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NTC ORLANDO
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TECHNICAL MEMORANDUM PILOT STUDY WORK PLAN OPERABLE UNIT 4 (OU 4) HAWTHORN ZONE EOS INJECTIONS NTC ORLANDO FL

02/06/2015

RESOLUTION CONSULTANTS

Subject: **Pilot Study Work Plan**
OU 4 Hawthorn Zone EOS® Injections
Former Naval Training Center, Orlando, Florida

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Date: February 6, 2015

On behalf of the Navy, Resolution Consultants (RC) has prepared this Draft Pilot Study Work Plan for Hawthorn Zone Emulsified Oil Substrate (EOS®) injections at Operable Unit (OU) 4 located at the former Naval Training Center (NTC) Orlando, Florida. This work plan was prepared under Comprehensive Long-term Environmental Action Navy (CLEAN) Contract N62470-11-D-8013, Contract Task Order (CTO) No. JM69.

Introduction

OU 4 is located within Area C of the former NTC Orlando and is the site of the former Navy laundry and dry cleaning facility. Chlorinated solvent contamination remains in groundwater as a result of dry cleaning activities. Various treatment alternatives have been implemented for remediation of the shallow and intermediate aquifers; however recent data indicates significant concentrations of chlorinated volatile organic compounds (cVOCS) remain in the water bearing zone (WBZ) of the Hawthorn aquifer, at a depth of over 100 feet below land surface (bls). The site layout is presented in **Figure 1**.

The objectives of this Pilot Study are to:

- Evaluate the capacity of injection wells screened within the Hawthorn zone to distribute substrate (Phase I);
- Evaluate the capacity of injection wells to create a substrate screen within the Hawthorn zone (Phase II);
- Load the WBZ with substrate in order to stimulate the existing microbial population and enhance anaerobic degradation of the chlorinated solvent plume; and
- Provide design parameters for future injection efforts, including maximum injection rates, injection pressures, and an effective radius of influence (ROI).

Background

Hawthorn zone groundwater contamination is located within the northeastern portion of Area C,

under property that was recently sold to Greystar Development Company (Greystar). Greystar has successfully achieved the release of previous land use restrictions and obtained approved site development plans. Site development was initiated with silt fencing installation in November 2014, and concrete and asphalt demolition was underway in December 2014. All of the existing Hawthorn wells within the footprint of the Hawthorn WBZ contaminant plume will be abandoned in conjunction with site development. Replacement wells will be installed following the completion of major construction activities.

A Sampling and Analysis Plan (SAP) was prepared for groundwater sampling and drilling activities to assess the current conditions in the Hawthorn WBZ (RC, September 2014). Groundwater samples were collected from existing monitoring wells in October 2014, and drilling activities, including additional groundwater sampling, were completed in November 2014. Sampling data was consistent with the results of previous efforts. Screening data confirmed the upgradient extent of groundwater contamination as well as the top of the Hawthorn clay interval.

Field screening data along with analytical laboratory data from the 2014 Hawthorn zone groundwater sampling event is provided in **Table 1**. This data, which will be presented in a Remedial Investigation Addendum Report in 2015, indicates that subsurface conditions are generally as expected based on Long Term Monitoring data. A cross section showing site lithology in relation to Hawthorn zone well screens is provided as **Figure 2**. Concentrations of tetrachloroethene (PCE) in monitoring well OLD-13-62D suggest that dense non-aqueous phase liquid (DNAPL) is present in the Hawthorn WBZ. The presence of a microbial population was confirmed, and a compound specific isotope analysis baseline was established.

Approach

This pilot study is designed as a two-phase approach. Phase I of this pilot study involves injection of substrate using two recently installed injection wells in treatment zone D3 (reference **Figure 3**). In accordance with the SAP, two borings (SB09 and SB12) were converted to injection wells for the purpose of evaluating distribution methods for future remedies. These wells will be used for EOS® injections. The objective of Phase I is to evaluate the capacity of these injection wells to distribute EOS® to the Hawthorn water bearing zone while providing substrate to the apparent DNAPL source area.

Phase II involves injecting EOS® in three treatment zones through temporary injection points installed using rotosonic methods. In order to avoid costly drill rig standby during injection efforts, temporary well points will be installed in each injection location. The objective of this effort is to further treat the source area and establish a permeable reactive screen to intercept the northward migrating contaminant plume. Phase II design parameters may be revised based on Phase I

observations. All temporary injection points will be abandoned by grouting following completion of the injection activities.

EOS® Pro was selected as the preferred substrate for this pilot study. EOS® was previously distributed to the shallow zone (5 to 30 feet bls) and deep zone (60 to 125 feet bls) from December 2006 to August 2008 through a recirculation system using injection and extraction wells (CH2MHill Constructors, Inc., December 2009). Deep injection zones D1 and D2 are shown in **Figure 1**.

EOS® is a food-grade oil/water emulsion designed to quickly stimulate microbial activity as well as to provide long-term nourishment to enhance anaerobic bioremediation of chlorinated solvents. EOS® can be distributed throughout a source area to reduce the contaminant mass flux out of the source area and to treat the contaminants over time. It is designed to treat both mobile dissolved contaminants and relatively immobile sorbed/residual contaminants. Addition of EOS® can rapidly reduce contaminant concentrations in the aqueous phase by partitioning of a portion of the solvent mass into the EOS® (i.e., sequestration). Biodegradation of the EOS® then stimulates anaerobic conditions and rapid biodegradation of solvents in the aqueous phase. As contaminants are slowly released by desorption from the aquifer matrix or by dissolution from residual DNAPL, EOS® will still be present to sustain anaerobic biodegradation processes.

Biodegradation kinetics can be depressed by low pH levels; however, the natural pH of the Hawthorn WBZ is in the range of 6 to 7; therefore a pH buffer will not be added to the injection solution. A sodium bromide tracer will be added to the mixture to enable a Hach bromide ion detector to detect the mixture in adjacent wells. Distribution will be further evaluated using total organic carbon (TOC) samples. TOC results will be used to confirm distribution of the EOS® Pro mixture after a spike in bromide readings indicates that the injectate has travelled from the injection well through the treatment zone, to the adjacent well. An increase in TOC of more than a factor of 10 compared to background (pre-injection concentrations) will indicate EOS® breakthrough in the performance sentry wells.

EOS® **Volumes**

The volume of EOS® was determined using the manufacturer's design tool. Volumes were calculated for the three proposed treatment zones:

- Treatment zone D3 is estimated at 50 feet by 50 feet by 15 feet deep. This zone was selected based on part per million (ppm) concentrations of PCE observed in monitoring well OLD-13-62D.
- Zone D4 is estimated at 30 feet by 30 feet by 15 feet deep and was selected based on ppm concentrations of PCE observed in monitoring well OLD-13-60D.

- Zone D5 is located in the northern portion of the Hawthorn zone plume and was selected to provide a bio screen to intercept the contaminant plume as it migrates towards the property boundary. The location is intended to intercept the plume before it leaves the site, but is away from the property boundary.

Volume calculations are provided in **Attachment A**. The EOS® design tool was used to evaluate the necessary volume of substrate required for each treatment zone. Several input parameters including fraction of organic carbon were estimated based on experience and literature. The calculated substrate requirement is most significantly determined by oil entrapment in the aquifer material, rather than hydrogen demand and carbon loss.

Calculation sheets for injection pore volumes are also provided in **Attachment A**. These calculations are based on an assumed ROI of 12.5 feet and 25% of the pore volume being replaced by the EOS® mixture. A summary of the proposed injection volumes is provided in **Table 2**. Injection volumes for treatment zone D3 are split between two existing injection wells and five proposed injection locations. The existing injection wells have 10 foot screens and the proposed injection wells will be installed with 15-foot screen intervals in this treatment zone. Therefore, more EOS® will be injected in the Phase II injection locations than in the Phase I injection wells.

Implementation – Phase I

EOS® Pro will be injected into two wells in zone D3 (OLD-13-INJ01D and OLD-13-INJ02D). These wells are 2-inch diameter with 10 feet of 0.010-inch slotted screen from 110 to 120 feet bls. Well construction and lithologic information for these wells is provided in **Attachment B**.

EOS® Pro will be mixed with water on-site in batch tanks prior to injection. Sodium bromide will be added to the batch mix to a concentration of 1,000 ppm. Treated discharge water from the site pump and treat system will be used for the injections.

The diluted mixture will be injected using a centrifugal pump (trash pump). A totalizing flow meter and pressure gage will be mounted onto the injection piping in order to record injection flow rates and corresponding pressures. Both wells will be injected individually to evaluate influence at adjacent well OLD-13-62D. Note that mixtures and volumes may be adjusted during injection activities based on field observations.

Following injection of the EOS® mixture, an equal volume of chase water will be injected into each well location, for a design replacement of 50% of the available pore volume.

Implementation – Phase II

Phase II volumes will be re-evaluated based on field observations during Phase I. Injection volumes

and injection point locations may be revised to ensure that all product is delivered to the subsurface.

EOS® Pro will be injected into the Hawthorn aquifer in three zones illustrated in **Figure 3**. The Hawthorn aquifer will be accessed via rotosonic methods. Injections will be performed between 100 to 130 feet bls. Sodium bromide will be added to the batch mix to a concentration of 1,000 ppm. Following injection of the EOS® mixture, an equal volume of chase water will be injected into each well location, for a design replacement of 50% of the available pore volume. Treated discharge water from the site pump and treat system will be used for the injections.

A totalizing flow meter and pressure gage will be mounted onto the injection piping in order to record injection flow rates and corresponding pressures. Note that mixtures and volumes may be adjusted during injection activities based on field observations.

Due to the required depth of the injections, rotosonic methods will be used for substrate delivery. The proposed volume of EOS® Pro mixture to be injected is expected to take several weeks and therefore multiple simultaneous injections will be attempted. Temporary well screens will be placed in order to limit drill rig standby rates during injections. All boreholes will be grouted upon completion of the injection efforts.

Underground Injection Control (UIC)

See **Attachment C** for the current Florida Department of Environmental Protection (FDEP) EOS® Pro acceptance letter and draft UIC notification letter. The EOS® Pro application will be conducted using Class V, Group 4 aquifer remediation wells. The zone of discharge (ZOD) will be monitored following injection activities to insure any exceeded parameters to return to their groundwater standards or background level, whichever is less stringent. Refer to **Figure 3** for the estimated ZOD. The estimated time to achieve cleanup of the site based on recent concentration history in OLD-13-62D is 50 months.

Injection of relatively low volumes of diluted substrate is not expected to cause harmful plume migration or increase the threat to potable or irrigation wells. Degradation of carbon substrates frequently causes the generation of dissolved methane and methane gas. The site is currently vacant and proposed buildings are designed with active vapor recovery systems; therefore, no adverse impacts due to vadose zone migration are expected. Upon completion of remediation, all reagents will be depleted with no remaining by products. The proposed monitoring schedule associated with the injection of EOS® Pro is described below.

Evaluation Criteria

Injection flow rates and corresponding pressures will be recorded along with injection volumes

during both the Phase I and Phase II events. Nearby wells will be monitored for changes in water level, and a Hach bromide ion detector will be used to evaluate ROI during injection events.

Phase I performance data will be collected from adjacent wells DPT-2B and OLD-13-62D. These wells will be sampled on a monthly basis following EOS® injection, until the wells are abandoned for site development. Groundwater samples will be analyzed for select cVOCs, TOC and other natural attenuation parameters as indicated in **Table 3**. Additionally, in order to satisfy the FDEP ZOD variance requirements, total recoverable petroleum hydrocarbons (TRPH), chloride and sodium will be analyzed during the monthly sampling events. Baseline samples will be collected from OLD-13-62D prior to Phase I injections.

Phase II performance data will be collected from wells DPT-1B and DPT-2B; OLD-13-60D, OLD-13-62D, OLD-13-66D and OLD-13-69D. These wells will be sampled on a monthly basis following EOS® injection, until the wells are abandoned for development. Groundwater samples will be analyzed for select cVOCs, natural attenuation parameters, and ZOD parameters as indicated in **Table 4**. Baseline samples will be collected from OLD-13-602D and OLD-13-69DC4 prior to Phase II injections.

At the conclusion of the pilot study, and prior to well abandonment by the developer, the Hawthorn wells will be sampled as indicated in **Table 5**. In addition to select cVOCs, natural attenuation parameters, and ZOD parameters, groundwater samples will be collected for microbial analyses using quantitative polymerase chain reaction (qPCR) to evaluate the growth of microbial populations as a result of the injection of the organic substrate into the aquifer, and compound specific isotope analysis (CSIA) will be performed for the cVOCs PCE, trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC) for comparison to baseline. This final data set will also be used to position replacement wells following site development.

Survey

No survey is planned for this effort. The locations and elevations of all permanent wells have been previously surveyed. The locations of the temporary injection wells and injection points will be determined by field measurements. The site is relatively level in the area of the proposed pilot study activities and depth measurements will be related to ground surface.

Investigative Derived Waste

The soil borings for Phase II are expected to generate Investigative Derived Waste (IDW) in the form of drill cuttings, decontamination fluids and decontamination trash (plastic sheeting, gloves). Purge water from the pilot study will be containerized and transferred to the pump and treat system for processing and disposal. IDW will be managed in accordance with Section 8.4.5 of the

Draft Tier II Sampling and Analysis Plan for RI Addendum Sampling Activities (RC, September 2014).

Closure

Resolution Consultants appreciates the opportunity to be of service on this project. If you have any questions or require additional information, please contact me at (407) 513-8251.

Date: 7/15/15

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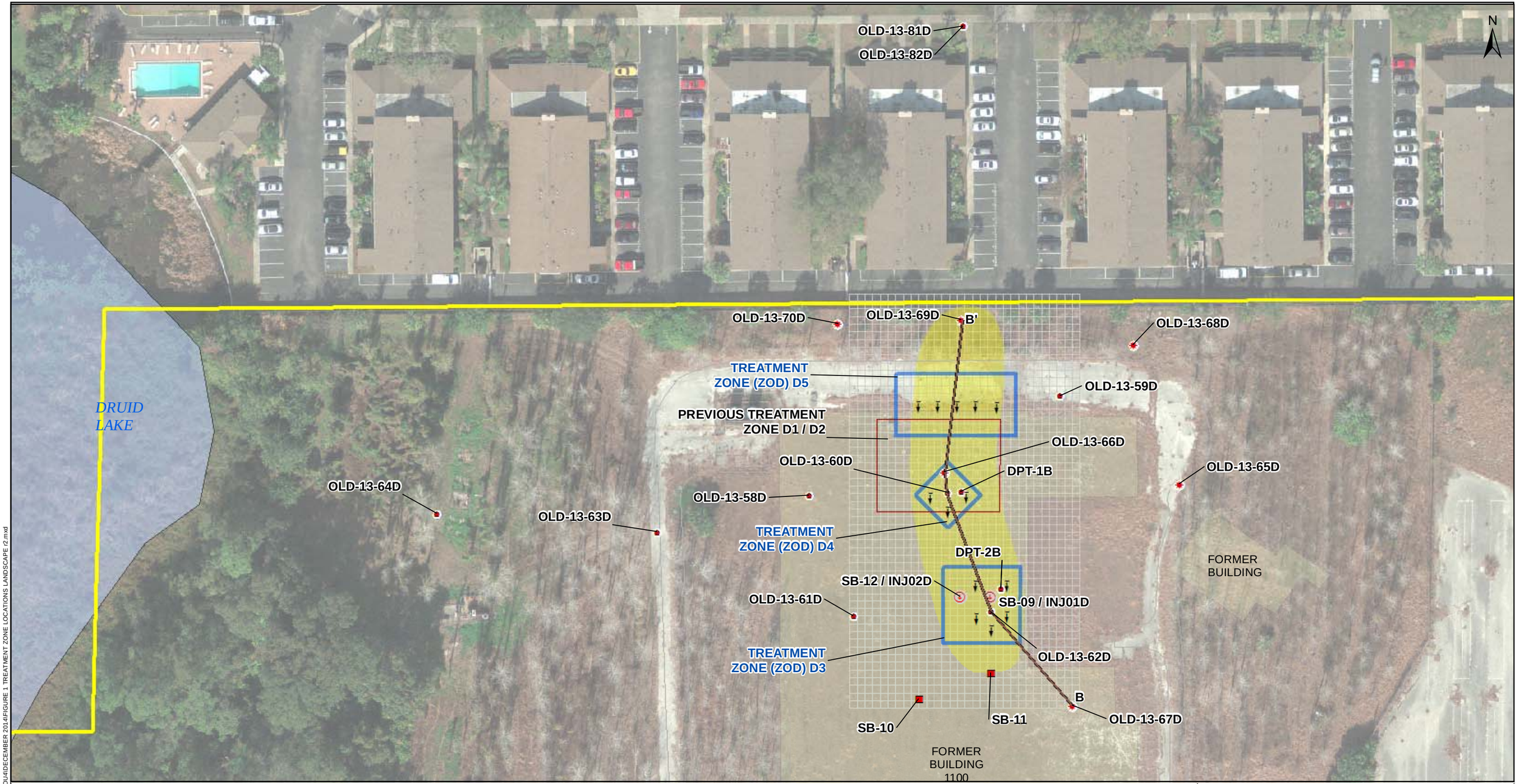
FIGURES



