

**TECHNICAL MEMORANDUM**

**PHASE 1**

**MONITORING WELL INSTALLATION**

**Remedial Investigation/Feasibility Study**  
**Astoria Area-Wide Petroleum Site**  
**Astoria, Oregon**

**April 30, 2004**



**Prepared by:**

*EnviroLogic Resources, Inc.*  
P.O. Box 80762  
Portland, Oregon 97280  
(503)768-5121

*www.h2ogeo.com*

---

**TECHNICAL MEMORANDUM**

**PHASE 1**

**MONITORING WELL INSTALLATION**

**Remedial Investigation/Feasibility Study**  
**Astoria Area-Wide Petroleum Site**  
**Astoria, Oregon**

**April 30, 2004**

**Prepared for:**  
**Astoria Area-Wide PRP Group**

**Prepared by:**

*EnviroLogic Resources, Inc.*  
**P.O. Box 80762**  
**Portland, Oregon 97280**  
**(503)768-5121**  
*www.h2ogeo.com*

---

**TECHNICAL MEMORANDUM  
PHASE 1 MONITORING WELL INSTALLATION**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

**April 30, 2004**

---

This report has been prepared by *EnviroLogic Resources, Inc.*, of Portland, Oregon.

*EnviroLogic Resources, Inc.* Project No. 10077.004

By

---

Melanie N. Bocianowski  
Project Geologist

---

Nancy East-Smith, RG  
Senior Project Geologist

---

Thomas J. Calabrese, RG  
Principal/Hydrogeologist  
Project Manager

**CONTENTS**

**1.0 INTRODUCTION ..... 1**

**1.1 BACKGROUND ..... 3**

**1.2 SUMMARY OF WORK COMPLETED..... 4**

**1.3 MODIFICATIONS TO THE WORK PLAN..... 5**

**2.0 METHODS AND PROCEDURES..... 7**

**2.1 DRILLING PROGRAM ..... 7**

**2.2 INVESTIGATION DERIVED WASTE ..... 9**

**2.3 QUALITY ASSURANCE/QUALITY CONTROL ..... 9**

**3.0 LOCAL HYDROGEOLOGY ..... 11**

**4.0 CLOSING COMMENTS ..... 13**

**5.0 REFERENCES..... 14**

**TABLES**

    Table 1      Monitoring Well Construction Details

    Table 2      Well Development Record

**FIGURES**

    Figure 1      Site Location

    Figure 2      Site Plan

    Figure 3      Monitoring Well Locations

**APPENDICES**

    Appendix A    Boring/Well Logs

**TECHNICAL MEMORANDUM  
PHASE 1 MONITORING WELL INSTALLATION**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

**1.0 INTRODUCTION**

This Technical Memorandum presents the results of monitoring well installation fieldwork completed in August and September 2003 for the Remedial Investigation/Feasibility Study (RI/FS) at the Astoria Area-Wide Petroleum Site. The fieldwork was performed at the site from August 25 through September 17, 2003, in accordance with the Work Plan Addendum, Phase 2 Ground Water Assessment (*EnviroLogic Resources*, 2003b). This technical memorandum presents details of the monitoring well installation phase of the Phase 1 Ground-Water Assessment. Analytical results from soil samples collected during well installation will be presented in a Phase 2 soil/source characterization report. Ground-water sampling and analytical results will be presented in a report of the first quarterly monitoring event, which occurred in October 2003. Modifications to the Phase 1 RI Work Plan and Work Plan Addenda, methods and procedures, well construction details, and local hydrogeology are outlined in this technical memorandum.

The Oregon Department of Environmental Quality (DEQ) issued a unilateral order requiring the investigation and potential cleanup of properties in an area near the Port of Astoria in Astoria, Oregon. The Order (DEQ Unilateral Order No. ECSR-NWR-01-11) was issued to several of the current and former facility operators, property owners, and leaseholders that have engaged in industrial and commercial activities. ChevronTexaco Products Company (ChevronTexaco), Delphia Oil Company (Delphia), McCall Oil and Chemical Company (McCall), Ed Niemi Oil Company (Niemi Oil), Flying Dutchman and Harris Enterprises (Harris/Van West), Port of Astoria (the Port), Qwest Communications International (Qwest),

and Shell Oil Company (Shell), collectively potentially responsible parties (PRPs), are identified in the Order and have agreed to comply with its requirements. The following is a list of the consultants representing each PRP:

<b>PRP</b>	<b>CONSULTANT</b>
ChevronTexaco	SAIC
Delphia Oil	Maul, Foster & Alongi, Inc.
Harris/Van West	Kleinfelder, Inc.
McCall Oil	Anchor Environmental, LLC
Niemi Oil	AMEC, Inc.
Port of Astoria	<i>EnviroLogic Resources, Inc.</i>
Qwest	Tetra Tech EM, Inc.
Shell Oil	Hart Crowser, Inc.

Exxon Mobil Corporation has also agreed to participate in investigations conducted by the PRP group. The areas within which investigations are focused are termed the Astoria Area-Wide Petroleum Site (Astoria Area-Wide) and the Regional Study Area (RSA). The boundaries of these areas are shown on Figure 1.

The RI/FS and IRAM Development Work Plan Phase 1 (RI/FS Work Plan) was submitted by the PRPs to the DEQ on July 15, 2002 (*EnviroLogic Resources, 2002b*). The Work Plan provides details regarding investigations to be conducted during the Phase 1 RI at the Astoria Area-Wide site. The Work Plan Addendum, Phase 1 Ground Water Assessment was submitted to the DEQ on July 2, 2003 (*EnviroLogic Resources, 2003b*). The Work Plan Addendum, Phase 2 Soil Characterization (*EnviroLogic Resources, 2003c*) was submitted to the DEQ on July 28, 2003.

## **1.1 BACKGROUND**

The Astoria Area-Wide site comprises properties located at and near the Port of Astoria in Astoria, Oregon (Figure 1). The RSA includes the Astoria Area-Wide site and the surrounding areas. The RSA is located in Section 7, Township 8 North, Range 9 West, and Section 12, Township 8 North, Range 10 West, Willamette Base and Meridian. The Astoria Area-Wide site includes that property bounded by the Burlington Northern Railroad tracks to the southeast, Portway to the northeast, the Columbia River to the northwest, and Hamburg Street (including the former McCall bulk plant); and the property bounded by the Burlington Northern Railroad tracks to the northwest, Hamburg Street to the southwest, Marine Drive to the southeast, and Portway to the northeast.

A topographic high to the east forms a prominent hill overlooking the RSA. West Marine Drive (US Highways 26, 30, and 101) is located on a topographic bench, at the base of the prominent hill, approximately 15 feet above the level of the Port facilities. The Columbia River flows to the west on the north side of the RSA. Young's Bay lies to the south.

The area around the Port has been used for petroleum storage and distribution since the 1920s. Aboveground storage tanks (AST), underground storage tanks (UST), and pipelines are present on several of the facilities subject to this investigation. Historically, the area was home to at least four bulk petroleum storage facilities and five vehicle fueling or service stations between West Marine Drive and the Columbia River in the RSA. Pipelines from at least two of the bulk fuel storage facilities extend onto piers at the Port. The area is currently zoned for industrial and commercial uses and the zoning is expected to remain unchanged. Figure 2 shows the RSA and the locations of each of the properties subject to the Order. Remedial actions have been conducted at several facilities in association with the occurrence of petroleum hydrocarbons.

## **1.2 SUMMARY OF WORK COMPLETED**

The Work Plan Addendum, Phase 1 Ground Water Assessment (*EnviroLogic Resources, 2003b*) included the rationale for the proposed monitoring well locations. The methods and procedures followed during well installation are presented in the RI/FS Work Plan (Appendix A and Appendix E). Eleven monitoring wells and two recovery wells already exist at the site. The location of these previously existing monitoring wells and recovery wells are shown on Figure 3.

Thirty-six monitoring wells were installed at the Astoria Area-Wide site between August 25, 2003, and September 17, 2003. The completed well locations are shown on Figure 3. Six wells are located northwest of Industry Street near the Port offices [MW-32(A), MW-33(A), MW-34(A), MW-41(A), MW-42(A), and MW-43(A)]. Three wells are located at the former McCall Bulk plant [MW-46(A), MW-47(A), and MW-48(A)]. Five wells are located near the former Mobil/Niemi Bulk Oil facility [MW-37(A), MW-39(A), MW-40(A), MW-44(A), and MW-44(A)]. Four wells are located in the area of the former furniture and steel works buildings between Portway and Industry Street [MW-22(A), MW-30(A), MW-31(A), and MW-35(A)]. Three wells are located at the former Shell bulk plant [MW-19(A), MW-20(A), MW-21(A)]. MW-18(A) is located between the former Shell bulk plant and the Delphia Oil property. Six wells are located on or near the Delphia Oil property and Val's Texaco property [MW-12(A), MW-13(A), MW-14(A), MW-15(A), MW-16(A), and MW-17(A)]. Four wells are at or near the Niemi Oil Cardlock property [MW-23(A), MW-26(A), MW-28(A), and MW-29(A)]. Monitoring well MW-24(A) is located at the base of the Harris/VanWest property. Monitoring wells MW-27(A) and MW-36(A) are located on the Qwest property; and MW-38(A) is located northwest of Industry Street, southeast of the former Mobil/Niemi bulk oil facility. One of the proposed upgradient wells, MW-25(A) was not completed because ground water was not encountered in the boring above a depth of 25 feet.



### **1.3 MODIFICATIONS TO THE WORK PLAN**

Appendix A (Field Sampling Plan, FSP) and Appendix E (Technical Specifications for Drilling Operations) of the Work Plan outlined the methods and procedures which were to be followed by the PRP field representative and the drillers while drilling and sampling soil borings and constructing monitoring wells at the Astoria Area-Wide site. Modifications to these appendices are documented below:

One implemented modification was related to decontamination procedures. As documented in the Phase 1 Soil Technical Memorandum (*EnviroLogic Resources, 2003a*), the original decontamination procedures were not effective. A more effective procedure for a Geoprobe<sup>®</sup> type drill rig was presented for future field exploration activities. This procedure was modified for use with a hollow-stem auger type rig. The decontamination procedure consisted of:

- Initial tap water rinse to remove large particles, if applicable (all down hole equipment);
- Alconox tap water rinse (sampling equipment only);
- Steam tap water pressure rinse (all downhole equipment); and
- Final deionized water rinse for sampling gear.

A second modification occurred during this phase of field activities. In a few cases, soil samples were collected into sample jars instead of remaining in the brass sleeves. This was necessary when soil recovery was small or brass sleeves were not inserted into the sampler. Otherwise, samples were contained by placing end caps over Teflon sheeting on the brass sleeves; then sealed in a resealable bag.

Modifications to the Work Plan Addendum, Phase 1 Ground Water Assessment (*EnviroLogic Resources, 2003b*) included

- A modification requested by DEQ was to adjust the location of MW-38(A). The modified location of MW-38(A) is shown on Figure 2.
- Monitoring well MW-25(A) was not installed because ground water was not encountered above a depth of 25 feet during drilling. Drilling deeper to install a deeper monitoring well was considered not representative of the shallow ground-water aquifer that the remainder of the monitoring wells at the site penetrate.

## **2.0 METHODS AND PROCEDURES**

Standardized methods and procedures were developed prior to commencement of field activities. This protocol helped to control the quality of samples collected, provided a consistent framework for description of geologic materials, and helped to protect the health and safety of all site personnel. Quality-assurance protocols utilized are discussed in detail in the Quality Assurance Project Plan (QAPP) in Appendix B of the RI/FS Work Plan. Technical Specifications for Drilling Operations are in Appendix E of the RI/FS Work Plan.

### **2.1 DRILLING PROGRAM**

Geo-Tech Explorations, Inc., of Tualatin, Oregon, installed 36 monitoring wells at the Astoria Area-Wide site using hollow-stem auger drilling rigs. Prior to drilling at the Astoria Area-Wide site, the Utility Notification Service Center arranged for the location of underground utilities in the work area to be marked. Locates Down Under of Milwaukie, Oregon also performed specific boring clearances at each proposed well location. Proposed well locations were relocated where necessary, usually within five feet of the original location.

Prior to drilling, the Astoria Area-Wide Health and Safety Plan was reviewed by the drillers and field representatives. After the initial safety meeting, the drilling program began. Decontamination procedures were established to control the movement of potential contaminants to clean, uncontaminated areas, and to prevent cross-contamination between wells and samples. Before and after each use, the drilling equipment was decontaminated by using a high-pressure hot-water washer. The water was contained on a trailer, and then transferred to a 4,000-gallon Baker tank located near the base of Slip 2. Water was transferred by using a submersible pump with a hose directed directly into the tank. Soil cuttings were deposited in a Baker bin located adjacent to the Baker tank.

Soil samples collected for laboratory analysis from many of the well borings will help to further characterize soil/source conditions at the Astoria Area-Wide site. Standardized protocols were employed during the soil-sampling operation. Soil samples were collected during hollow stem auger drilling by driving a 1.5-foot long, 2-inch I.D., split-spoon sampler with a 140-pound hammer. Brass sleeves were inserted into the sampler when samples were collected for laboratory analysis. End caps were fitted over Teflon sheeting at the ends of the brass sleeve and stored in resealable bags in a cooler with ice. Where samples were not necessary, the soil was collected in the split spoon sampler without sleeves. Soil samples were generally obtained and logged at 5-foot intervals (5, 10, 15, etc. feet) as specified in the project Work Plan. A portion of each soil sample was also collected into resealable bags for PID readings to be taken.

The borings were advanced to the specified depth. Once the drilling was complete, a monitoring well was constructed. Ten feet of Schedule 40 PVC slotted well screen with 0.01 diameter slots was connected to solid casing and a well point, and then inserted into the borehole with the augers still in place. The bottom 10 feet of each well is screened. The depth of the wells depends on the depth to water at each location. A filter pack was installed by pouring 10x20 silica sand between the well casing and the auger. The sand was placed to approximately one foot above the screen. A weighted tape was used to measure the depth of sand. The well was then surged with a surge block until the filter pack settled. More sand was added if necessary to keep the filter pack one foot above the screen. Then bentonite was installed between the well casing and the auger to approximately one foot below ground surface. As the sand and bentonite were poured into the well bore, the augers were slowly lifted out of the ground. Surface completions were made with flush-mounted traffic-rated monuments and concrete. The construction details for each monitoring well are presented in Table 1.

After installation, each monitoring well was developed. Data related to well development are presented in Table 2. Well development occurred at least approximately 24 hours after installation. Development included surging and pumping water from the well. Surging was

performed with a metal surge block on PVC piping. To pump the water from the well, a purger pump, which was connected to nylon reinforced PVC tubing, was lowered into the well. The pump was connected to a portable battery for power. The wells were surged with the surge block at least two times during development. Moving the pump up and down during pumping allowed for extra surging. Development was not considered complete until at least 3 borehole volumes were pumped from the well and the pH, temperature, and specific conductance had stabilized. By the end of development the water in the wells was mostly or completely free of sediment and appeared clear. In a few wells, ground-water recharge was minimal and therefore not as much water was pumped out or there was not enough water for field parameter measurements to stabilize. The purged water was collected into drums, and then transferred into the Baker tank for storage.

## **2.2 INVESTIGATION DERIVED WASTE**

Investigation derived waste (IDW), including soil cuttings and decontamination water were stored on-site in one staging area. Soil cuttings and water were stored close together at the base of Slip 2. Decontamination water is stored in a 4,000-gallon Baker tank and soil cuttings are stored in a 20 cubic yard Baker bin. The bin was lined with visqueen before adding soil.

The concentrations of constituents in the decontamination and purge water were below discharge limits and the water was discharged from the Baker tank to a nearby storm water catch basin that has an outfall in Slip 2. Samples of the water in the Baker Tank were collected and analyzed to compare concentrations to the discharge limits set by DEQ in a letter dated August 27, 2003.

## **2.3 QUALITY ASSURANCE/QUALITY CONTROL**

Samples were collected from known or suspected areas of contamination and from areas located to provide representative distribution of the data. Sampling procedures and protocols

for each sampling activity were developed to meet the project data quality objectives and were based on proven and acceptable sampling methods as established by EPA guidance documents, Oregon state regulations, and professional judgment.

Field equipment blanks were collected and analyzed along with laboratory method blanks to evaluate whether the analytical results are representative of the sampled material and not influenced by non-site related contamination. Laboratory QC samples included laboratory matrix or method spikes, laboratory matrix spike duplicates, laboratory duplicates, and laboratory method blanks. These are described in Appendix B of the Work Plan (*EnviroLogic Resources, 2002b*).

### **3.0 LOCAL HYDROGEOLOGY**

Based on a review of the recent boring logs and boring logs from the previous investigations most of the Astoria Area-Wide site is underlain by gray and light brown sand fill. Lenses of silt and clay are present in the fill as well as gravel, wood, and other organics. In addition three native materials were encountered beneath the site; two native river deposits and the Astoria Formation. The native materials were not encountered near the site surface but at depth. This is consistent with the conceptual hydrogeologic model presented in the RI/FS Work Plan (*EnviroLogic Resources, 2002b*).

Native river deposits consisting of dark greenish-gray silty sandy clay with cobbles were encountered beneath the Qwest site, such as in SB-802(Q) and SB-835(Q). The deposit was encountered at approximately 9-10 feet bgs. Very hard, mostly dry gray clay was encountered beneath the greenish-gray river material at approximately 13 feet. This very hard clay was encountered in soil borings on the west side of the Niemi Oil Cardlock, the east side of Qwest, and beneath Harris/VanWest. The borings encountering the clay layer include SB-017(A), SB-834(A), SB-632(N), and SB-004(A). The wells constructed from these borings do not produce significant amounts of water and go dry quickly. A well was not constructed at the boring location SB-004(A) because no water was encountered in this boring. This boring included mudstone and yellowish-red and yellowish-brown silts that were also encountered in soil borings located at the Harris/Van West [SB-404 (F)] and the Young's Bay Texaco [SB-101(C) and SB-103(C)] sites, respectively. These borings also did not produce significant amounts of water. The mudstone and silts were encountered near the base of the borings from depths of 14 to 18 feet bgs. The mudstone and silt are interpreted to be part of the Astoria Formation.

Depth to ground water was generally encountered between 7 and 11 feet bgs at the site, except along West Marine Drive. The three sites along West Marine Drive have a surface elevation approximately 15 feet above the remainder of the site and the depth to ground

water was generally 22 feet bgs. Boring logs are presented in Appendix B. These logs also show the well construction details in a graphical format



#### **4.0 CLOSING COMMENTS**

Evaluations of the quality of analytical data received as part of the well installation program will be presented in subsequent reports. Soil data validation and occurrence of COIs in soil will be presented in a technical memorandum documenting Phase 2 soil/source characterization work. Ground-water data validation and occurrence of COIs in ground water will be presented in the first quarterly ground-water monitoring report.

## 5.0 REFERENCES

*EnviroLogic Resources, Inc.*, 2002a, RI/FS and IRAM Development Proposal, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated January 21, 2002.

*EnviroLogic Resources, Inc.*, 2002b, RI/FS and IRAM Development Work Plan, Phase 1, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated July 15, 2002.

*EnviroLogic Resources, Inc.*, 2003a, Phase 1 Soil Technical Memorandum, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated January 30, 2003.

*EnviroLogic Resources, Inc.*, 2003b, Work Plan Addendum, Phase 2 Ground Water Assessment, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated July 2, 2003.

*EnviroLogic Resources, Inc.*, 2003c, Work Plan Addendum, Phase 2 Soil Characterization, Remedial Investigation/Feasibility Study, Astoria Area-Wide Petroleum Site, Astoria, Oregon: consultant report dated July 28, 2003.

