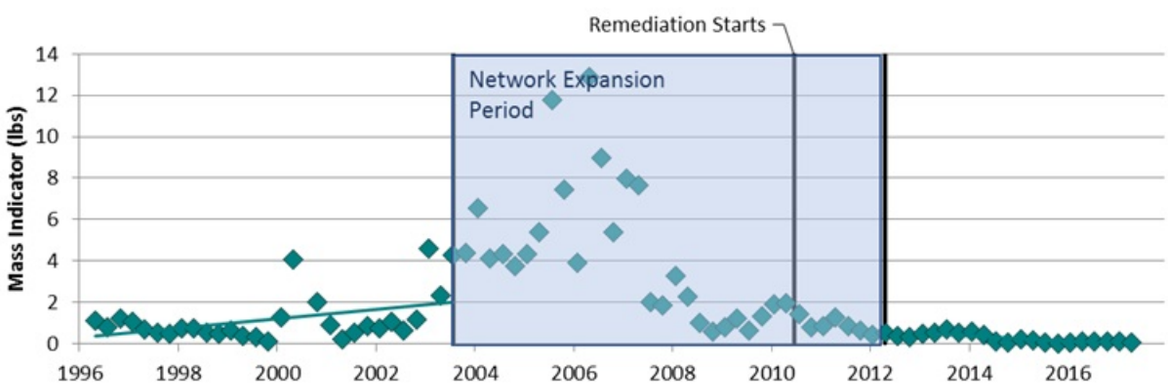
MTBE Plume Average Concentration Trend



May-1996 to Aug-2003
Increasing Trend
Mann-Kendall: 99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

MTBE Plume Mass Indicator Trend



May-1996 to Aug-2003
No Trend/Increasing Trend
Mann-Kendall: 87% Confidence
Regression: 98% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

Zoom

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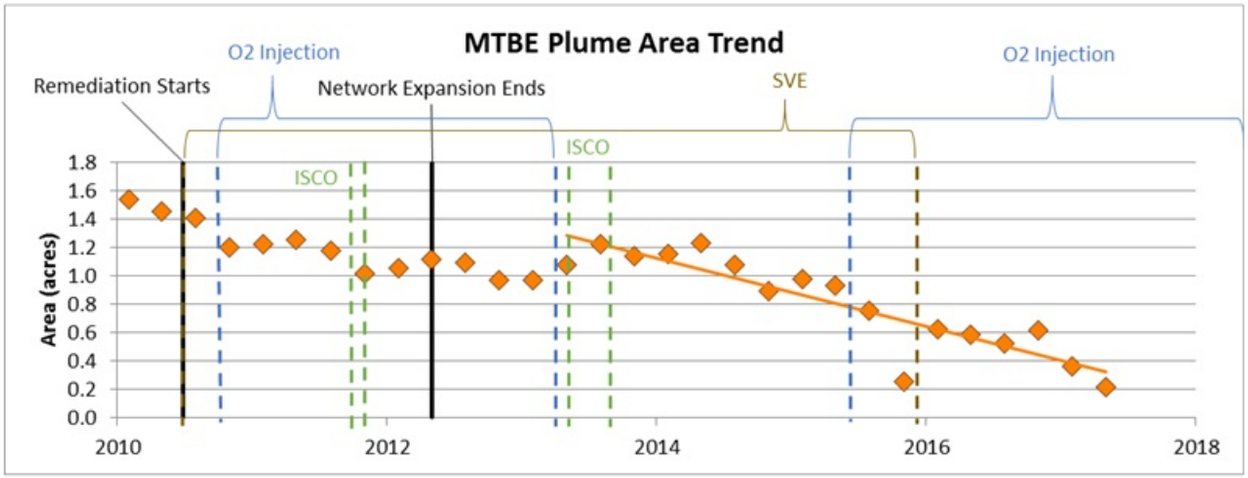
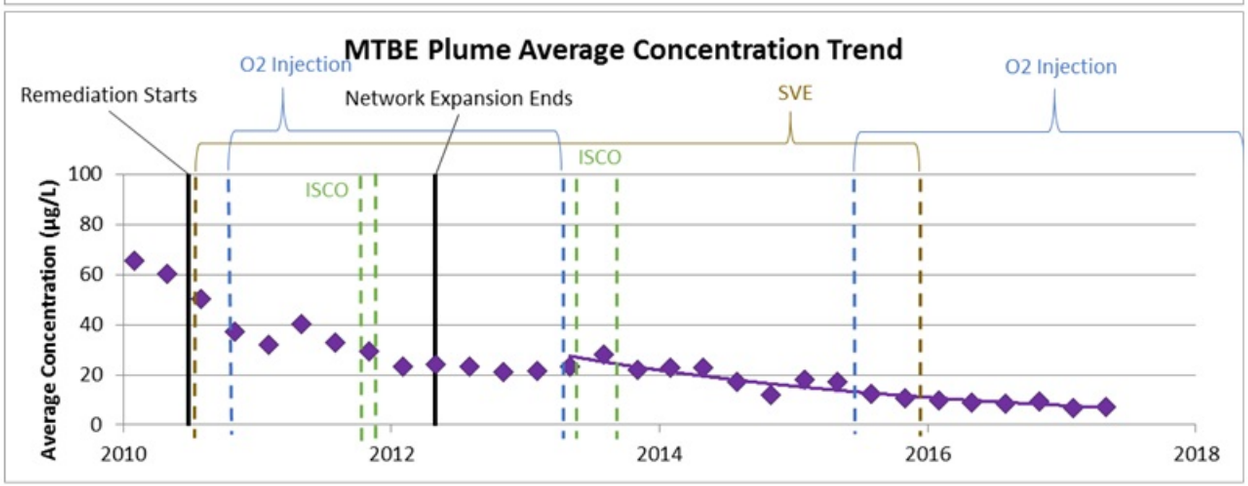