Legend

- Proposed Injection Well Location
- CMT Monitoring Well Locations
- Monitoring Well Locations
- Wells Proposed for Injection
- Rotosonic Boring Location
- Previous Treatment Zones D1 / D2
- Proposed Treatment Zones (ZOD) D3, D4 and D5
- Approximate Extent of VOCs (Hawthorne)
- Operable Unit 4 Boundary
- YES
- Cross-Section Location

Note:
ZOD - Zone of Discharge
See Figure 2 for Cross-Section Details

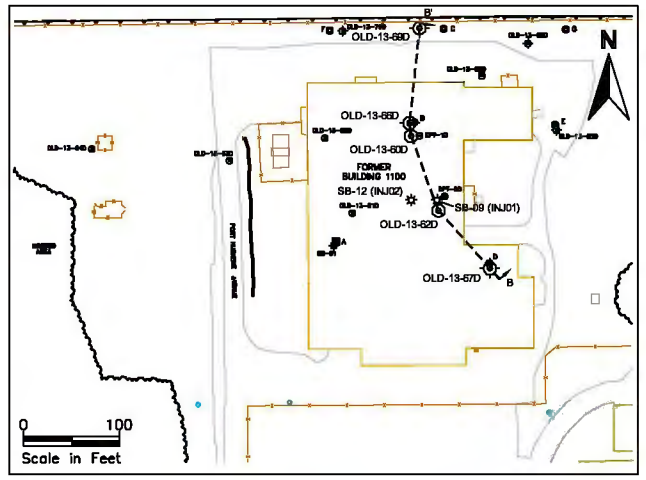
0 60 120 Feet

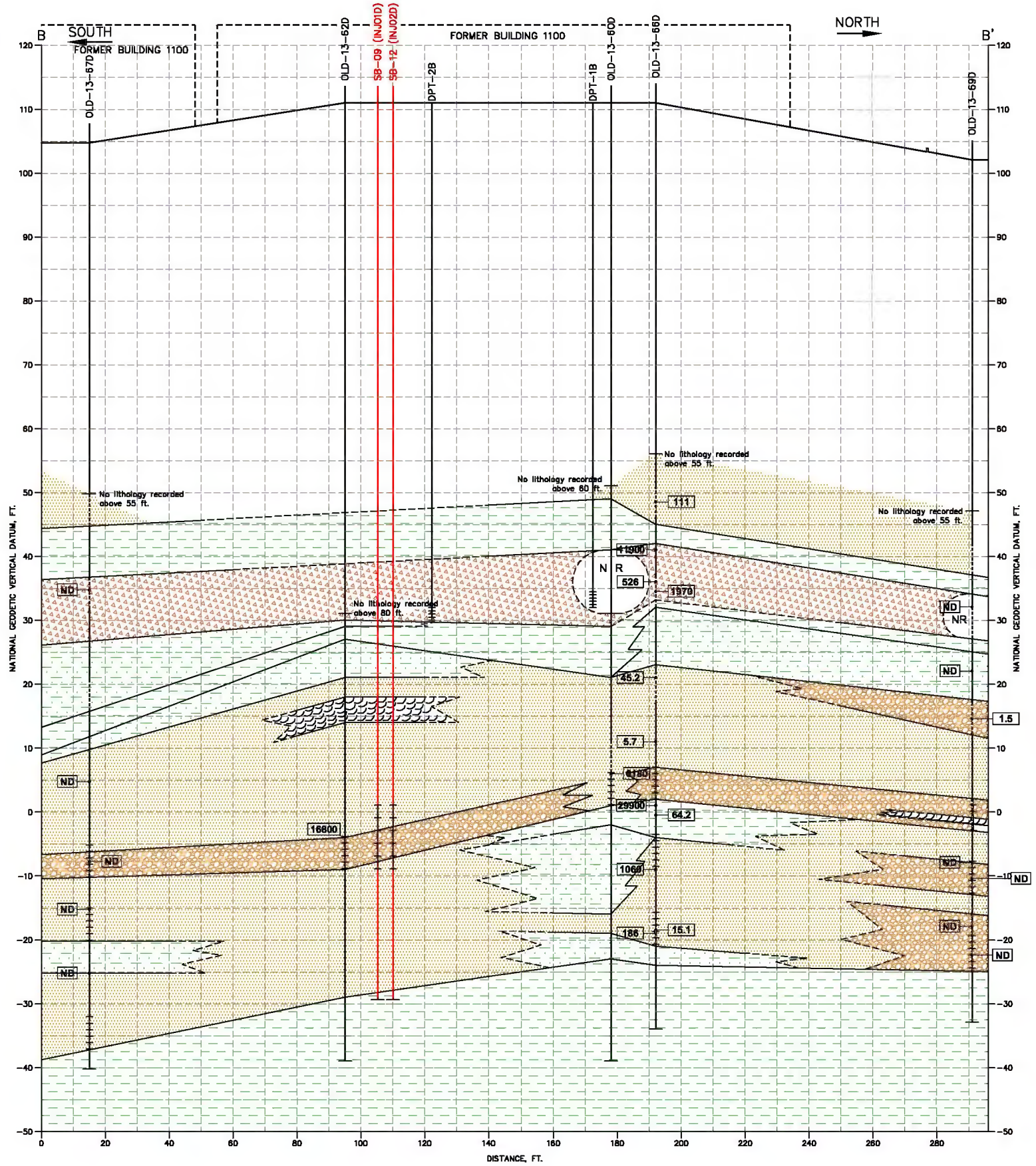
FIGURE 1
HAWTHORNE WELL LOCATION MAP
Operable Unit 4
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: M. Sweeney	DATE: 1/12/2015
DRAWN BY: M. Barron	TASK ORDER NUMBER: JM69

L:\projects\Navy CLEAN\NTC Orlando\9.0_Geospatial\MXDs\OU4\DECEMBER 2014\FIGURE 1 TREATMENT ZONE LOCATIONS LANDSCAPE (2.mxd





GEOLOGY

- GRAVEL
- SAND
- CLAYEY SAND
- SILT
- CLAY
- SHELL HASH
- SHELL OR MARINE FOSSIL BED
- NR — NO RETURN (NO SAMPLE)

MONITORING WELL

OLD-35-11C — WELL DESIGNATION

GROUND SURFACE

TOP OF SCREEN

GROUNDWATER PROFILE DATA: 5.7 — June 2006

MONITORING WELL DATA: ND — July/August 2006

BOTTOM OF SCREEN

Note: Concentrations shown are PCE in groundwater, ug/L

NOTE:
NOT TO SCALE
SOURCE: OAK RIDGE CAD FILES

FIGURE 2
HAWTHORN CROSS-SECTION SKETCH

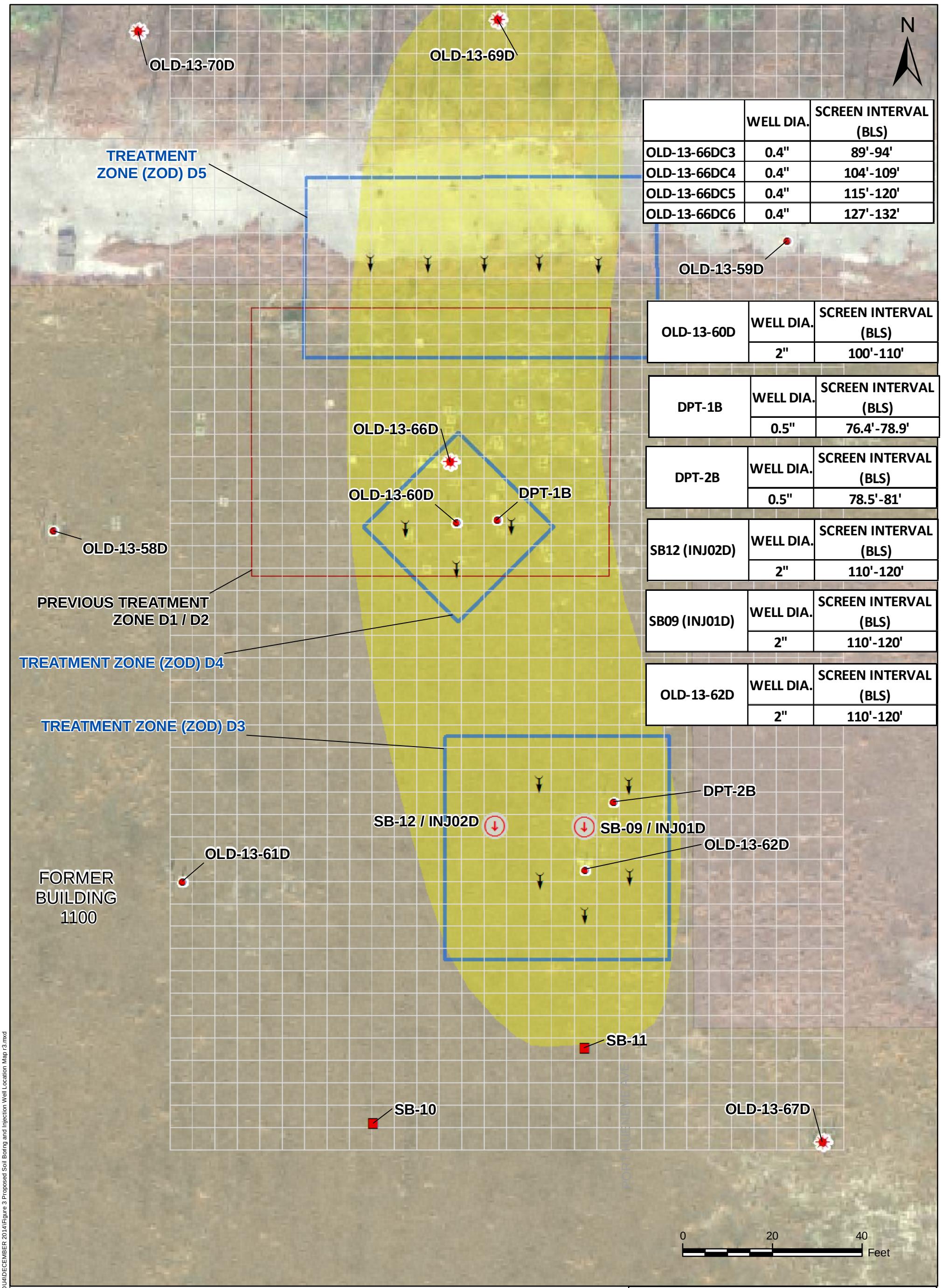
Operable Unit 4
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

NAVFAC Naval Facilities Engineering Command

RESOLUTION CONSULTANTS

REQUESTED BY: M. Sweeney	DATE: 8/27/2014
EDITED BY: BARRON, MIKE	TASK ORDER NUMBER: JM42

L:\projects\Navy CLEAN\NTC Orlando\9.0_Geospatial\CAD\OU 4\DECEMBER 2014\FIGURE 2 HAWTHORNE CROSS-SECTION.dwg



	WELL DIA.	SCREEN INTERVAL (BLS)
OLD-13-66DC3	0.4"	89'-94'
OLD-13-66DC4	0.4"	104'-109'
OLD-13-66DC5	0.4"	115'-120'
OLD-13-66DC6	0.4"	127'-132'

OLD-13-60D	WELL DIA.	SCREEN INTERVAL (BLS)
	2"	100'-110'

DPT-1B	WELL DIA.	SCREEN INTERVAL (BLS)
	0.5"	76.4'-78.9'

DPT-2B	WELL DIA.	SCREEN INTERVAL (BLS)
	0.5"	78.5'-81'

SB12 (INJ02D)	WELL DIA.	SCREEN INTERVAL (BLS)
	2"	110'-120'

SB09 (INJ01D)	WELL DIA.	SCREEN INTERVAL (BLS)
	2"	110'-120'

OLD-13-62D	WELL DIA.	SCREEN INTERVAL (BLS)
	2"	110'-120'

Legend

- CMT Monitoring Well Locations
- Monitoring Well Locations
- Proposed Injection Well Location
- Wells Proposed for Injection
- Rotosonic Boring Location
- GRID
- Previous Treatment Zones D1 / D2
- Proposed Treatment Zones (ZOD) D3, D4 and D5
- Approximate Extent of VOCs (Hawthorne)
- Operable Unit 4 Boundary

Notes:
ZOD - Zone of Discharge
Aerial Source: FDOT, January 2012

FIGURE 3
PROPOSED INJECTION MAP

Operable Unit 4
NAVAL TRAINING CENTER ORLANDO
ORLANDO, FLORIDA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: M. Sweeney	DATE: 1/12/2015
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L:\projects\Navy CLEAN\NTC Orlando\9.0_Geospatial\MXDs\OU4\DECEMBER 2014\Figure 3 Proposed Soil Boring and Injection Well Location Map r3.mxd

TABLES

TABLE 1
OCTOBER 2014 DATA SUMMARY
Operable Unit 4
Former Naval Training Center
Orlando, Florida

