

TRANSMITTAL

Date: 29 September 2000

From: Lynn Marie Hornecker *LMH*

To: **John Broderick**
California Regional Water Quality Control Board
Santa Ana Region

Subj: Bioventing Pilot Test at Tank Farm 555
Marine Corps Air Station, El Toro

The purposes of this transmittal are to describe our proposal to conduct a bioventing pilot test at Underground Storage Tank (UST) Site 550 at Tank Farm 555 and to provide responses to your comments dated 28 August 2000 pertaining to the Site Assessment Report for UST Sites 548 and 551 at Tank Farm 555. We discussed the bioventing proposal in general terms with you during our telephone conversation on 11 September 2000.

We propose to construct a bioventing system at UST Site 550 to collect data for the evaluation of soil permeability, radius of oxygen delivery, and oxygen utilization rates during biodegradation. The system will include one 4-inch diameter bioventing well with three (3) monitoring points. Additional information is provided in the attached documents.

Soil samples were collected from five (5) borings along the perimeter of UST 550 during January 2000. Petroleum hydrocarbons, characterized as jet fuel, were identified in samples collected between depths of 10 and 35 feet below ground surface at concentrations from 1,500 to 32,000 milligrams per kilogram. Groundwater was encountered at depths from approximately 29 to 46 feet below ground surface near UST 550, and total extractable petroleum hydrocarbons were detected at 220 micrograms per liter in a hydropunch sample collected from boring SB-05.

We propose to begin construction of the bioventing well and the monitoring points in October 2000 and we propose to conduct the testing activities in the October to December 2000 time period.

Please do not hesitate to call me at (619) 532-0783 if you have questions pertaining to this transmittal. A formal transmittal letter may follow.

Attachment:

Technical Information Memorandum (IT, 2000)
Responses to RWQCB comments dated 28 August 2000

CF w/attachment:

Dean Gould (BRAC Environmental Coordinator, MCAS El Toro)
Don Clause (MCAS El Toro)
Arghavan Rashidi-Fard, Orange County Health Care Agency
Polin Modanlou (County of Orange)
Project File (MCAS El Toro)

Responses to Comments from the Regional Water Quality Control Board, Santa Ana Region dated 28 August 2000

Subject: Comments on Site Assessment Report, UST Sites 548 and 551, Former Marine Corps Air Station, El Toro

Author: John Broderick, SLIC/DoD/AGT Section, California Regional Water Quality Control Board, Santa Ana Region	
Addressee: Dean Gould, BRAC Environmental Coordinator	
Date: 28 August 2000	
<i>Comments</i>	<i>Responses</i>
We have completed our review of the above referenced document, dated October 31, 1998, which we received on December 21, 1998. We have the following comments on the report:	Thank you very much for providing comments.
1. We believe that the site characterizations are incomplete for thsee UST release sites. Therefore, we do not concur with the recommendation for closure in place for the releases at UST Sites 548 and 551.	1. Comment acknowledged. We are proceeding with plans to evaluate bioventing as a pilot test project for the remediation of the residual petroleum hydrocarbons at Tank Farm 555.
2. At a minimum, two vertical or slant borings need to be completed through each of the former tank bottoms, to assess the potential area of release.	2. Comment will be incorporated into Tank Farm 555 closure strategy. We will plan to collect samples through the tank bottoms. During closure in place activities, we anticipate that we will remove the tops of the tanks order to enable a small drill rig or concrete coring device to open holes in the tank bottoms for the collection of soil samples.
3. The report indicates that these USTs had at least one associated dry well. Have the dry well(s) been assessed? If not, then a boring adjacent to each well is necessary, to allow you to evaluate the possibility of vertical pathways for contaminant migration.	3. Comment will be incorporated into Tank Farm 555 closure strategy. Dry wells were located near each of the five large tanks at Tank Farm 555. Soil samples have been collected in the vicinity of some of the dry wells. Previously collected data will be evaluated, and additional sampling at dry wells will be conducted, as appropriate.



OHM Remediation Services Corp.

3347 Michelson Drive, Suite 200

Irvine, CA 92612-1692

Tel. 949.261.6441

Fax. 949.474.8309

A Member of The IT Group

September 28, 2000

Ms. Bozier H. Demaree
Contracting Officer
Naval Facilities Engineering Command
Southwest Division
1220 Pacific Highway
San Diego, CA 92132-5187

Attention: Ms. Lynn Hornecker

**Re: Bioventing Pilot Test at Tank Farm 555
MCAS El Toro, California
Contract N68711-93-D-1459, Delivery Order 070,
Document Control No. SW 9170, Revision 0**

Dear Ms. Hornecker:

Based on the review of soil analytical data from recent site verification activities and stratigraphy at the Tank Farm 555 site, OHM is proposing a bioventing pilot test at Tank Farm 555 to determine the optimum system design for a full-scale bioventing system installation.

Specifically, Tank 550 has the highest levels of contamination in soil and the pilot test as described in this memo will be performed at tank 550. Soil samples were collected from five vertical soil borings (550-SB-01 to SB-05) and one angle boring (550-SB-06A) drilled around the perimeter of tank 550 in January 2000. Also, groundwater samples were collected using hydropunch method from borings 550-SB-01, SB-04, and SB-05 respectively.

Review of the geologic boring logs indicate that soil underlying the tank 550 site is composed of a shallow sandy silt (8 to 18 feet thick) that is underlain by sand and weathered sandstone (4 to 20 feet thick). These units are underlain by bedrock composed of unweathered sandstone, which is relatively less permeable than the overlying soils. Groundwater was encountered at approximately between 45 to 46 feet bgs in SB-01, 39 to 40 feet bgs in SB-04, and 29 to 30 feet bgs in soil boring SB-05 respectively. The soil boring locations from January 2000 drilling activities are shown in the figure and Geologic boring logs of Tank 550 are also attached in Appendix A.

Petroleum hydrocarbons, characterized as jet fuel, were identified in samples collected between depths of 10 and 35 feet below ground surface (bgs) at concentrations ranging from 1,500 to 32,000 milligrams per kilogram (mg/kg). Benzene was identified in one soil sample as an estimated value ("J" flagged) of 0.02 mg/kg. Total extractable petroleum hydrocarbons were detected at 220 micrograms per liter in a hydropunch sample collected in one boring.

The objective of the design of a bioventing system is to design a system that results in aeration of

the contaminated soil with little or no volatilization. Aeration may be accomplished through air injection, soil-gas extraction, or both injection and extraction in parallel. In any of these configurations, bioventing is designed to minimize volatilization and optimize biodegradation. Therefore, bioventing typically uses low air flow rates. Air injection is the preferred configuration for full-scale bioventing systems unless conditions such as residual LNAPL or a concern for surface emissions are present. The optimal air flow rate for both injection or extraction is the minimum required to satisfy the oxygen demand. Air can be injected at flow rates low enough to avoid surface emissions by inducing in situ vapor phase biodegradation of the volatilized hydrocarbons.