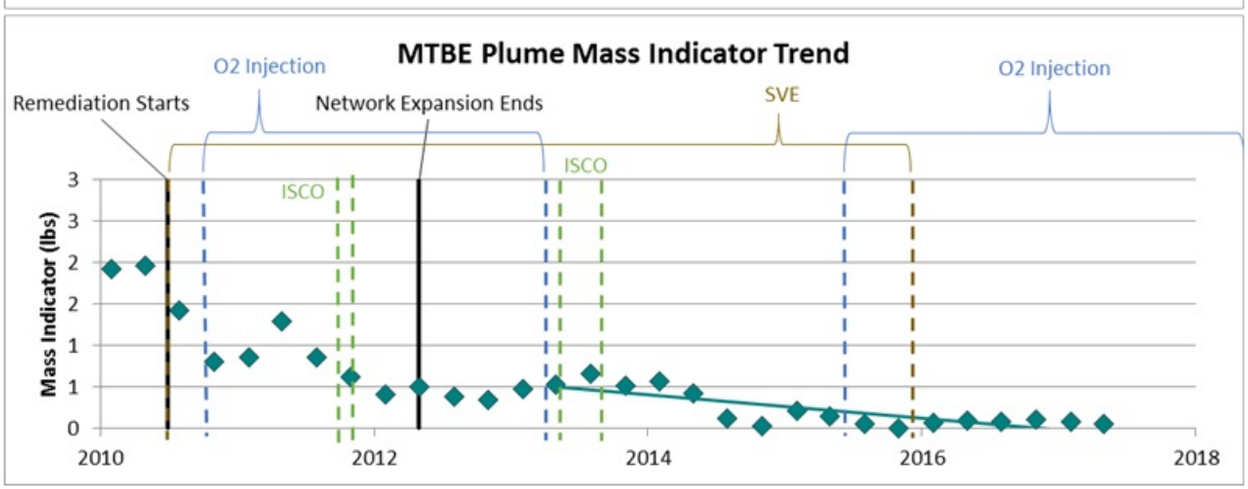
May-1996 to Aug-2003
Increasing Trend
Mann-Kendall: 98% Confidence
Regression: 96% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence



May-1996 to Aug-2003
Increasing Trend
Mann-Kendall: 99% Confidence
Regression: >99% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence



May-1996 to Aug-2003
No Trend/Increasing Trend
Mann-Kendall: 87% Confidence
Regression: 98% Confidence

May-2013 to May-2017
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

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MTBE
May-2013

Concentration (µg/L)

2,000
1,000
500
250
100
50
25
15
10
5

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- 112 — Concentration (µg/L)
- NS (146) — Well Not Sampled (Assigned Value Shown)
- General Groundwater Flow
- Plume Center of Mass