			VOLATILE ORGANIC COMPOUNDS				FIELD PARAMETERS				LABORATORY NATURAL ATTENUATION PARAMETERS								FIELD TESTS				CSIA				DHC				
			Tetrachloro-ethene (PCE)	Trichloro-ethene (TCE)	cis-1,2-Dichloro-ethene	Vinyl Chloride	pH (SU)	Specific Conductance (µS/cm)	Oxidation - Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Nitrate mg/L	Nitrite mg/L	Sulfate mg/L	Chloride mg/L	Total Organic Carbon (TOC) mg/L	Methane µg/L	Ethane µg/L	Ethene µg/L	Alkalinity mg/L	Ferrous Iron mg/L	OVA ppm	Color-Tech PCE Concentration (ppm)	PCE (ug/L)	TCE (ug/L)	cis-DCE (ug/L)	VC (ug/L)	DHC (cells/mL)	TCE (cells/mL)	BVC (cells/mL)	VCR (cells/mL)	EBAC (cells/mL)
		GCTL	3	3	70	1																									
		NADC	300	300	700	100																									
Well ID	Sample Date	Depth Interval Feet BLS																													
OLD-13-DPT-2B	4/2/2014	78.5 - 81	**40.6**	**36.6**	**24.8**	**3.6**	6.89	715	2.9	0.79	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-58D	10/20/2014	100.5 - 110.5	<0.26	<0.30	<0.33	<0.33	7.43	2384	223.3	0.48	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-59D	10/19/2014	100 - 110	<0.26	<0.30	<0.33	<0.33	6.93	179	-78.7	0.53	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-60D	10/20/2014	100 - 110	**2,350**	**241**	**74**	<8.1	7.46	3450	-99.6	0.16	<0.210	<0.070	**0.140 J**	**1,100**	**1.1**	**582**	<1.96	**2.74 J**	--	--	--	--	**6,700**	**310**	**160**	**14**	**11,500**	<0.50	**6,090**	**523**	**177,000**
OLD-13-61D	10/21/2014	99 - 109	<1.00	<1.00	<1.00	<1.00	7.56	1206	-74.0	0.22	--	--	--	--	--	--	--	--	95	0.3	--	--	--	--	--	--	--	--	--	--	--
OLD-13-62D	10/20/2014	110 - 120	**10,700**	**392**	**170 J**	<65	7.59	1404	-157.1	0.14	<0.210	<0.070	**0.180 J**	**370**	**1.2**	**435**	<1.96	**2.79 J**	--	--	--	--	**16,000**	**400**	**170**	**22**	**16,000**	**564**	**0.600**	<0.500	**359,000**
OLD-13-63D	10/21/2014	96 - 106	<1.00	**3.8**	**49**	<1.00	7.80	645	15.9	0.31	--	--	--	--	--	--	--	--	75	0.8	--	--	--	--	--	--	--	--	--	--	--
OLD-13-65DC4	10/21/2014	102 - 107	<1.00	<1.00	<1.00	<1.00	7.44	341	0.6	0.87	--	--	--	--	--	--	--	--	20	0.35	--	--	--	--	--	--	--	--	--	--	--
OLD-13-65DC5	10/21/2014	113 - 118	<1.00	<1.00	<1.00	<1.00	6.89	333	-20.6	1.14	--	--	--	--	--	--	--	--	70	0.3	--	--	--	--	--	--	--	--	--	--	--
OLD-13-65DC6	10/21/2014	125 - 130	<1.00	<1.00	<1.00	<1.00	7.07	341	-13.7	1.09	--	--	--	--	--	--	--	--	60	0.15	--	--	--	--	--	--	--	--	--	--	--
OLD-13-66DC4	10/21/2014	104 - 109	**120**	**140**	**550**	**1.0 J**	7.23	3108	-49.0	1.14	--	--	--	--	--	--	--	--	75	1.5	--	--	--	--	--	--	--	--	--	--	--
OLD-13-66DC5	10/20/2014	115 - 120	**460**	**830**	**1,900**	**2.3**	7.17	1837	-13.0	1.22	<0.210	<0.070	**2.0 J**	**530**	**1.4**	**573**	<1.96	**7.30**	50	1.5	--	--	**540**	**620**	**1800**	**5**	**382**	**0.100 J**	**0.600**	<0.500	**284,000**
OLD-13-66DC5-a	10/20/2014	115 - 120	**510**	**810**	**1,900**	**2.5**	7.17	1837	-13.0	1.22	--	--	--	--	--	--	--	--	50	1.5	--	--	--	--	--	--	--	--	--	--	--
OLD-13-66DC6	10/21/2014	127 - 132	**260**	**350**	**1,000**	**1.6 J**	6.77	394	-29.7	1.11	--	--	--	--	--	--	--	--	30	0.25	--	--	--	--	--	--	--	--	--	--	--
OLD-13-67DC4	4/1/2014	110 - 115	<0.26	<0.30	<0.33	<0.33	7.51	568	-77.4	0.31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-67DC5	10/21/2014	120 - 125	<1.00	<1.00	<1.00	<1.00	7.16	724	-56.0	0.29	--	--	--	--	--	--	--	--	60	0.5	--	--	--	--	--	--	--	--	--	--	--
OLD-13-67DC6	10/21/2014	137 - 142	<1.00	<1.00	<1.00	<1.00	7.34	361	-66.0	0.20	--	--	--	--	--	--	--	--	30	0.15	--	--	--	--	--	--	--	--	--	--	--
OLD-13-68DC5	10/21/2014	105 - 110	<1.00	<1.00	<1.00	<1.00	7.48	350	45.6	0.53	--	--	--	--	--	--	--	--	105	0.1	--	--	--	--	--	--	--	--	--	--	--
OLD-13-68DC6	10/21/2014	118 - 128	<1.00	<1.00	<1.00	<1.00	7.43	684	6.5	0.36	--	--	--	--	--	--	--	--	50	0.1	--	--	--	--	--	--	--	--	--	--	--
OLD-13-69DC4	10/20/2014	100 - 105	**2,260**	**243**	**46.2**	<8.1	7.45	3644	-136.8	0.30	<0.210	<0.070	**0.250 J**	**1,200**	**1.4**	**569**	<1.96	**4.73**	--	--	--	--	**2,500**	**260**	**120**	**7**	**5,140**	**23.4**	**2,870**	**272**	**130,000**
OLD-13-69DC5	10/20/2014	110 - 115	**494**	**583**	**1210**	**154**	7.46	2379	-129.0	0.40	<0.210	<0.070	**0.590 J**	**710**	**1.4**	**580**	<1.96	**1.97**	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-69DC6	4/1/2014	122 - 127	**1.5**	**1.9**	**8.1**	**2.0**	7.24	3892	-83.3	0.32	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-70DC4	10/20/2014	101 - 106	<0.26	<0.30	<0.33	<0.33	7.16	2750	155.8	0.61	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-70DC5	10/21/2014	112 - 117	**1.0 J**	<1.00	**1.6 J**	<1.00	7.10	641	-43.1	1.25	--	--	--	--	--	--	--	--	100	0.0	--	--	--	--	--	--	--	--	--	--	--
OLD-13-70DC6	10/21/2014	123 - 128	<1.00	<1.00	<1.00	<1.00	7.64	358	-16.8	1.34	--	--	--	--	--	--	--	--	110	0.5	--	--	--	--	--	--	--	--	--	--	--
OLD-13-81D	10/20/2014	97 - 102	<0.26	<0.30	<0.33	<0.33	7.46	1597	-140.1	0.16	<0.210	<0.070	**0.360 J**	**450**	**1.0**	**525**	<1.96	<2.71	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-82D	10/20/2014	115 - 120	<0.26	<0.30	<0.33	<0.33	7.97	318	-128.4	0.25	<0.210	<0.070	**2.2 J**	**4.4 J**	**1.7**	**341**	<1.96	<2.71	--	--	--	--	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/18/2014	100-105	**2.3**	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.3	0	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/18/2014	105-110	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5	0	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/18/2014	110-115	**50**	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	642	0	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/18/2014	115-120	**18,000**	**400**	**46**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	25.1	80	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/18/2014	120-125	**7,900**	**130**	**22**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.1	28	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/18/2014	125-130	**380**	**10**	**1.1 J**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.6	3	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/19/2014	130-135	**110**	**1.7 J**	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	--	--	--	--	--	--
OLD-13-SB09	11/19/2014	135-140	**46**	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	--	--	--	--	--	--
OLD-13-SB10	11/21/2014	115-120	<1.0	<1.0	**0.69 J**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.7	0	--	--	--	--	--	--	--	--	--
OLD-13-SB10	11/21/2014	125-130	<1.0	<1.0	**0.78 J**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	--	--	--	--	--	--
OLD-13-SB10	11/21/2014	135-140	**41**	**10**	**1.9 J**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	18.6	0	--	--	--	--	--	--	--	--	--
OLD-13-SB11	11/20/2014	115-120	**240**	**86**	**20**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	55.5	3.5	--	--	--	--	--	--	--	--	--
OLD-13-SB11	11/20/2014	125-130	**13**	**2.1**	**0.65 J**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	--	--	--	--	--	--
OLD-13-SB11	11/20/2014	135-140	**4.2**	**1.1 J**	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	--	--	--	--	--	--
OLD-13-SB12	11/25/2014	115-120	**510**	**25**	**5.3 J**	<5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	--	--	--	--	--	--
OLD-13-SB12	11/25/2014	125-130	**160**	**6.0**	**1.1 J**	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	5	--	--	--	--	--	--	--	--	--
OLD-13-SB12	11/25/2014	135-140	**620**	**30**	**4.4 J**	<5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	18	--	--	--	--	--	--	--	--	--
OLD-13-SB12-a	11/25/2014	135-140	**610**	**32**	**5.2 J**	<5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	--	--	--	--	--	--

Notes: -- Not Sampled
All VOC values reported in micrograms per liter (µg/L) unless otherwise noted.
J - Indicates a value estimated above the MDL but less than the reporting limit
SU - standard units
µS/cm - microsiemens per centimeter
mV - millivolts
mg/L - milligrams per liter
ppm - parts per million
mL - milliliter
Bold - analyte was detected above the laboratory reporting limit
Exceeds the Groundwater Cleanup Target Level (GCTL, 62-777,FAC)

TABLE 2
EOS PRO VOLUME SUMMARY
Operable Unit 4
Former Naval Training Center Orlando

Location	Injection Interval Feet BLS	EOS Pro Volume gallons	Water Volume gallons	Total Mixture Volume gallons	Injection Volume Including Chase Water gallons	Estimated Injection Time hours	Estimated Injection Time days
Treatment Zone D3							
SB09-INJ01	110 - 120	70	2684	2754	5508	18	2
SB12-INJ02	110 - 120	70	2684	2754	5508	18	2
Phase 1 total		**140**	**5368**	**5508**	**11016**	**37**	**5**
INJ PT (5 total)	115 - 130	104	4027	4131	8262	28	3
Phase 2 subtotal		**520**	**20135**	**20655**	**41310**	**138**	**17**
Treatment Zone D4						0	0
INJ PT (3 total)	115 - 130	92	4039	4131	8262	28	3
Phase 2 subtotal		**276**	**12117**	**12393**	**24786**	**83**	**10**
Treatment Zone D5						0	0
INJ PT (5 total)	100 - 120	55	5453	5508	11016	37	5
Phase 2 subtotal		**275**	**27265**	**27540**	**55080**	**184**	**23**
TOTALS		**1211**	**64885**	**66096**	**132192**	**441**	**55**

BLS - below land surface

Table 3 Pilot Study Sampling Schedule - Phase I
OU 4, NTC Orlando, FL

		Analysis Group	VOCs[1]	TOC	Anions[2]	MEE	TRPH[3]	Sodium[3]
CTO JM69 Operable Unit 4 (OU4) EOS® Injection Pilot Study Sampling Dates TBD		**Preparation and Analytical Method**	EPA Method SW8260B	EPA Method SW9060A	EPA Method SW9056A	EPA Method RSK 175 SOP VGC-11	Method FL-PRO	EPA Method SW6010C/3005A
		Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP VGCMS-05	ENCO Orlando / WETS-66	ENCO Orlando / SOP WETS-57	ENCO Orlando / SOP WETS-57	ENCO Orlando / SOP SVCGC-14	ENCO Jacksonville / SOP EXMT 12 and SOP MET- 05
		Data Package Turnaround Time	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days
		Container Type/ Volume required (if different than container volume)	3 x 40mL glass, Septa vial Teflon-lined septum sealed cap	2 x 40 mL glass, Septa vial Teflon-lined septum sealed cap	1 x 500 mL plastic	3 x 40mL glass, Septa vial Teflon-lined septum sealed cap	2 x 1 L Amber glass, teflon-lined cap	1 x 1 500mL plastic
		Preservative	Hydrochloric Acid (HCl) pH <2 Ice to 4°C	Phosphoric Acid pH <2 Ice to 4°C	Ice to 4°C	Ice to 4°C HCl pH <2	Sulfuric acid (H_2SO_4) pH < 2 ice to 4°C	Nitric Acid (HNO_3) pH <2/ Ice to 4°C
		Holding Time (Preparation/ Analysis)	NA / 14 days	NA / 28 days	NA / 48 hours for nitrate/nitrite 28 days for chloride/sulfate	NA / 14 days	7 days / 40 days	NA / 6 months
Sample ID	**Matrix**	**Depth/Sampling Interval (Screen Interval, feet bgs)**						
OLD-13-62D	Groundwater	110 to 120	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly
DPT-2B	Groundwater	78.5 to 81	monthly					
Field QC Samples		**Total Number of Primary Samples**	**3**	**2**	**2**	**2**	**2**	**2**
Trip Blank	Ambient Field Blank	NA	monthly					
		Total Number of Samples to the Laboratory	**5**	**2**	**2**	**2**	**2**	**2**

Notes:

TOC = total organic carbon

MEE = methane, ethane, and ethene.

[1] VOCs to be analyzed consist of PCE, TCE, cis-1,2-DCE, 1,1-dichloroethene, and vinyl chloride.

[2] Anions consist of the following: chloride, nitrite, nitrate, and sulfate.

[3] UIC testing inlcudes TRPH (FL PRO) and sodium. Chloride is included in the anions list.

Environmental Conservation Laboratories, Inc. (ENCO Orlando); 10775 Central Port Drive Orlando, FL 32824; Point of Contact: Marcia Colon; Phone: 407-826-5314

Table 4 Pilot Study Sampling Schedule - Phase II
OU 4, NTC Orlando, FL

CTO JM69 Operable Unit 4 (OU4) EOS® Injection Pilot Study Sampling Dates TBD		Analysis Group	VOCs[1]	TOC	Anions[2]	MEE	TRPH[3]	Sodium[3]
		Preparation and Analytical Method	EPA Method SW8260B	EPA Method SW9060A	EPA Method SW9056A	EPA Method RSK 175 SOP VGC-11	Method FL-PRO	EPA Method SW6010C/3005A
		Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP VGCMS-05	ENCO Orlando / WETS-66	ENCO Orlando / SOP WETS-57	ENCO Orlando/ SOP WETS-57	ENCO Orlando / SOP SVCGC-14	ENCO Jacksonville / SOP EXMT 12 and SOP MET- 05
		Data Package Turnaround Time	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days
		Container Type/ Volume required (if different than container volume)	3 x 40mL glass, Septa vial Teflon-lined septum sealed cap	2 x 40 mL glass, Septa vial Teflon-lined septum sealed cap	1 x 500 mL plastic	3 x 40mL glass, Septa vial Teflon-lined septum sealed cap	2 x 1 L Amber glass, teflon-lined cap	1 x 1 500mL plastic
		Preservative	Hydrochloric Acid (HCl) pH <2 Ice to 4°C	Phosphoric Acid pH <2 Ice to 4°C	Ice to 4°C	Ice to 4°C HCl pH <2	Sulfuric acid (H_2SO_4) pH < 2 ice to 4°C	Nitric Acid (HNO_3) pH <2/ Ice to 4°C
		Holding Time (Preparation/ Analysis)	NA / 14 days	NA / 28 days	NA / 48 hours for nitrate/nitrite 28 days for chloride/sulfate	NA / 14 days	7 days / 40 days	NA / 6 months
Sample ID	**Matrix**	**Depth/Sampling Interval (Screen Interval, feet bgs)**						
DPT-1B	Groundwater	76.4 to 78.9	monthly					
DPT-2B	Groundwater	78.5 to 81	monthly					
OLD-13-60D	Groundwater	100 to 110	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly
OLD-13-62D	Groundwater	110 to 120	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly
OLD-13-66DC3	Groundwater	89 to 94	monthly					
OLD-13-66DC4	Groundwater	104 to 109	monthly					
OLD-13-66DC5	Groundwater	115 to 120	monthly					
OLD-13-66DC6	Groundwater	127 to 132	monthly					
OLD-13-69DC4	Groundwater	100 to 105	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly	baseline, monthly
OLD-13-69DC5	Groundwater	110 to 115	monthly					
OLD-13-69DC6	Groundwater	122 to 127	monthly					
Field QC Samples		**Total Number of Primary Samples**	**14**	**6**	**6**	**6**	**6**	**6**
OLD-13-66DC4-a	Field Duplicate	104 to 109	baseline, monthly					
OLD-13-66DC3-ms	MS	110 to 120	baseline, monthly					
OLD-13-66DC3-msd	MSD	110 to 120	baseline, monthly					
Trip Blank	Ambient Field Blank	NA	baseline, monthly					
		Total Number of Samples to the Laboratory	**22**	**6**	**6**	**6**	**6**	**6**

Notes:

TOC = total organic carbon

MEE = methane, ethane, and ethene.

[1] VOCs to be analyzed consist of PCE, TCE, cis-1,2-DCE, 1,1-dichloroethene, and vinyl chloride.

[2] Anions consist of the following: chloride, nitrite, nitrate, and sulfate. Ferrous iron and alkalinity will also be measured in the field using test kits.

[3] UIC testing inlcudes TRPH (FL PRO) and sodium. Chloride is included in the anions list.