***TABLES***

---

TABLE 1

WELL CONSTRUCTION DETAILS

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Northing	Eastings	Reference Pt Elevation (feet msl at TOC)	Borehole Cross Reference	State Well ID	Surface Casing	Borehole Diameter (inches)	Casing Diameter (inches)	Casing Material	Screen Diameter (inches)	Screen Material
MW-1(M)	936599.486	7351297.572	14.54			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-2(M)	936530.791	7351348.236	15.06			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-3(M)	936568.313	7351406.763	15.45			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-4(M)	936477.915	7351421.833	15.50			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-5(M)	936446.436	7351500.403	16.44			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-6(M)	936550.238	7351279.371	13.79			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-7(M)	936485.617	7351302.960	14.86			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-8(M)	936633.137	7351313.880	15.25			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-9(M)	936626.508	7351451.934	15.42			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-10(M)	936731.336	7351321.429	16.34			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-11(M)	936729.240	7351467.813	16.36			Sched 40 PVC	8	2	Sched 40 PVC	2	0.020 slotted PVC
MW-12(A)	936314.138	7352293.111	30.58	SB-329(D)	58682	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-13(A)	936334.085	7352241.488	31.36	SB-331(D)	58685	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-14(A)	936438.991	7352296.778	23.39	SB-323(D)		Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-15(A)	936386.330	7352192.877	16.95	SB-321(D)	58651	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-16(A)	936525.728	7352217.851	16.48	SB-330(D)	58680	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-17(A)	936436.580	7352066.972	15.69	SB-016(A)	58670	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-18(A)	936480.671	7352092.844	16.23	SB-003(A)	58669	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-19(A)	936575.474	7352122.213	17.98	SB-912(S)	58666	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-20(A)	936607.420	7352021.007	17.04	SB-913(S)		Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-21(A)	936680.008	7351918.040	15.90	SB-914(S)	58668	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-22(A)	936494.034	7351908.218	16.13	SB-014(A)	58662	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-23(A)	936289.934	7351993.982	16.22	SB-631(N)		Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-24(A)	936178.951	7351866.186	16.56	SB-017(A)	58677	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-26(A)	936228.573	7351881.738	16.27	SB-632(N)	58679	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-27(A)	936211.566	7351808.165	16.36	SB-834(Q)	58676	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-28(A)	936322.039	7351904.695	16.13	SB-630(N)	58678	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-29(A)	936309.114	7351825.232	15.84	SB-015(A)	58686	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-30(A)	936397.174	7351760.934	16.67	SB-013(A)	58665	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-31(A)	936530.233	7351708.131	16.23	SB-012(A)	58663	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-32(A)	936658.478	7351629.597	16.51	SB-002(A)	58655	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-33(A)	936796.987	7351489.292	16.14	SB-001(A)	58656	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-34(A)	936521.866	7351547.440	15.83	SB-010(A)	58654	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-35(A)	936383.840	7351623.420	16.50	SB-011(A)	58664	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-36(A)	936188.391	7351680.069	16.14	SB-835(Q)	58675	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-37(A)	936250.527	7351532.055	18.22	SB-018(A)	58661	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-38(A)	936089.963	7351406.382	17.20	SB-005(A)	58674	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-39(A)	936173.003	7351431.091	17.29	SB-629(N)		Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC

**TABLE 1**

**WELL CONSTRUCTION DETAILS**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Locator ID	Northing	Easting	Reference Pt Elevation (feet msl at TOC)	Borehole Cross Reference	State Well ID	Surface Casing	Borehole Diameter (inches)	Casing Diameter (inches)	Casing Material	Screen Diameter (inches)	Screen Material
MW-40(A)	936375.283	7351463.578	16.17	SB-019(A)	58657	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-41(A)	936448.934	7351458.350	15.67	SB-009(A)	58653	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-42(A)	936439.391	7351371.438	15.91	SB-007(A)	58652	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-43(A)	936374.994	7351371.438	15.94	SB-008(A)	58651	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-44(A)	936332.492	7351384.014	15.31	SB-627(N)	58658	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-45(A)	936215.481	7351344.047	17.32	SB-628(N)	58660	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-46(A)	935841.070	7350941.175	16.00	SB-253(C)	58671	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-47(A)	935986.536	7350785.091	16.39	SB-254(C)	58673	Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
MW-48(A)	935832.958	7350516.937	16.21	SB-255(C)		Sched 40 PVC	8	2	Sched 40 PVC	2	0.010 Slotted Sched 40 PVC
R-1(M)	936619.280	7351336.572	13.75			PVC	12	6	PVC	6	0.020 slotted PVC
R-2(M)	936650.673	7351447.581	15.16			PVC	15	6	PVC	6	0.020 slotted PVC

TABLE 1

## WELL CONSTRUCTION DETAILS

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Filter Pack	Filter Pack Interval	Surface Seal	Total Well Depth	Borehole Depth	Screened Interval	Installation Date	Installed By	Drilling Method	Development Date	Development Method	Developed By
		(feet)		(feet)	(feet)	(feet)						
MW-1(M)	20x40 sand	4 - 19	Concrete	19.5	21.5	5.0 - 19.5	11/10/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-2(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	11/10/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-3(M)	20x40 sand	4 - 20	Concrete	19.5'	21.5	5.0 - 19.5	11/10/1994	GeoTech	Hollow-Stem Auger	9/13/2002	Swab/Pump	GeoTech
MW-4(M)	20x40 sand	4 - 25	Concrete	25.0	26.5	5.0 - 25.0	11/11/1994	GeoTech	Hollow-Stem Auger	9/13/2002	Swab/Pump	GeoTech
MW-5(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	11/11/1994	GeoTech	Hollow-Stem Auger			
MW-6(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	11/30/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-7(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	12/1/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-8(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	12/1/1994	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-9(M)	20x40 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	12/1/1994	GeoTech	Hollow-Stem Auger	9/13/2002	Swab/Pump	GeoTech
MW-10(M)	10x20 sand	4 - 20	Concrete	20.0	21.5	5.0 - 20.0	3/3/1995	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-11(M)	10x20 sand	4 - 20	Concrete	20.0	20.5	5.0-20.0	3/3/1995	GeoTech	Hollow-Stem Auger	9/12/2002	Swab/Pump	GeoTech
MW-12(A)	10x20 sand	14 - 25	Concrete	25	26.5	15 - 25	09/09/2003	GeoTech	Hollow-Stem Auger	09/11/2003	Swab/Pump	EnviroLogic
MW-13(A)	10x20 sand	15 - 16	Concrete	26	27	16 - 26	09/11/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-14(A)	10x20 sand	7 - 18	Concrete	18	20	8 - 18	09/10/2003	GeoTech	GeoProbe/Hollow-Stem Auger	09/11/2003	Swab/Pump	EnviroLogic
MW-15(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/09/2003	GeoTech	Hollow-Stem Auger	09/10/2003	Swab/Pump	EnviroLogic
MW-16(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/09/2003	GeoTech	Hollow-Stem Auger	09/10/2003	Swab/Pump	EnviroLogic
MW-17(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-18(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-19(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-20(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-21(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-22(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/02/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-23(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/10/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-24(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/08/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-26(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/08/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-27(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/05/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-28(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/08/2003	GeoTech	Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-29(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/10/2003	GeoTech	GeoProbe/Hollow-Stem Auger	09/12/2003	Swab/Pump	EnviroLogic
MW-30(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-31(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/02/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-32(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-33(A)	10x20 sand	6 - 17	Concrete	17	17	7 - 17	08/27/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-34(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-35(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/03/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-36(A)	10x20 sand	4 - 15	Concrete	15	15	5 - 15	09/05/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-37(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/28/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-38(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/05/2003	GeoTech	Hollow-Stem Auger	09/15/2003	Swab/Pump	EnviroLogic
MW-39(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/28/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic

**TABLE 1**

**WELL CONSTRUCTION DETAILS**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Locator ID	Filter Pack	Filter Pack Interval (feet)	Surface Seal	Total Well Depth (feet)	Borehole Depth (feet)	Screened Interval (feet)	Installation Date	Installed By	Drilling Method	Development Date	Development Method	Developed By
MW-40(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-41(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/27/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-42(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/26/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-43(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/26/2003	GeoTech	Hollow-Stem Auger	08/28/2003	Swab/Pump	EnviroLogic
MW-44(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	08/28/2003	GeoTech	Hollow-Stem Auger	09/16/2003	Swab/Pump	EnviroLogic
MW-45(A)	10x20 sand	6 - 17	Concrete	17	17	7 - 17	08/28/2003	GeoTech	Hollow-Stem Auger	08/29/2003	Swab/Pump	EnviroLogic
MW-46(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-47(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
MW-48(A)	10x20 sand	4 - 15	Concrete	15	16.5	5 - 15	09/04/2003	GeoTech	Hollow-Stem Auger	09/17/2003	Swab/Pump	EnviroLogic
R-1(M)	20-40 sand	4 - 28	Concrete	28.0	30	5.0 - 27.5	12/1/1994	GeoTech	Hollow-Stem Auger			
R-2(M)	20-40 sand	4 - 28	Concrete	28.0	30	5.0 - 28.0	3/3/1995	GeoTech	Hollow-Stem Auger			

**TABLE 2**

**WELL DEVELOPMENT RECORD**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Well #	Date	Time Start	Time Finish	DTB Before	DTW Before	Method	Water Removed (gal)	Well Volumes	pH	Temp (C)	Cond (uS)	DTB After	Comments
<b>MW-12(A)</b>	9/11/2003	15:19	17:33	25.31	18.94	Swab/Subp	50		6.53	14.2	755	25.38	
									6.48	14.1	746		
									6.51	14.1	746		
<b>MW-13(A)</b>	9/12/2003	7:16	14:10	26.41	22.3	Swab/Subp	54		6.92	15.3	696	26.42	Complete Discharge
									7.04	15	686		
									7.08	14.9	684		
									7.09	14.9	681		
<b>MW-14(A)</b>	9/11/2003	10:22	11:55	18.81	14.71	Swab/Subp	50		6.75	14.7	652		Complete Discharge Slightly turbid
									6.72	14.7	654		
									6.74	14.8	656		
<b>MW-15(A)</b>	9/10/2003 9/11/2003	8:38	9:30	14.81	8.8	Swab/Subp	53		7.43	14.6	784		Mostly clear
									7.39	14.7	780		
									7.38	14.7	775		
<b>MW-16(A)</b>	9/10/2003	8:25	9:46	15.16	8.36	Swab/Subp	55		6.44	16.6	629	15.21	Complete Discharge Clear
									6.47	16.5	641		
									6.49	16.5	633		
<b>MW-17(A)</b>	9/12/2003	9:32	10:05	15.22	8.12	Swab/Subp	53		6.93	14.5	587	15.35	Clear
									6.84	14.5	577		
									6.79	14.4	577		
									6.79	14.4	576		
<b>MW-18(A)</b>	9/12/2003	8:11	9:15	15.31	8.62	Swab/Subp	64		6.49	16.4	625	15.36	Clear
									6.56	16.4	611		
									6.66	16.4	595		
									6.66	16.3	596		



**TABLE 2**

**WELL DEVELOPMENT RECORD**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Well #	Date	Time Start	Time Finish	DTB Before	DTW Before	Method	Water Removed (gal)	Well Volumes	pH	Temp (C)	Cond (uS)	DTB After	Comments
<b>MW-19(A)</b>	9/16/2003	10:55		15.3	10.42	Swab/Subp	35		6.22	14.6	426		
									6.34	14.6	436		
									6.37	14.5	440		
									6.38	14.6	434		
									6.38	14.6	437		
<b>MW-20(A)</b>	9/16/2003	10:05	13:00	15.35	9.87	Swab/Subp	50		6.3	15.5	314	15.39	
									6.38	15.3	315		
									6.44	15.3	316		
									6.47	15.2	313		
<b>MW-21(A)</b>	9/16/2003	8:15	8:45	15.31	9.11	Swab/Subp	47		6.31	15.4	277	15.35	
									6.39	15.4	273		
									6.4	15.4	275		
									6.41	15.4	273		
<b>MW-22(A)</b>	9/16/2003	9:00	9:45	15.03	9.03	Swab/Subp	45		6.32	14.1	342	15.08	
									6.38	14.1	341		
									6.41	14.1	340		
									6.43	14.1	339		
<b>MW-23(A)</b>	9/16/2003	13:00	14:05	14.9	8.61	Swab/Subp	85		6.03	15	344	14.93	
									6.21	14.5	339		
									6.28	14.5	340		
									6.29	14.5	337		
<b>MW-24(A)</b>	9/15/2003	14:15	16:00	14.87	8.94	Swab/Subp	50		6.12	15.9	311		
	9/16/2003								6.31	14.8	309		
									6.58	14.4			
<b>MW-26(A)</b>	9/15/2003	13:30	17:40	15.3	5.88	Swab/Subp	50		6.32	14.5	517	15.35	
									6.67	14	536		
									6.69	14.1	523		
									6.6	14.1	516		
									6.6	13.8	511		

**TABLE 2**

**WELL DEVELOPMENT RECORD**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Well #	Date	Time Start	Time Finish	DTB Before	DTW Before	Method	Water Removed (gal)	Well Volumes	pH	Temp (C)	Cond (uS)	DTB After	Comments
<b>MW-27(A)</b>	9/15/2003	11:25	13:10	15.21	9	Swab/Subp	50		6.38	16.8	235	15.24	Discharge completely
									6.34	16.2	261		
									6.2	17.5	232		
									6.16	16.2	238		
									6.01	17.2	225		
									6.13	16.6	230		
<b>MW-28(A)</b>	9/12/2003	10:17	11:00	15.3	8.78	Swab/Subp	55		6.2	16	238	15.36	Slightly cloudy
									6.37	16.8	396		
									6.36	16.6	390		
									6.35	16.5	388		
									6.35	16.7	388	Clear	
<b>MW-29(A)</b>	9/12/2003	11:11	12:00	15.34	8.61	Swab/Subp	55		6.34	16.9	314	15.37	
									6.38	16.7	309		
									6.39	16.6	308		
									6.4	16.5	310		
									6.4	16.5	308	Clear	
<b>MW-30(A)</b>	9/15/2003	15:50	16:50	15.1	9.7	Swab/Subp	50		6.24	14.5	356	15.11	
									6.38	14.1	351		
									6.49	14	344		
									6.49	13.9	342		
									6.51	13.9	341	Clear	
<b>MW-31(A)</b>	9/15/2003	15:00	15:30	15.31	9.71	Swab/Subp	47		6.38	15.7	423		
									6.54	15.3	413		
									6.61	15.4	396		
									6.62	15.2	397		
									6.62	15.2	396		
<b>MW-32(A)</b>	8/29/2003	9:14	9:49	15.33	10.3	Swab/Subp	42		6.71	15.4	413	15.36	
									6.74	15.3	403		
									6.75	15.2	404	Clear	

**TABLE 2**

**WELL DEVELOPMENT RECORD**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Well #	Date	Time Start	Time Finish	DTB Before	DTW Before	Method	Water Removed (gal)	Well Volumes	pH	Temp (C)	Cond (uS)	DTB After	Comments
<b>MW-33(A)</b>	8/29/2003	8:14	8:56	17.24	10.86	Swab/Subpt	53		6.64	15.5	412	17.31	
									6.61	15.4	403		
									6.62	15.4	407		
<b>MW-34(A)</b>	9/17/2003	11:25	12:12	15.31	9.6	Swab/Subpt	55		6.27	16.1	369	15.35	
									6.36	15.6	369		
									6.39	15.6	371		
									6.4	15.4	369		
									6.39	15.5	366		
<b>MW-35(A)</b>	9/16/2003	17:50	18:45	15.25	9.76	Swab/Subpt	45		6.34	14.4	145.5	15.32	
									6.4	14.1	145.6		
									6.45	14.1	145.2		
<b>MW-36(A)</b>	9/15/2003			15.36	8.71	Swab/Subpt	17						Not much water
<b>MW-37(A)</b>	9/16/2003	16:00	17:00	15.39	11.19	Swab/Subpt	55		6.31	14.2	343	15.41	
									6.4	13.9	340		
									6.44	13.8	339		
									6.44	13.8	339		
<b>MW-38(A)</b>	9/15/2003	10:00	11:00	15.31	8.77	Swab/Subpt	52		6.1	17.2	357	15.38	
									6.42	16.8	343		
									6.42	16.8	341		
									6.42	16.8	342		
<b>MW-39(A)</b>	8/29/2003	14:08	15:50	15.34	8.81	Swab/Subpt	28		6.27	14.9	158.9	15.41	Complete Discharge
									6.36	14.6	136.8		
									6.41	14.8	138.5		
									6.41	14.8	138.9		
<b>MW-40(A)</b>	9/16/2003	15:00	15:50	15.36	9.52	Swab/Subpt	56		6.35	15.9	377	15.42	
									6.37	15.1	346		
									6.37	15	349		
									6.39	14.7	351		
									6.38	14.7	349		

**TABLE 2**

**WELL DEVELOPMENT RECORD**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Well #	Date	Time Start	Time Finish	DTB Before	DTW Before	Method	Water Removed (gal)	Well Volumes	pH	Temp (C)	Cond (uS)	DTB After	Comments
<b>MW-41(A)</b>	9/17/2003	12:20	13:16	15.33	9.25	Swab/Subp	55		6.7	15.9	339	15.35	
									6.57	15.7	333		
									6.5	15.6	330		
									6.46	15.5	330		
									6.44	15.5	329		
<b>MW-42(A)</b>	8/29/2003	7:11	7:52	15.36	9.24	Swab/Subp Bail	55		6.54	15.4	517	15.37	
									6.55	15.2	458		
									6.55	15.1	451		
<b>MW-43(A)</b>	8/28/2003	16:27	17:25		8.8	Swab/Subp	60		6.68	14.7	300	15.35	
									6.8	14.5	194.9		
									6.8	14.9	194.8		
<b>MW-44(A)</b>	9/16/2003	15:50	17:15	15.35	8.45	Swab/Subp	70		6.16	17.1	344	15.41	
									6.22	16.7	345		
									6.23	16.8	342		
<b>MW-45(A)</b>	8/29/2003	10:24	13:25	17.07	9.34	Swab/Subp Bail	73		6.23	15.8	176.8	17.16	
									6.5	15.4	173.2		
									6.51	15.4	174.1		
									6.53	15.5	173.8		
<b>MW-46(A)</b>	9/17/2003	10:13	11:15	15.28	7.37	Swab/Subp	68		6.19	14.1	186	15.34	
									6.28	14	184		
									6.31	13.9	184		
									6.32	13.9	184		
									6.37	14	182		
									6.34	14.5	182		
									6.35	14	180		
									6.34	14	180		
									6.35	14	180		
									6.35	14	180		
									6.35	13.9	180		

**TABLE 2**

**WELL DEVELOPMENT RECORD**

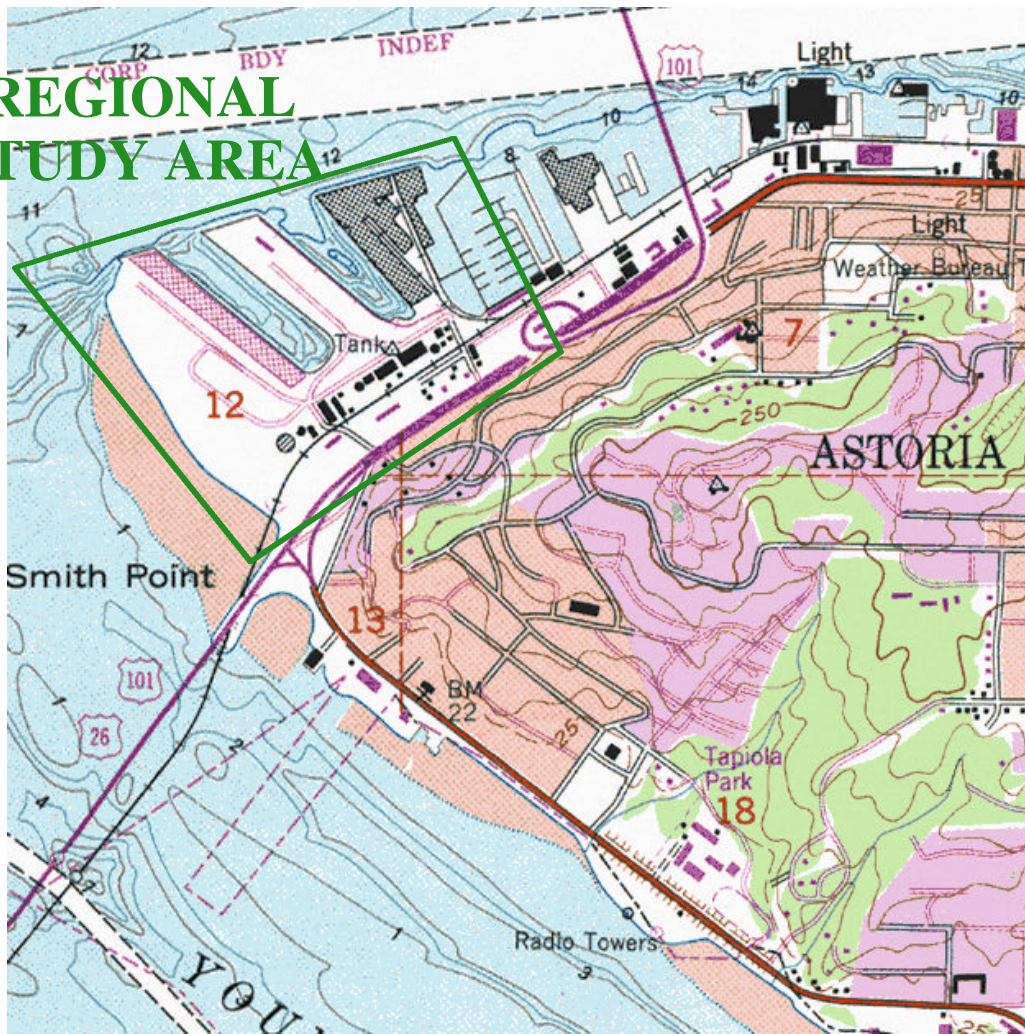
**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Well #	Date	Time Start	Time Finish	DTB Before	DTW Before	Method	Water Removed (gal)	Well Volumes	pH	Temp (C)	Cond (uS)	DTB After	Comments
<b>MW-47(A)</b>	9/17/2003	9:22	9:58	15.31	8.22	Swab/Subp	55		6.32	14.8	177	15.37	
									6.38	14.7	163		
									6.41	14.6	161		
									6.43	14.6	160		
									6.43	14.6	160		
<b>MW-48(A)</b>	9/17/2003	8:30	9:15	15.11	8.38	Swab/Subp	56		6.11	14.4	258	15.88	
									6.24	14.2	255		
									6.31	14.2	253		
									6.34	14.2	252		
<b>R-1(M)</b>	9/17/2003	13:34	14:45	19.33	5.56	Subpump	55		6.48	18.6	169	19.34	
									6.38	18.3	165		
									6.37	18	164		
									6.35	17.9	165		
									6.34	18.3	167		