The purpose of the field pilot testing is to collect site-specific data that will be used to select and design a full-scale bioventing system at Tank Farm 555. The data to be collected will be used to determine soil air permeability in the vadose zone, radius of influence for oxygen delivery in soil, and oxygen utilization rates through biodegradation. The data collected will be used to develop design and operation parameters for the full-scale system, including the following:

- Number, spacing, and design of remediation wells
- Air flow rates
- Process equipment capacity at the operating conditions
- Pipe sizing

In addition, the pilot test results will provide information integral to the optimum operation of the full-scale remediation system, such as the potential for migration of volatile organic compounds (VOCs) due to air injection.

A total of four wells (one well and three monitoring points) will be installed in the vicinity of tank 550 for the purposes of the bioventing test. A bioventing well (TK550-BV01) will be installed in the northeast vicinity of tank 550 as shown on the attached figure in Appendix B.

These wells will be constructed as a 4-inch, Schedule 40 PVC well screened (0.020 inch slot size) from 9 to 30 bgs. Three monitoring points will be installed at 15, 30, and 50 foot distances from the bioventing well TK550-BV01. The monitoring points will be triple completion vadose zone wells, screened in the shallow, middle, and deep zones of the contaminated zone to monitor soil-gas concentrations and subsurface air flow in accordance with design and construction guidance by the United States Air Force Center for Environmental Excellence (AFCEE) (AFCEE, 1996) and Draft Project Plan for In-Situ Treatment Systems for Underground Storage Tank Program issued by OHM in February 1996 under DO 24.

The monitoring point casings will be constructed of 1-inch Schedule 80 PVC pipe. Thermocouples will be installed in one monitoring point within the shallowest and deepest screen interval to measure *in situ* soil temperatures. In addition to the wells installed for the purposes of this test, an existing piezometer near the entrance to the tank farm will be utilized as a background monitoring point. Typical well construction and monitoring point diagrams are attached in Appendix C.

An air injection compressor or blower with a volume rating of 50 standard cubic feet per minute (SCFM) and a maximum discharge pressure of 50 pounds per square inch gauge (psig) will be

utilized for the bioventing test. The injection system will be equipped with mechanical accessories including pressure and temperature gauges, an air flow meter, a sampling port, and an air pressure regulator. The pressure regulator will be used to control the pressure of air entering the injection well. Helium gas will be injected into the air stream as a tracer gas.

Soil-gas samples will be collected from the wells prior to the start of the pilot test to establish baseline conditions. The soil-gas samples will be monitored for the following parameters:

- Oxygen (Gas Tech 3252OX or equivalent)
- Carbon dioxide (Gas Tech 3252OX or equivalent)
- Methane (Gas Tech 3252OX or equivalent)
- Hydrocarbons (Gas Tech Analyzer or FID)
- Helium (Marks Helium Detector or equivalent)

At bioventing sites, the required number and spacing of wells is determined using the oxygen radius of influence, i.e., the radius of oxygen delivery. An estimate of the oxygen radius of influence can be made by measuring the pressure radius of influence, which in this pilot test is defined as the distance from a vent well where pressure can be measured at 1 inch of water column. In general, the oxygen radius of influence is greater than the pressure radius of influence when the cutoff criterion of 1 inch of water column is used. This makes the pressure radius of influence a reasonably conservative, rapid method of estimating through calculations based on air flow rates and oxygen utilization rates. For design purposes, the radius of influence will be estimated from a combination of pressure measurements, air flow, and oxygen utilization rates.

The flow rate required to operate a bioventing system is dependent on the oxygen demand of the indigenous microorganisms. This can be determined from maximum oxygen utilization rates measured during *in situ* respiration testing, the volume of contaminated soil, and gas-filled porosity.

Field tests at tank 550 will consist of a soil-air permeability test followed by an *in situ* respiration test. Prior to performing any tests, baseline measurements of well vapor will be conducted using field monitoring instruments as described above.

The primary objective for conducting the soil air permeability test is to determine the soil-air permeability for the vadose zone and the radius of influence of the wells. Site-specific information will be utilized for design of the full-scale remediation system, including well placement, configurations, and operating conditions.

The soil-air permeability test will consist of a maximum pressure test followed by a rate step test. The maximum pressure test will be conducted to determine the maximum operating pressure that can be achieved at the test wellhead subject to the subsurface soil conditions (without fracturing the soil) and that can induce an injection radius of influence of at least 30 feet. The radius of influence will be determined as the furthest distance from the injection well at which the pressure is measured to at least 1 inch of water column.

Determining the radius of influence at different flow rates will allow for more accurate blower sizing.

During both maximum and step tests, field measurements will be conducted. It is anticipated a maximum duration of 2 hours will be sufficient for each test to achieve the steady state condition. Pressure, flow, and air temperature readings will be taken immediately after the air injection system is started and properly adjusted and periodically during the testing.

In addition, pressure readings will be collected from the three monitoring points at the following frequency after the system starts:

- every 1 minute for the first 10 minutes
- every 5 minutes from 10 to 30 minutes
- every 10 thereafter for the first hour
- every 15 minutes thereafter for the second hour (or until a steady state condition is achieved)

After the completion of each test, oxygen, carbon dioxide, helium, methane, and total volatile hydrocarbon concentrations in the soil-gas at the wellhead will be measured using the monitoring instruments. The data will be compared against the baseline readings to determine if increases in the concentrations have occurred as a result of air injection. Air pressure, temperature, and flow readings at the wellhead will be recorded for each pressure level tested. During the air injection testing, helium will be injected at a rate of 1 to 3 percent of the air injection rate as a tracer gas. Helium levels in soil-gas will be monitored during the *in situ* respiration test.

The *in situ* respiration test will be performed to assess the aerobic biodegradation rate in the subsurface soil. This test will be implemented immediately after completion of the soil-air permeability test.

The respiration test will begin with examining the oxygen level in the test wells. It is anticipated that the air injection well will also be one of the respiration test wells. If the oxygen concentration in any of the wells has shown an increase of a minimum of 5 percent (e.g., from 10 to 15 percent) compared to the baseline reading, respiration tests will be performed on those wells.

The respiration test will involve collection of oxygen, carbon dioxide, methane, helium, and total hydrocarbon vapor concentrations at the monitoring point and background wellheads at the following frequency using the appropriate monitoring instruments:

- immediately after injection system shutdown (this will take place during the final permeability step test)
- 30 minutes thereafter for the next 2 hours
- every 2 hours thereafter up to the first 8 hours (counted from the initial measurement)
- every 12 hours thereafter for the first 24 hours (counted from the initial measurement)
- every 24 hours thereafter until the fifth day from the initial measurement of the measured

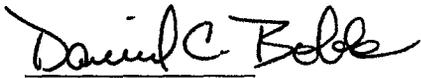
oxygen level is less than 5 percent, whichever occurs first

Helium dissipation rates will be compared to oxygen depletion rates to evaluate whether the oxygen depletion is due to bioactivity or physical dispersion in the subsurface (AFCEE, 1996).