Environmental Conservation Laboratories, Inc. (ENCO Orlando); 10775 Central Port Drive Orlando, FL 32824; Point of Contact: Marcia Colon; Phone: 407-826-5314

Table 5 Pilot Study Sampling Schedule - Final Event
OU 4, NTC Orlando, FL

CTO JM69 Operable Unit 4 (OU4) EOS® Injection Pilot Study Sampling Dates TBD		Analysis Group	VOCs[1]	TOC	Anions[2]	MEE	qPCR[3]	CSIA[4]	TRPH[5]	Sodium[3]
		Preparation and Analytical Method	EPA Method SW8260B	EPA Method SW9060A	EPA Method SW9056A	EPA Method RSK 175 SOP VGC-11	qPCR (Microbial Insights Method)	$\delta^{13}C$ for PCE and degradation products	Method FL-PRO	EPA Method SW6010C/3005A
		Analytical Laboratory/ Preparation and Analytical SOP Reference	ENCO Orlando / SOP VGCMS-05	ENCO Orlando / WETS-66	ENCO Orlando / SOP WETS-57	ENCO Orlando/ SOP WETS-57	Microbial Insights/DNA-qPCR	PAES / SOPAM24	ENCO Orlando / SOP SVCGC-14	ENCO Jacksonville / SOP EXMT-12 and SOP MET- 05
		Data Package Turnaround Time	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days	21 Calendar days	30 Calendar days	21 Calendar days	21 Calendar days
		Container Type/ Volume required (if different than container volume)	3 x 40mL glass, Septa vial Teflon-lined septum sealed cap	2 x 40 mL glass, Septa vial Teflon-lined septum sealed cap	1 x 500 mL plastic	3 x 40mL glass, Septa vial Teflon-lined septum sealed cap	1 filter (after filtering a minimum of 1 L of water) or 2 liters HDPE	9 x 40mL glass, Septa vial Teflon-lined septum sealed cap	2 x 1 L Amber glass, teflon-lined cap	1 x 1 500mL plastic
		Preservative	Hydrochloric Acid (HCl) pH <2 Ice to 4°C	Phosphoric Acid pH <2 Ice to 4°C	Ice to 4°C	Ice to 4°C HCl pH <2	Ice to ≤ 6ºC	Ice to 4°C HCl pH <2	Sulfuric acid (H_2SO_4) pH < 2 ice to 4°C	Nitric Acid (HNO_3) pH <2/ Ice to 4°C
		Holding Time (Preparation/ Analysis)	NA / 14 days	NA / 28 days	NA / 48 hours for nitrate/nitrite 28 days for chloride/sulfate	NA / 14 days	NA / 24 hours	NA	7 days / 40 days	NA / 6 months
Sample ID	**Matrix**	**Depth/Sampling Interval (Screen Interval, feet bgs)**								
OLD-13-58D	Groundwater	100.5 to 110.5	1							
OLD-13-59D	Groundwater	100 to 110	1							
OLD-13-60D	Groundwater	100 to 110	1	1	1	1	1	1	1	1
OLD-13-61D	Groundwater	99 to 109	1							
OLD-13-62D	Groundwater	110 to 120	1	1	1	1	1	1	1	1
OLD-13-63D	Groundwater	96 to 106	1							
OLD-13-65DC5	Groundwater	113 to 118	1							
OLD-13-66DC3	Groundwater	89 to 94	1							
OLD-13-66DC4	Groundwater	104 to 109	1							
OLD-13-66DC5	Groundwater	115 to 120	1	1	1	1	1	1	1	1
OLD-13-66DC6	Groundwater	127 to 132	1							
OLD-13-67DC4	Groundwater	110 to 115	1							
OLD-13-68DC5	Groundwater	105 to 110	1							
OLD-13-69DC4	Groundwater	100 to 105	1	1	1	1	1	1	1	1
OLD-13-69DC5	Groundwater	110 to 115	1							
OLD-13-69DC6	Groundwater	122 to 127	1							
OLD-13-70DC4	Groundwater	101 to 106	1							
OLD-13-70DC5	Groundwater	112 to 117	1							
OLD-13-INJ01D	Groundwater	110 to 120	1							
OLD-13-INJ02D	Groundwater	110 to 120	1							
DPT-1B	Groundwater	76.4 to 78.9	1							
DPT-2B	Groundwater	78.5 to 81	1							
Field QC Samples		**Total Number of Primary Samples**	**22**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
OLD-13-66DC4-a	Field Duplicate	104 to 109	1							
OLD-13-69DC5-a	Field Duplicate	110 to 115	1							
OLD-13-SB12-ms	MS	110 to 120	1							
OLD-13-SB12-msd	MSD	110 to 120	1							
Trip Blank	Ambient Field Blank	NA	1							
		Total Number of Samples to the Laboratory	**27**	**4**	**4**	**4**	**4**	**4**	**4**	**4**

Notes:

DNA-qPCR = deoxyribonucleic acid - quantitative polymerase chain reaction

DHC = *Dehalococcoides* spp.

TOC = total organic carbon

MEE = methane, ethane, and ethene.

[1] VOCs to be analyzed consist of PCE, TCE, cis-1,2-DCE, 1,1-dichloroethene, and vinyl chloride.

[2] Anions consist of the following: chloride, nitrite, nitrate, and sulfate. Ferrous iron and alkalinity will also be measured in the field using test kits.

[3] Screening analysis for the following gene targets: qDHC, qTCE, qVC, qBVC (DHC functional genes), and qEBAC (total bacteria biomass).

[4] Compound Specific Isotope Analysis (CSIA) to be performed for the following compounds: PCE, TCE, cDCE, and VC.

[5] UIC testing inlcudes TRPH (FL PRO) and sodium. Chloride is included in the anions list.

Environmental Conservation Laboratories, Inc. (ENCO Orlando); 10775 Central Port Drive Orlando, FL 32824; Point of Contact: Marcia Colon; Phone: 407-826-5314

Microbial Insights, Inc.; 10515 Research Dr., Knoxville, TN 37932; Point of Contact: Kate Clark; Phone: (865) 573-8188, ext. 100

Pace Analytical Energy Services, LLC; (PAES; formely Microseeps, Inc.); 220 William Pitt Way, Pittsburgh, PA 15238; Point of Contact: Robbin Robl; Phone: 412-826-4483

ATTACHMENT A

Volume Calculations

Design Summary

Site Information

Site Name	***OU4 - Area 1 (D3 - 62D)***	
Location	***orlando fl***	
Project Number		
Treatment Type	Value	Units
Barrier or Source Treatment	***Source Area***	
EOS Product	***EOS Pro***	
Length of Treatment Area Parallel to Groundwater Flow, \"x\"	***50***	ft
Width of treatment area perpendicular to groundwater flow, "y"	***50***	ft
Treatment thickness, "z"	***15***	ft
Nominal soil type	***Clay***	
Estimated Total Porosity	***0.3***	
Estimated Effective Porosity	***0.3***	
Soil bulk density	***115.8038658***	pcf
Fraction of Organic Carbon	***0.001***	
Biochemical		
pH of groundwater	***7.4***	SU
Alkalinity of Groundwater	***170***	mg/L as CaCO3
Geohydrology		
Hydraulic Conductivity	***3.6***	ft/d
Hydraulic Gradient	***-0.003***	ft/ft
Seepage Velocity	***0.01***	ft/d
Contact time	***100***	days
Design Life per application	***5***	yrs

Analytical

Dissolved Oxygen (DO)	***0.45***	mg/L
Nitrate Nitrogen (NO3- - N)	***0.5***	mg/L
Sulfate (SO42-)	***6***	mg/L
Tetrachloroethene (PCE), C2Cl4	***10.7***	mg/L
Trichloroethene (TCE), C2HCl3	***0.83***	mg/L
cis-1,2-dichloroethene (c-DCE), C2H2Cl2	***1.9***	mg/L
Vinyl Chloride (VC), C2H3Cl	***0.15***	mg/L

Design

Design Factor	***1.5***	times
Stoichiometric Hydrogen Demand	***6.873542293***	lbs
Effective treatment thickness for substrate, "ze"	***30***	
Absorptive Capacity of soil	***0.003***	
Substrate from hydrogen demand	***186.7812865***	lbs
Substrate required from Adsorption	***4901.80811***	lbs
DOC Released	***159.2110985***	lbs
Estimated Amount of Fe2+ Formed	***10***	mg/L
Estimated Amount of Manganese (Mn2+) Formed	***5***	mg/L
Estimated Amount of CH4 Formed	***5***	mg/L
Target Amount of DOC to Release	***60***	mg/L
Mass to be treated	***1302793.49***	lbs
Estimated total groundwater volume treated over design life	***84174.08875***	gal

Calculated Substrate Requirement

Substrate Requirement Based on Hydrogen Demand and Carbon Loss	***186.7812865***	lbs
Substrate Requirement Based on Oil Entrapment by Aquifer Material	***4901.80811***	lbs
EOS Pro Requirement	***12***	drums
(assumes 55 gallons per drum)	***660***	gal

Substrate Distribution

Injection well screen length	***10***	ft
Direct injection interval	***15***	ft
Number of injection wells	***2***	ea
Number of direct injection locations	***5***	ea
Total injection interval	***95***	lf
EOS Pro distribution	***7***	gal/lf
EOS Pro volume per injection well	***69***	gal
EOS Pro volume per direct injection pt	***104***	gal

Design Summary

Site Information

Site Name	***OU4 - Area 2 (D4 - 60D)***	
Location	***orlando fl***	
Project Number		
Treatment Type	Value	Units
Barrier or Source Treatment	***Source Area***	
EOS Product	***EOS Pro***	
Length of Treatment Area Parallel to Groundwater Flow, \"x\"	***30***	ft
Width of treatment area perpendicular to groundwater flow, "y"	***30***	ft
Treatment thickness, "z"	***15***	ft
Nominal soil type	***Clay***	
Estimated Total Porosity	***0.3***	
Estimated Effective Porosity	***0.3***	
Soil bulk density	***115.8038658***	pcf
Fraction of Organic Carbon	***0.001***	
Biochemical		
pH of groundwater	***7.4***	SU
Alkalinity of Groundwater	***170***	mg/L as CaCO3
Geohydrology		
Hydraulic Conductivity	***3.6***	ft/d
Hydraulic Gradient	***-0.003***	ft/ft
Seepage Velocity	***0.01***	ft/d
Contact time	***100***	days
Design Life per application	***5***	yrs

Analytical

Dissolved Oxygen (DO)	***0.45***	mg/L
Nitrate Nitrogen (NO3- - N)	***0.5***	mg/L
Sulfate (SO42-)	***6***	mg/L
Tetrachloroethene (PCE), C2Cl4	***10.7***	mg/L
Trichloroethene (TCE), C2HCl3	***0.83***	mg/L
cis-1,2-dichloroethene (c-DCE), C2H2Cl2	***1.9***	mg/L
Vinyl Chloride (VC), C2H3Cl	***0.15***	mg/L

Design

Design Factor	***1.5***	times
Stoichiometric Hydrogen Demand	***2.848750749***	lbs
Effective treatment thickness for substrate, "ze"	***30***	
Absorptive Capacity of soil	***0.003***	
Substrate from hydrogen demand	***78.84163001***	lbs
Substrate required from Adsorption	***1764.65092***	lbs
DOC Released	***67.41512088***	lbs
Estimated Amount of Fe2+ Formed	***10***	mg/L
Estimated Amount of Manganese (Mn2+) Formed	***5***	mg/L
Estimated Amount of CH4 Formed	***5***	mg/L
Target Amount of DOC to Release	***60***	mg/L
Mass to be treated	***469005.6565***	lbs
Estimated total groundwater volume treated over design life	***30314.35195***	gal

Calculated Substrate Requirement

Substrate Requirement Based on Hydrogen Demand and Carbon Loss	***78.84163001***	lbs
Substrate Requirement Based on Oil Entrapment by Aquifer Material	***1764.65092***	lbs
EOS Pro Requirement	***5***	drums
(assumes 55 gallons per drum)	***275***	gal
EOS Pro volume per injection point	***92***	gal

Design Summary

Site Information

Site Name	***OU4 - Area 3 (D5-barrier)***	
Location	***orlando fl***	
Project Number		
Treatment Type	Value	Units
Barrier or Source Treatment	***Barrier***	
EOS Product	***EOS Pro***	
Spacing Between Injection Wells, \"x\"	***13***	ft
Width of treatment area perpendicular to groundwater flow, "y"	***60***	ft
Treatment thickness, "z"	***20***	ft
Nominal soil type	***Clay***	
Estimated Total Porosity	***0.3***	
Estimated Effective Porosity	***0.3***	
Soil bulk density	***115.8038658***	pcf
Fraction of Organic Carbon	***0.001***	
Biochemical		
pH of groundwater	***7.4***	SU
Alkalinity of Groundwater	***170***	mg/L as CaCO3
Geohydrology		
Hydraulic Conductivity	***3.6***	ft/d
Hydraulic Gradient	***-0.003***	ft/ft
Seepage Velocity	***0.01***	ft/d
Contact time	***100***	days
Design Life per application	***10***	yrs

Analytical

Dissolved Oxygen (DO)	***0.45***	mg/L
Nitrate Nitrogen (NO3- - N)	***0.5***	mg/L
Sulfate (SO42-)	***6***	mg/L
Tetrachloroethene (PCE), C2Cl4	***10.7***	mg/L
Trichloroethene (TCE), C2HCl3	***0.83***	mg/L
cis-1,2-dichloroethene (c-DCE), C2H2Cl2	***1.9***	mg/L
Vinyl Chloride (VC), C2H3Cl	***0.15***	mg/L

Design

Design Factor	***1.5***	times
Stoichiometric Hydrogen Demand	***6.796159902***	lbs
Effective treatment thickness for substrate, "ze"	***30***	
Absorptive Capacity of soil	***0.003***	
Substrate from hydrogen demand	***210.6414746***	lbs
Substrate required from Adsorption	***2039.152174***	lbs
DOC Released	***183.381672***	lbs
Estimated Amount of Fe2+ Formed	***10***	mg/L
Estimated Amount of Manganese (Mn2+) Formed	***5***	mg/L
Estimated Amount of CH4 Formed	***5***	mg/L
Target Amount of DOC to Release	***60***	mg/L
Mass to be treated	***541962.0919***	lbs
Estimated total groundwater volume treated over design life	***35045.32892***	gal

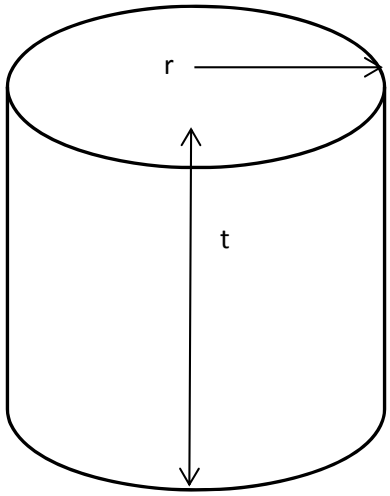
Calculated Substrate Requirement

Substrate Requirement Based on Hydrogen Demand and Carbon Loss	***210.6414746***	lbs
Substrate Requirement Based on Oil Entrapment by Aquifer Material	***2039.152174***	lbs
EOS Pro Requirement	***5***	drums
(assumes 55 gallons per drum)	***275***	gal
EOS Pro volume per injection point	***55***	gal

INJECTION PORE VOLUME CALCULATIONS

Hawthorn WBZ at OU 4, NTC Orlando, FL

TREATMENT ZONE D3 - INJ01/INJ02



Injection volume	2,754	gallons
EOS solution	2.5%	
EOS volume	70	gallons
Dilution water volume	2,684	gallons
EOS volume	70	gallons
Mixture volume	2,754	gallons
Injection Mixture volume/ft	275	gallons

r = 12.5 feet

t = 10 feet

$$A = \pi r^2$$

$$Vtotal = t * \pi r^2$$

4,909 =Vtotal in cubic feet

$$Vpore = Vtotal * n$$

where:

Vtotal = total volume

Vpore = pore volume

n = porosity

n = 0.3

1,473 cubic feet 7.48 gallons per ft^3

11,016 gallons

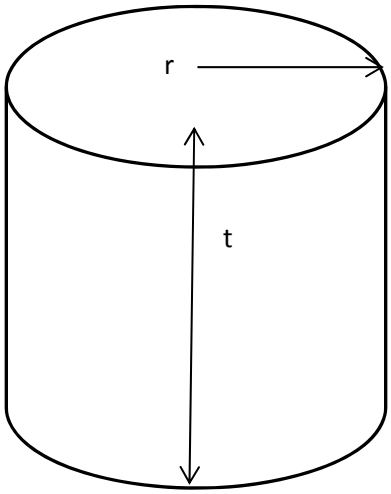
assume that 25% of pore volume is accessible

injection volume **2,754** gallons

INJECTION PORE VOLUME CALCULATIONS

Hawthorn WBZ at OU 4, NTC Orlando, FL

TREATMENT ZONE D3 - Five Additional Proposed Injection Points



Injection volume	4,131	gallons
EOS solution	2.5%	
EOS volume	104	gallons
Dilution water volume	4,027	gallons
EOS volume	104	gallons
Mixture volume	4,131	gallons
Injection Mixture volume/ft	275	gallons

r = 12.5 feet

t = 15 feet

$$A = \pi r^2$$

$$Vtotal = t * \pi r^2$$

7,363 =Vtotal in cubic feet

$$Vpore = Vtotal * n$$

where:

Vtotal = total volume

Vpore = pore volume

n = porosity

n = 0.3

2,209 cubic feet 7.481 gallons per ft^3

16,524 gallons

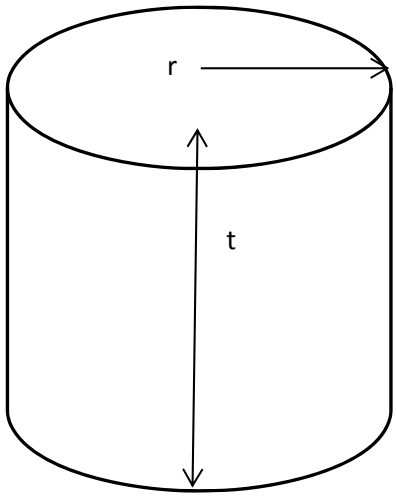
assume that 25% of pore volume is accessible

injection volume 4,131 gallons

INJECTION PORE VOLUME CALCULATIONS

Hawthorn WBZ at OU 4, NTC Orlando, FL

TREATMENT ZONE D4 - Three Proposed Injection Points



Injection volume	4,131	gallons
EOS solution	2.2%	
EOS volume	92	gallons
Dilution water volume	4,039	gallons
EOS volume	92	gallons
Mixture volume	4,131	gallons
Injection Mixture volume/ft	275	gallons

r = 12.5 feet

t = 15 feet

$$A = \pi r^2$$

$$Vtotal = t * \pi r^2$$

7,363 =Vtotal in cubic feet

$$Vpore = Vtotal * n$$

where:

Vtotal = total volume

Vpore = pore volume

n = porosity

n = 0.3

2,209 cubic feet 7 gallons per ft^3

16,524 gallons

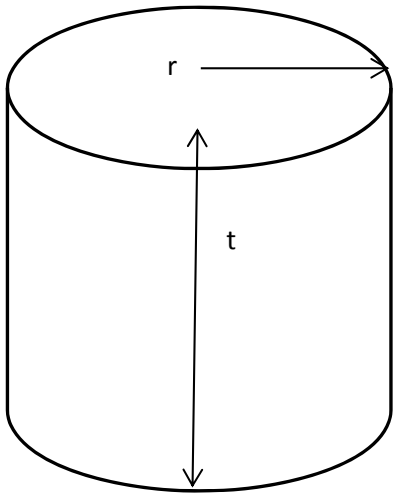
assume that 25% of pore volume is accessible

injection volume 4,131 gallons

INJECTION PORE VOLUME CALCULATIONS

Hawthorn WBZ at OU 4, NTC Orlando, FL

TREATMENT ZONE D5 - Five Proposed Injection Points



Injection volume	5,508	gallons
EOS solution	1.0%	
EOS volume	55	gallons
Dilution water volume	5,453	gallons
EOS volume	55	gallons
Mixture volume	5,508	gallons
Injection Mixture volume/ft	275	gallons

r = 12.5 feet

t = 20 feet

$$A = \pi r^2$$

$$Vtotal = t * \pi r^2$$

9,817 =Vtotal in cubic feet

$$Vpore = Vtotal * n$$

where:

Vtotal = total volume

Vpore = pore volume

n = porosity

n = 0.3

2,945 cubic feet 7.481 gallons per ft^3

22,032 gallons

assume that 25% of pore volume is accessible

injection volume 5,508 gallons

ATTACHMENT B

November 2014 Soil Boring Logs and Injection Well Construction Details

BORING LOG

Boring/Well Number: OLD-13-SB09 / OLD-13-INJ01D	Permit Number:		FDEP Facility Identification Number: NA
Site Name: NTC ORLANDO OU4	Borehole Start Date: 11-17-14 End Date: 11-19-14	Borehole Start Time: 1020 (AM) PM End Time: 1140 (AM) PM	
Environmental Contractor: AECOM (REMEDIATION CONSULTANTS)	Geologist's Name: DAN PHILLIPS		Environmental Technician's Name: DANE TRAN
Drilling Company: GPI (DRILL PRO)	Pavement Thickness (inches): NA	Borehole Diameter (inches): 6"	Borehole Depth (feet): 140'
Drilling Method(s): ROTOSONIC	Apparent Borehole DTW (in feet from soil moisture content): 4'	Measured Well DTW (in feet after water recharges in well): 12.5'	OVA (list model and check type): ~~Foxboro GC128~~ MINI RAE 2000 FID (PID)

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☒ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

INJECTION WELL OLD-13-INJ01D

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
PH	0-5	60	NA				1	Soil/grass concrete asphalt @ surface	SP	D	
							2	BROWN + LT. GRAY FINE-GRAINED SANDS (FGS)		TO	
							3			W	
							4				
				5.1	NA	NA	5				
SC	5-10	60	NA				6	PALE BROWN (10YR 6/3) FGS	SP	S	
							7				
							8				
							9				
				3.5	NA	NA	10				
SC	10-20	120	NA				11	10-15 VERY DK BROWN TO BLACK SILTY FGS	SM	S	
							12				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB09 / INSOID	NA	NTC ORLANDO OLY	11-17-14 / 11-19-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SS	10-20	120	NA				13	10-18 VERY DK BROWN TO BLACK SILTY FGS	SM	S	
							14				
				1.2	NA	NA	15				
							16				
							17				
							18	18-20 YELLOWISH BROWN (10 YR 5/6) TO BROWN (7.5 YR 4/4) SILTY TO CLAYEY SAND	SM	S	
							19				
				0.9	NA	NA	20				
SS	20-30	120	NA				21	20-25 YELLOWISH BROWN TO BROWN SL. SILTY FGS	SM	S	
							22				
							23				
							24				
				1.1	NA	NA	25	25-30 BROWN (7.5 YR 4/4) SL. SILTY FGS	SM	S	
							26				
							27				
							28				
							29				
				0.7	NA	NA	30				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
UZD-13-SB09/INSOID	NA	NTC ORLANDO OU4	11-17-19 / 11-17-19

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	30-40	120	NA				31	30-35 BROWNISH YELLOW (10YR 6/6) SL. SILTY FGS	SM	S	
							32				
							33				
							34				
				5.3	NA	NA	35	35-40 DK. YELLOWISH BROWN (10YR 4/6) SL. SILTY FGS	SM	S	
							36				
							37				
							38				
							39				
				1.1	NA	NA	40				
SC	40-53	120	NA				41	40-47 LT. YELLOWISH BROWN TO BROWNISH YELLOW (10YR 6/4 TO 6/6) SL. SILTY FGS	SM	S	
							42				
							43				
							44				
				0.9	NA	NA	45				
							46				
							47	47-50 GRAYISH BROWN (10YR 5/2) SL. SILTY FGS	SM	S	
							48				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
02D-13-SB09/INSCID	NA	NTC ORLANDO CLM	11-17-14 / 11-19-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	46-50	120	NA				49	47-50 GRAYISH BROWN (10YR 5/2) SC, SILTY FGS	SM	S	
				2.2	NA	NA	50				
SC	50-60	120	NA				51	50-60 SAME AS ABOVE	SM	S	
							52				
							53				
							54				
				0.5	NA	NA	55				
							56				
							57				
							58				
							59				
				0.2	NA	NA	60				
SC	60-70	120	NA				61	60-70 GRAY (2.5Y 5/1) SILTY/SANDY CLAY, VERY SOFT FROM 60-66' BLS BECOMING TIGHTER/MORE FIRM WITH DEPTH.	SC	S	
							62				
							63				
							64				
				1.1	NA	NA	65				
							66				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OUB-13-SB03/INJ03D	NA	NTC ORLANDO OUM	11-17-14 / 11-19-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	60-70	120	NA				67	66-70 GRAY (2.5Y 5/1) SILTY/SANDY CLAY, SOFT, MEDIUM PLASTICITY SL. FIRMER IN THE BOTTOM 2 FEET.	SC-CL	S	
				OB	NA	NA	68				
							69				
							70				
SC	70-80	0	NA				71	NO RECOVERY!!			
							72				
							73				
							74				
				NA	NA	NA	75				
							76				
							77				
							78				
							79				
				NA	NA	NA	80				
SC	80-90	120	NA				81	80-86 LT. GRAY (2.5Y 7/2) SAND/SILT/SHELL HASH, VERY LOOSE, APPROX. 30-40% SHELL	SM	S	
							82				
							83				
							84				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB03/INJ01D	NA	NTC ORLANDO OLD	11-17-14 / 11-19-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	80-90	120	NA	0.8	NA	NA	85	80-86 LT. GRAY (2.5 Y 7/2) SAND/SILT/SHELL HASH VERY LOOSE, SHELL 30-40%	SM	S	
							86				
							87	86-90 LT. OLIVE GRAY (5Y 6/2) SILTY FGS (ONLY A TRACE OF SHELL)	SM	S	
							88				
							89				
				0.6	NA	NA	90				
SC	90-105	180	NA				91	90-94 LT. OLIVE GRAY (5Y 6/2) CLAYEY SAND W/ 10-20% SHELL FRAGMENTS	SC	S	
							92				
							93				
							94	94-105 LT. OLIVE GRAY (5Y 6/2) SILTY SAND W/ NO SHELL	SM	S	
				0.2	NA	NA	95				
							96				
							97				
							98				
							99				
				0.2	NA	NA	100				
							101				
							102				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

Florida Department of Environmental Protection - Division of Waste Management - Bureau of Petroleum Storage Systems

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB09/INSOID	NA	NTC ORLANDO	11-17-14 / 11-19-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	90-105	180	NA				103	94-105 LT. OLIVE GRAY (5Y 6/2) SILTY SANDS W/NO TRACE of SHELL FRAGMENTS.	SM	S	
							104				
				0.3	NA	NA	105				GW SB09-100/105
SC	105-110	60	NA				106	105-106 SAME AS ABOVE	SM-GC	S	
								106-110 SAME COLOR, SILTY/CLAYEY SANDS + GRAVELS			
							107				
							108				
							109				GW
				0.5	NA	NA	110				SB09-105/110
SC	110-115	60	NA				111	110-112 MOTTLED GRAY TO LT. GRAY SL. CLAYEY SAND/SILT/GRAVEL	GC	S	
				61.1	NA	NA					
							112	112-115 LT. GRAY (2.5Y 7/2) SL. CLAYEY SAND/SILT + NO GRAVEL	SC	S	
							113				
							114				GW
				642	NA	NA	115				SB09-110/115
SC	115-120	60	NA				116	115-120 LT. GRAY (5Y 7/2) TIGHTLY PACKED, POORLY GRADED, SL. CLAYEY SILT/SAND	SM	S	
							117				
							118				
							119				GW
				25.1	NA	NA	120				SB09-115/120

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date:
OLD-13-SB09/IN501D	NA	NTC ORLANDO OUY	11-18-14 End Date: 11-19-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	120-125	60	NA				121	120-125 LT. OLIVE GRAY (5Y 6/2) TO LT. GRAY (5Y 7/2) POORLY GRADED, SILTY SAND, TIGHTLY PACKED	SM	S	
							122				
							123				
							124				GW SB09-120/125
				0.1	NA	NA	125				
SC	125-130	60	NA				126	125-130 LT. GRAY (5Y 7/2) VERY TIGHTLY PACKED SILTY SAND	SM	S	
							127				
							128	(LESS TIGHT AT 128-130' BLS)			
							129				GW SB09-125/130
				10.6	NA	NA	130				
SC	130-135	60	NA				131	130-133 SAME AS ABOVE BECOMING CLAYEY - STILL TIGHTLY PACKED	SM	S	
							132				
							133	133-135 WHITE (5Y 8/1) SILTY CLAY - DENSE	CL	D	
							134				GW SB09-130/135
				0	NA	NA	135				
SC	135-140	60	NA				136	135-137.5 LT. OLIVE GRAY (5Y 6/2) SILTY CLAY	CL	M	
							137				
							138	137.5-140 CLAY BECOMES STIFF	CL	M	

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB09/INSOIL	NA	NTC ORLANDO OU4	11-17-14 / 11-19-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	135-140	60	NA					137.5-140 LT. OLIVE GRAY (5Y 6/2) SILTY CLAY, STIFF	CL	M	
				0	NA	NA	139				GW SB09-135/140
							140	BORING TERMINATED @ 140' BLS			
							141				
							142				
							143				
							144				
							145				
							146				
							147				
							148				
							149				
							150				
							151				
							152				
							153				
							154				
							155				
							156				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number: OLD-13-SB-10	Permit Number:	FDEP Facility Identification Number: NA
Site Name: NTC ORLANDO OU4	Borehole Start Date: 11-21-14 End Date: 11-24-14	Borehole Start Time: 0900 (AM) PM End Time: 1330 ~~AM~~ (PM)
Environmental Contractor: (AECOM) RESOLUTION CONSULTANTS	Geologist's Name: DAN PHILLIPS	Environmental Technician's Name: DAVE TRAN
Drilling Company: GPI (DRILPRO)	Pavement Thickness (inches): NA	Borehole Diameter (inches): 6" / Borehole Depth (feet): 150'
Drilling Method(s): ROTOSONIC	Apparent Borehole DTW (in feet from soil moisture content): 4'	Measured Well DTW (in feet after water recharges in well): NA / OVA (list model and check type): ~~Foxboro OC128~~ MINIRAE 2000 (PID) FID (PID)

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☐ Well ☒ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
								Soil/grass concrete asphalt @ surface			
PH	0-5	60	NA				1	0-5 BROWN TO GRAY FGS	SP	D	
							2			D	
							3			M	
							4			W	
				0	NA	NA	5			S	
SC	5-10	30	NA				6	5-10 DK BROWN SL. SILTY FGS TO LT. BROWNISH GRAY FGS	SP SM	S	
							7				
							8				
							9				
				0	NA	NA	10				
SC	10-20	120	NA				11	10-15 BLACK (10YR 2/2) SL. SILTY FGS	SM	S	
							12				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number: OLD-13-SB-10	Permit Number:	FDEP Facility Identification Number: NA
Site Name: NTC ORLANDO OU4	Borehole Start Date: 11-21-14 End Date: 11-24-14	Borehole Start Time: 0900 (AM) PM End Time: 1330 ~~AM~~ (PM)
Environmental Contractor: (AECOM) RESOLUTION CONSULTANTS	Geologist's Name: DAN PHILLIPS	Environmental Technician's Name: DAVE TRAN
Drilling Company: GPI (DRILPRO)	Pavement Thickness (inches): NA	Borehole Diameter (inches): 6" / Borehole Depth (feet): 150'
Drilling Method(s): ROTOSONIC	Apparent Borehole DTW (in feet from soil moisture content): 4'	Measured Well DTW (in feet after water recharges in well): NA / OVA (list model and check type): ~~Foxboro OC128~~ MINIRAE 2000 (PID) FID (PID)