***FIGURES***

---

# REGIONAL STUDY AREA



(from USGS, Astoria [1984], OR 7.5' Quadrangles)

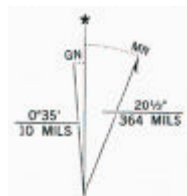
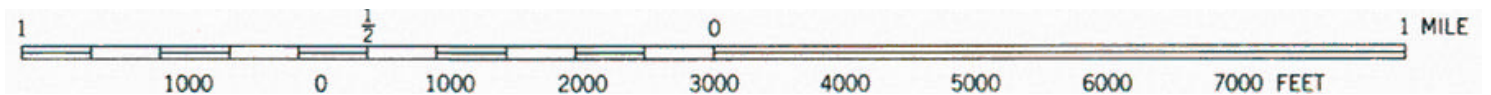


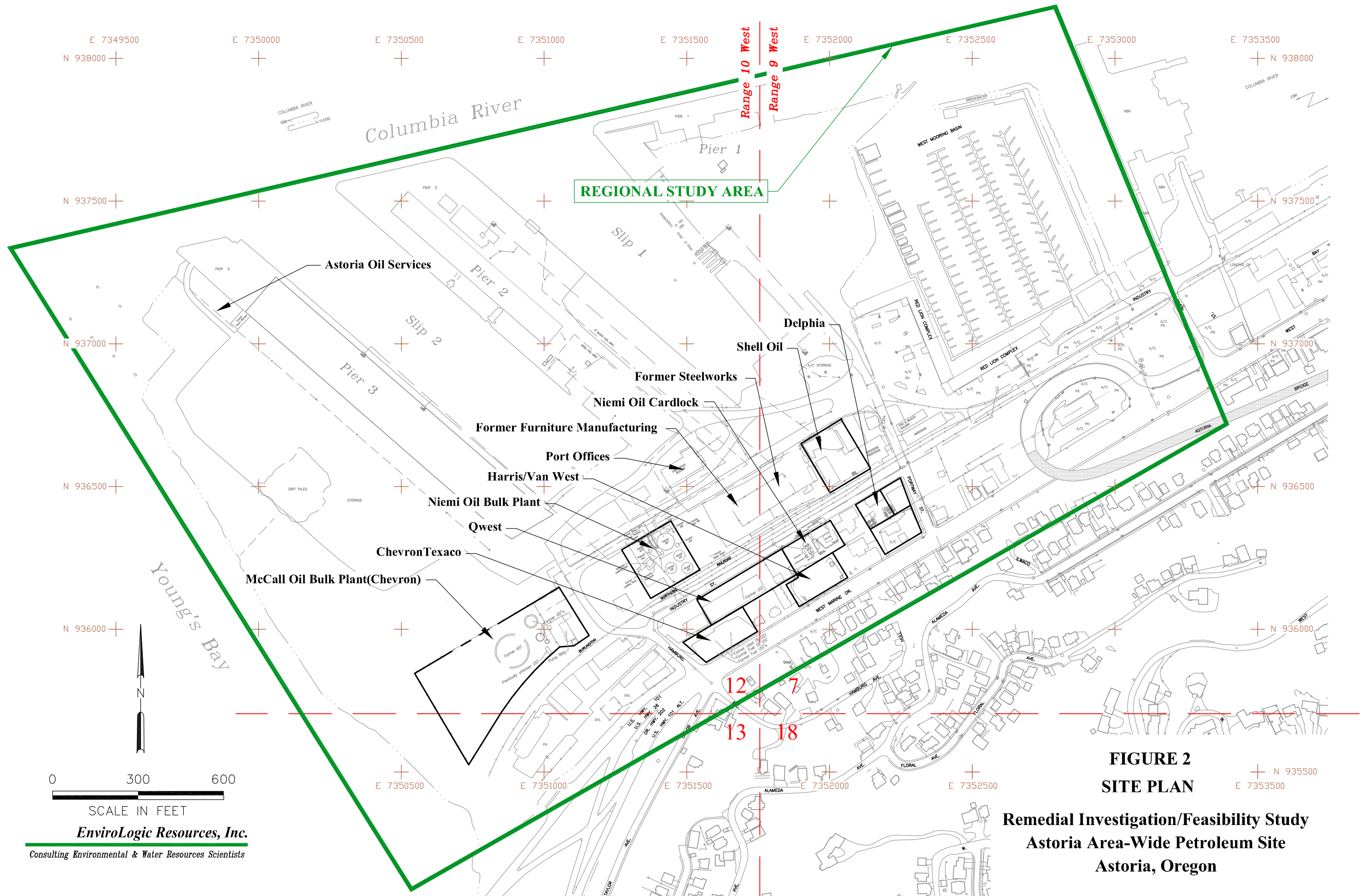
FIGURE 1

## SITE LOCATION

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

**EnviroLogic Resources, Inc.**

Consulting Environmental & Water Resources Scientists



**REGIONAL STUDY AREA**

Range 10 West

Range 9 West

**FIGURE 2  
SITE PLAN**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

E 7349500  
E 7350000  
E 7350500  
E 7351000  
E 7351500  
E 7352000  
E 7352500  
E 7353000  
E 7353500  
N 938000  
N 937500  
N 937000  
N 936500  
N 936000  
N 935500  
N 935000

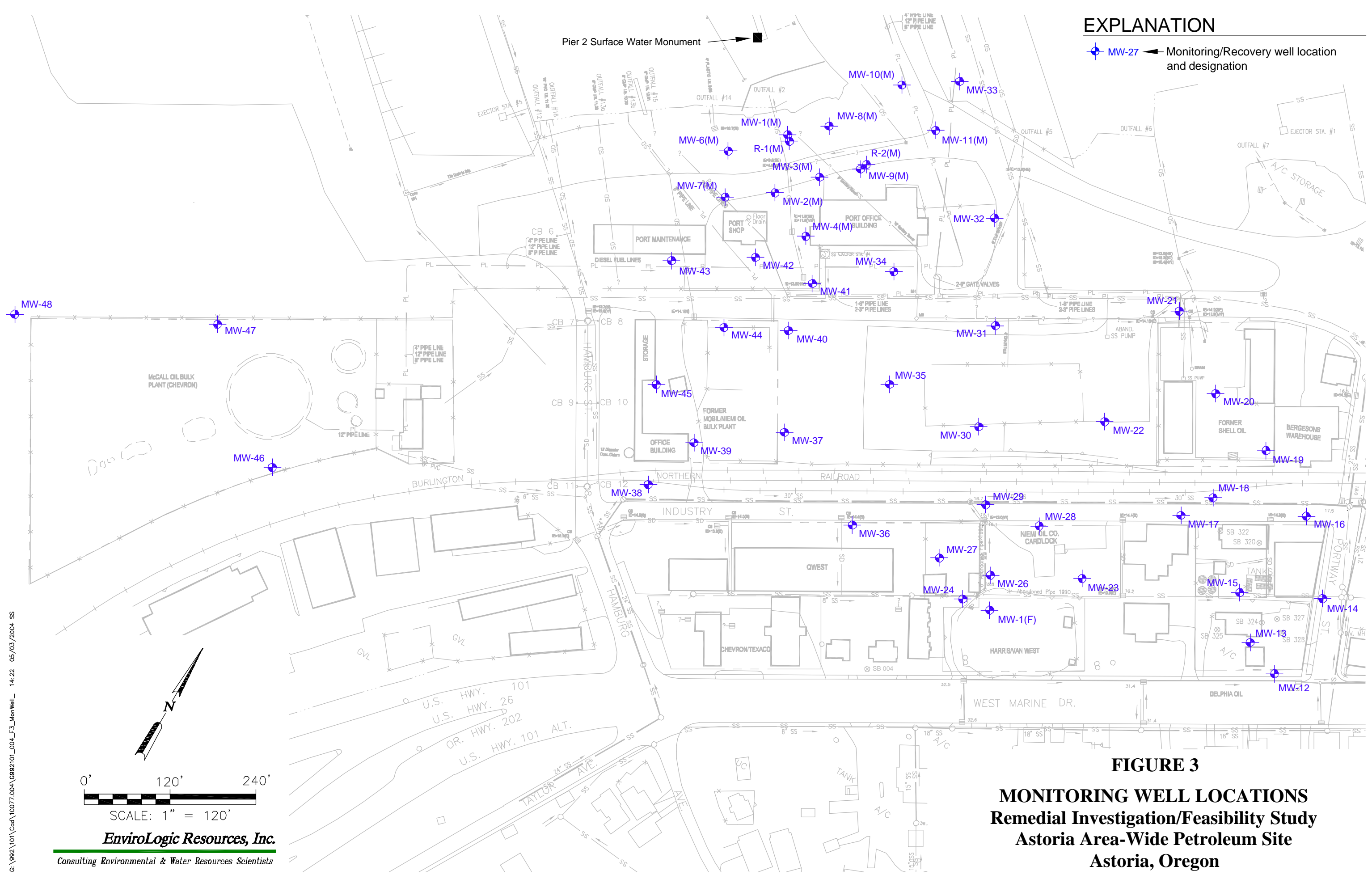
0 300 600

SCALE IN FEET

**EnviroLogic Resources, Inc.**

Consulting Environmental & Water Resources Scientists





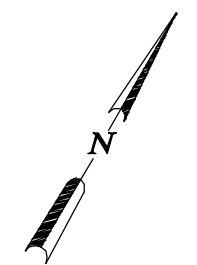
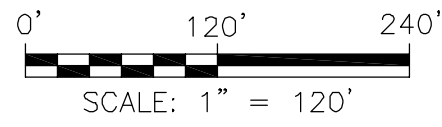
**EXPLANATION**

◆ MW-27 ← Monitoring/Recovery well location and designation

Pier 2 Surface Water Monument

**FIGURE 3**

**MONITORING WELL LOCATIONS**  
**Remedial Investigation/Feasibility Study**  
**Astoria Area-Wide Petroleum Site**  
**Astoria, Oregon**



**EnviroLogic Resources, Inc.**

Consulting Environmental & Water Resources Scientists

G:\982\101\Cad\10077.004\G992101\_004\_F3\_MonWell\_14.22\_05/03/2004 SS

*APPENDIX A*

*WELL CONSTRUCTION LOGS*

---

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 17 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/27/2003

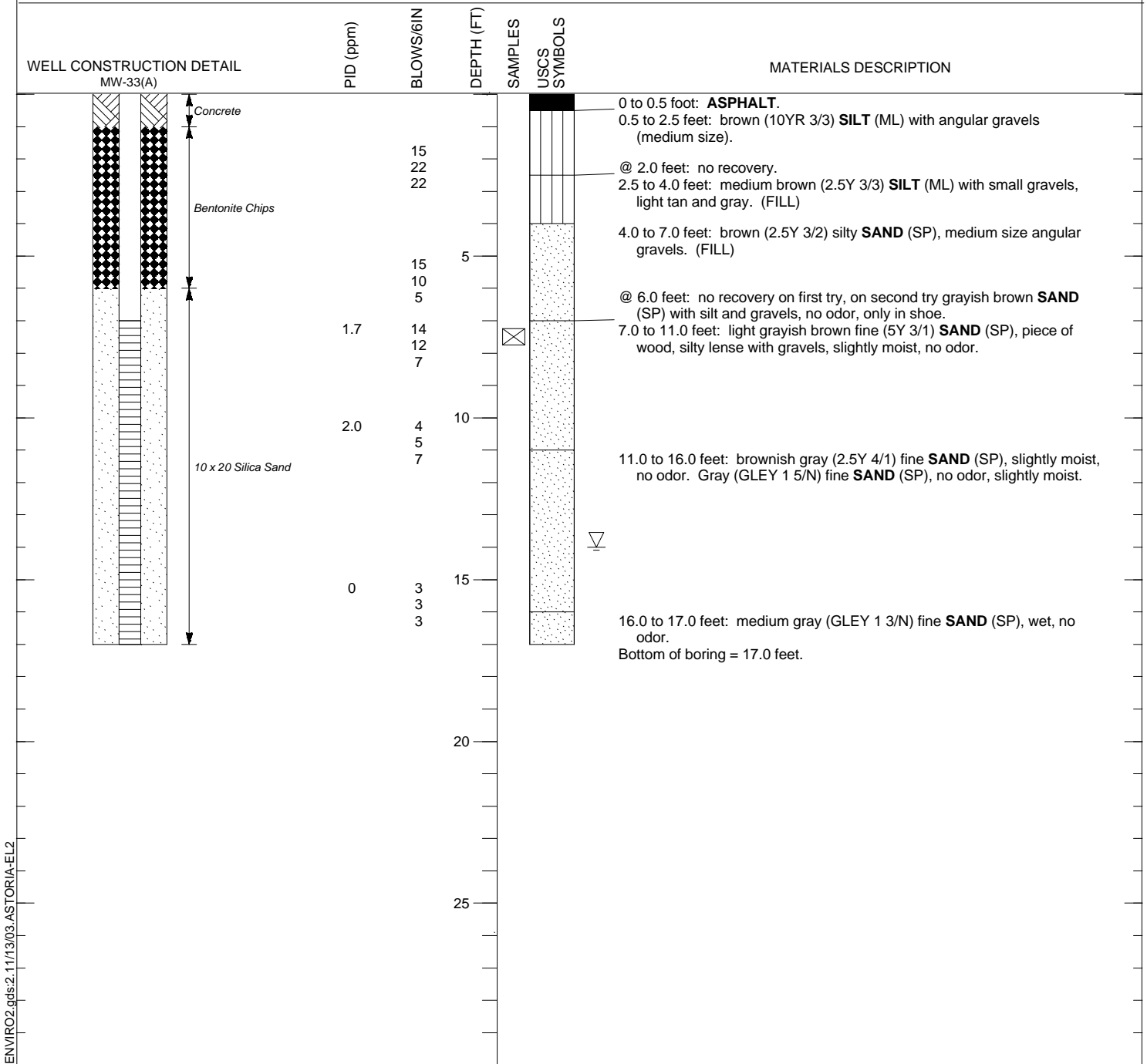


FIGURE A-1

LOG OF  
 SOIL BORING SB-001(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

EnviroLogic Resources, Inc.