After completion of the bio venting pilot test, a technical memorandum that will include findings and relevant data from the pilot test will be issued within 30 days to the Navy.

Should you have any questions or comments, please feel free to call the undersigned at (949)-261-6441.

Sincerely,
OHM Remediation Services, Corp.



Dan Bobke
Project Engineer



Dhananjay Rawal
Project Manager

cc: Lucreatria Holloway, SWDIV, COTR (1C/1E)
OHM PMO File (1C/1E),
Project File, Correspondence B.01

Attachment:

Appendix A Geologic Boring
Appendix B Figure 1, Proposed Bioventing Wells
Appendix C Well Construction Maps

Appendix A
Geologic Boring Logs

Geologic Log of Boring 550 SB-01

Project MCAS/EL TORO	Northing -	Drilling Company BC2	
Project Number 918609	Easting -	Drill Rig LIMITED ACCESS	Begin Drilling 1/14/00
Client SWDIV	TOC Elevation -	Driller RAMON JEPEDA	End Drilling 1/14/00
Location TANK FARM 555	TOP OF RIM -	Drill Method HOLLOW STEM AUGER	Well Completion Date 1/14/00
Geologist B. TANAKA		DIAGRAM NOT TO SCALE	
Borehole Diameter 6-INCHES	Total Depth of Borehole 46 FEET	Depth to Water 45 FEET	

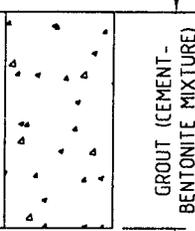
DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	BORING DETAIL
Soil Sand with Gravel at surface. Boring was hand augered to 10 feet bgs for utility clearance. The first 10 feet was logged from hand auger cuttings. Silt (ML): Light brown (2.5Y 5/6), fine micaceous, slightly plastic silts, slightly moist, no odor detected.	0							
Silt (ML): same as above.	2							
	4							
	6							
	8							
Silt (ML): Olive (5Y 4/4), fine, plastic, firm to hard, silt with fine sand, slightly moist, strong odor detected.	10	ML		220 250 285		1000	0000	
18609-2569 Sample collected at 9.5-10 feet bgs.								
Silt (ML): same as above, slightly moist, strong odor.	14							
	16				1500			
	18							
Sandstone: Weathered, fractured, Greenish gray (Chart 1 6/1), weakly cemented to moderately fractured in layers, soft to hard, slightly moist, dry, strong odor.	20			280 1500		22 50/12	0 4.5 6	
18609-2570 Samples collected at 19.5-20 feet bgs.								
SANDSTONE: same as above, strong odor.	24				1500			
	26							
	28							
SANDSTONE: Weathered, Olive yellow (2.5Y 6/6), very hard, slightly moist to moist, strong odor.	30			0 25 200		22 50/12	0 4.5 6	
18609-2571 Samples collected at 29.5-30 feet bgs.								
SANDSTONE: same as above, slightly moist, strong odor.	34				275			
	36							
	38							
Sandstone: Very dark gray (Chart 1 3/0), friable, brittle to hard, very fine sand, moderately cemented, uniform, fractured to unfractured in core.	40			0 0		20 25	0 6	
18609-2572 Sample collected at 39.5-40 feet bgs.								

Apr 10, 2000 - 10:27:47 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB01-1.dwg



Geologic Log of Boring 550 SB-01

Project MCAS/EL TORO		Northing -	Drilling Company BC2	
Project Number 918609		Easting -	Drill Rig LIMITED ACCESS	Begin Drilling 1/19/00
Client SWDIV		TOC Elevation -	Driller RAMON JEPEDA	End Drilling 1/19/00
Location TANK FARM 555		TOP OF RIM -	Drill Method HOLLOW STEM AUGER	Well Completion Date 1/19/00
Geologist B. TANAKA		DIAGRAM NOT TO SCALE		
Borehole Diameter 6-INCHES		Total Depth of Borehole 46 FEET	Depth to Water 45 FEET	

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	BORING DETAIL
Sandstone: same as above, saturate thru samples, no odor detected.	40			X	0	30	6	 GROUT (CEMENT-BENTONITE MIXTURE)
<p>18609-2573 Groundwater sample collected at 45.5-46 feet bgs.</p> <p>End of boring at 46 feet bgs. No groundwater encountered. No soil sample collected at this depth. Soil sample was saturated. Boring was back filled with 6 (94lb) bags of Portland cement, 2 (60lb) bag of high yield Bentonite mixed with 100 gallons of potable water.</p>	42			X	0	30		
	44	U		X	0	30	4.5	
	46			X	0	30	4.5	
	48							
	50							
	52							
	54							
	56							
	58							
	60							
	62							
	64							
	66							
	68							
	70							
	72							
	74							
	76							
	78							
	80							

Apr 10, 2000 - 10:29:11 i: \OHM CORP\PROJECTS\18609\LOGS\TF555\550SB01-2.dwg

Geologic Log of Boring 550 SB-02

Project MCAS/EL TORO	Northing -	Drilling Company BC2	
Project Number 918609	Easting -	Drill Rig LIMITED ACCESS	Begin Drilling 1/18/00
Client SWDIV	TOC Elevation -	Driller RAMON JEPEDA	End Drilling 1/18/00
Location TANK FARM 555	TOP OF RIM -	Drill Method HOLLOW STEM AUGER	Well Completion Date 1/18/00
Geologist B. TANAKA		DIAGRAM NOT TO SCALE	
Borehole Diameter 6-INCHES	Total Depth of Borehole 45.5 FEET	Depth to Water NOT ENCOUNTERED	

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	Blows/6 in.	Recovery (inches)	BORING DETAIL
Soil at surface with Sands and Gravel, Pale yellow (2.5 8/2). Boring was hand augered to 10 feet bgs for utility clearance. The first 10 feet was logged from hand auger cuttings. Silts (ML): Light brown (2.5Y 5/6), fine micaceous, slightly plastic silts, slightly moist, no odor detected.	0						
Silts (ML): same as above, slightly moist, no odor detected.	2						
	4						
	6						
	8						
Sandy Silts (ML): Olive (5Y 4/4), fine, firm to hard, slightly plastic to plastic, very fine sand (5-8%), slightly moist, moderate to strong odor detected. 18609-2594 Sample collected at 9.5-10 feet bgs.	10	ML		850 760 1000	10 10 20	0000	
Silts (ML): same as above, slightly moist, strong odor detected.	14						
	16				1200		
Sands (SP): Weathered Sandstone, Olive yellow (2.5Y 6/8), well sorted, very fine to fine sand, subrounded to subangular, dense, slightly moist, strong odor. 18609-2595 Samples collected at 19.5-20 feet bgs.	20			800 800 800	32 50/ 12	000	
Sand (SP): same as above, slightly moist, strong odor.	24	SP					
	26				900		
SANDSTONE: Weathered, Olive yellow (5Y 6/6), fine grained, dense to hard, fractures in layers, slightly moist to dry, strong odor (weakly cemented). 18609-2596 Samples collected at 29.5-30 feet bgs.	30			900 900 780	46 50/ 12	000	
Silts (ML): Dark greenish gray (Chart 1 4/1), soft to firm silts, plastic, slightly moist, strong odor.	34						
	36	ML			1200		
Sandstone: Weathered, Dark greenish gray (Chart 1 4/1), very fine sand, weakly cemented, dense to hard, slightly moist to moist, slight to moderate odor, no visible water. 18609-2572 Sample collected at 39.5-40 feet bgs.	40			200 200	50 50/ 12	5 6	