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☐ Well ☒ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
								Soil/grass concrete asphalt @ surface			
PH	0-5	60	NA				1	0-5 BROWN TO GRAY FGS	SP	D	
							2			D	
							3			M	
							4			W	
				0	NA	NA	5			S	
SC	5-10	30	NA				6	5-10 DK BROWN SL. SILTY FGS TO LT. BROWNISH GRAY FGS	SP SM	S	
							7				
							8				
							9				
				0	NA	NA	10				
SC	10-20	120	NA				11	10-15 BLACK (10YR 2/2) SL. SILTY FGS	SM	S	
							12				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB10	NA	MTC ORLANDO ONY	11-21-14 / 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	10-20	120	NA				13				
							14				
				0	NA	NA	15	15-20 BROWN (7.5YR 4/4) FGS SL. CLAYEY @ 15-18' BLS.	SM-SC	S	
							16				
							17				
							18				
							19				
				0	NA	NA	20				
SC	20-40	240	NA				21	~~20-25~~ (20) 20-25 STRONG BROWN (7.5YR 4/6) FGS, SL. SILTY	SM		
							22				
							23				
							24				
				0	NA	NA	25	25-40 STRONG BROWN (7.5YR 5/6) FGS, SL. SILTY.	SM		
							26				
							27				
							28				
							29				
				0	NA	NA	30				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB10	NA	NTC ORLANDO OUA	11-21-14 / 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	20-40	240	NA				31	25-40 STRONG BROWN (7.5 YR 5/6) SL. SILTY FGS	SM	S	
							32				
							33				
							34				
				0	NA	NA	35				
							36				
							37				
							38				
							39				
				0	NA	NA	40				
SC	40-60	240	NA				41	40-58 BROWNISH YELLOW (10YR 6/6) SL. SILTY FGS	SM	S	
							42				
							43				
							44				
				0	NA	NA	45				
							46				
							47				
							48				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date:
MB-13-SB10	NA	MC ORLANDO OUC	11-21-14
			End Date: 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	40-60	240	NA				49	40-52 BRANNISH YELLOW (10YR 6/6) SL. SILTY FGS	SM	S	
				0	NA	NA	50				
							51				
							52	52-60 LT. OLIVE BROWN (2.5Y 5/3) SL. SILTY FGS	SM	S	
							53				
							54				
				0	NA	NA	55				
							56				
							57				
							58				
							59				
				0	NA	NA	60				
SC	60-80	240	NA				61	60-66 BK. GRAY (5Y 4/1) CLAY, SOFT	CL	S	
							62				
							63				
							64				
				0	NA	NA	65				
							66				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: 11-21-14
021-13-SB11	NA	MTC ORLANDO OUY	End Date: 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	60-80	240	NA				67	66-68 LT. GRAY (5Y 7/1) CLAY, SOFT	CL	S	
							68	68-70 LT. GRAY SHELL/CLAY/SILT MIX - LOOSE	CL	S	
							69				
				0	NA	NA	70	70-72 LT. GRAY CLAY, SOFT	CL	S	
							71				
							72	72-78 ~~LT. GRAY~~ WHITE (5Y 8/1) SHELL/CLAY/SILT MIX - VERY LOOSE	CL	S	
							73				
							74				
				0	NA	NA	75				
							76				
							77				
							78	78-80 OLIVE GRAY (5Y 4/2) SILTY FGS	SM	S	
							79				
				0	NA	NA	80				
SC	80-100	240	NA				81	80-84 GRAY (5Y 6/1) SILTY FGS	SM	S	
							82				
							83				
							84				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date:
OLD-13-SB10	NA	NTC ORLANDO OU4	11-21-14
			End Date: 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	82-100	240	NA								
				0	NA	NA	85	84-89 OLIVE GRAY (5Y 5/2) SILTY FGS	SM	S	
							86				
							87				
							88				
							89	89-95 OLIVE GRAY (5Y 5/2) CLAYEY FGS WITH SHELL (10-20%)	SM	S	
				0	NA	NA	90				
							91				
							92				
							93				
							94				
				0	NA	NA	95	95-100 OLIVE GRAY (5Y 5/2) SILTY FGS	SM	S	
							96				
							97				
							98				
							99				
				0	NA	NA	100				
SC	100-120	240	NA					100-104 SAME AS ABOVE	SM	S	
							101				
							102				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
ORA-13-SB10	NA	NTC ORLANDO OUY	11-21-14 / 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	100-120	240	NA				103	100-104 OLIVE GRAY (5Y 5/2) SILTY FGS	SM	S	
							104	104-109 OLIVE GRAY (5Y 5/2) GRAVELLY CLAY/SAND MIX.	CL	S	
				0.2	NA	NA	105				
							106				
							107				
							108				
							109	109-114 OLIVE GRAY (5Y 5/2) SL. CLAYEY FGS	SC	S	
				0.1	NA	NA	110				
							111				
							112				
							113				
							114	114-116 LT. GRAY (5Y 7/2) GRAVELLY CLAY	CL	S	
				0.3	NA	NA	115				
							116	116-120 LT. GRAY (5Y 7/2) SILTY CLAY	CL	S	
							117				
							118				
							119				
				0.7	NA	NA	120				GW SB11-115/120

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date:
OLD-13-SB10	NA	NTC ORLANDO OLY	11-21-14 End Date: 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	120-130	120	NA				121	120-126 GRAY (5Y 5/1) SILTY + SL. CLAYEY FGS, TIGHTLY PACKED.	SM-SC	S	
							122				
							123				
							124				
				0	NA	NA	125				
							126	126-130 LT. GRAY (5Y 7/2) SILTY CLAY, STIFF/TIGHT.	CL	S	
							127				
							128				
							129				
				0	NA	NA	130				SW SB11-125/130
SC	130-140	120	NA				131	130-135 LT. GRAY (5Y 7/2) SANDY CLAY, SOMEWHAT TIGHTLY PACKED.	CL	S	
							132				
							133				
							134				
				5.7	NA	NA	135	135-136 WHITE (5Y 8/1) SILTY CLAY, VERY TIGHT	CL	S	
							136	136-137.5 GRAY (5Y 6/1) SANDY CLAY.	CL	S	
							137				
							138	137.5-140 GRAY SILTY FGS. LOOSE	SM	S	

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: 11-21-14
02D-13-SB10	NA	NTC ORLANDO OU4	End Date: 11-24-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	130-140	120	NA				139	137.5-140 GRAY (5Y 6/1) SILTY FGS - LOOSE	SM	S	
				18.6	NA	NA	140				GW SB11-135/140
SC	140-150	120	NA				141	140-142 LT. GRAY (5Y 7/2) SANDY/SILTY CLAY, TIGHTLY PACKED.	CL	S	
							142				
							143	142-146 LT. OLIVE GRAY (5Y 6/2) SILTY CLAY, TIGHT ~~SP OLIVE GRAY (5Y 5/2)~~	CL	S	
							144				
				1.5	NA	NA	145				
							146	146-150 OLIVE GRAY (5Y 5/2) CLAY, VERY STIFF	CL	S	
							147				
							148				ATTEMPTED BUT NOT COLLECTED.
							149				GW
				1.7	NA	NA	150				SB11-145/150
							151	BORING TERMINATED @ 150'			FORMATION TOO TIGHT.
							152				
							153				
							154				
							155				
							156				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number: ~~OLD-13SB-11~~ OLD-13-SB11	Permit Number:		FDEP Facility Identification Number: NA
Site Name: NTC ORLANDO OU4	Borehole Start Date: 11-19-14 End Date: 11-20-14	Borehole Start Time: ~~1430~~ AM PM End Time: ~~1615~~ 1700 AM PM	
Environmental Contractor: RESOLUTION CONS (AECOM)	Geologist's Name: DAN PHILLIPS		Environmental Technician's Name: DAVE TRAN
Drilling Company: GPI (DRILLPRO)	Pavement Thickness (inches): NA	Borehole Diameter (inches): 6"	Borehole Depth (feet): 140'
Drilling Method(s): ROTOSONIC	Apparent Borehole DTW (in feet from soil moisture content): 4'	Measured Well DTW (in feet after water recharges in well): NA	OVA (list model and check type): ~~Foxboro GC128~~ MULTIRAE 2000 FID PID

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☐ Well ☒ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
PH	0-5	60	NA				1	Soil/grass concrete asphalt @ surface	SP	D	
							2	BROWN TO LT. GRAY FINE-GRAINED		TO	
							3	SAND (FGS).		W	
							4				
				0	NA	NA	5				
SC	5-10	30	NA				6	5-10 DK. GRAYISH BROWN (10YR 4/2)	SP	S	
							7	TO WHITE (10YR 8/1)			
							8	FGS			
							9				
				NA	NA	NA	10				
SC	10-30	204	NA				11	POOR RECOVERY AT TOP	SP	S	
							12	(NO 10' SAMPLE RETRIEVED FOR PID SCREENING)			

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-B-SB-11	NA	NTC ORLANDO OU4	1-19-14 / 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	10-30	204	NA				13	10-13 WASHED OUT	SM	S	
								13-20 BLACK (10YR 2/1) SL. SILTY FGS.			
							14				
				0	NA	NA	15				
							16				
							17				
							18				
							19				
				0.1	NA	NA	20	20-25 BROWN (7.5 4/3) SL. CLAYEY FGS	SM	S	
							21				
							22				
							23				
							24				
				0.1	NA	NA	25	25-27 BRAWNISH YELLOW (10YR 6/6) FGS, SL. SILTY	SM	S	
							26				
							27	27-30 STRONG BROWN (7.5YR 5/6), SL SILTY	SM	S	
							28				
							29				
				0.2	NA	NA	30				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OU6-13-SB-11	NA	NTC GRECANDS OU4	1-19-14 / 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	30-50	240	NA				31	30-48 BROWNISH YELLOW (10 YR 6/6) SC. SILTY FGS	SM	S	
							32				
							33				
							34				
				0	NA	NA	35				
							36				
							37				
							38				
							39				
				0	NA	NA	40				
							41				
							42				
							43				
							44				
				0	NA	NA	45				
							46				
							47				
							48				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
a-B-SB-11	NA	NTC ORLANDO OU4	1-19-14 / 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	30-50	240	NA				49	48-50 GRAYISH BROWN (2.5Y 5/2) SC. SILTY FGS	SM	S	
				0	NA	NA	50				
SC	50-70	240	NA				51	50-58 OLIVE GRAY (5Y 5/2) SC. SILTY FGS	SM	S	
							52				
							53				
							54				
				0	NA	NA	55				
							56				
							57				
							58	58-60 DK GRAY (5Y 4/1) CLAYEY SAND	SC	S	
							59				
				0	NA	NA	60	60-66 DK. GRAY (5Y 4/1) CLAY, SOFT	CL	S	
							61				
							62				
							63				
							64				
				0	NA	NA	65				
							66				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

Florida Department of Environmental Protection - Division of Waste Management - Bureau of Petroleum Storage Systems

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date:
OLD-13-SB-11	NA	NTC ORLANDO OU4	1-19-14
			End Date: 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	50-70	240	NA					66-70 LT. GRAY (2.5Y 7/1) CLAY, VERY SOFT	CL	S	
							67				
							68				
							69				
				0	NA	NA	70				
SC	70-90	240	NA					70.77 WHITE (5Y 8/1) SILT/CLAY/SHELL HASH, LOOSE FORMATION SHELL APPROX. 60-70% (1' OF ~~VERY~~ SOFT CLAY @ 72' BLS)	SC	S	
							71				
							72				
							73				
							74				
				0	NA	NA	75				
							76				
							77	77-85 OLIVE GRAY (5Y 5/2) CLAY + SANDY CLAY, SOFT.	SC	S	
							78				
							79				
				0	NA	NA	80				
							81				
							82				
							83				
							84				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB-11	NA	NTC ORLANDO OUG	1-19-14 / 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	70-90	240	NA				85	85-90 OLIVE GRAY (5Y 5/2) CLAYEY SAND/SANDY CLAY	SC	S	
				0	NA	NA	86				
							87				
							88				
							89				
				0	NA	NA	90				
SC	90-110	240	NA				91	90-95 OLIVE GRAY (5Y 5/2) CLAYEY SAND/SANDY CLAY w/ SHELL - APPROX. 10%	SC	S	
							92				
							93				
							94				
				0	NA	NA	95	95-107 OLIVE GRAY (5Y 5/2) SILTY + SL. CLAYEY SAND (FINE) - NO SHELL EXCEPT SOME SHELL 104' BLS	SM-SC	S	
							96				
							97				
							98				
							99				
				0	NA	NA	100				
							101				
							102				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OU3-13-SB-11	NA	NTC ORLANDO OU4	1-19-14 / 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	90-110	240	NA					95-107 OLIVE GRAY (5Y 5/2) SILTY + SL. CLAYEY FGS - NO SHELL	SM-SC	S	
							103				
							104				
				0	NA	NA	105				
							106				
							107	107-110 SAME COLOR AS ABOVE SILTY FGS MIX WITH POORLY SORTED/NON GRADED GRAVEL APPROX. 30-40%	GC-SW	S	
							108				
							109				
				0.1	NA	NA	110				
SC	110-120	120	NA					110-113 GRAY (5Y 6/1) SILTY + SL. CLAYEY FGS MIX WITH TRACE OF GRAVELS	SP	S	
							111				
							112				
							113	113-115 LT. GRAY TO WHITE (5Y 7/1 TO 8/1) SANDY CLAY WITH ~~TRACES~~ SOME CEMENTED SHELL FRAGMENTS	SC	S	
							114				
				6.3	NA	NA	115				
							116	115-118.5 LT. GRAY (5Y 7/2) SILTY + SL. CLAYEY FGS	SC	S	
							117				
							118	118.5-120 LT. GRAY (5Y 7/1) SILTY + SL. CLAYEY FGS	SC	S	
							119				
				55.5	NA	NA	120				GW SB11-115/120

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OAD-B-SB-11	NA	NTC ORLANDO OHLY	1-19-14 / 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	120-122.5	120	NA				121	120 - 122.5 GRAY (5Y 5/1) SILTY + SL. CLAYEY FGS.	SC	S	
							122				
							123	122.5 - 129 LT. GRAY (5Y 7/1) SILTY CLAY, TIGHTLY PACKED.	CL	S	
							124				
				0	NA	NA	125				
							126				
							127				
							128				
							129	129 - 130 OLIVE GRAY (5Y 5/2) SILTY + SL. CLAYEY FGS	SC	S	GW SB11-125/130
				0	NA	NA	130				
SC	130-132.5	120	NA				131	130 - 133.5 LT. GRAY (5Y 7/2) CLAYEY ~~SAND~~ FGS	SC	S	
							132				
							133				
							134	133.5 - 135 LT. GRAY (5Y 7/1) SILTY CLAY, TIGHTLY PACKED	CL	S	
				0	NA	NA	135	135 - 138 GRAY (5Y 5/2) CLAYEY FGS.	SC	S	
							136				
							137				
							138				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
CLD-13-SB-11	NA	NTC ORLANDO OU4	1-19-14 / 1-20-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	130-140	120	NA				139	135-140 LT. OLIVE GRAY (5Y 6/2) SILTY CLAY - TIGHT PACKING	CL	S	GW SB-11-135/140
				0	NA	NA	140				
							141	BORING TERMINATED @ 140			
							142				
							143				
							144				
							145				
							146				
							147				
							148				
							149				
							150				
							151				
							152				
							153				
							154				
							155				
							156				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number: OLD-13-SB12 / OLD-13-INJ02D	Permit Number:		FDEP Facility Identification Number: NA
Site Name: NTC ORLANDO OU4	Borehole Start Date: 11-24-14 End Date: 11-26-14	Borehole Start Time: 1405 AM (PM) End Time: 1020 (AM) PM	
Environmental Contractor: RESOLUTION CONS / AECOM	Geologist's Name: DAN PHILLIPS		Environmental Technician's Name: MATT MARTIN
Drilling Company: GPI (DRILLPRO)	Pavement Thickness (inches): NA	Borehole Diameter (inches): 6"	Borehole Depth (feet): 140'
Drilling Method(s): ROTOSONIC	Apparent Borehole DTW (in feet from soil moisture content): 4	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): ~~Foxboro GC128~~ MINI RAE 2000 FID (PID)

Disposition of Drill Cuttings [check method(s)]: ☑ Drum ☐ Spread ☐ Backfill ☐ Stockpile ☐ Other

(describe if other or multiple items are checked):

Borehole Completion (check one): ☒ Well ☐ Grout ☐ Bentonite ☐ Backfill ☐ Other (describe)