Plume Characteristics

Plume Area: **1.1 acres**
Plume Average Concentration: **23.2 µg/L**
Plume Mass Indicator: **0.52 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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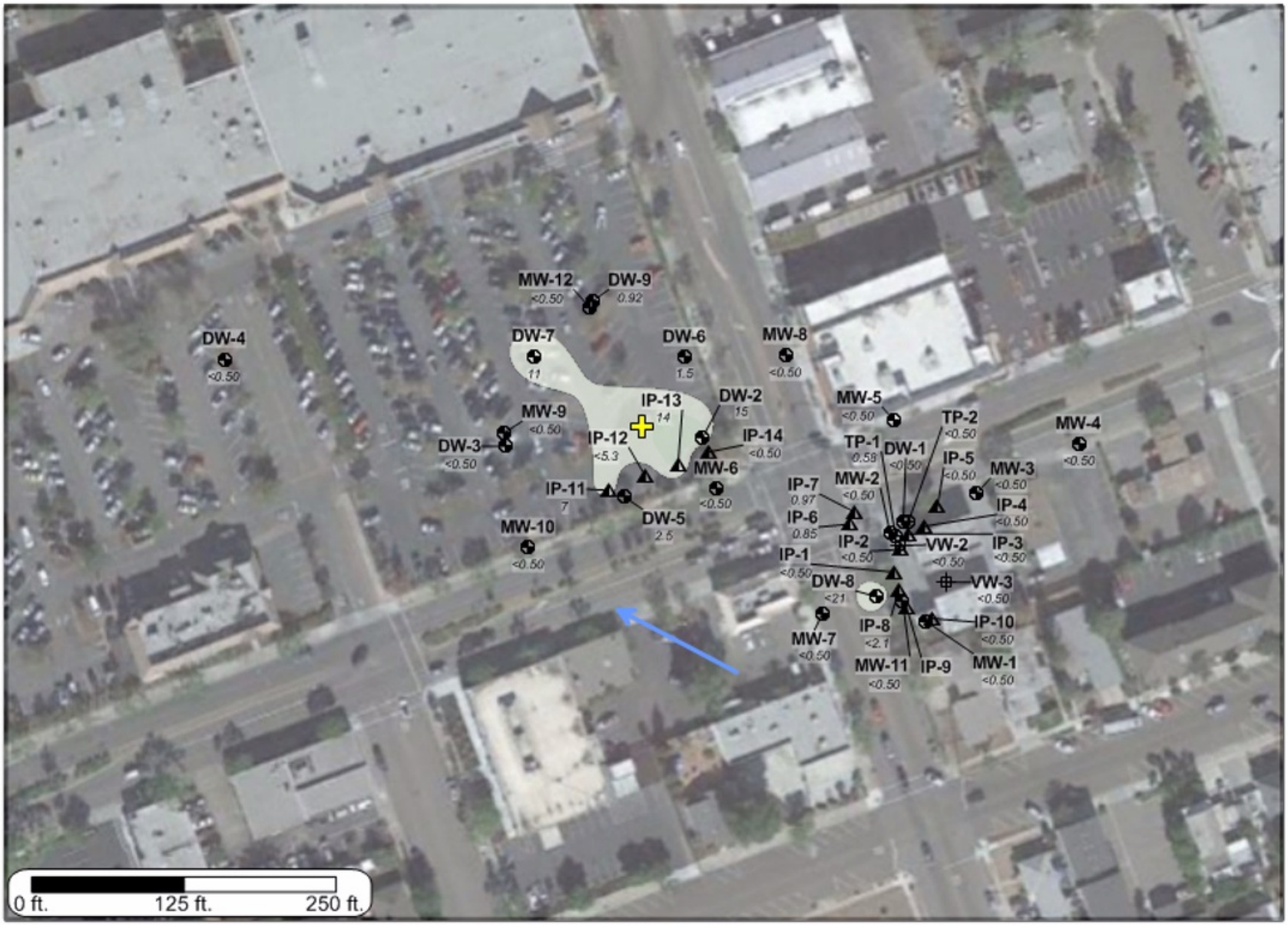

MTBE
May-2017

Concentration (µg/L)

2,000
1,000
500
250
100
50
25
15
10
5

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- 112 — Concentration (µg/L)
- NS (146) — Well Not Sampled (Assigned Value Shown)
- General Groundwater Flow
- Plume Center of Mass