Apr 10, 2000 - 10:35:10 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB02-1.dwg



Geologic Log of Boring 550 SB-02

Project **MCAS/EL TORO**

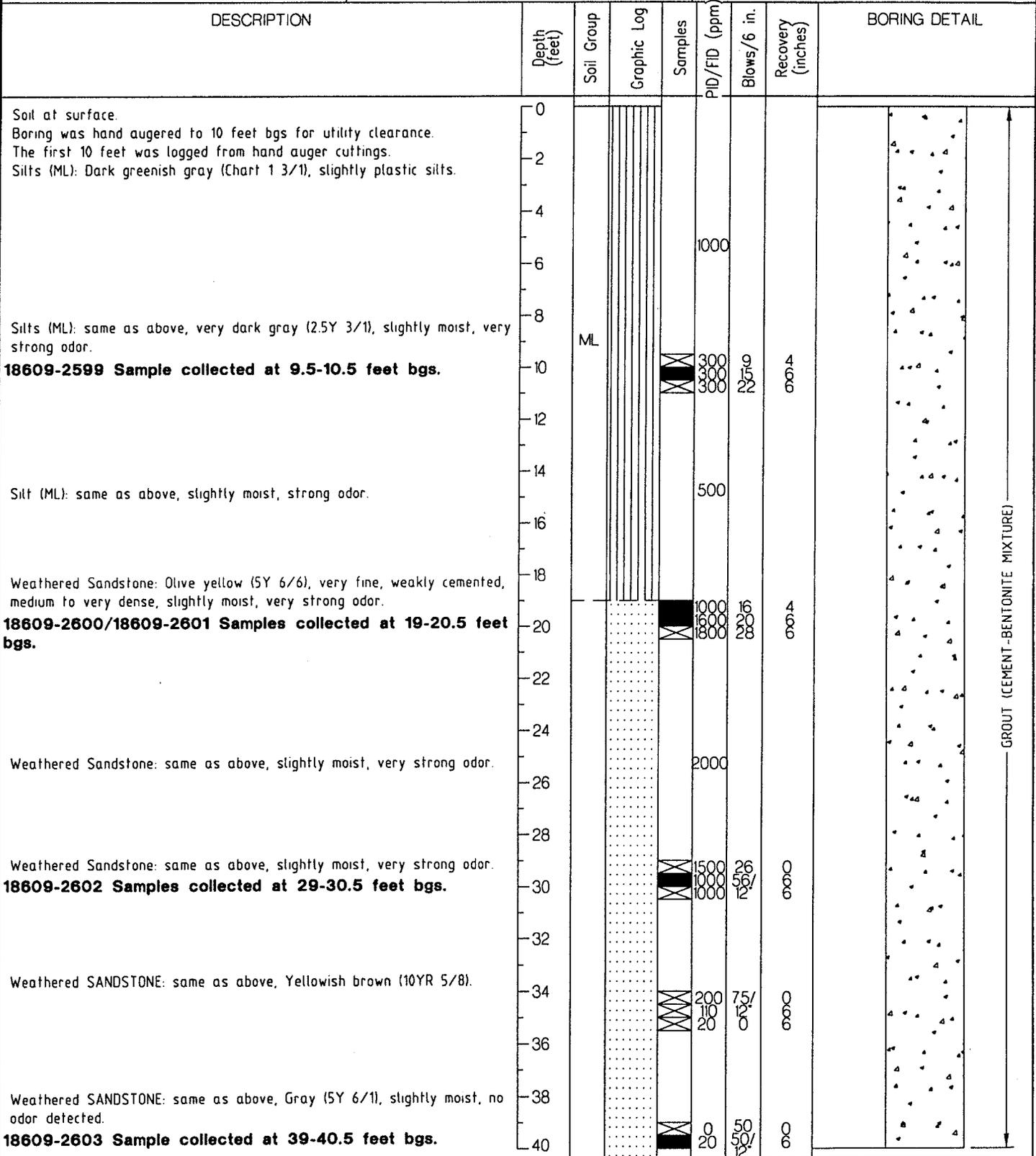
Project No. **918708**

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 In.	Recovery (6 inches)	WELL DETAIL
<p>Sandstone: Weathered, Olive (SY 5/6), slightly moist, very strong odor.</p> <p>Sandstone: Weathered, Gray (SY 5/1), uniform, very fine sand, dense to hard, slightly moist, slight odor.</p> <p>End of boring at 45.5 feet bgs. No groundwater encountered. Boring was back filled with 6 (94lb) bags of Portland cement, 3 (60lb) bag of high yield Bentonite mixed with 100 gallons of potable water.</p>	40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80			200 1500 15 20 6	41 50 12	6 6000	<p style="text-align: center;">GROUT (CEMENT-BENTONITE MIXTURE)</p>	

Apr 10, 2000 - 10:39:22 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB02-2.dwg

Geologic Log of Boring 550 SB-03

Project MCAS/EL TORO	Northing -	Drilling Company BC2
Project Number 918609	Easting -	Drill Rtg LIMITED ACCESS
Client SWDIV	TOC Elevation -	Driller RAMON JEPEDA
Location TANK FARM 555	TOP OF RIM -	Drill Method HOLLOW STEM AUGER
Geologist B. TANAKA	DIAGRAM NOT TO SCALE	
Borehole Diameter 6-INCHES	Total Depth of Borehole 40.5 FEET	Depth to Water NOT ENCOUNTERED



Apr 13, 2000 - 09:21:34 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB03-1.dwg