INJECTION WELL OLD-13-INJ02D

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
PH	0-5	60	NA				1	Soil/grass concrete asphalt @ surface			
							2	0-5 BROWN + GRAY FGS	SP	S	
							3				
							4				
				NA	NA	NA	5				
SC	5-10	36					6	5-10 LT. BROWNISH GRAY (10Y 6/2)	SP SM	S	
							7				
							8				
							9				
				0	NA	NA	10				
SC	10-20	105					11	10-17 VERY DK. GRAY (10YR 3/1) TO BLACK, SL. SILTY FGS	SM	S	
							12				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLA-13-SB12	NA	NTC ORLANDO OUY	11-24-14 / 11-26-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	10-20	108	NA				13	10-17.5 VERY DK. GRAY TO BLACK, SC. SILTY FGS	SM	S	
							14				
				0	NA	NA	15				
							16				
							17	17.5-20 YELLOWISH BROWN (10YR 5/4) CLAYEY SAND	SC	S	
							18				
							19				
				0	NA	NA	20				
SC	20-40	240	NA				21	20-25 BROWN (7.5YR 4/3) SC. SILTY FGS	SM	S	
							22	22-23 SAME COLOR - SANDY CLAY			
							23				
							24				
				0	NA	NA	25	25-40 STRONG BROWN (7.5YR 5/6) TO BROWNISH YELLOW (10YR 6/6) SL. SILTY FGS.	SM	S	
							26				
							27				
							28				
							29				
				0	NA	NA	30				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date:
OLD-13 - SB12	NA	MTC ORLANDO OU4	11-24-14 End Date: 11-25-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	20-40	240	NA				31	25-40 STRONG BROWN (7.5YR 5/6) TO BRUNNISH YELLOW (10YR 6/6) SL. SILTY FGS.	SM	S	
							32				
							33				
							34				
				0.1	NA	NA	35				
							36				
							37				
							38				
							39				
				0	NA	NA	40				
SC	40-60	216	NA				41	40-49.5 YELLOWISH BROWN (10YR 5/6) FGS	SP	S	
							42				
							43				
							44				
				0	NA	NA	45				
							46				
							47				
							48				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB12	NA	NTC ORLANDO OU4	11-24-14 / 11-26-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	40-60	216	NA				49	40-49.5 YELLOWISH BROWN (10YR 5/6) FGS	SP	S	
				0	NA	NA	50	49.5-60 LT. OLIVE BROWN (2.5Y 5/3) SL. SILTY FGS	SM	S	
							51				
							52				
							53				
							54				
				0	NA	NA	55				
							56				
							57				
							58				
							59				
				0	NA	NA	60				
SC	60-80		NA				61	60-62 GRAY (5Y 5/1) SL SILTY FGS	SM	S	
							62	62-63.5 DK. GRAY (5Y 4/1) CLAY	CL	S	
							63				
							64	63.5-67 DK. GRAY (5Y 4/1) SILTY/SANDY CLAY	CL	S	
				0	NA	NA	65				
							66				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB12	NA	NTC ORLANDO OUW	11-24-14 / 11-25-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	60-80	240	NA				67	67-72 DK. GRAY (5Y 4/1) CLAY, SOFT (MED)	CL	S	
							68				
							69				
				0	NA	NA	70				
							71				
							72	72-80 LT. GRAY (2.5Y 7/1) TO WHITE (2.5Y 8/1) SHELL/CLAY/SILT (MASH	GC	S	
							73				
							74				
				0	NA	NA	75				
							76				
							77				
							78				
							79				
				0	NA	NA	80				
SC	80-100	240	NA				81	80-90 OLIVE GRAY (5Y 5/2) CLAYEY SAND/SANDY CLAY.	SC	S	
							82				
							83				
							84				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date:
OLD-13-SB12	NA	NTC ORLANDO OUY	11-24-14
			End Date: 11-25-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	80-100	240		0	NA	NA	85	80-90 OLIVE GRAY (5Y 5/2) CLAYEY SAND/SANDY CLAY	SC	S	
							86				
							87				
							88				
							89				
				0	NA	NA	90	90-95 LT. OLIVE GRAY (5Y 6/2) TO OLIVE GRAY (5Y 5/2) SANDY CLAY w/ SHELL (APPROX. 10-15%).	SC	S	
							91				
							92				
				~~0~~	~~NA~~	DP	93				
							94				
				0	NA	NA	95	95-100 OLIVE GRAY (5Y 5/2) CLAYEY SAND - NO SHELL	SC	S	
							96				
							97				
							98				
							99				
				0	NA	NA	100				
SC	100-105	240	NA				101	100-105 OLIVE GRAY (5Y 5/2) SL. SILTY FGS	SM	S	
							102				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13-SB12	NA	NTC ORLANDO OUA	11-24-14 / 11-26-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	100-120	240	NA				103	100-105 OLIVE GRAY (5Y 5/2) SL. SILTY FGS	SM	S	
							104				
				0	NA	NA	105	105-109 OLIVE GRAY (5Y 5/2) SL. SILTY + SOMETIMES SL. CLAYEY FGS w/ GRAVEL, WELL GRADED, 20%	SW	S	
							106				
							107				
							108				
							109	109-111 GRAY (5Y 6/1) GRAVELLY CLAY	GC	S	
				8.5	NA	NA	110				
							111	111-120 LT. GRAY (5Y 7/2) SL. SILTY + SANDY CLAY, SOFT	CL	S	
							112				
							113				
							114				
				222	NA	NA	115				
							116				
							117				
							118				
							119				GW
				0	NA	NA	120				SB12-115/120

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OLD-13_SB12	NA	NTC ORLANDO OU4	11-24-14 / 11-25-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	120-130	240	NA				121	120-122.5 OLIVE GRAY (5Y 5/2) SILTY + SLIGHTLY CLAYEY SAND	SM	S	
							122				
							123	122.5-127.5 LT. GRAY (5Y 7/2) SILTY CLAY; TIGHT.	CL	S	
							124				
				0	NA	NA	125				
							126				
							127				
							128	127.5-130 LT. OLIVE GRAY (5Y 6/2) SILTY/SANDY CLAY	CL	S	
							129				GW
				0	NA	NA	130				SB12-125/130
SC	130-140	240	NA				131	130-134 GRAY (5Y 6/1) SILTY/CLAYEY SAND	SM	S	
							132				
							133				
							134	134-140 LT. GRAY (5Y 7/2) SL. SILTY CLAY			
				0	NA	NA	135				
							136				
							137				
							138				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings
Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

BORING LOG

Boring/Well Number:	FDEP Facility Identification Number:	Site Name:	Borehole Start Date: / End Date:
OCA-13-SB12	NA	NTC ORLANDO OU4	11-24-14 / 11-26-14

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	130-140	240	NA					134-140 LT. GRAY (5Y 7/2) SC. SILTY CLAY	CL	S	
							139				GW
				0	NA	NA	140				SB12-135/140
							141	TERMINATED BORING @ 140' BLS			
							142				
							143				
							144				
							145				
							146				
							147				
							148				
							149				
							150				
							151				
							152				
							153				
							154				
							155				
							156				

Sample Type Codes: **PH** = Post Hole; **HA** = Hand Auger; **SS** = Split Spoon; **ST** = Shelby Tube; **DP** = Direct Push; **SC** = Sonic Core; **DC** = Drill Cuttings

Moisture Content Codes: **D** = Dry; **M** = Moist; **W** = Wet; **S** = Saturated

Florida Department of Environmental Protection - Division of Waste Management - Bureau of Petroleum Storage Systems

WELL CONSTRUCTION AND DEVELOPMENT LOG

WELL CONSTRUCTION DATA

Well Number: OLD-13-INJ-01D	Site Name: NTC Orlando OU4	FDEP Facility I.D. Number: NA	Well Install Date(s): 11-19-2014

Well Location and Type (check appropriate boxes):
- [x] On-Site
- [ ] Right-of-Way
- [ ] Off-Site Private Property
- [x] Above Grade (AG)
- [ ] Flush-to-Grade

If AG, list feet of riser above land surface:

Well Purpose:
- [ ] Perched Monitoring
- [ ] Shallow (Water-Table) Monitoring
- [ ] Intermediate or Deep Monitoring
- [x] Remediation or Other (describe): Injection Well

Well Install Method: ROTOSONIC

Surface Casing Install Method: NA

Borehole Depth (feet): 140'	Well Depth (feet): 120'	Borehole Diameter (inches): 6"	Manhole Diameter (inches): NA	Well Pad Size: NA ____ feet by ____ feet

Riser Diameter and Material: 2" SCH 40 PVC	Riser/Screen Connections: [x] Flush-Threaded [ ] Other (describe)	Riser Length: 110 feet + 5' STICKUP from 0 feet to 110 feet
Screen Diameter and Material: 2" SCH 40 PVC	Screen Slot Size: 0.010	Screen Length: 10 feet from 110 feet to 120 feet
1st Surface Casing Material: also check: [ ] Permanent [ ] Temporary	1st Surface Casing I.D. (inches):	1st Surface Casing Length: ____ feet from 0 feet to ____ feet
2nd Surface Casing Material: also check: [ ] Permanent [ ] Temporary	2nd Surface Casing I.D. (inches):	2nd Surface Casing Length: ____ feet from 0 feet to ____ feet
3rd Surface Casing Material: also check: [ ] Permanent [ ] Temporary	3rd Surface Casing I.D. (inches):	3rd Surface Casing Length: ____ feet from 0 feet to ____ feet
Filter Pack Material and Size: 20/30 SAND	Prepacked Filter Around Screen (check one): [ ] Yes [x] No	Filter Pack Length: 14 feet from 108 feet to 122 feet
Filter Pack Seal Material and Size: SODIUM BENTONITE (ENVIRO PLUG)		Filter Pack Seal Length: 2 feet from 106 feet to 108 feet
Surface Seal Material: CEMENT/GROUT		Surface Seal Length: 106 feet from 0 feet to 106 feet

WELL DEVELOPMENT DATA

Well Development Date: 1-24-14	Well Development Method (check one): [ ] Surge/Pump [x] Pump [ ] Compressed Air [ ] Other (describe)	
Development Pump Type (check): [ ] Centrifugal [ ] Peristaltic [x] Submersible [ ] Other (describe)	Depth to Groundwater (before developing in feet): 12	
Pumping Rate (gallons per minute): 1.5	Maximum Drawdown of Groundwater During Development (feet): UNKNOWN	Well Purged Dry (check one): [ ] Yes [x] No
Pumping Condition (check one): [x] Continuous [ ] Intermittent	Total Development Water Removed (gallons): 45	Development Duration (minutes): 30
Development Water Drummed (check one): [x] Yes [ ] No		
Water Appearance (color and odor) At Start of Development: WHITE TO LT. GRAY - OPAQUE - NO ODOR	Water Appearance (color and odor) At End of Development: LT. GRAY HAZE - NO ODOR	

WELL CONSTRUCTION OR DEVELOPMENT REMARKS

Florida Department of Environmental Protection - Division of Waste Management - Bureau of Petroleum Storage Systems

WELL CONSTRUCTION AND DEVELOPMENT LOG

WELL CONSTRUCTION DATA

Well Number: OU4-13-INJ-02D	Site Name: NTC Orlando OU4	FDEP Facility I.D. Number: NA	Well Install Date(s): 11-26-2014

Well Location and Type (check appropriate boxes):
- [x] On-Site
- [ ] Right-of-Way
- [ ] Off-Site Private Property
- [x] Above Grade (AG)
- [ ] Flush-to-Grade

If AG, list feet of riser above land surface:

Well Purpose:
- [ ] Perched Monitoring
- [ ] Shallow (Water-Table) Monitoring
- [ ] Intermediate or Deep Monitoring
- [x] Remediation or Other (describe): Injection Well

Well Install Method: ROTOSONIC

Surface Casing Install Method: NA

Borehole Depth (feet): 140'	Well Depth (feet): 120'	Borehole Diameter (inches): 6"	Manhole Diameter (inches): NA

Well Pad Size: NA ____ feet by ____ feet

Riser Diameter and Material: 2" SCH 40 PVC

Riser/Screen Connections:
- [ ] Flush-Threaded
- [ ] Other (describe)

Riser Length: 110 feet + 5 stickup from 0 feet to 110 feet

Screen Diameter and Material: 2" SCH 40 PVC

Screen Slot Size: 0.010

Screen Length: 10 feet from 110 feet to 120 feet

1st Surface Casing Material: also check: [ ] Permanent [ ] Temporary

1st Surface Casing I.D. (inches):

1st Surface Casing Length: ____ feet from 0 feet to ____ feet

2nd Surface Casing Material: also check: [ ] Permanent [ ] Temporary

2nd Surface Casing I.D. (inches):

2nd Surface Casing Length: ____ feet from 0 feet to ____ feet

3rd Surface Casing Material: also check: [ ] Permanent [ ] Temporary

3rd Surface Casing I.D. (inches):

3rd Surface Casing Length: ____ feet from 0 feet to ____ feet

Filter Pack Material and Size: 20/30 SAND

Prepacked Filter Around Screen (check one):
- [ ] Yes
- [x] No

Filter Pack Length: 14 feet from 108 feet to 122 feet

Filter Pack Seal Material and Size: SODIUM BENTONITE (ENVIRO PLUG)

Filter Pack Seal Length: 2 feet from 106 feet to 108 feet

Surface Seal Material: CEMENT / GROUT

Surface Seal Length: 106 feet from 0 feet to 106 feet

WELL DEVELOPMENT DATA

Well Development Date: 11-26-14

Well Development Method (check one):
- [ ] Surge/Pump
- [x] Pump
- [ ] Compressed Air
- [ ] Other (describe)

Development Pump Type (check):
- [ ] Centrifugal
- [ ] Peristaltic
- [x] Submersible
- [ ] Other (describe)

Depth to Groundwater (before developing in feet): 11.90

Pumping Rate (gallons per minute): 1.5

Maximum Drawdown of Groundwater During Development (feet): UNKNOWN

Well Purged Dry (check one):
- [ ] Yes
- [x] No

Pumping Condition (check one):
- [x] Continuous
- [ ] Intermittent

Total Development Water Removed (gallons): 45

Development Duration (minutes): 30

Development Water Drummed (check one):
- [x] Yes
- [ ] No

Water Appearance (color and odor) At Start of Development: TAN/GRAY - OPAQUE - NO ODOR

Water Appearance (color and odor) At End of Development: LT. GRAY HAZE - NO ODOR

WELL CONSTRUCTION OR DEVELOPMENT REMARKS

ATTACHMENT C

UIC Permit Information

Florida Department of

Memorandum Environmental Protection

TO: Cathy McCarty, P.G.
Florida Department of Environmental Protection
Bureau of Water Facilities Regulation
Underground Injection Control Section - MS 3530
2600 Blair Stone Road, Tallahassee, FL 32399-2400

FROM: _____ (Note 1.)
_____
_____

DATE: _____

SUBJ: **Proposed Injection Well(s) for In Situ Aquifer Remediation at a Remedial Action Site**

Pursuant to paragraph 62-528.630(2)(c), F.A.C., inventory information is hereby provided regarding the proposed construction of temporary injection well(s) for the purpose of in situ aquifer remediation at a contaminated site.

Facility name:	Operable Unit 4 (OU 4)
Facility address:	1060 Warehouse Rd.
City/County:	Orlando/Orange
Latitude/Longitude:	28°33'39.0" N/ 81°20'46.4" W
FDEP Facility Number:	DOD_14_1997
Facility owner's name:	Art Sanford, Restoration Program Manager
Facility owner's address:	Naval Facilities Engineering Command BRAC Program Management Office East 203 S. Davis Drive, Bldg 247 Joint Base Charleston, SC 29404
Well contractor's name:	Groundwater Protection dba DrillPro. (Note 2.)
Well contractor's address:	2300 Silver Star Rd. Orlando, FL 32804Orlando, FL 32804 _____ _____

Facility name: _____
FDEP facility no.: _____

AFFECTED AQUIFER

Name of aquifer: Hawthorn water bearing zone
Depth to groundwater (feet): 5
Aquifer thickness (feet): 40
Areal extent of contamination (square feet): 12,500

INJECTION WELLS

A site map showing the location and spacing of injection wells, the areal extent of the groundwater contamination plume, and associated monitoring wells is attached. The injection well(s) features are summarized below, and/or a schematic of the injection well(s) is attached.

Direct-push or HSA/Mud rotary [Rotosonic] *(circle the appropriate well type)*
Diameter of well(s) (i.e., riser pipe & screen) (inches): 2
Total depth of well(s) (feet): 120
Screened interval: ___110____ to _120_____ feet below land surface
Grouted interval: __0_____ to ___106____ feet below land surface
Casing diameter, if applicable (inches): ____NA_____
Cased depth, if applicable: _____ to _____ feet below land surface
Casing material, if applicable: _____

PROJECT DESCRIPTION

The in situ, injection-type aquifer remediation product/process remediates contaminants by:
(check those that apply)

xx bioremediation,
☐ chemical oxidation, or
☐ other (describe) _____

Brief description of the project:
EOS® Pro with sodium bromide tracer

Summary of major design considerations and features of the project:

Number of injection wells: 15
Injection volume per well (gallons): ~5,500 to ~11,000
Single or multiple injection events: single
Injection volume total (all wells, all events): ~132,000 gallons

Facility name: _____
FDEP facility no.: _____

FLUID TO BE INJECTED

Composition of injected fluid:
(ingredient, wt. %) (Note 3.): EOS® Pro 5%, sodium bromide 1000 ppm

TEMPORARY INJECTION ZONE OF DISCHARGE (ZOD)

(check those that apply)

☐ No ZOD needed. The fluid to be injected meets the primary and secondary groundwater standards of Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapters 62-520 and 62-777, F.A.C.

☒ ZOD permission by rule 62-520.310(8)(c), F.A.C., for reagent chemical species and/or parameter(s) in the fluid to be injected (or re-injected) that exceed secondary groundwater standards. ZOD permission by this rule also applies to chemical species in the fluid to be injected that exceed primary groundwater standards or minimum groundwater criteria, provided those species are prime constituents of the reagents used to remediate site contaminants. The list of chemical species and parameters for which the approved Remedial Action Plan identifies zone size, duration and groundwater monitoring are as follows:
__TRPH, sodium, chloride

☐ ZOD permission by rule 62-520.310(8)(c), F.A.C., for the following contaminants of concern that exceed their groundwater standards in the fluid to be re-injected as part of a closed-loop re-injection system for which the approved Remedial Action Plan identifies zone size, duration and groundwater monitoring:

☐ ZOD permission by variance because fluid to be injected contains the following impurities that are not prime constituents of the reagents used to remediate the site's contaminants, and the concentration of those impurities in the fluid to be injected are in excess of their primary groundwater standards:

☐ A variance needs to be granted before the remediation can be conducted.