Plume Characteristics

Plume Area: **0.22 acres**
Plume Average Concentration: **7.3 µg/L**
Plume Mass Indicator: **0.055 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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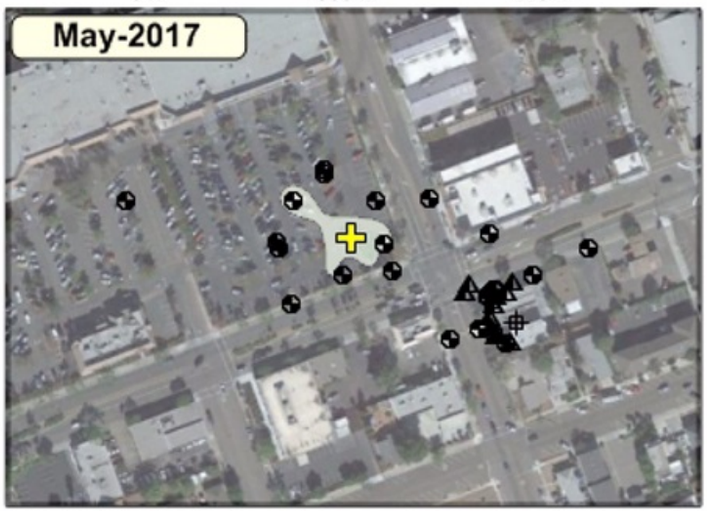
Plume Differences May-2013 vs May-2017

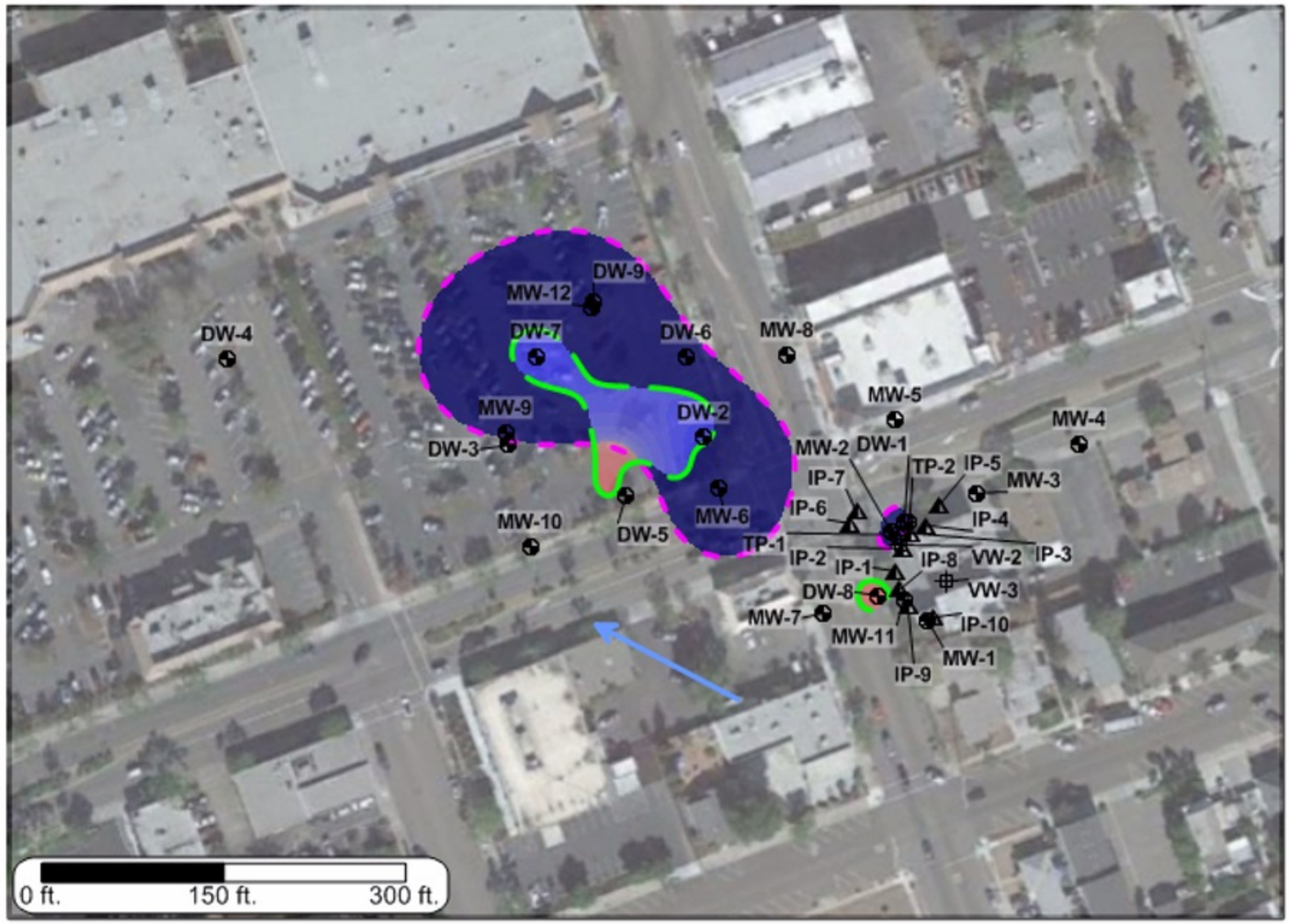
MTBE

Concentration (µg/L)

5 10 15 25 50 100 250 500 1,000 2,000

0 ft. 300 ft. 600 ft.