Geologic Log of Boring 550 SB-03

Project **MCAS/EL TORO**

Project No. **918708**

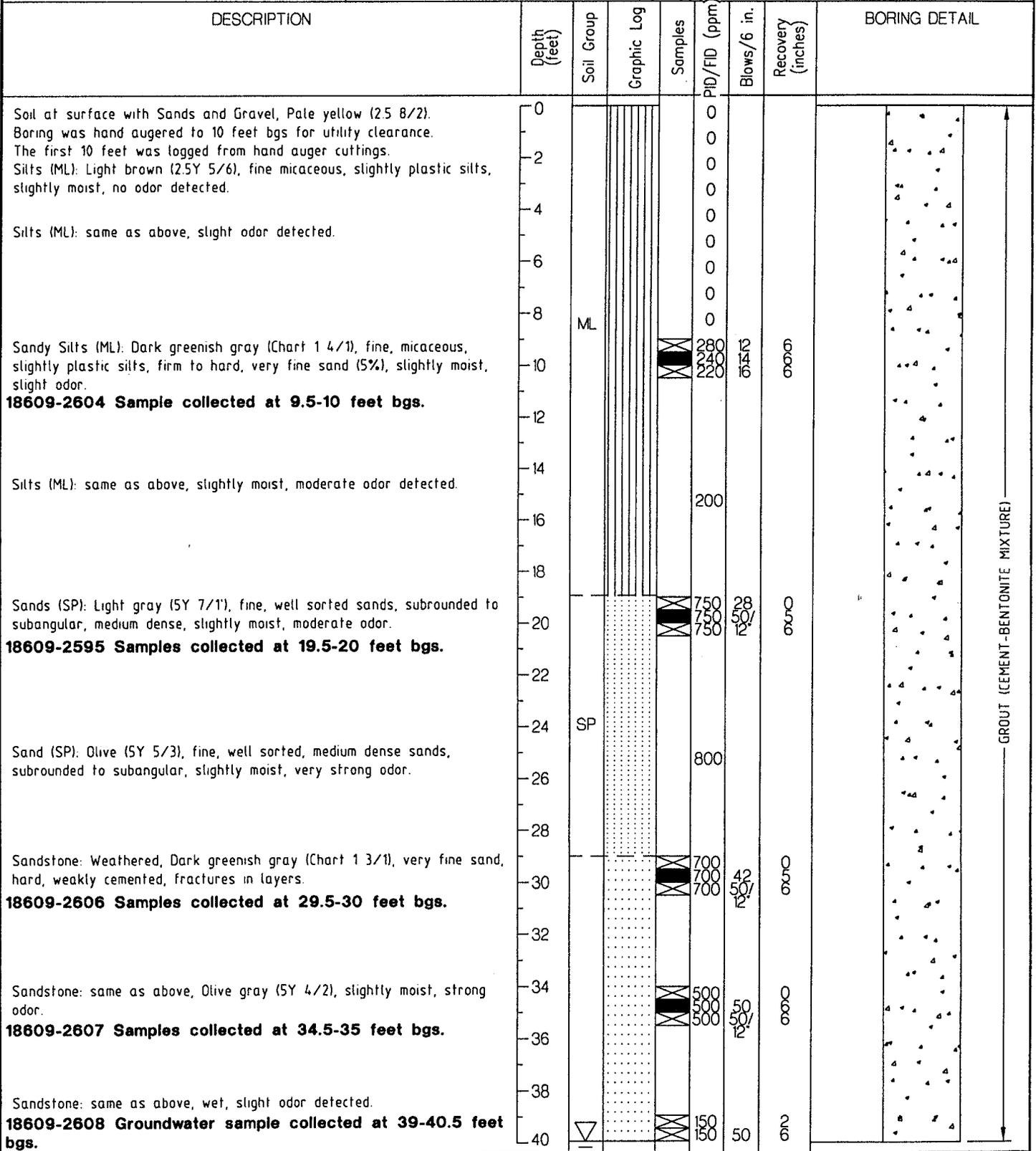
DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 In.	Recovery (6 inches)	WELL DETAIL
<p>End of boring at 40.5 feet bgs. No groundwater encountered. Boring was back filled with 4 (94lb) bags of Portland cement, 1 (60lb) bag of high yield Bentonite mixed with 55 gallons of potable water.</p>	<p>40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80</p>				0	0	6	

Apr 10, 2000 - 10:48:56 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB03-2.dwg



Geologic Log of Boring 550 SB-04

Project MCAS/EL TORO		Northing -		Drilling Company BC2			
Project Number 918609		Easting -		Drill Rig LIMITED ACCESS			
Client SWDIV		TOC Elevation -		Driller RAMON JEPEDA			
Location TANK FARM 555		TOP OF RIM -		Drill Method HOLLOW STEM AUGER			
Geologist B. TANAKA		DIAGRAM NOT TO SCALE				Well Completion Date 1/18/00	
Borehole Diameter 6-INCHES		Total Depth of Borehole 41 FEET			Depth to Water 40 FEET		



Apr 10, 2000 - 10:53:14 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB04-1.dwg