Consulting Environmental & Water Resources Scientists

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/27/2003

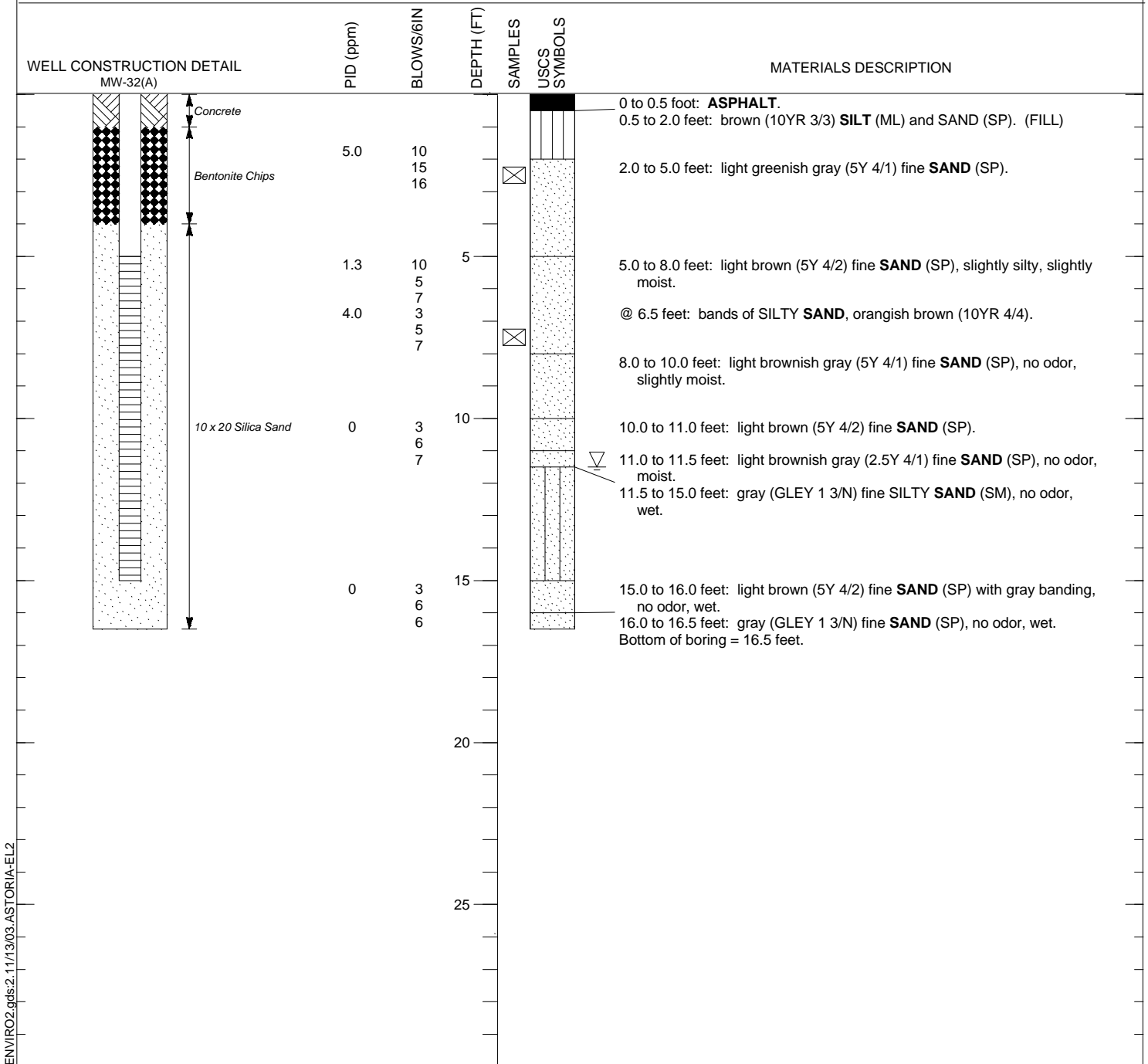


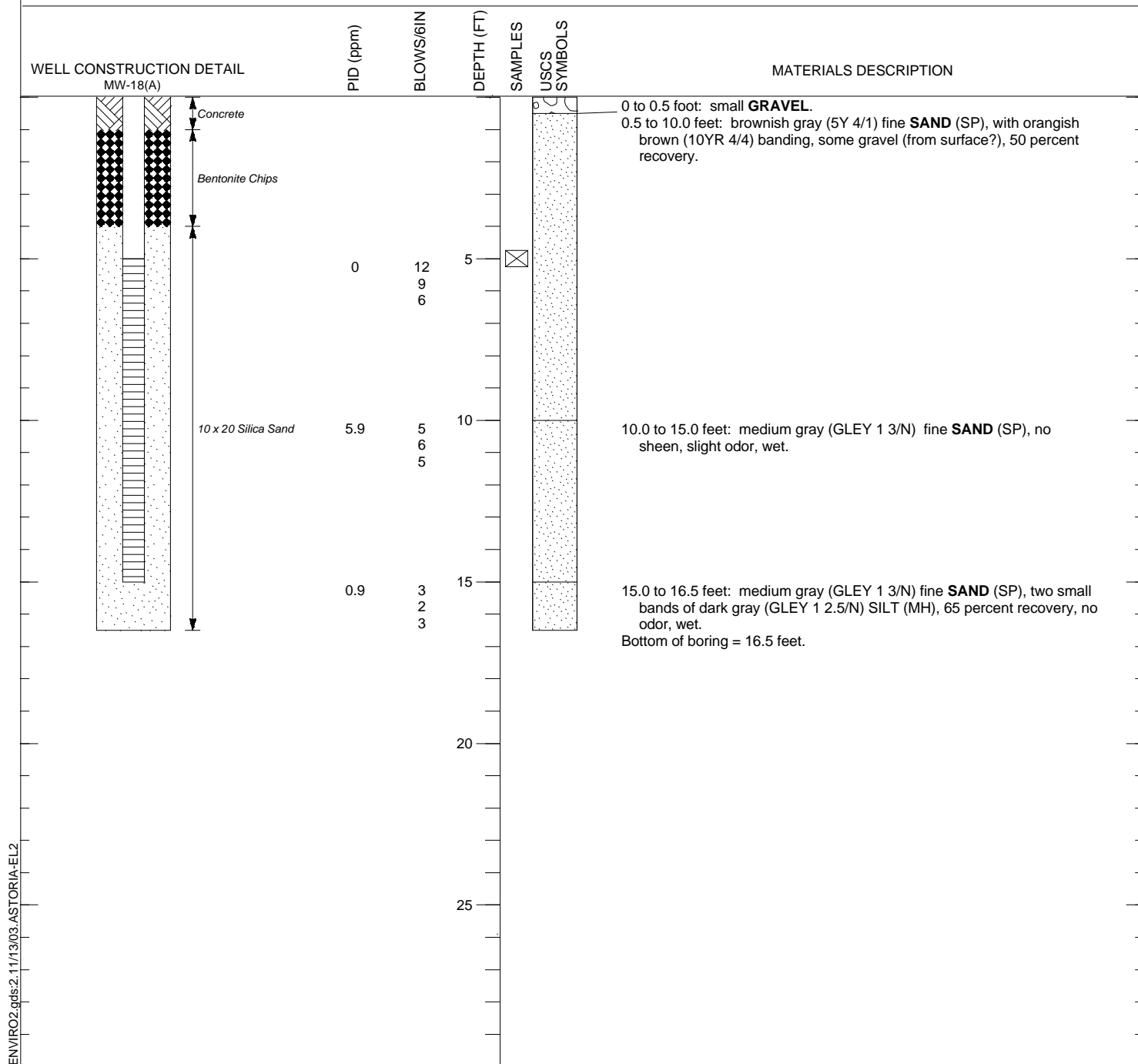
FIGURE A-2

LOG OF  
 SOIL BORING SB-002(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/04/2003



**FIGURE A-3**

**LOG OF  
 SOIL BORING SB-003(A)**

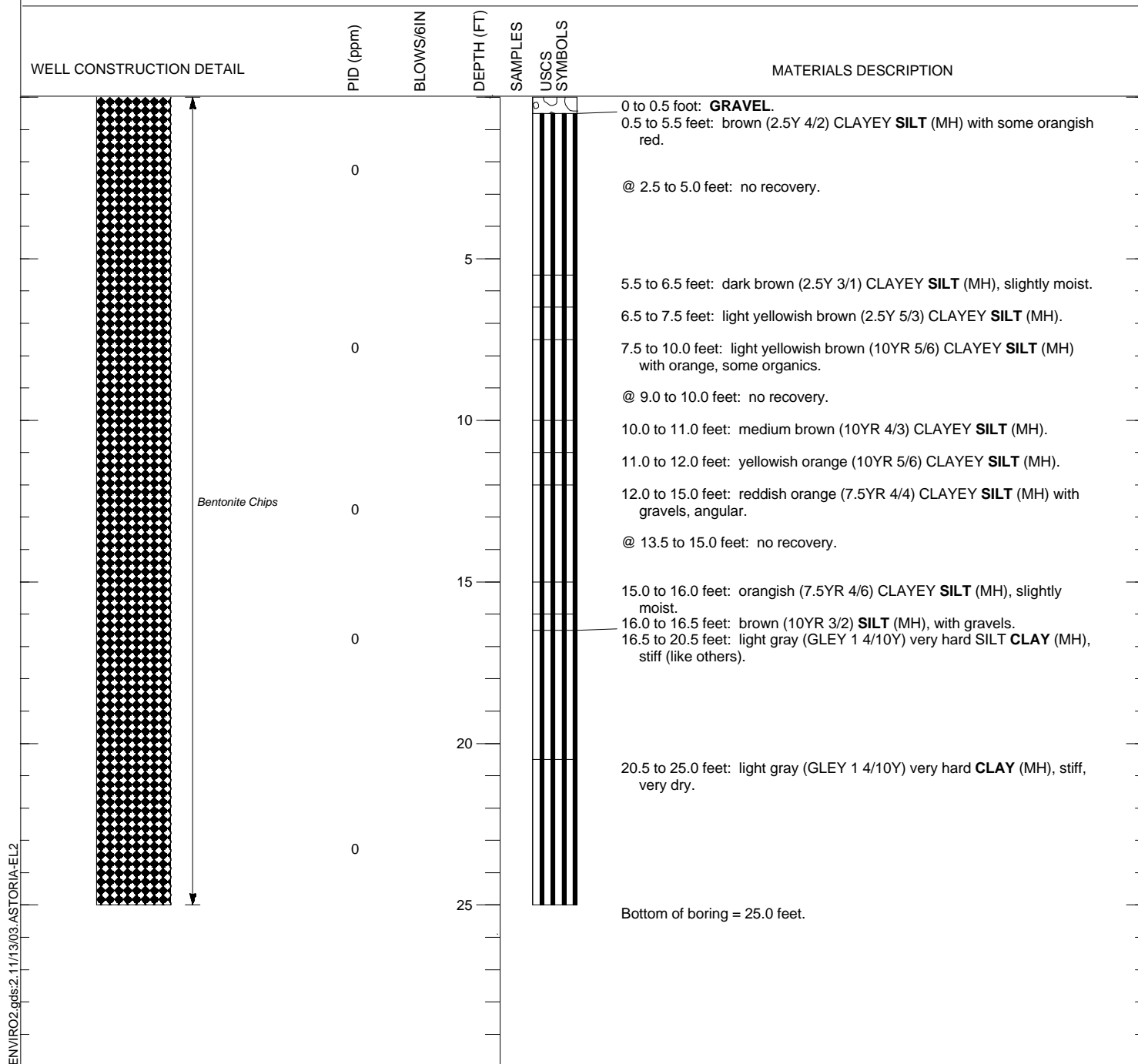
**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

**EnviroLogic Resources, Inc.**

Consulting Environmental & Water Resources Scientists

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Geoprobe  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 25 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/11/2003



**FIGURE A-4**

**LOG OF  
SOIL BORING SB-004(A)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/05/2003

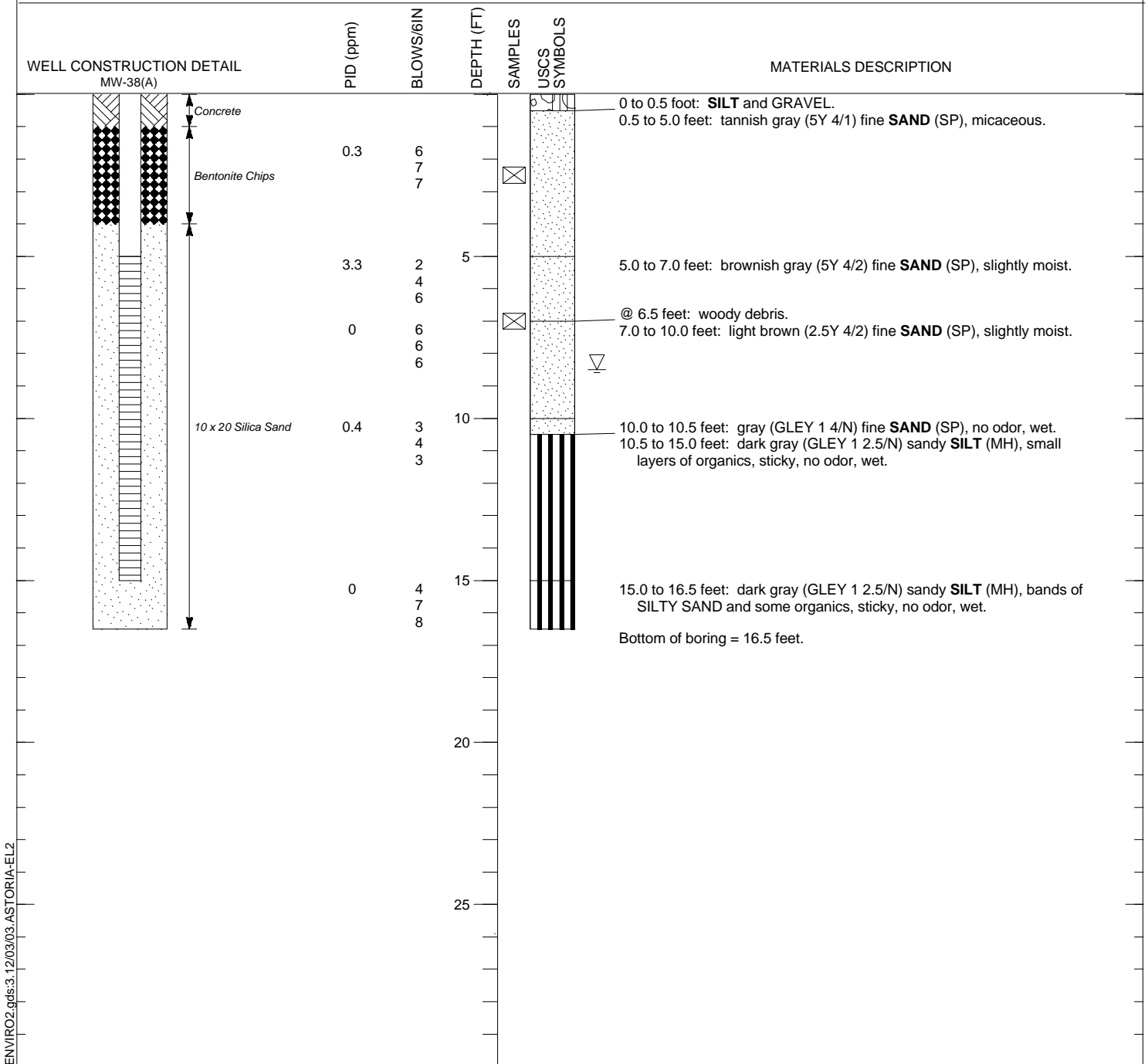


FIGURE A-5

LOG OF  
 SOIL BORING SB-005(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/26/2003

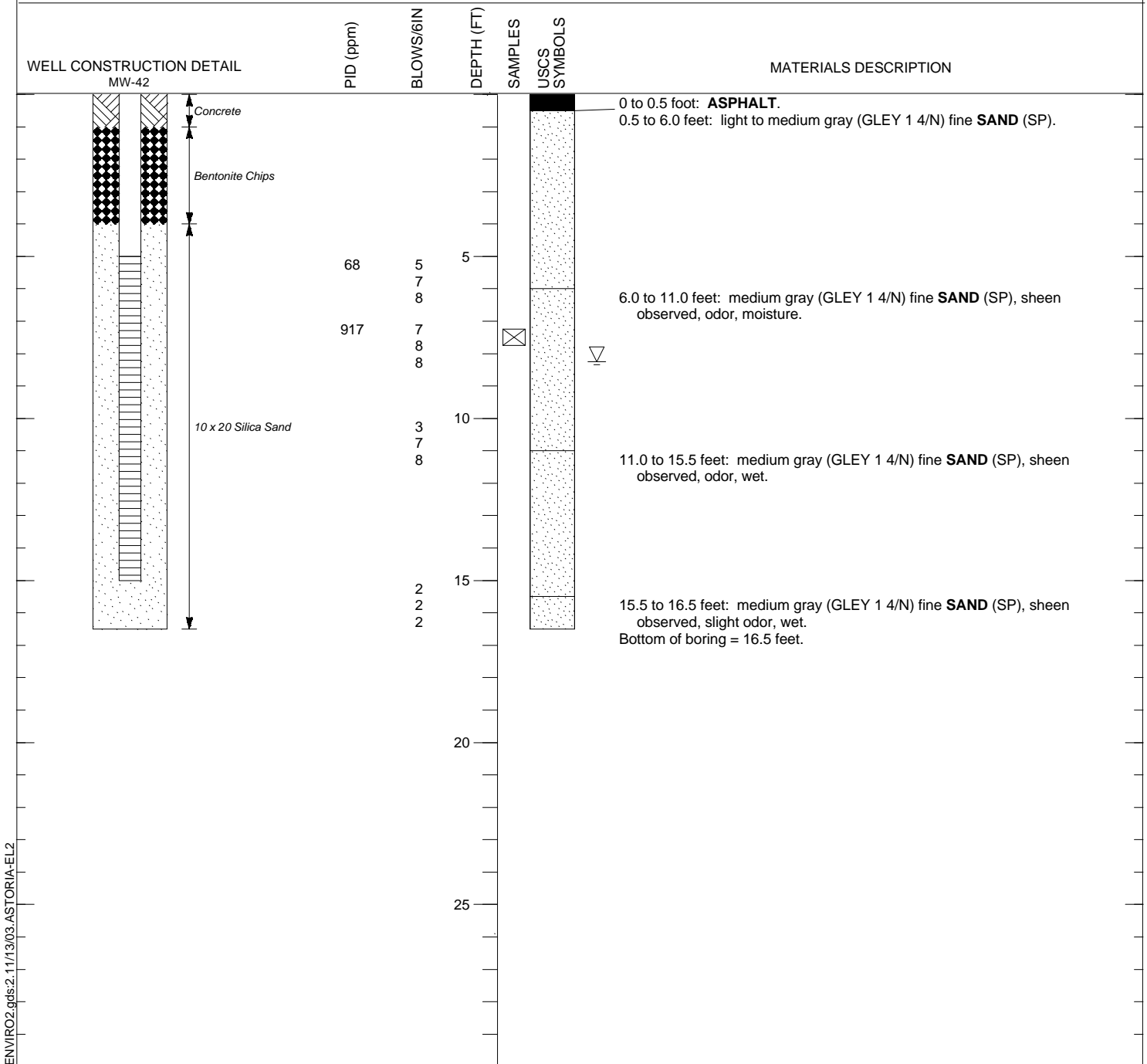


FIGURE A-6

LOG OF  
 SOIL BORING SB-007(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon



PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/26/2003

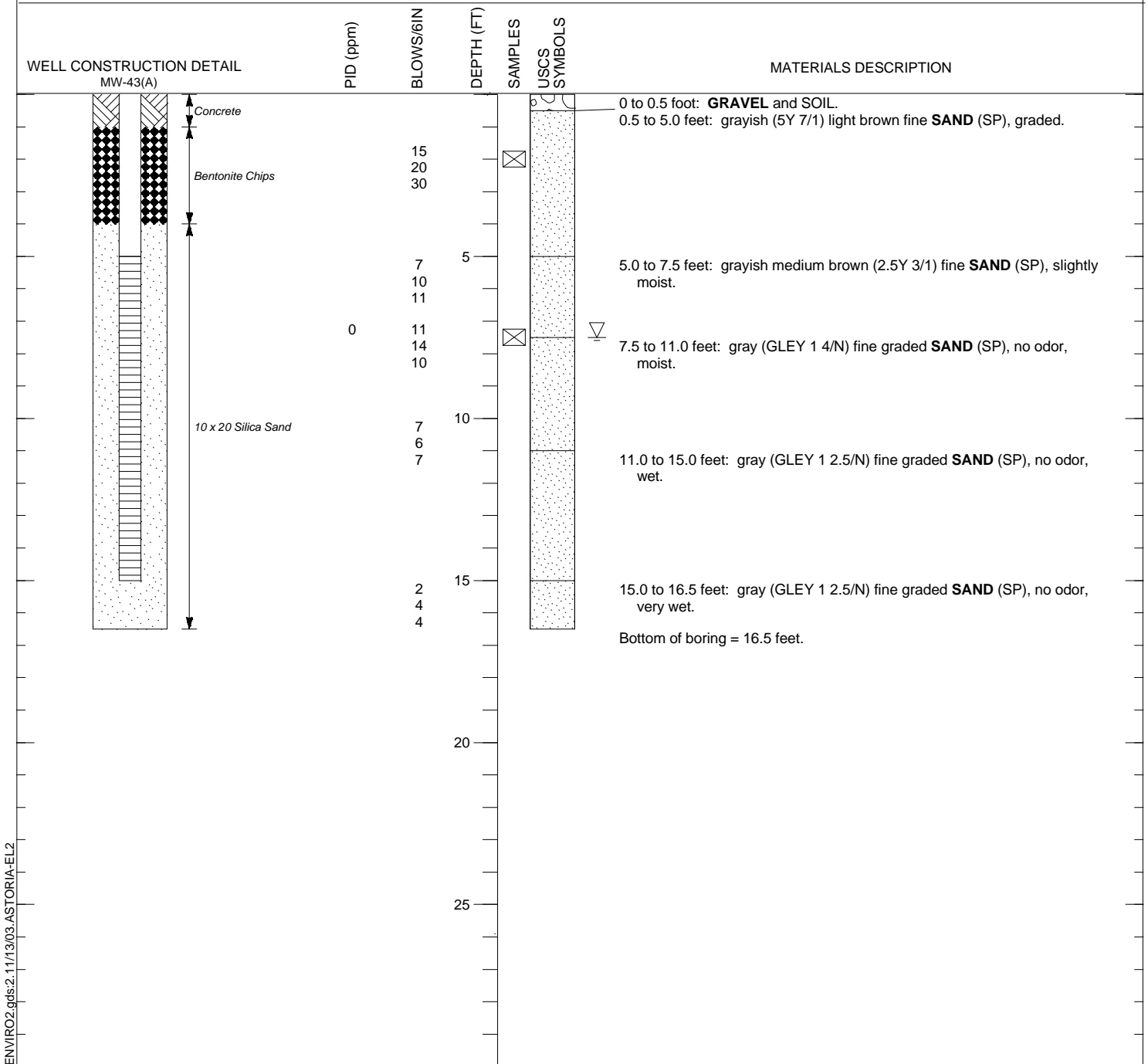


FIGURE A-7

LOG OF  
 SOIL BORING SB-008(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/27/2003