☐ A variance has already been granted for the impurities listed above:

Date variance granted: _____ Zone size (feet):_____ Duration (time):_____

♦♦♦

☐ If ZOD permission by rule 62-520.310(8)(c), F.A.C., or by variance is checked above, then a figure that delineates the ZOD is attached, or ☐ the ZOD is described as follows:

Facility name: _____
FDEP facility no.: _____

CLEANUP CRITERIA AND ENFORCEABLE APPROVAL ORDER

In situ injection-type aquifer remediation of the contaminants of concern at this site is intended to meet the groundwater cleanup target levels established for them in accordance with applicable and appropriate chapters of the Florida Administrative Code and cited in the approved Remedial Action Plan. Additionally, all other groundwater standards will be met at the time of project completion for any residuals associated with the ingredients of the injected remediation products, and any by-products or intermediates produced as a result of the chemical or biochemical transformation of those ingredients or the contaminants of concern during their use. Applicable primary and secondary drinking water standards are set forth in Chapter 62-550, F.A.C., and additional groundwater quality criteria are set forth in Chapters 62-520 and 62-777, F.A.C.

The remediation plan estimates that site remediation will take ___50_____ months. We will notify you if there are any modifications to the remediation strategy which will affect the injection well design or the chemical composition and volume of the injected remediation product(s).

The proposed remediation plan was approved on _____ by an enforceable approval order. A copy is attached. The remediation system installation is expected to commence within 60 days. Please call me at _____ if you require additional information.

##

Note 1. This notification memorandum is primarily for use by state technical reviewers, but remediation contractors may fill in all blanks except those labeled “FROM” and “DATE” on page 1, and the “approval date”, and “telephone number” blanks in the last paragraph on page 4. Those blanks are filled only by the regulator. In the case that the memorandum form is partially completed by the remediation contractor, the FDEP technical reviewer must verify that the information provided by the contractor is accurate and complete. Local programs are not authorized to approve underground injections into aquifers. Reason: Per agreement with EPA, the FDEP cannot delegate this authority. Local programs, after reviewing a Remedial Action Plan or an injection proposal document, should follow the instructions in the March 16, 2000, memorandum to arrange for Department headquarters’ execution of an approval order, and then complete this memorandum.

Note 2. If an injection well installation contractor has not yet been selected, then indicate the name and address of the project’s general remediation contractor/consultant.

Note 3. Complete chemical analysis of the fluid to be injected is required by Chapter 62-528, F.A.C. Some remediation products and processes may have already submitted this information at the time of application for acceptance by the Innovative Technology Acceptance Program. For those situations, when completing the Fluid To Be Injected section of this memorandum, it will suffice to indicate: (1) an Innovative Technology Acceptance letter has been issued; (2) the date of the acceptance letter; (3) the acceptance letter contains the chemical analysis, or a voucher for the confidential disclosure of the injected fluid’s chemical composition if it is a proprietary formulation; and (4) the fluid will be injected at concentrations that are less than or equal to those cited in the acceptance letter. For products and processes that do not hold an Innovative Technology Acceptance letter, but for which the site-specific Remedial Action Plan provides a complete description of the chemical composition of the fluid to be injected, it will be necessary to enter this information into the Fluid To Be Injected section of this memorandum.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

March 21, 2013

Via Electronic Mail
BElkins@EOSRemediation.com

Brad Elkins
EOS Remediation LLC
1101 Nowell Road
Raleigh, North Carolina 27607

Re: **Three Edible Oil Substrate Products: EOS_{PRO}, EOS_{LS}, and EOS_{450}**

Dear Mr. Elkins:

The Division of Waste Management (Division) hereby accepts three Edible Oil Substrate (EOS) products, EOS_{PRO}, EOS_{LS}, and EOS_{450} for in situ anaerobic bioremediation of chlorinated hydrocarbons and other suitable contaminants in groundwater and soil. EOS is a U.S.-patented product containing vegetable oil, soluble substrate, a soluble source of hydrogen, and other additives. This acceptance supersedes the first EOS acceptance issued April 7, 2003, and an update issued May 20, 2005 for the single original product formulation known only as EOS. Enclosure 1 contains a voucher for the confidential disclosure of the specific ingredients and their proportions in the three products, and Enclosure 2 contains regulatory information.

The Division does not provide endorsement of specific or brand name remediation products or processes, but it does recognize the need to determine their acceptability in the context of environmental regulations, safety and the protection of public health. For that reason, the Division issues an "acceptance" letter, not an approval. In no way shall an acceptance be construed as a certification of performance. Additionally, vendors, upon receipt of an acceptance, must market their product or process on its own merits regarding performance, cost, and safety in comparison to competing alternatives in the marketplace.

Remedial Action Plans that propose the use of an accepted product or process should include a copy of the acceptance letter in the plan's appendix, and reference it in the text of the document. It is not a requirement that a particular remediation product or process have an official acceptance letter in order for it to be proposed in a site-specific Remedial Action Plan. The plan, however, must contain sufficient information about the product or process to show that it meets all applicable rules and regulations.

The Division reserves the right to revoke its acceptance of a product or process if it has been falsely represented. Additionally, Division acceptance of any product or process does not imply it has been deemed applicable for all cleanup situations, or that it is preferred over other

treatment or cleanup techniques in any particular case. A site-specific evaluation of applicability and cost-effectiveness must be considered for any product or process, whether conventional or innovative, and adequate site-specific design details must be provided in a Remedial Action Plan submitted for Department review and approval. If you have any questions, please contact us at the numbers below.

Sincerely,

X Rick Ruscito

Rick Ruscito

X

Gary Millington

Rick Ruscito, P.E.
Ecology and Environment, Inc.
Bureau of Petroleum Storage Systems
Petroleum Cleanup Program Section 6
rruscito@ene.com
(850) 877-1133, extension 3722

Gary Millington, P.E.
Division of Waste Management
Bureau of Waste Cleanup
Program and Technical Support Section
gary.millington@dep.state.fl.us
(850) 245-7502

enc: (1) Proprietary Information Voucher
(2) Regulatory Information

c: Tom Conrardy, P.E. – FDEP/Tallahassee
Rob Cowdery, P.E. – FDEP/Tallahassee

History:

Rev. 0: 4/7/03

Rev 1: 5/20/05

Rev 2: 3/21/13
PPL #457
BurLab (1187)
ITR #64443
INN_195

ENCLOSURE 1

PROPRIETARY INFORMATION VOUCHER

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

March 21, 2013

Brad Elkins
EOS Remediation LLC
1101 Nowell Road
Raleigh, North Carolina 27607

Re: Proprietary Information Voucher for
Three Edible Oil Substrate Products: EOS_{PRO}, EOS_{LS}, and EOS_{450}

Dear Mr. Elkins:

The Division of Waste Management (Division) is in receipt of a confidential version of a Material Safety Data Sheet (MSDS) dated November 2, 2012 that discloses all of the ingredients and the ranges of their percentages by weight in three Edible Oil Substrate products: EOS_{PRO}, EOS_{LS}, and EOS_{450}. Additionally, the Division hereby documents the occurrence of a private telephone conversation on November 19, 2012 in which you disclosed the exact weight percent of each ingredient, because the ranges alone in this case were not sufficient for a proper regulatory evaluation. The additional information via telephone has been recorded in written form and placed in the same secure location as the confidential MSDS.

Having reviewed the confidential disclosures, the Division hereby vouches for their content, and provides advice in Enclosure 2 on how to comply with applicable regulations of the Florida Administrative Code (F.A.C.) when each of these three EOS products is used for the cleanup of contamination in accordance with a Department-approved, site-specific Remedial Action Plan. The Department, in offering its advice, has been careful to mention only enough general information about the chemical species and parameters that must be monitored by users in order to comply with Underground Injection Control regulations, but not so much information as to compromise the proprietary aspects of the products.

The Division also notes that some information about these three products has already been made available to the public on the Internet by EOS Remediation LLC. The information already available to the public for each of the three is as follows: the weight percent vegetable oil but not the specific type of oil; the weight percent of soluble substrate but not the specific chemical name; and the number of pounds of hydrogen provided by each pound of each product.

For Underground Injection Control purposes, injection-type aquifer remediation plans must specify both the volume and the complete chemical composition of the fluid to be injected. But since the details of the ingredients and their proportions in EOS_{PRO}, EOS_{LS}, and EOS_{450} are proprietary, it will suffice to indicate just the fluid volume of each EOS product to be injected, and then provide a note that a confidential disclosure of the proprietary details has already been submitted to the Department and accepted. Reference should be made to this voucher, and a copy of it should be included as an appendix to the plan. If you have any questions, please contact us at the numbers below.

Sincerely,

X Rick Ruscito

Rick Ruscito

Rick Ruscito, P.E.
Ecology and Environment, Inc.
Bureau of Petroleum Storage Systems
Petroleum Cleanup Program Section 6
rruscito@ene.com
(850) 877-1133, extension 3722

X

Gary Millington

Gary Millington, P.E.
Division of Waste Management
Bureau of Waste Cleanup
Program and Technical Support Section
gary.millington@dep.state.fl.us
(850) 245-7502

ENCLOSURE 2

REGULATORY INFORMATION

a. Regulations: Chapters of the Florida Administrative Code (F.A.C.) that may be applicable, either in part or in their entirety, include but are not necessarily limited to Chapter 62-550, F.A.C., for primary and secondary water quality standards; Chapter 62-520, F.A.C. for groundwater classes and standards, and groundwater permitting and monitoring requirements; Chapter 62-528, F.A.C., for Underground Injection Control (UIC), particularly Part V, for Class V, Group 4 aquifer remediation projects; Chapters 62-770, 62-780, 62-782, and 62-785 F.A.C., for cleanup criteria; and Chapter 62-777, F.A.C., for cleanup target levels.

   Users of EOS_{PRO}, EOS_{LS}, and EOS_{450} shall comply with all applicable regulations. This includes meeting applicable groundwater cleanup target levels for the contaminants of concern, the residual concentrations of reagent ingredients, and any byproducts of concern produced by chemical and biological reactions induced by those ingredients during the timeframe of the cleanup project. For the ingredients of concern that are present in excess of their groundwater standards, the timeframe is that which is permitted for a temporary injection zone of discharge (ZOD) as described below.

b. UIC and ZOD permits: Per Rule 62-528.630(2)(c), F.A.C., Class V injection-type aquifer remediation wells are exempt from the permitting requirements of Rule 62-528.635, F.A.C., when authorized by a Department-approved Remedial Action Plan or other enforceable mechanism, provided the requirements of the rules governing the remediation project, as well as the construction, operation, and monitoring requirements of Chapter 62-528, F.A.C., are met. Per Rule 62-528.630(2)(c), F.A.C., <u>the issuance of an enforceable, site-specific Remedial Action Plan Approval Order by the Department for injection-type aquifer remediation constitutes the granting of a Class V injection well construction/clearance permit. And per Rule 62-520.310(8)(c), F.A.C., if a temporary ZOD is necessary, and permissible by way of that rule, then the issuance of the site-specific Remedial Action Plan Approval Order also constitutes the granting of permission for the temporary ZOD</u>.

c. UIC notification: Remedial Action Plans proposing injection-type aquifer remediation shall include information pursuant to Rules 62-528.630(2)(c)1 through 6, F.A.C., for the inventory purposes of the UIC program. Reviewers of those plans, upon issuance of an enforceable Remedial Action Plan Approval Order by the Department, must submit a completed copy of the UIC inventory notification form to the UIC program in Tallahassee.

d. General information about temporary ZODs: For groundwater remediation, the composition of an injected material must meet the primary and secondary drinking water standards set forth in Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapter 62-520, F.A.C., pursuant to UIC Rule 62-528.600(2)(d), F.A.C. Aquifer remediation products that do not meet these requirements must seek relief from water quality criteria by one of two mechanisms. Permission for a temporary ZOD may be obtained via Rule 62-520.310(8)(c), F.A.C. If a ZOD cannot be obtained by rule, it will be necessary to seek a variance from Department rules in accordance with Section 120.542, Florida Statutes.

Rule 62-520.310(8)(c), F.A.C., allows for a temporary ZOD for closed-loop re-injection systems, for the prime constituents of the reagents used to remediate site contaminants, and for groundwater secondary standards. In order to obtain permission for a temporary ZOD by rule, a site-specific Remedial Action Plan must indicate: (a) the chemical ingredients of concern in the fluid to be injected that will be present in excess of groundwater standards; (b) the size of the ZOD that is needed; (c) the amount of time that the ZOD will be needed; and (d) a plan for monitoring the injected chemical ingredients of concern. The size of the temporary ZOD will usually be the injection well radius of influence when the treatment system is a single injection point. For a multiple point system, the ZOD can usually be expressed and illustrated as the total area of the cluster formed by all the injection points, located side-by-side with overlapping radii of influence.

e. Specific ZOD information for EOS_{PRO}, EOS_{LS}, and EOS_{450}: For EOS_{PRO} and EOS_{LS}, ZOD permission and monitoring is necessary for TRPH. For EOS_{450}, ZOD permission and monitoring is necessary for TRPH and sodium. Site-specific Remedial Action Plans shall indicate which of the three proprietary products will be used, the volume and concentration at which it will be injected, and seek permission for a temporary ZOD by way of Rule 62-520.310(8)(c), F.A.C., as described in paragraph d above. In regard to typical injection concentrations, the manufacturer indicates that one (1) volume of the as-shipped product for each of the three EOS formulations is typically diluted with four (4) to twenty (20) volumes of water prior to injection, depending on site-specific conditions.

f. ZOD monitoring advice for EOS_{PRO}, EOS_{LS}, and EOS_{450}: For the ZOD parameters discussed in above paragraph e, quarterly monitoring of groundwater should suffice in most cases. The current groundwater standard for sodium is 160 milligrams per liter (mg/L), and the current groundwater standard for total recoverable petroleum hydrocarbons (TRPH), 5 mg/L. The vegetable oil ingredient of these three EOS products is a source of TRPH, a groundwater contaminant in the State of Florida, regardless of whether the source is a petroleum contaminant or the vegetable oil ingredient of a remediation product. Chloride, with a 250-mg/L groundwater standard, is not an ingredient of the three EOS products, but rather a byproduct when EOS is used to treat chlorinated contaminants. Use site-specific conditions to estimate if there is enough potential for chloride to be produced in excess of 250 mg/L. If so, then monitor the groundwater for chloride.

   Upon expiration of the time period granted for the ZOD, the concentration of each parameter discussed above must meet its respective groundwater standard or its natural-occurring background value at the specific cleanup site, whichever is less stringent.

g. Utilization of wells: If a remediation site happens to have an abundance of monitoring wells, then the Division has no objection to the use of some wells for the application of these three EOS products. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply reagents. This will avoid premature conclusion that the entire site meets cleanup goals. By making sure that designated tracking wells are not also used for treatment, there will be more assurance that the treatment process has permeated the entire site and that it did not remain localized to the area immediately surrounding each injection well.

h. Avoidance of migration: For injection-type, in-situ aquifer remediation projects, pursuant to Rule 62-528.630(3), F.A.C., injection of these three EOS products shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the ingredients of concern, site contaminants, or remediation byproducts results.

i. Abandonment of wells: Upon issuance of a Site Rehabilitation Completion Order, injection wells shall be abandoned pursuant to Section 62-528.645, F.A.C., and the Underground Injection Control Section of the Department shall be notified so that the treatment wells can be removed from the injection well inventory-tracking list.

j. Open-pit application: Applications of these three EOS products to an open pit in which the groundwater is exposed is not an injection, and notification of the UIC Section is not required. However, the applied material must still meet the requirements of paragraph 62-520.310(8)(c), F.A.C., and the groundwater in the application area should be monitored in the same manner as if the material had actually been injected.

k. Additives: If an additive is used with any of these three EOS products in the future, then a site-specific Remedial Action Plan must include a complete description of the additive's chemical composition and physical properties, the concentration of the additive in the fluid to be injected, the volume of the fluid to be injected, and seek permission for a temporary ZOD as described in paragraph d above if the fluid does not meet primary, secondary, and minimum groundwater standards.