Geologic Log of Boring 550 SB-04

Project **MCAS/EL TORO**

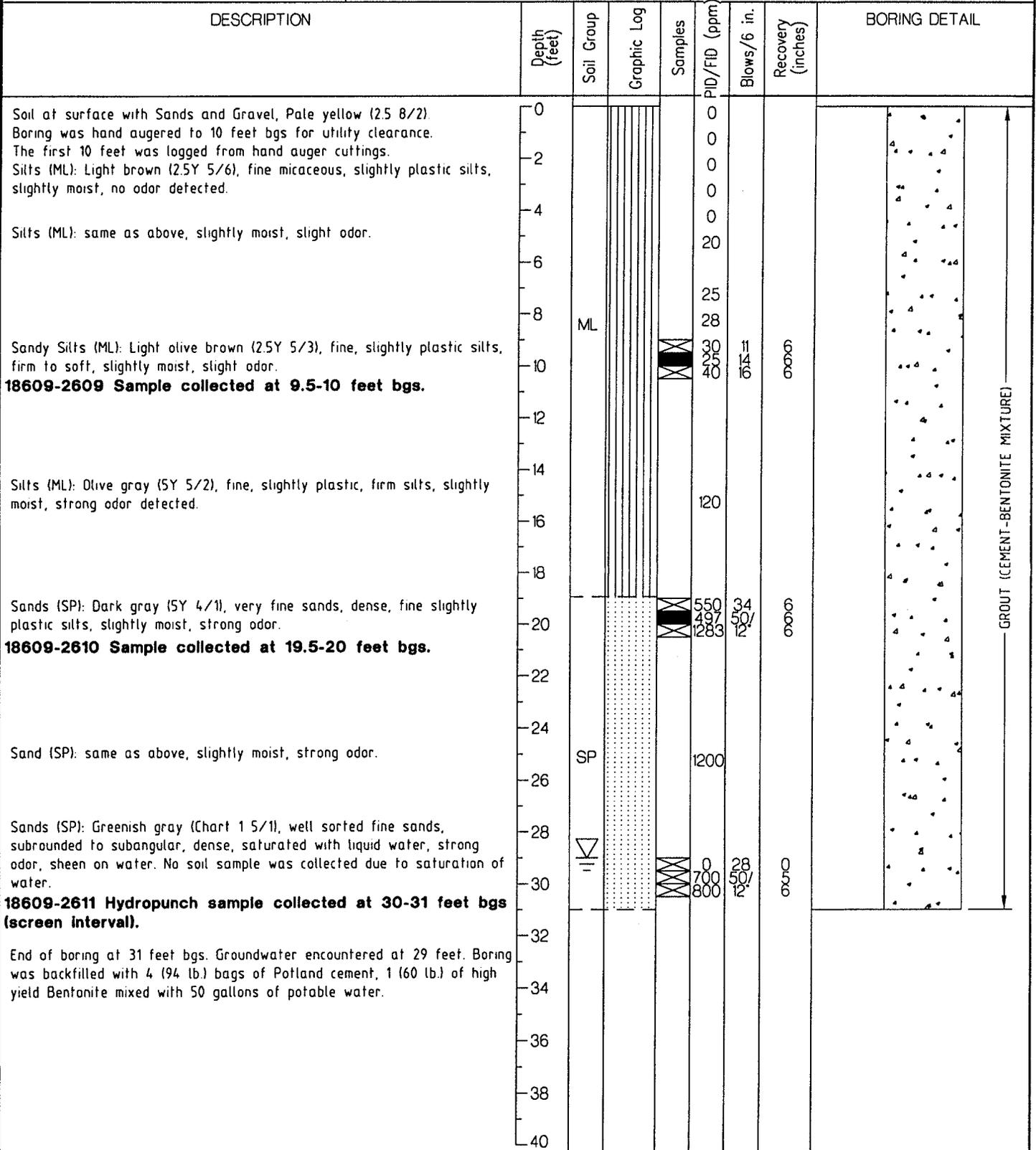
Project No. **918708**

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (6 inches)	WELL DETAIL
<p>Sandstone: same as above. No soil sample was collected due to soil being saturated. Hydropunch screen interval from 40'-41'.</p> <p>18609-2608 Hydropunch sample collected at 40-41 feet bgs.</p> <p>End of boring at 41 feet bgs. Groundwater encountered at 40 feet. Boring was back filled with 4 (94lb) bags of Portland cement, 1 (60lb) bag of high yield Bentonite mixed with 55 gallons of potable water.</p>	40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80				150	50/20	6	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">GROUT (CEMENT-BENTONITE MIXTURE)</p>

Apr. 10, 2000 - 10-54-43 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB04-2.dwg

Geologic Log of Boring 550 SB-05

Project MCAS/EL TORO	Northing -	Drilling Company BC2	
Project Number 918609	Easting -	Drill Rig LIMITED ACCESS	Begin Drilling 1/18/00
Client SWDIV	TOC Elevation -	Driller RAMON JEPEDA	End Drilling 1/18/00
Location TANK FARM 555	TOP OF RIM -	Drill Method HOLLOW STEM AUGER	Well Completion Date 1/18/00
Geologist B. TANAKA		DIAGRAM NOT TO SCALE	
Borehole Diameter 6-INCHES	Total Depth of Borehole 31 FEET	Depth to Water 29 FEET	



Apr 13, 2000 - 09:19:47 I: \OHM CORP\PROJECTS\18609\LOGS\TF555\550SB05-1.dwg

Geologic Log of Boring 550 SB-06A

Project MCAS/EL TORO	Northing -	Drilling Company BC2	
Project Number 918609	Easting -	Drill Rig CME 75	Begin Drilling 2/7/00
Client SWDIV	TOC Elevation -	Driller DIEGO TORRES	End Drilling 2/7/00
Location TANK FARM 555	TOP OF RIM -	Drill Method HOLLOW STEM AUGER	Well Completion Date 2/7/00
Geologist B. TANAKA		DIAGRAM NOT TO SCALE	
Borehole Diameter 8-INCHES	Total Depth of Borehole 75 FEET/45'	Depth to Water NOT ENCOUNTERED	

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	BORING DETAIL
Soil at surface. Boring was hand augered to 10 feet bgs for utility clearance. The first 10 feet was logged from hand auger cuttings. Silt (ML): very DARK GRAY 5.5YR 3/1, fine, slightly plastic, micaceous, slightly moist, no odor detected.	0							
Silt (ML): same as above, no odor detected.	2							GROUT (CEMENT-BENTONITE MIXTURE)
Silt (ML): same as above, slightly moist, no odor detected.	4							
Silt (ML): Olive (5Y 4/4), fine, slightly plastic, micaceous, slightly moist, soft to firm, no odor detected.	6							
Silt (ML): same as above, slightly moist, no odor detected.	8							
Silt (ML): same as above, slightly moist, no odor detected.	10							
Silt (ML): same as above, slightly moist, no odor detected.	12							
Silt (ML): same as above, slightly moist, no odor detected.	14							
Silt (ML): same as above, slightly moist, no odor detected.	16							
Silt (ML): same as above, slightly moist, no odor detected.	18							
Silt (ML): same as above, slightly moist, no odor detected.	20	ML						
Silt (ML): same as above, slightly moist, no odor detected.	22							
Silt (ML): same as above, slightly moist, no odor detected.	24							
Silt (ML): slightly moist, no odor detected.	26							
Silt (ML): slightly moist, no odor detected.	28							
Silt (ML): slightly moist, no odor detected.	30							
Silt (ML): slightly moist, no odor detected.	32							
Silt (ML): Greenish gray (Chart 1 6/1), weathered Siltstone, slightly moist, no odor detected. 18609-2777 Samples collected at 34.5-35 feet bgs.	34					50/14	0000	
Silt (ML): same as above, slightly moist, no odor detected.	36							
Silt (ML): same as above, slightly moist, no odor detected.	38							
Silt (ML): same as above, slightly moist, no odor detected.	40							

Apr 13, 2000 - 09:09:50 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB06A-1.dwg