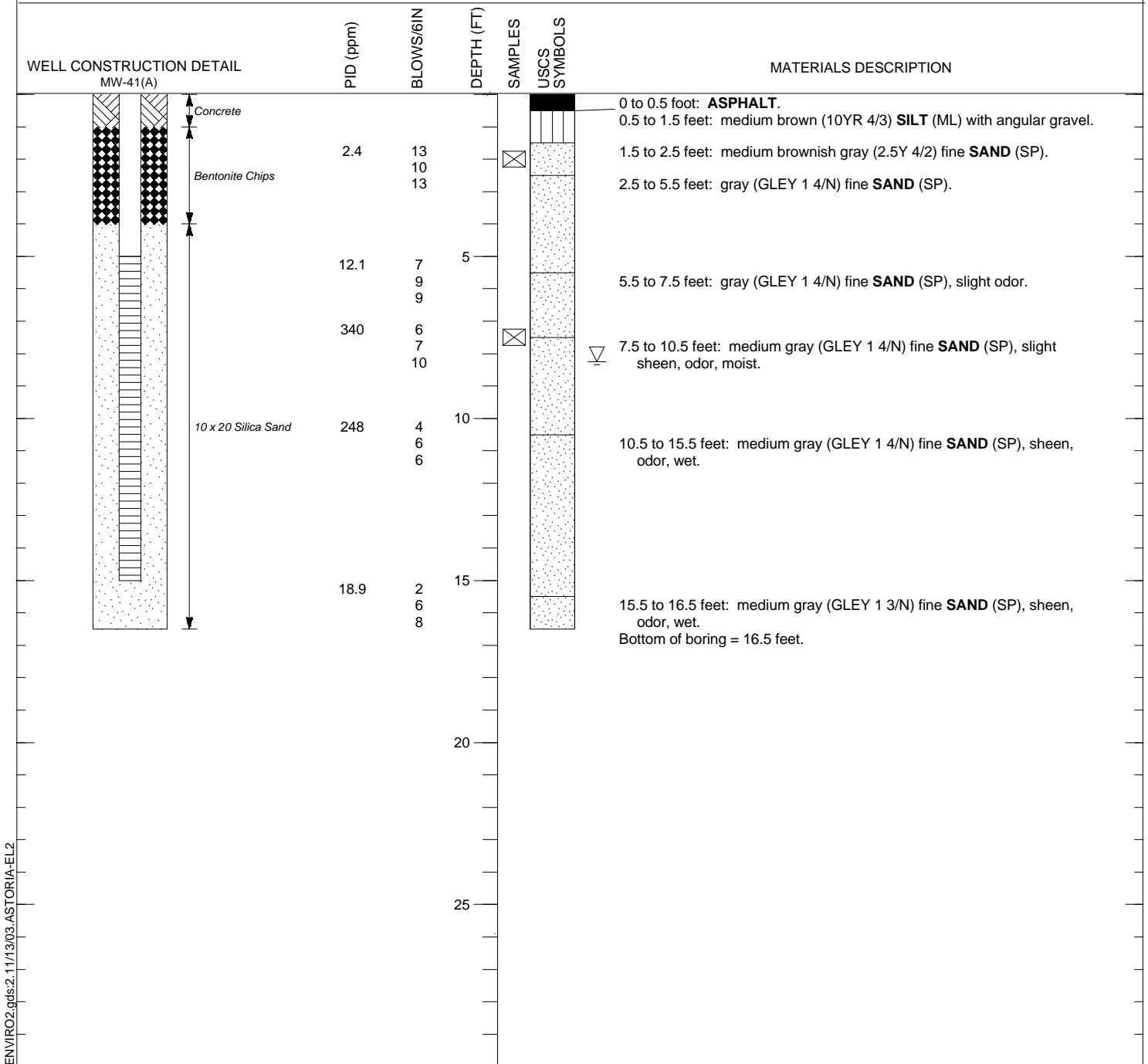


FIGURE A-8

LOG OF  
 SOIL BORING SB-009(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/27/2003

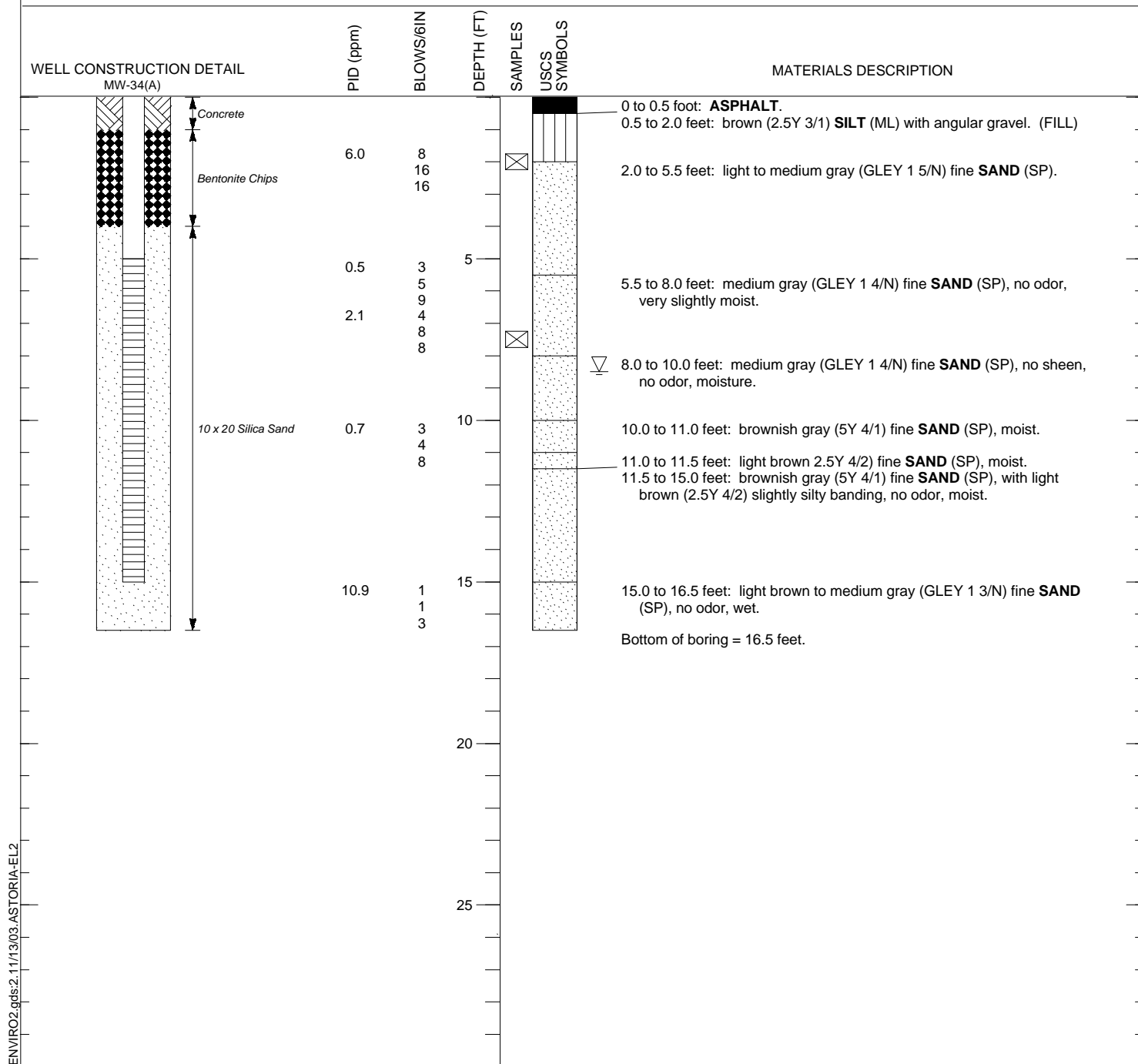


FIGURE A-9

LOG OF SOIL BORING SB-010(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/03/2003

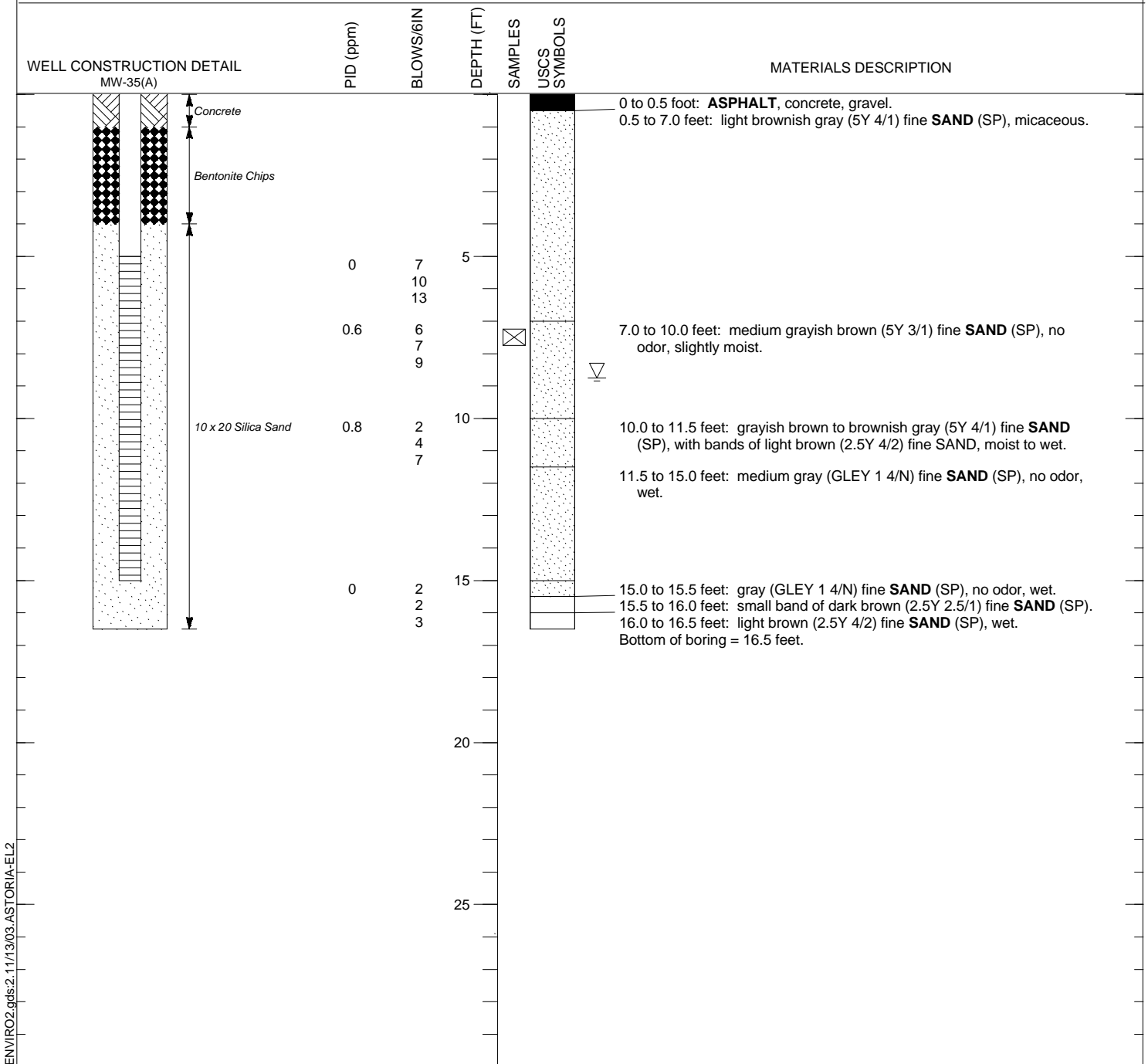


FIGURE A-10

LOG OF  
 SOIL BORING SB-011(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/02/2003

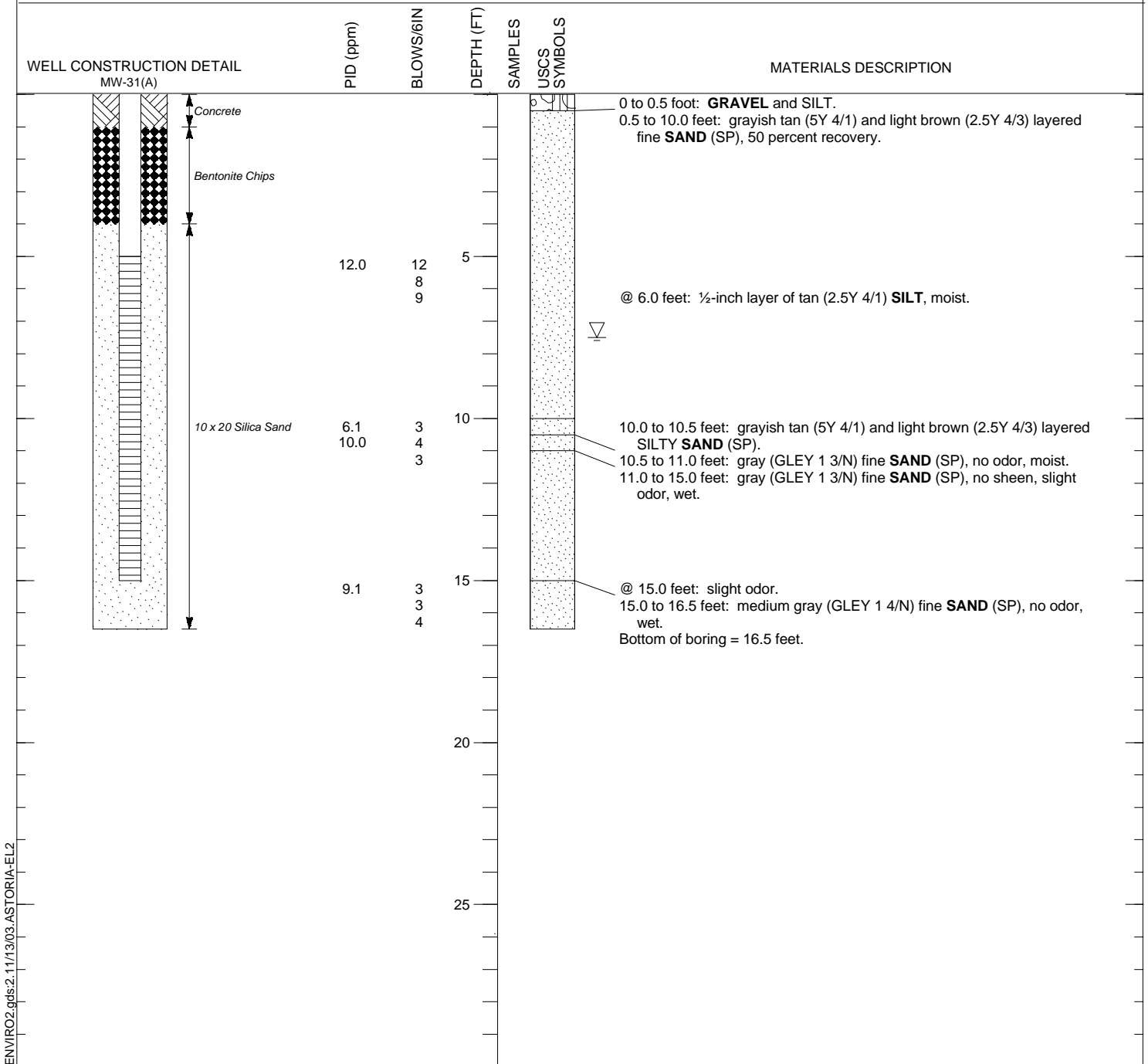


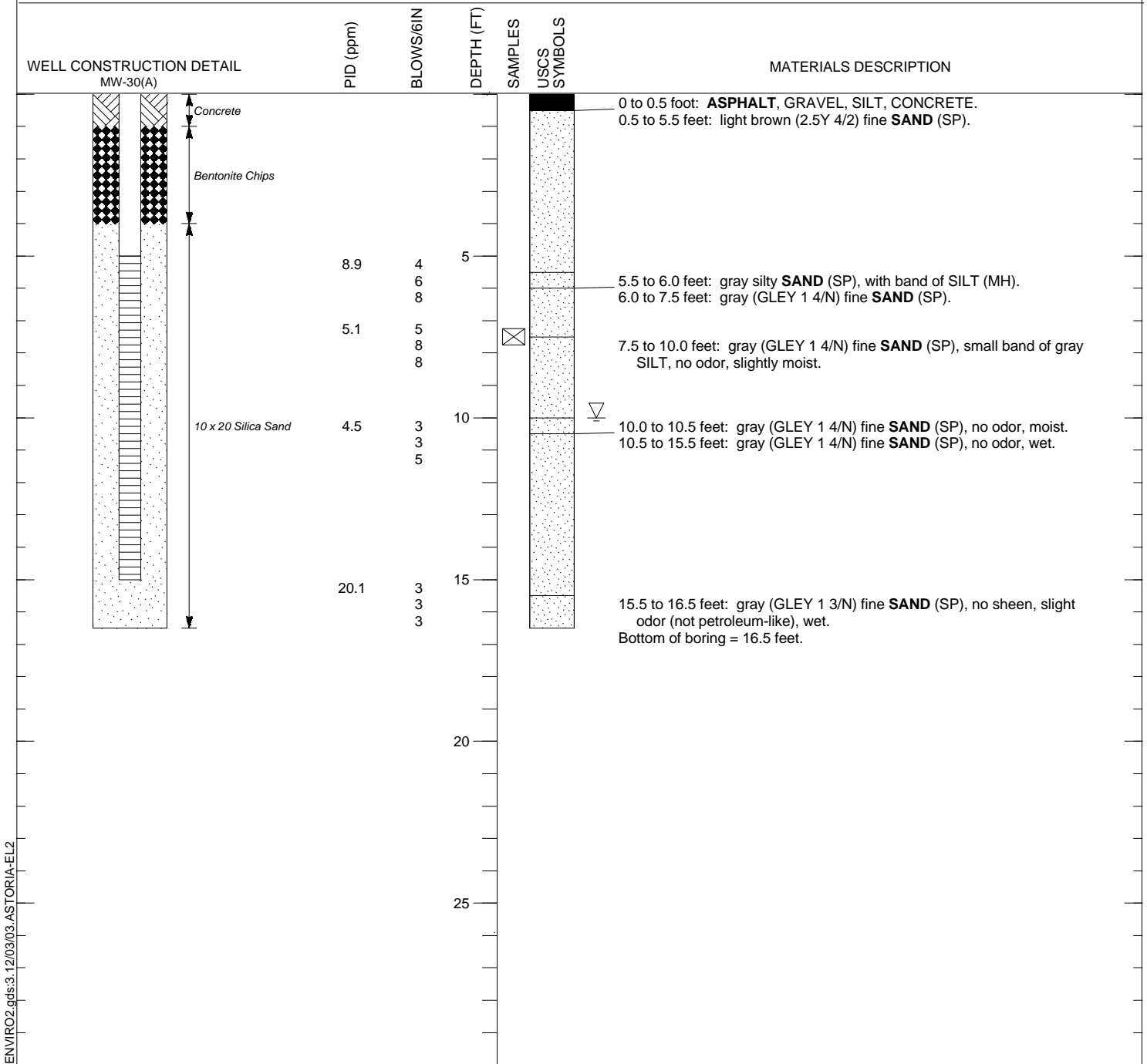
FIGURE A-11

LOG OF  
 SOIL BORING SB-012(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/03/2003