Spatial Change Indicator

-1 0 1

LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- General Groundwater Flow
- Plume Center of Mass
- May-2013 Plume Boundary
- May-2017 Plume Boundary

Plume Characteristics

Area: **80% Decrease**
Average Concentration: **69% Decrease**
Mass Indicator: **89% Decrease**
Mass Increase: **0.01 lbs Increase**
Mass Decrease: **0.42 lbs Decrease**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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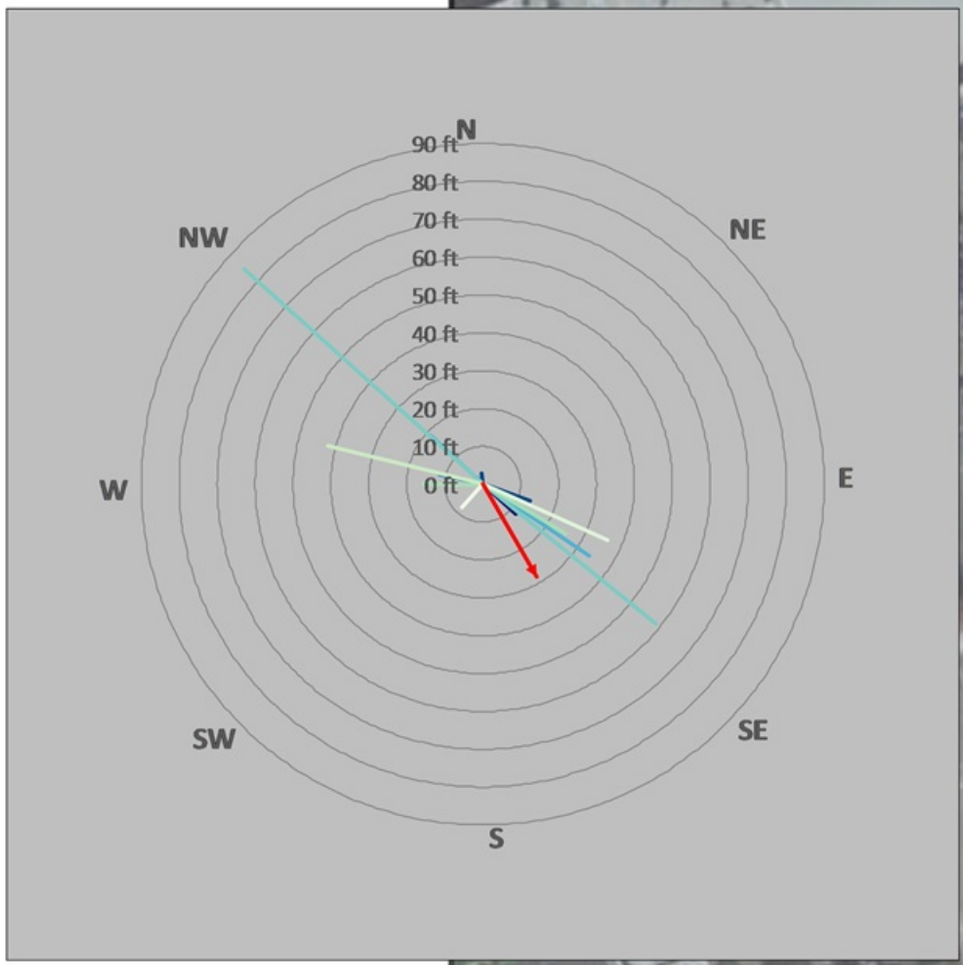
MTBE
Center of Mass



LEGEND

- MW-4M — Monitoring Well
- IP-4M — Injection Well
- VW-4M — Extraction Well
- TP-4M — Monitoring/Vapor Extraction Well
- General Groundwater Flow
- Center of Mass Movement
- Net Movement

N

Center of Mass Scale

2013 — 2015 — 2017

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