Geologic Log of Boring 550 SB-06A

Project **MCAS/EL TORO**

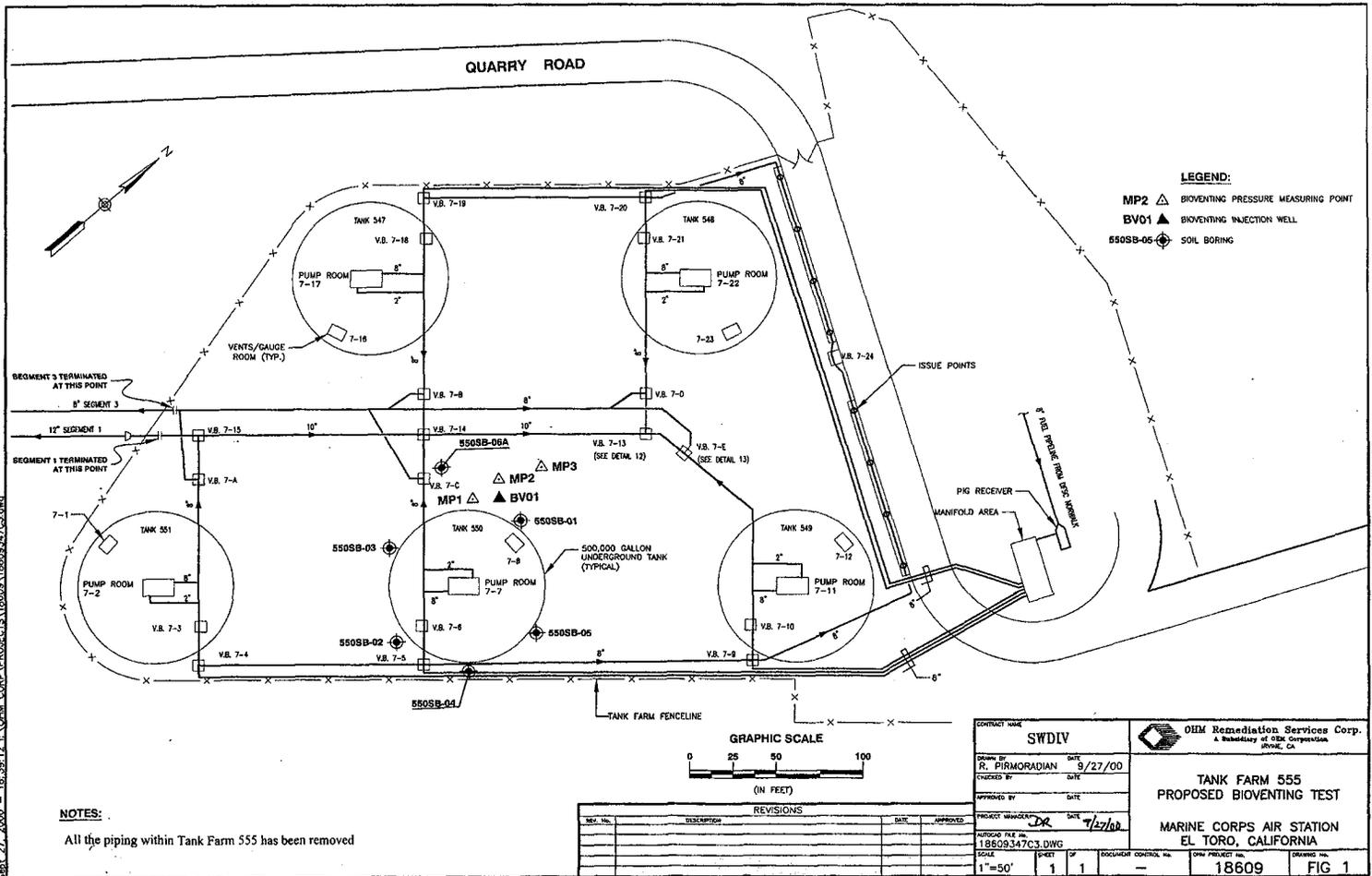
Project No. **918708**

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 In.	Recovery (6 inches)	WELL DETAIL
Silts (ML): same as above, slightly moist, no odor detected.	40		[Hatched Pattern]	[X]		0		<p style="text-align: center;">GROUT (CEMENT-BENTONITE MIXTURE)</p>
Silts (ML): same as above, slightly moist, no odor detected.	42	ML	[Hatched Pattern]			0		
Siltstone: Dark greenish gray (Chart 1 4/1), hard, fine grained, slightly moist to dry, no odor detected.	44		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	46		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	48		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	50		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	52		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	54		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	56		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	58		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	60		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	62		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	64		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	66		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected.	68		[Hatched Pattern]			0		
Siltstone: same as above, slightly moist to dry, no odor detected. 18609-2780 Sample collected at 69.5-70 feet bgs.	70		[Hatched Pattern]	[X]		0	0	
Siltstone: same as above, slightly moist to dry, no odor detected.	72		[Hatched Pattern]			0	0	
Siltstone: same as above, slightly moist to dry, no odor detected.	74		[Hatched Pattern]			0	0	
End of boring at 75 feet bgs. No groundwater was encountered in the boring. Boring was drilled at 45° from vertical. Boring was back filled with 6 (100 lb) bags of Bentonite grout mixed with 220 gallons of potable water.	76		[Hatched Pattern]			0	0	
	78		[Hatched Pattern]			0	0	
	80		[Hatched Pattern]			0	0	

Apr 10, 2000 - 11:00:50 I:\OHM CORP\PROJECTS\18609\LOGS\TF555\550SB06A-2.dwg

Appendix B

Figure 1, Proposed Bioventing Wells



LEGEND:
 MP2 ▲ BIOVENTING PRESSURE MEASURING POINT
 BV01 ▲ BIOVENTING INJECTION WELL
 550SB-05 ◉ SOIL BORING

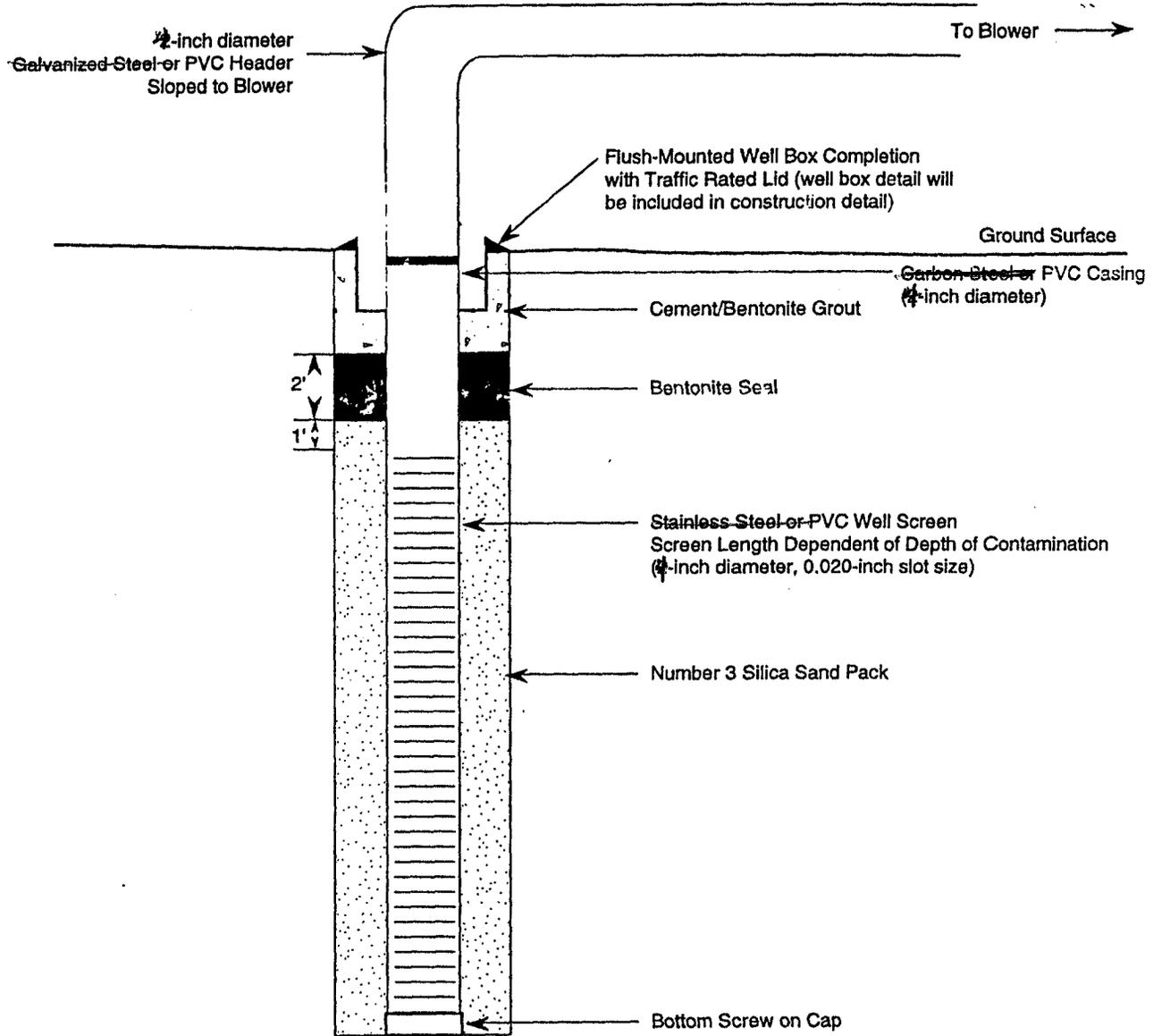
NOTES:
 All the piping within Tank Farm 555 has been removed