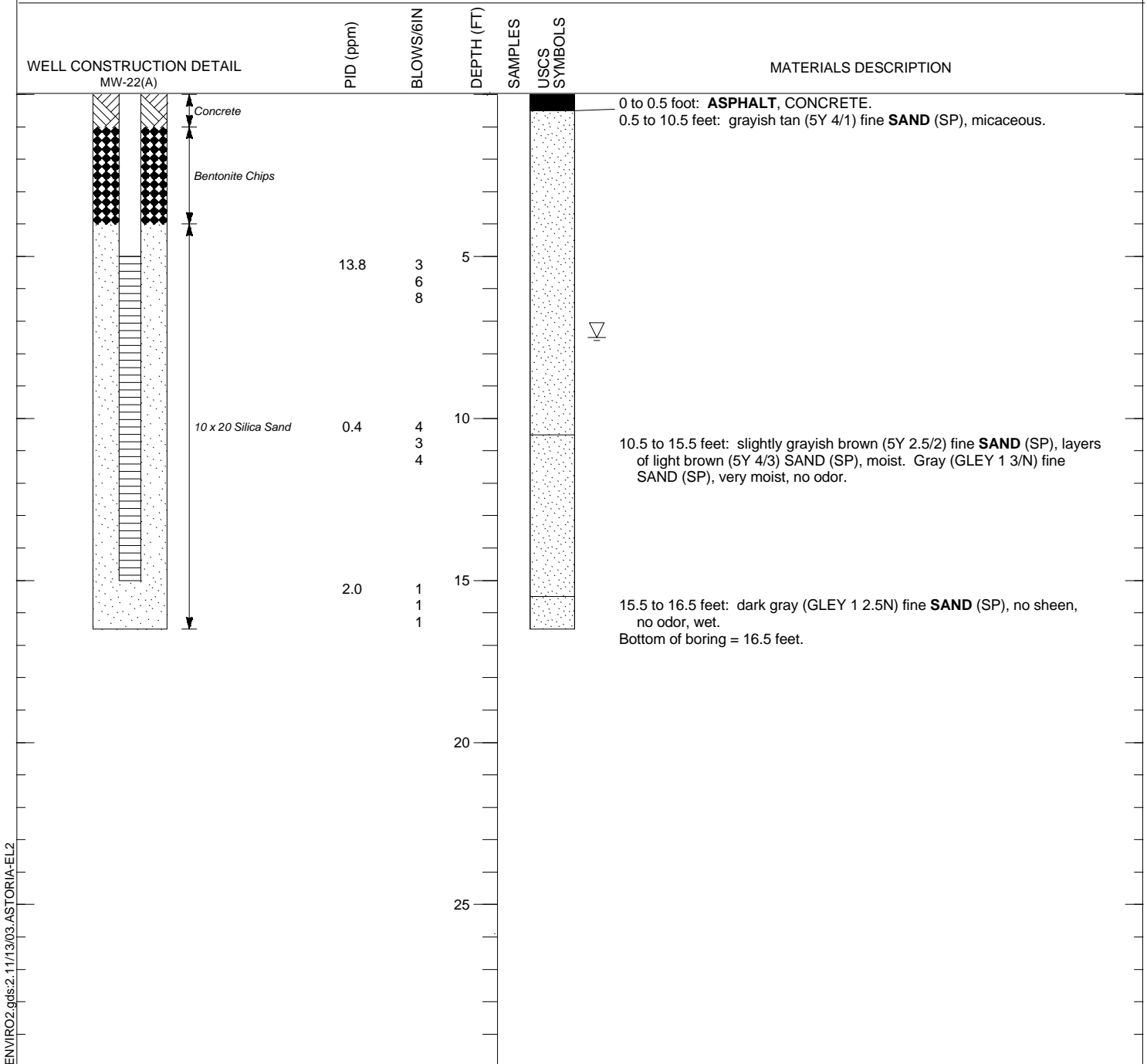
**FIGURE A-12**

**LOG OF  
 SOIL BORING SB-013(A)**

**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/02/2003



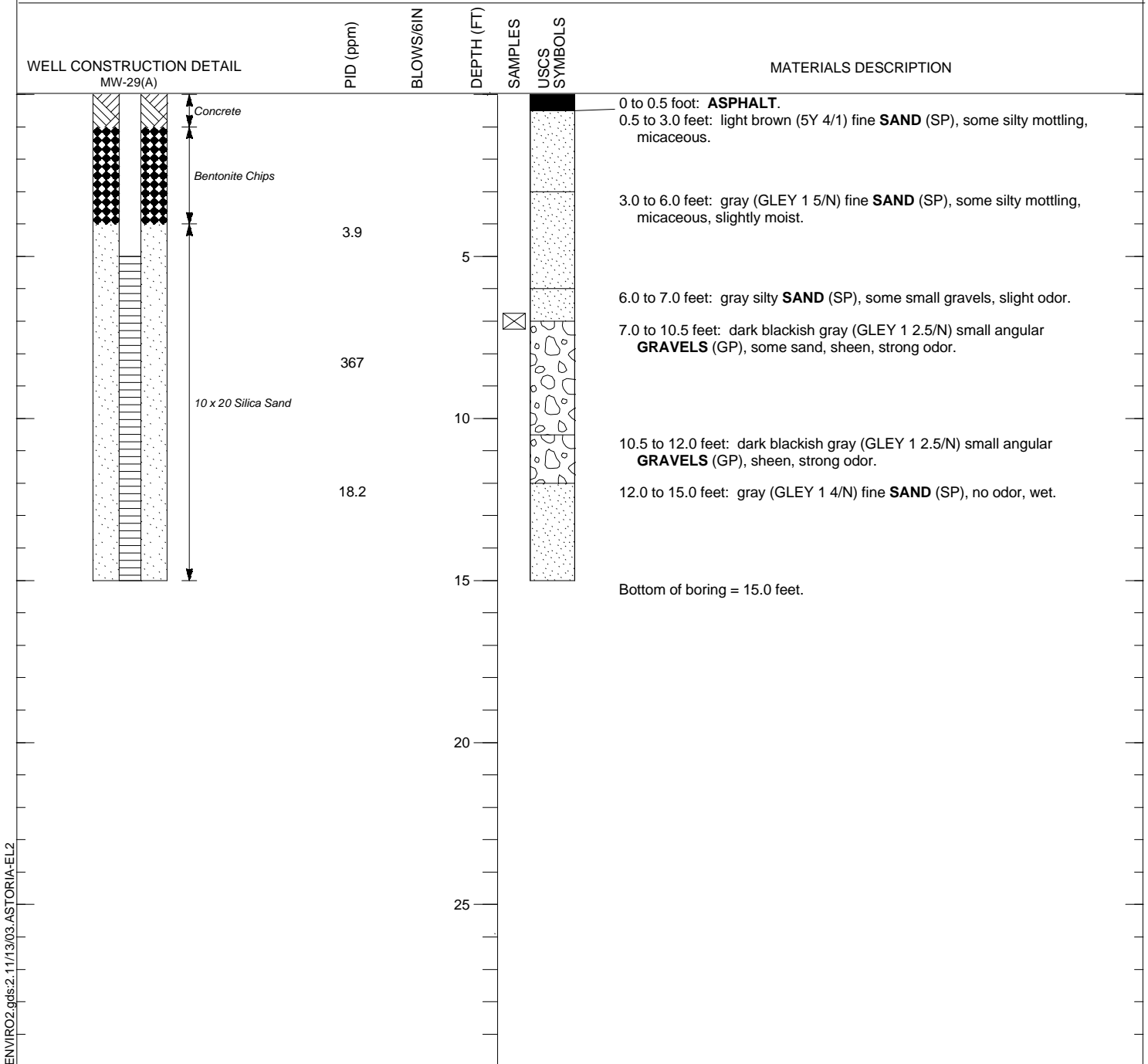
**FIGURE A-13**

**LOG OF  
 SOIL BORING SB-014(S)**

**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Geoprobe and Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 15 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/10/2003



ENVIRO2.gds:2.11/13/03.ASTORIA-EL2

**FIGURE A-14**

**LOG OF  
SOIL BORING SB-015(A)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**



PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/04/2003

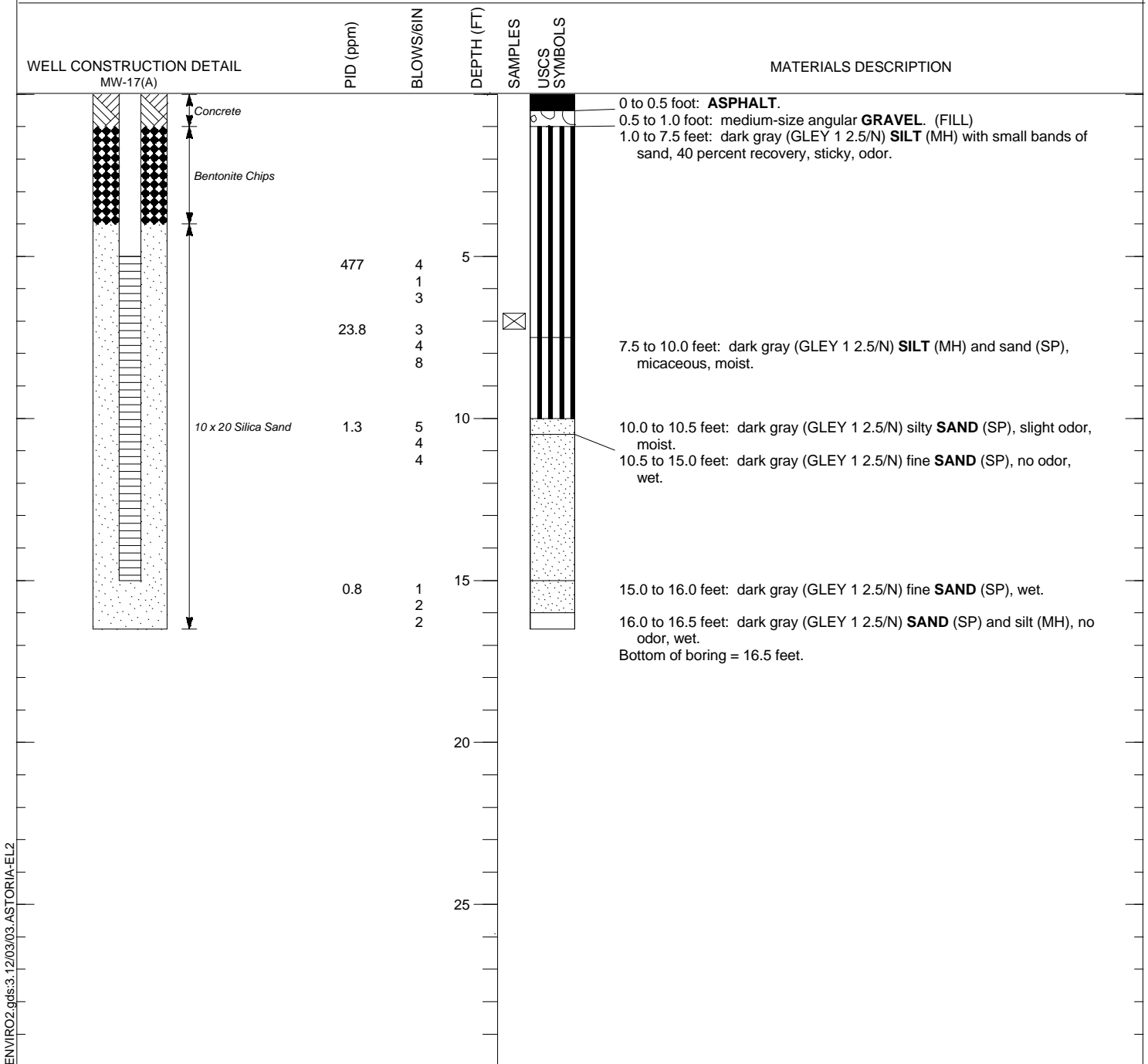


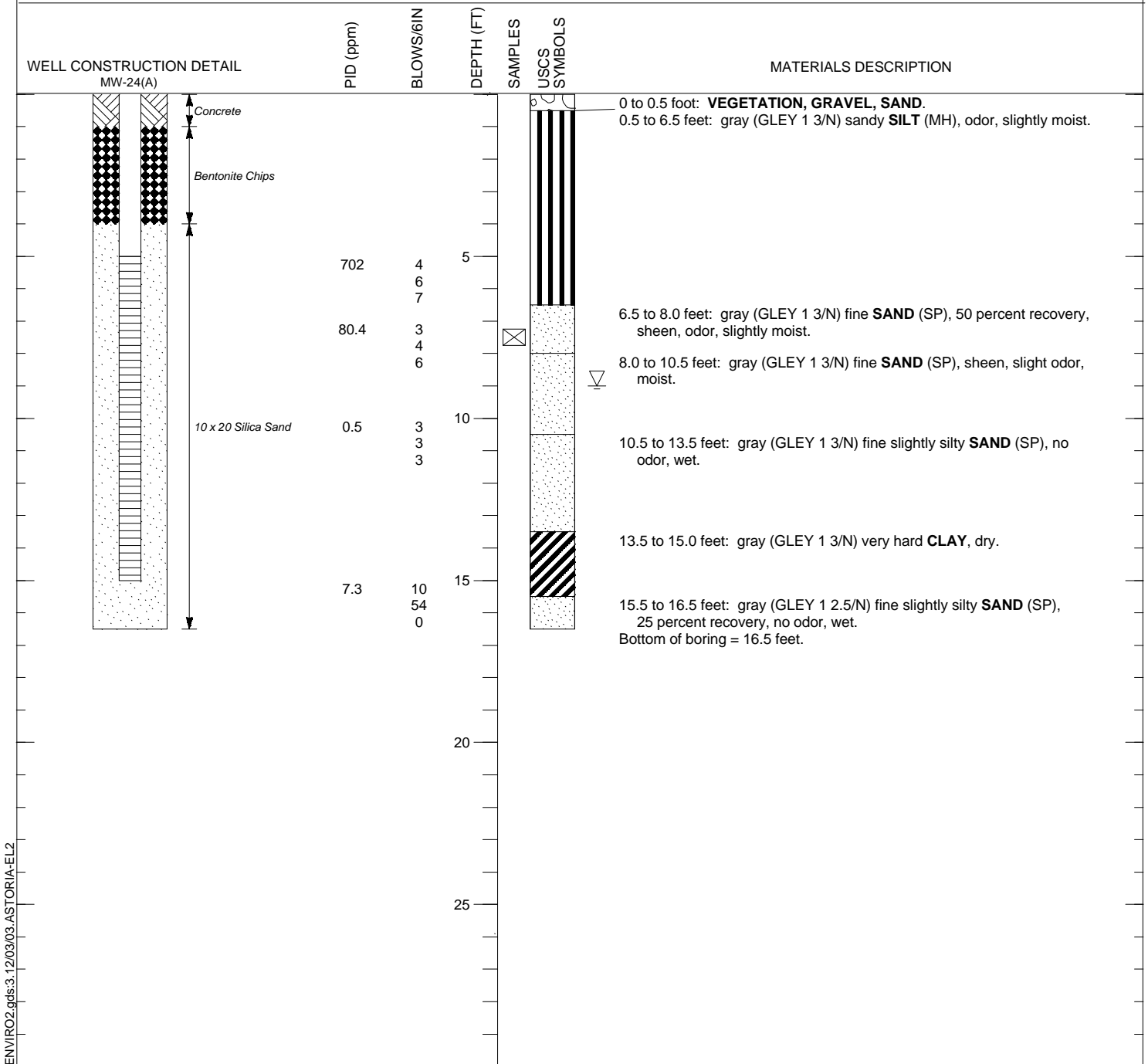
FIGURE A-15

LOG OF  
 SOIL BORING SB-016(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/08/2003



**FIGURE A-16**

**LOG OF  
 SOIL BORING SB-017(A)**

**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/28/2003

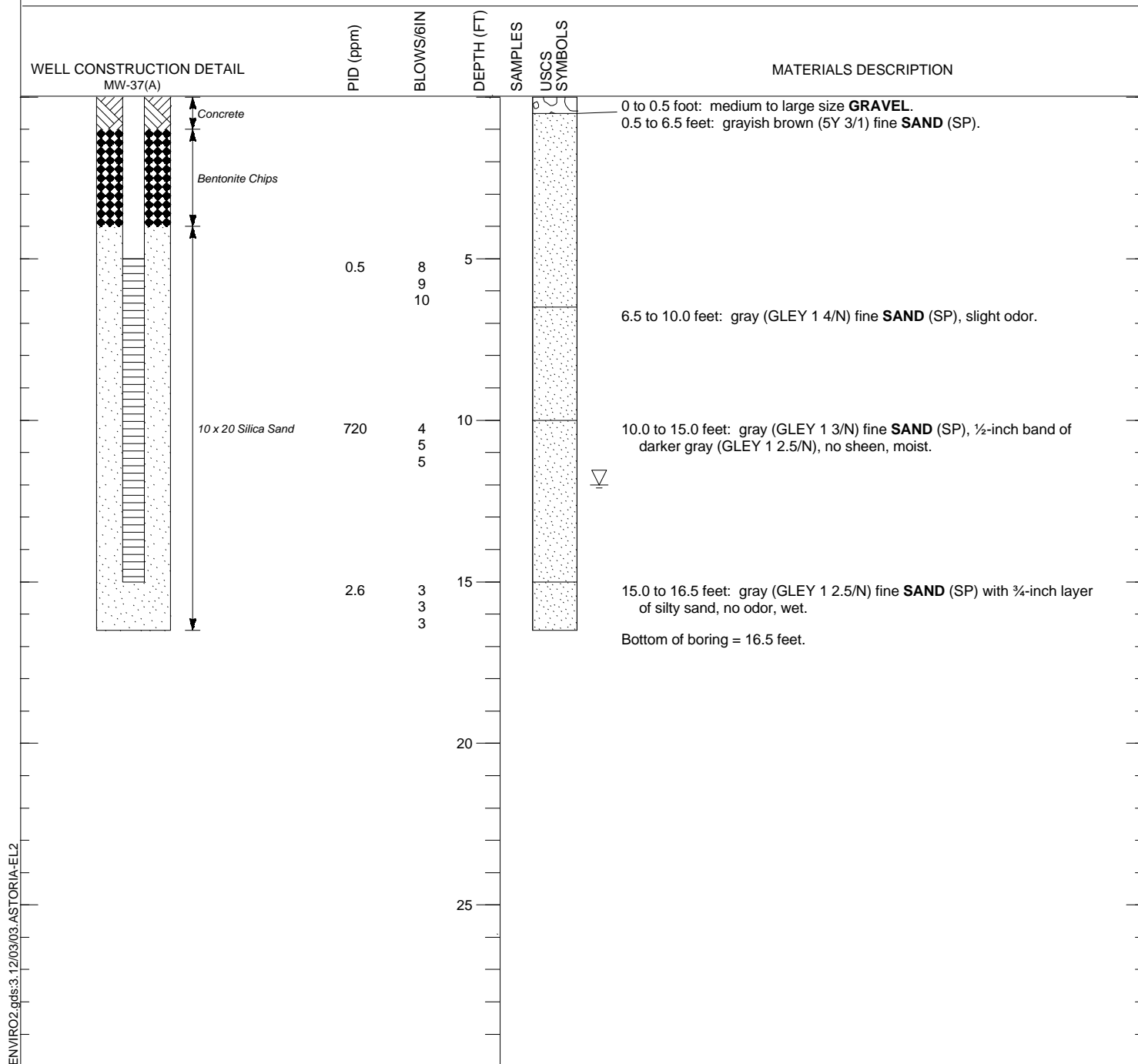


FIGURE A-17

LOG OF SOIL BORING SB-018(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/27/2003

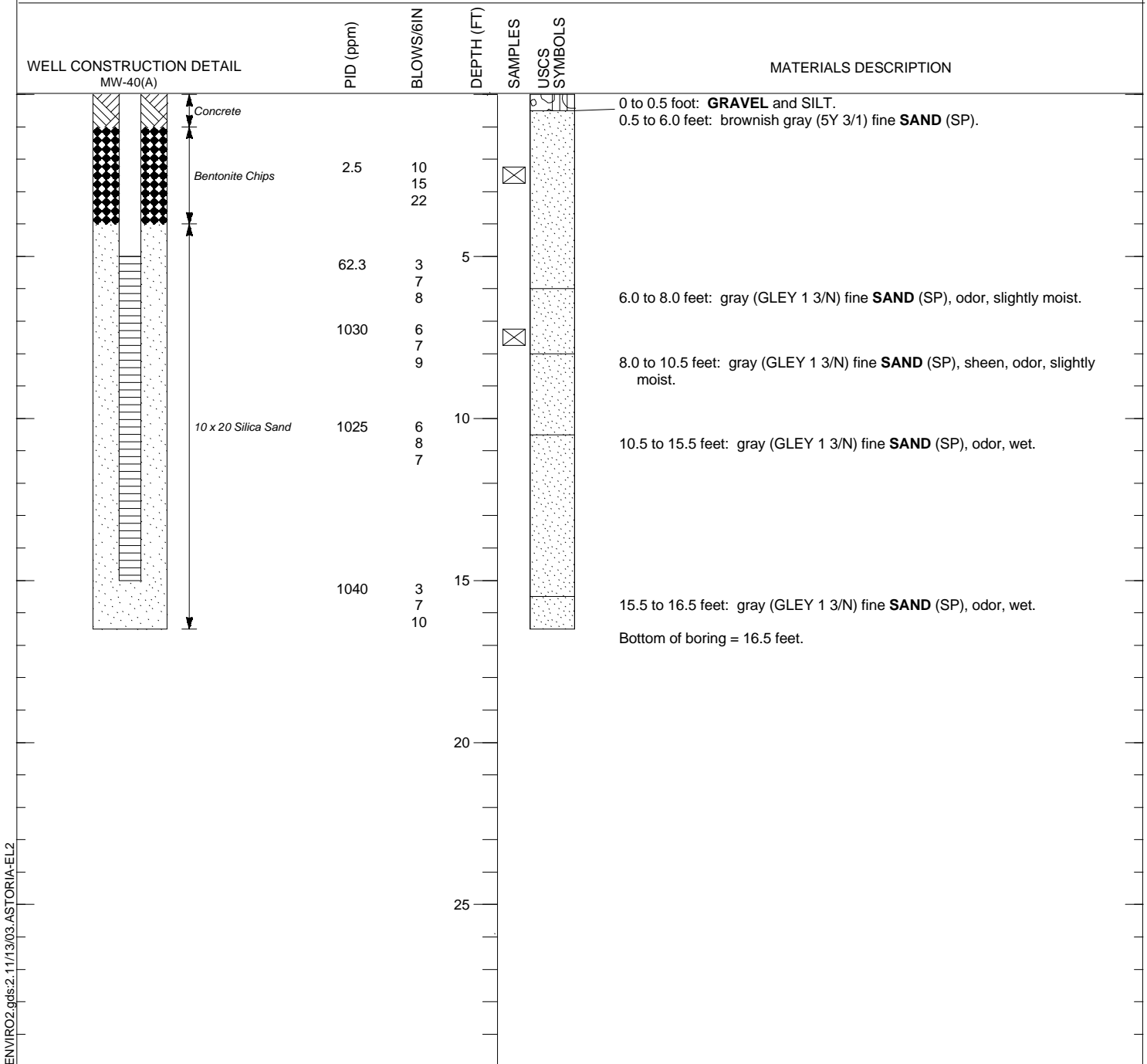


FIGURE A-18

LOG OF  
 SOIL BORING SB-019(A)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/04/2003

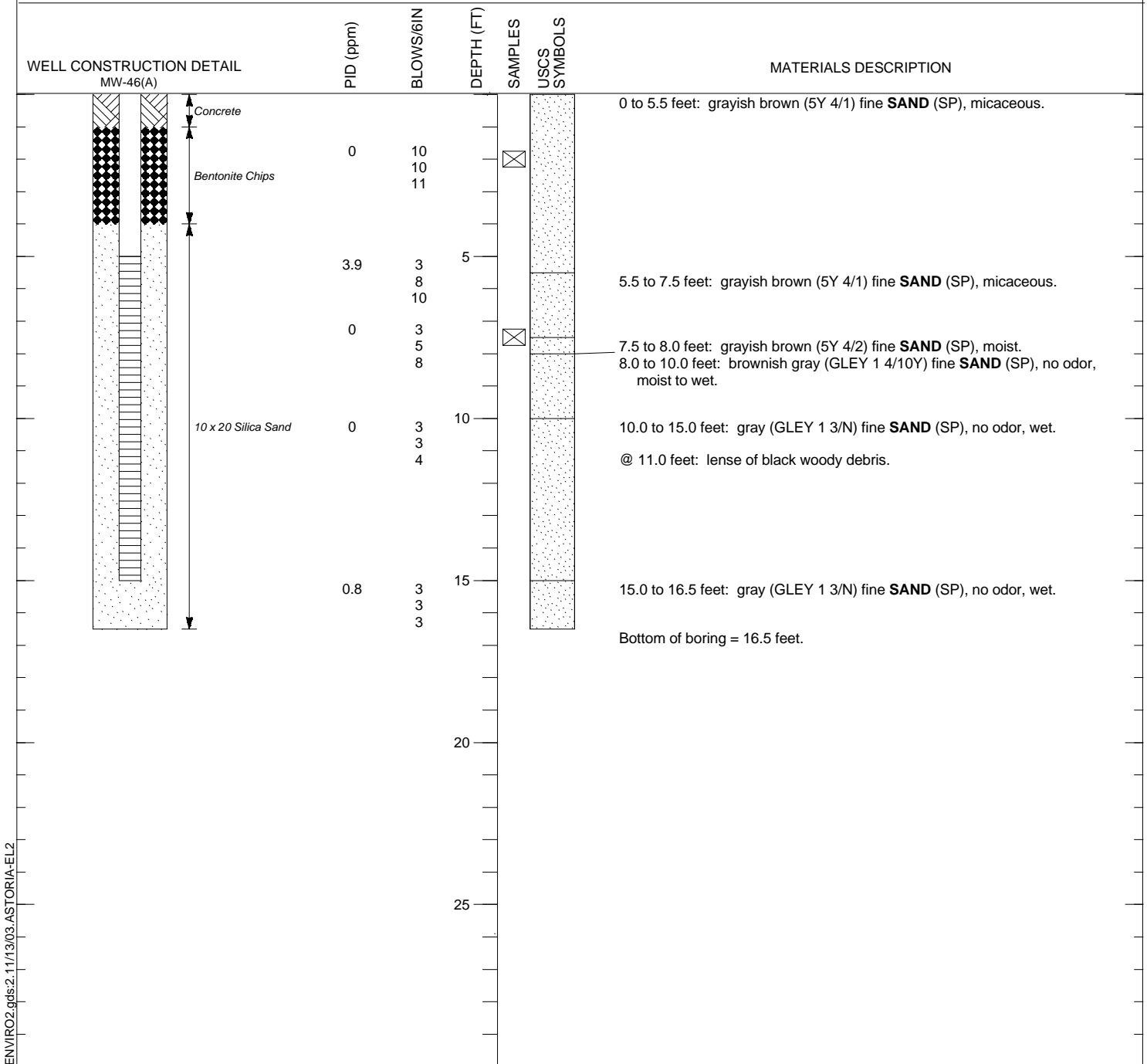


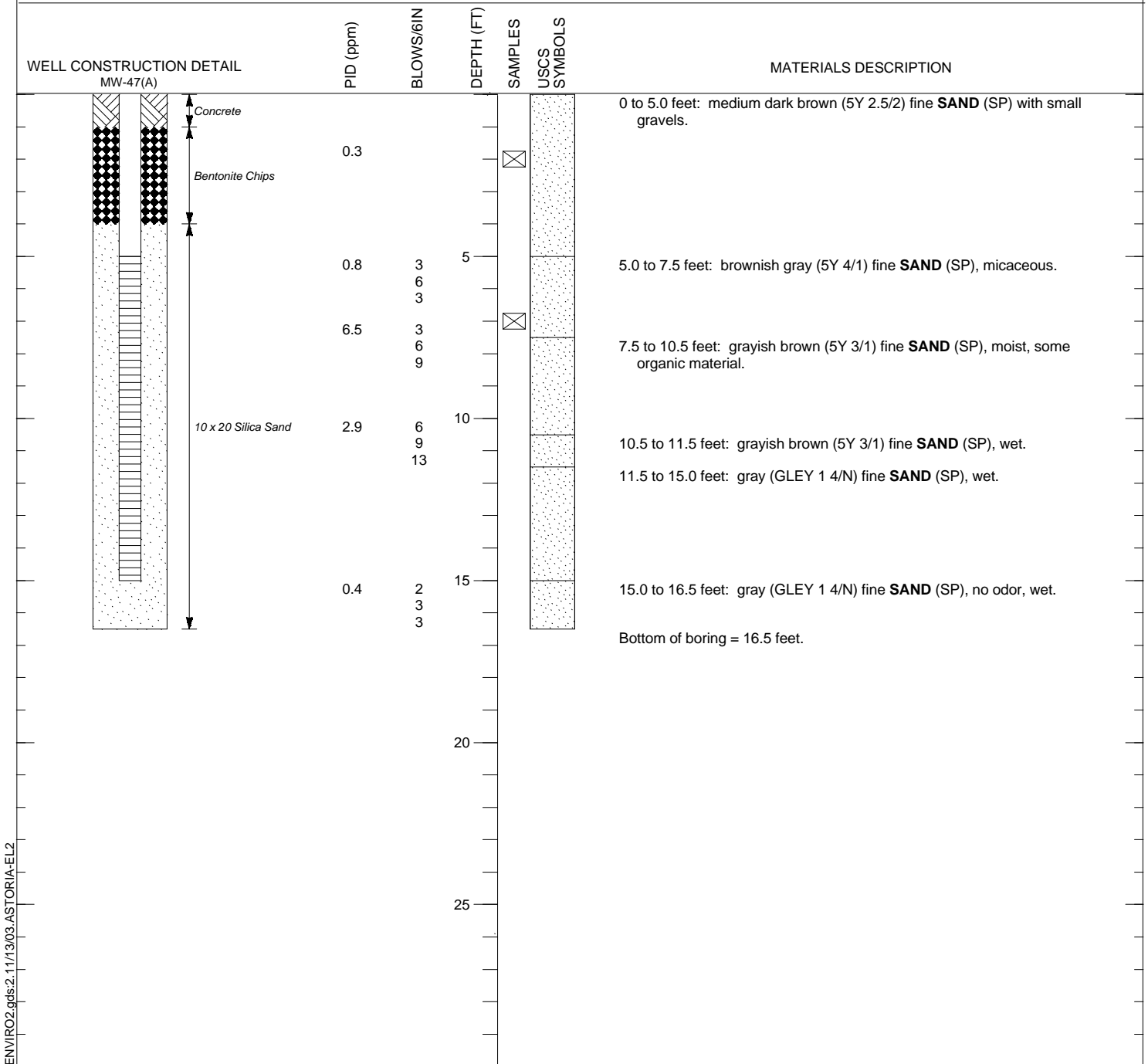
FIGURE A-19

LOG OF SOIL BORING SB-253(C)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/04/2003



ENVIRO2.gds:2.11/13/03.ASTORIA-EL2

**FIGURE A-20**

**LOG OF  
SOIL BORING SB-254(C)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/04/2003

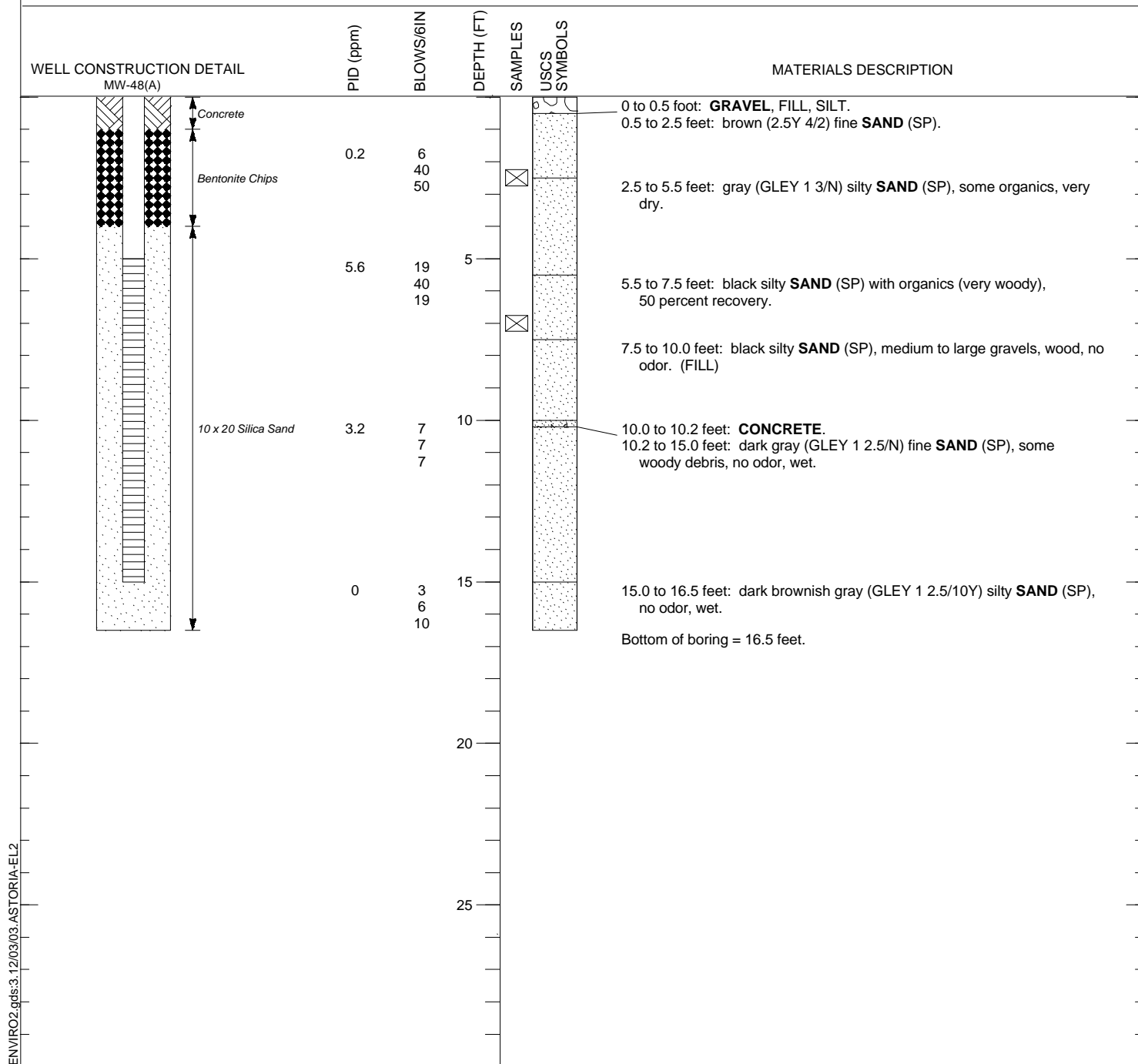


FIGURE A-21

LOG OF SOIL BORING SB-255(C)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/09/2003

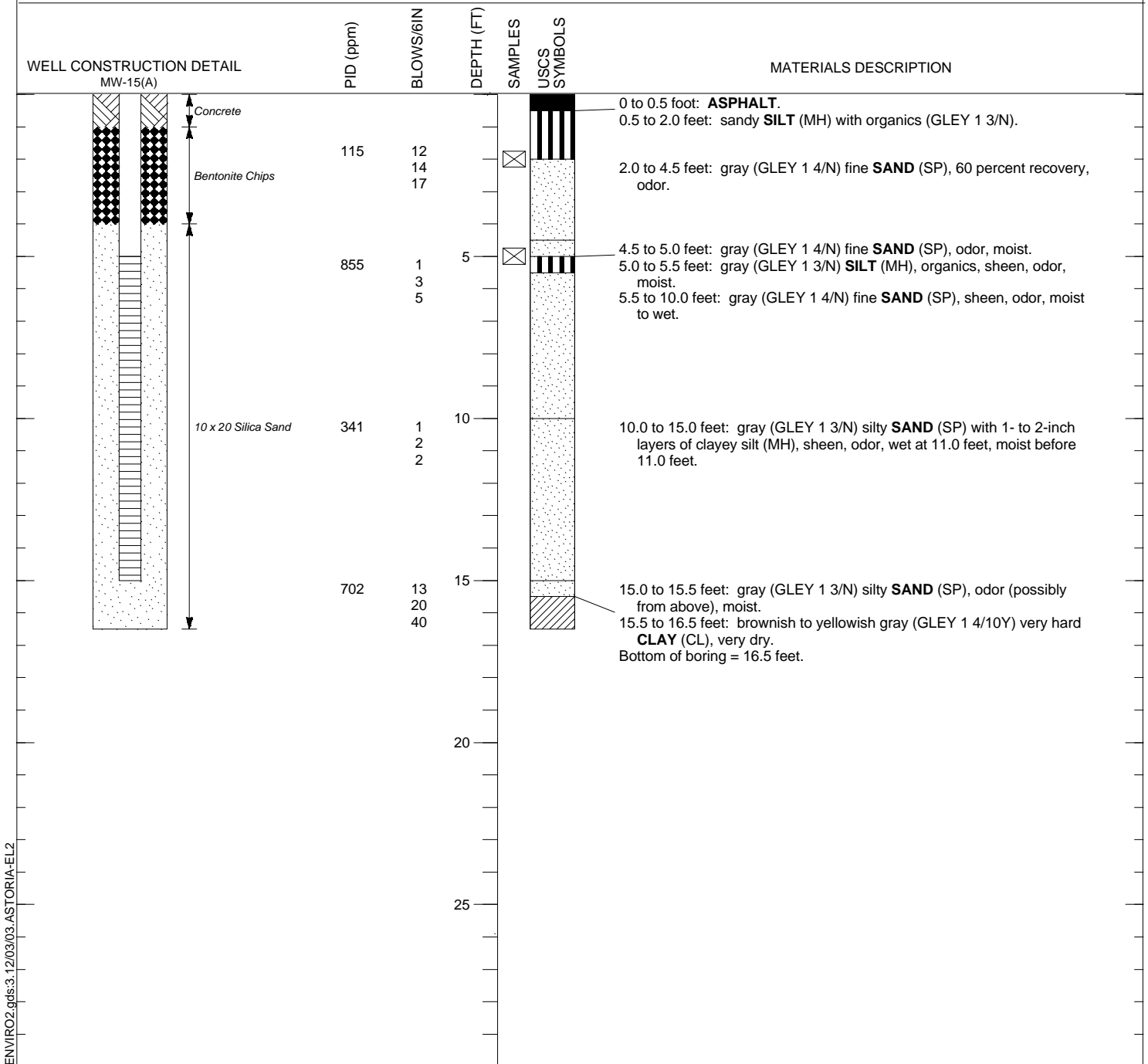


FIGURE A-22

LOG OF SOIL BORING SB-321(D)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon



PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Geoprobe and Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 20 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/10/2003