REVISIONS			
REV. NO.	DESCRIPTION	DATE	APPROVED

CONTRACT NO. SWDIV		OEM Remediation Services Corp. A Subsidiary of ODE Corporation IRVINE, CA	
DESIGNED BY R. PARMORADIAN	DATE 9/27/00	TANK FARM 555 PROPOSED BIOVENTING TEST MARINE CORPS AIR STATION EL TORO, CALIFORNIA	
CHECKED BY	DATE		
APPROVED BY	DATE		
PROJECT MANAGER DR	DATE 7/27/02	SCALE 1"=50'	FIG. NO. 1
PROJECT NO. 18609		DRAWING NO. FIG 1	

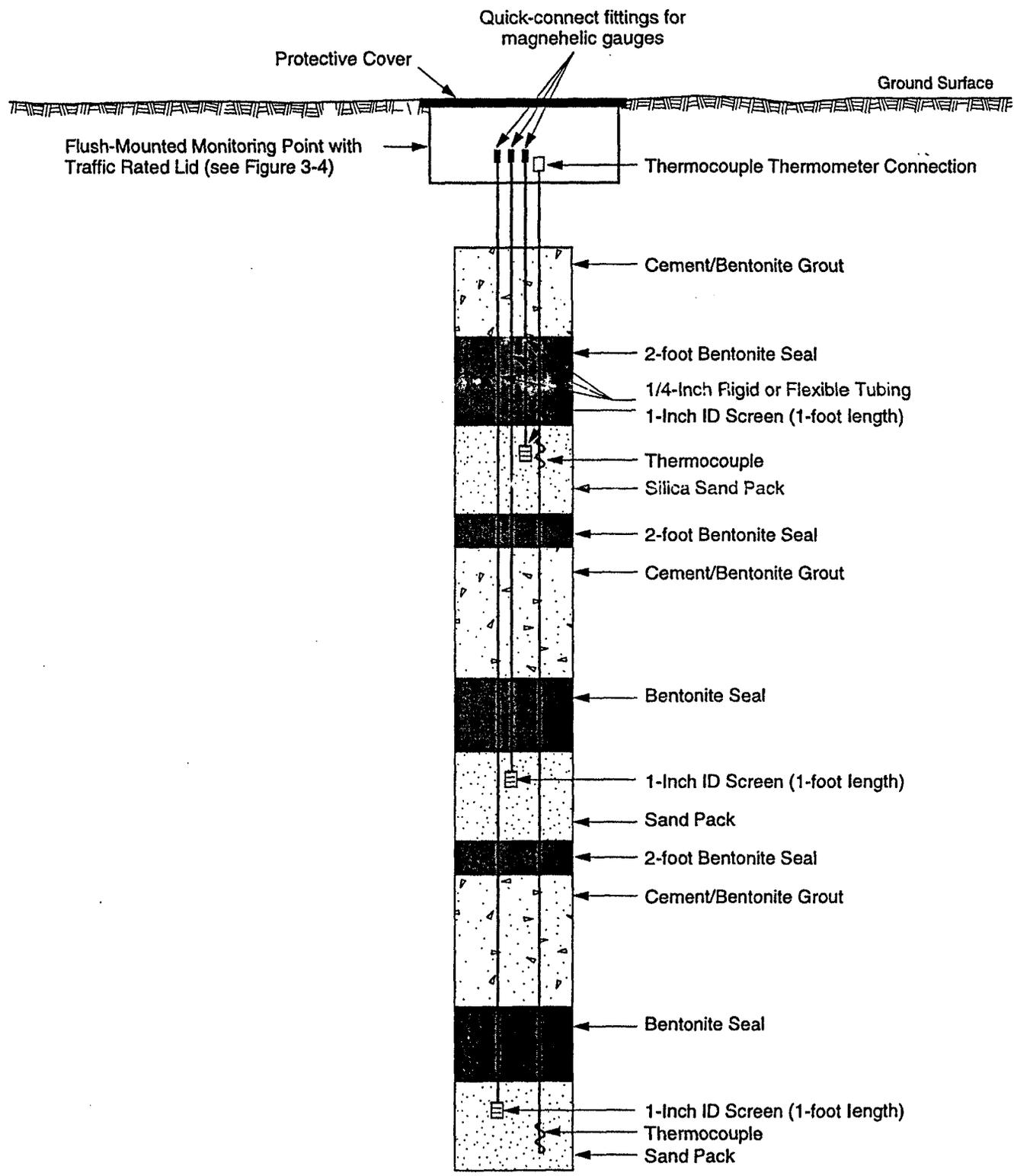
Sept. 27, 2000 - 18:39:12 \\CHM-CORP\PROJECTS\18609\18609347C3.dwg

Appendix C
Well Construction Maps



MARINE CORPS AIR STATION
 EL TORO
 VENT WELL DESIGN

FIGURE 3-3



MARINE CORPS AIR STATION
 EL TORO
 SOIL VAPOR MONITORING POINT DESIGN

FIGURE 3-4

TRANSMITTAL

Date: 27 Nov 2000

From: Lynn Marie Hornecker
MCAS El Toro

LMH

To: Diane Silva
Code 01LS.DS

Subj: CERCLA Administrative Record Materials
Marine Corps Air Station, El Toro

Installation: Marine Corps Air Station, El Toro

UIC Number: M60050

Document Title (or subject): Bioventing Pilot Test at Tank Farm 555

Author: Lynn Marie Hornecker, SWDIV

Recipient: John Broderick, RWDCB

Record Date: 29 Sep 2000

Approximate Number of Pages: 40

EPA Category: 01.1

Sites: Tank Farm 555

Key Words: petroleum

Contract: N/A

CTO Number: N/A

Site is near IRP Site 17