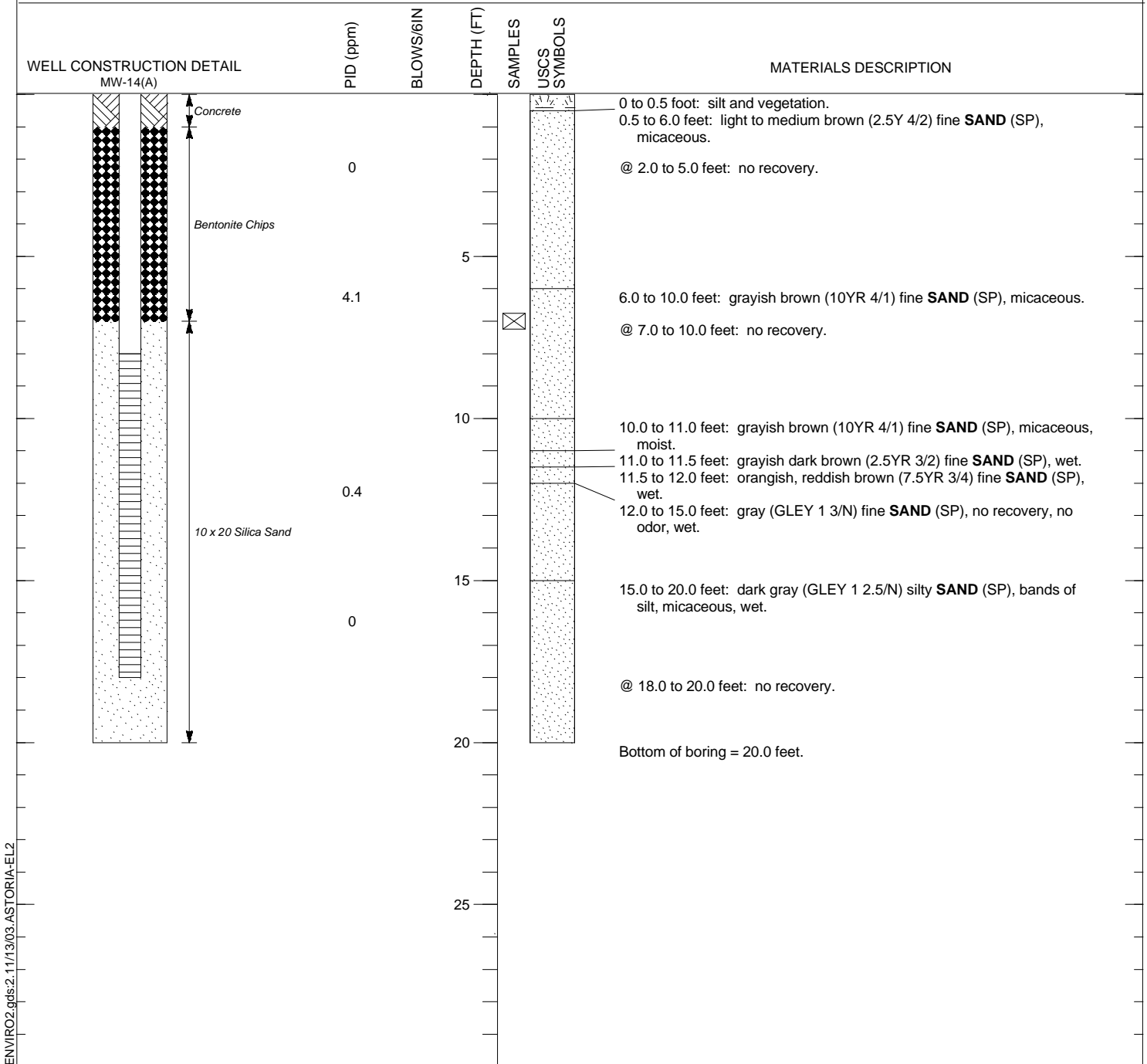


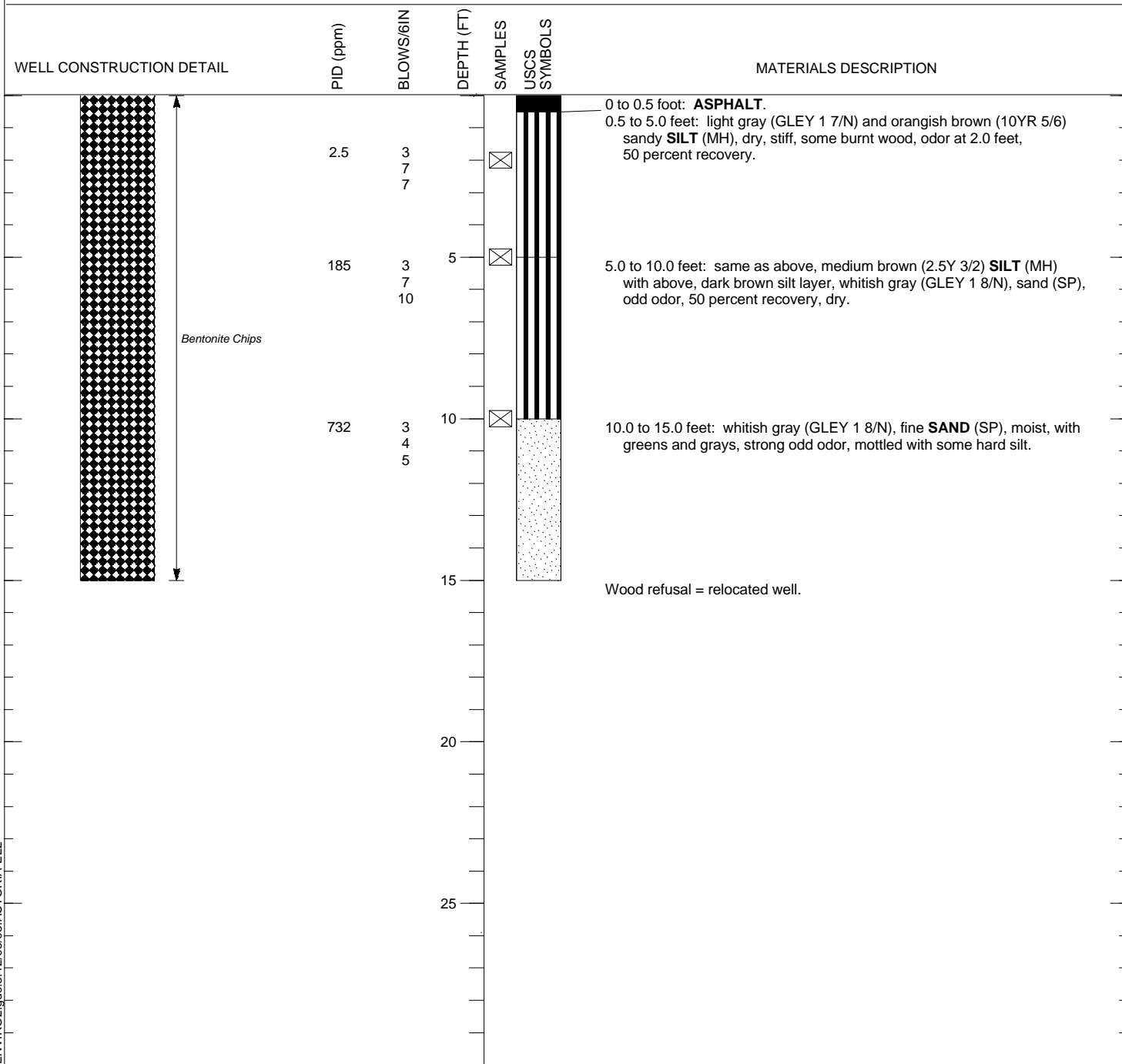
FIGURE A-23

LOG OF  
 SOIL BORING SB-323(D)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 15 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/09/2003



ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

**FIGURE A-24**

**LOG OF  
SOIL BORING SB-326(D)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 26.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/09/2003

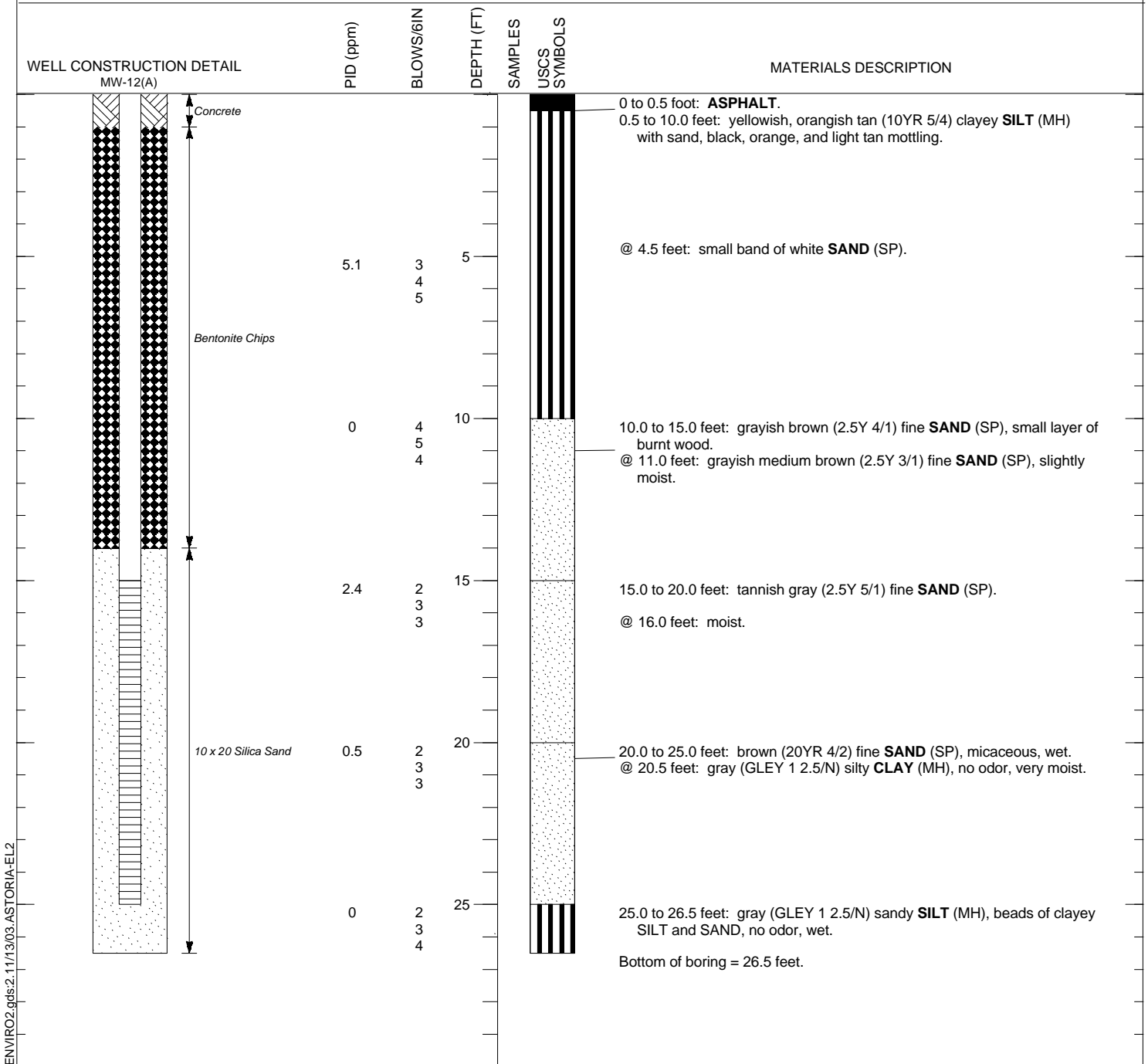


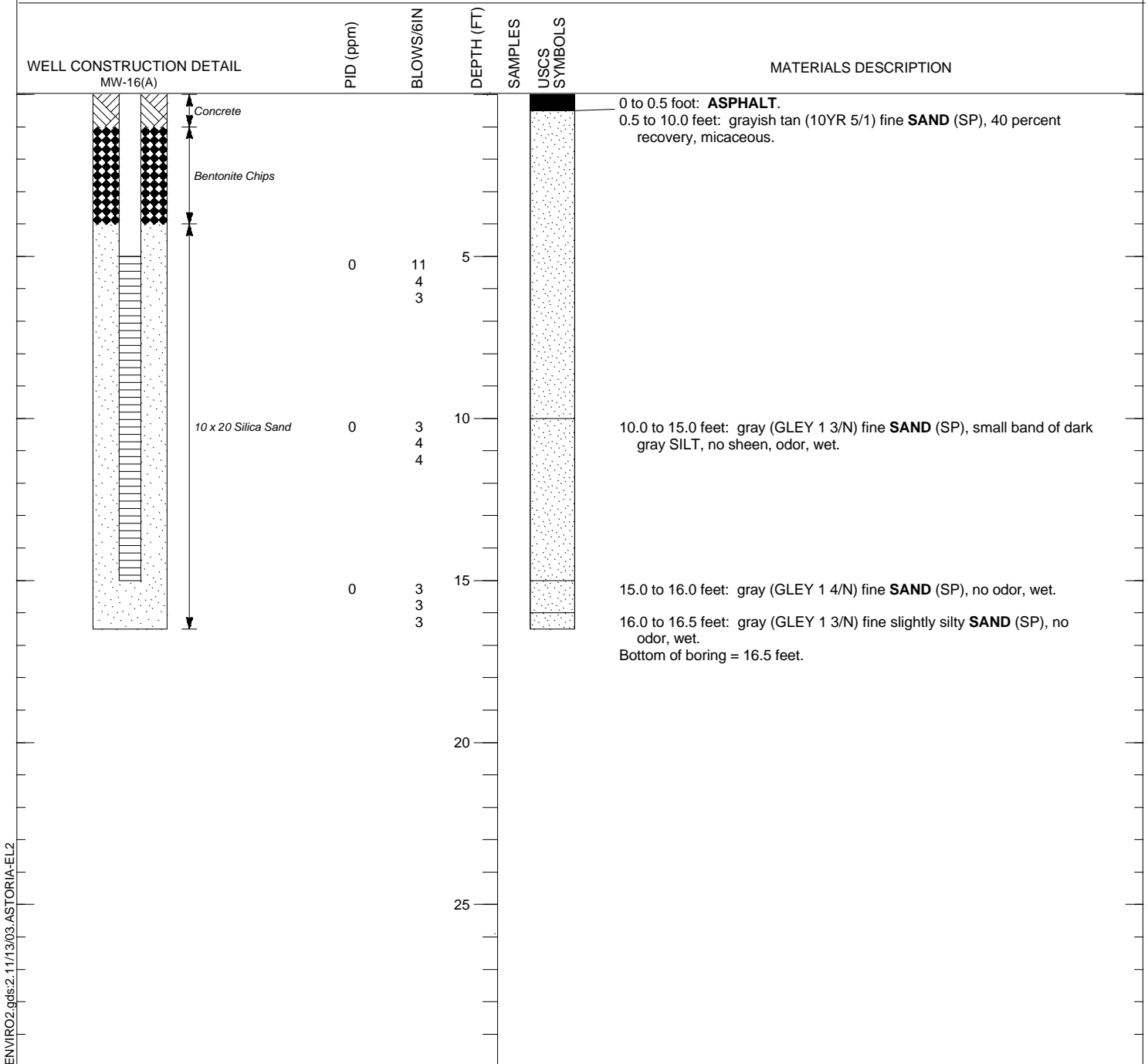
FIGURE A-25

LOG OF SOIL BORING SB-329(D)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/09/2003



ENVIRO2.gds:2.11/13/03.ASTORIA-EL2

**FIGURE A-26**

**LOG OF  
SOIL BORING SB-330(D)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 27 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/09/2003

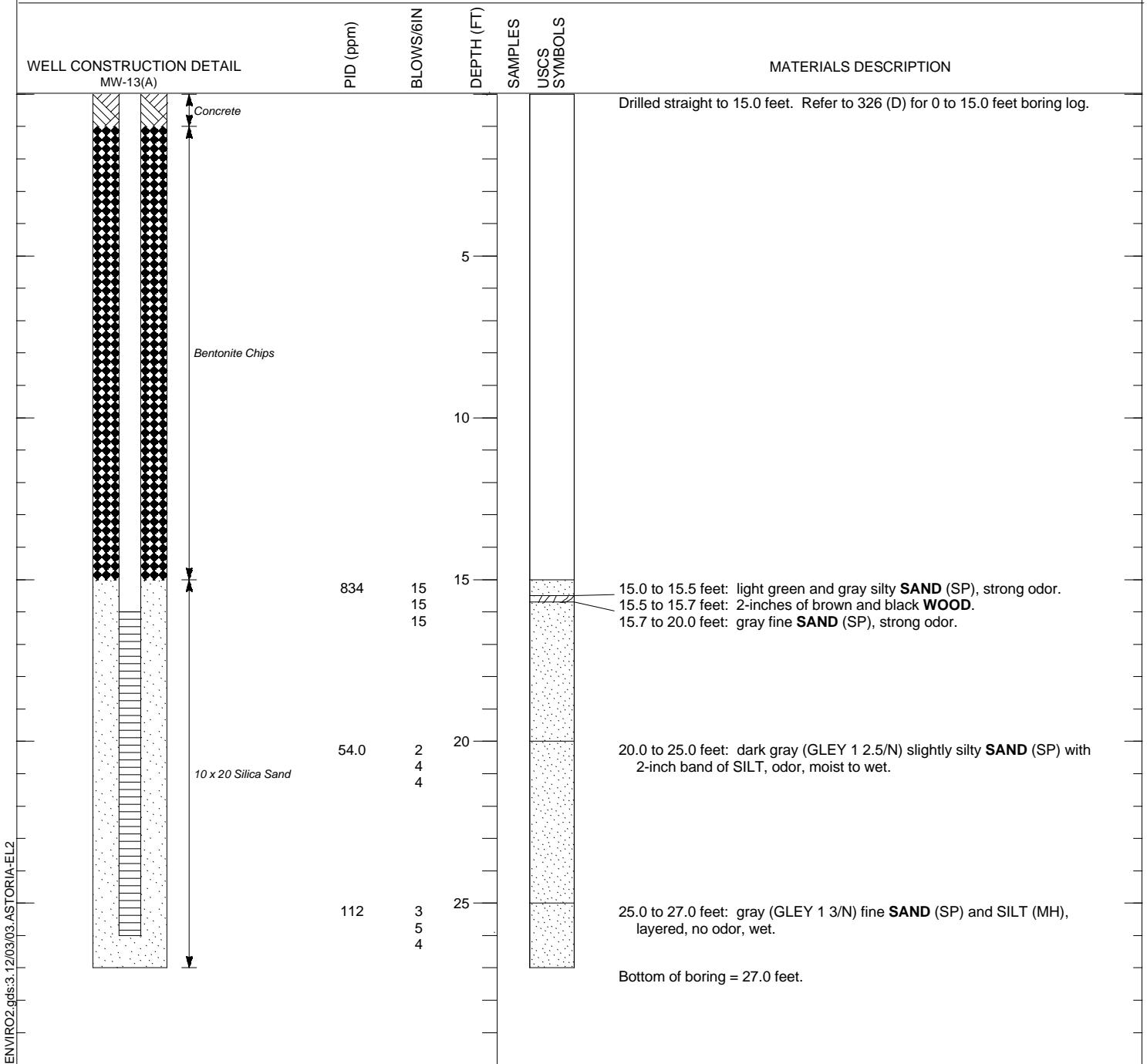


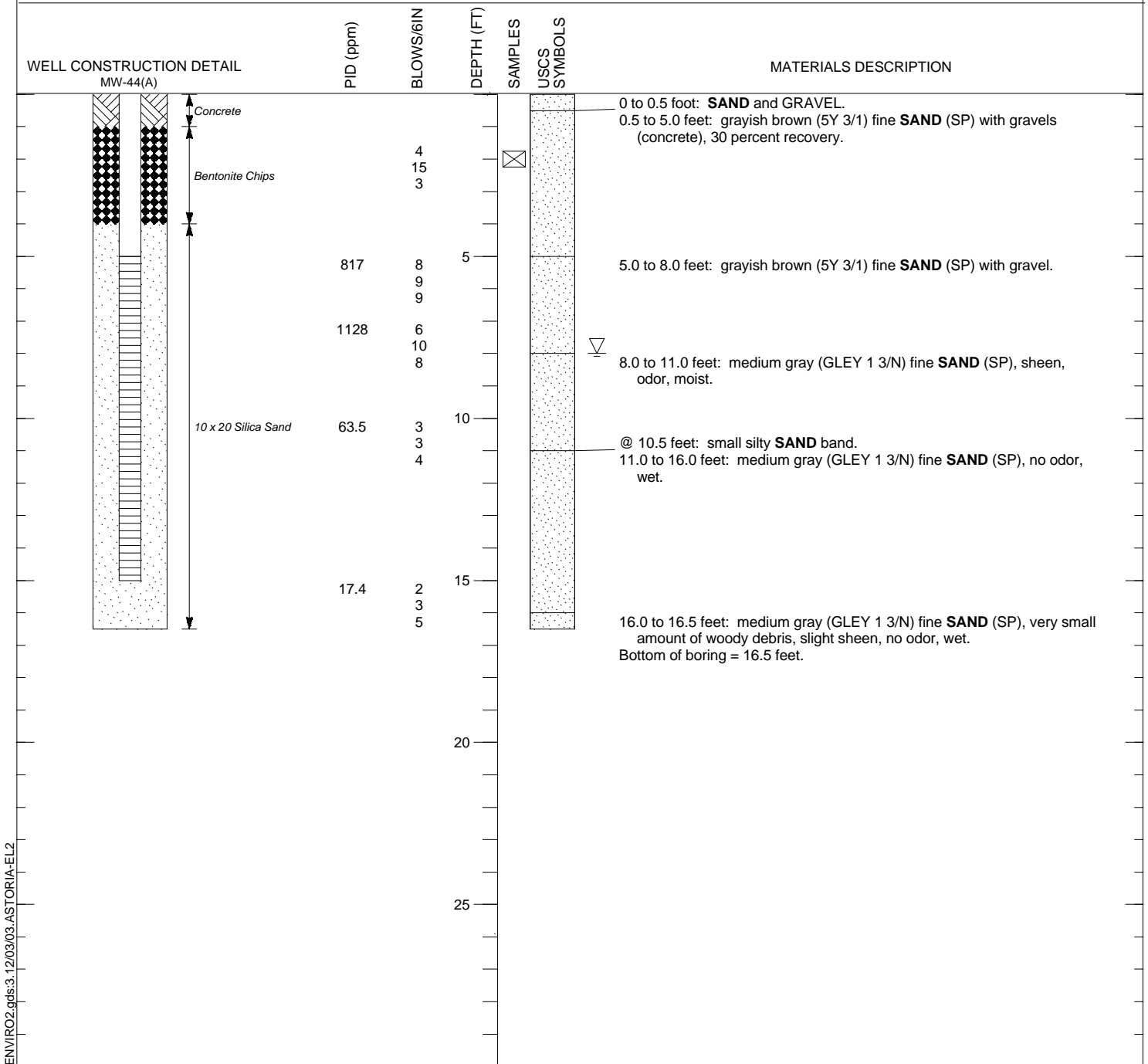
FIGURE A-27

LOG OF SOIL BORING SB-331(D)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/28/2003



ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

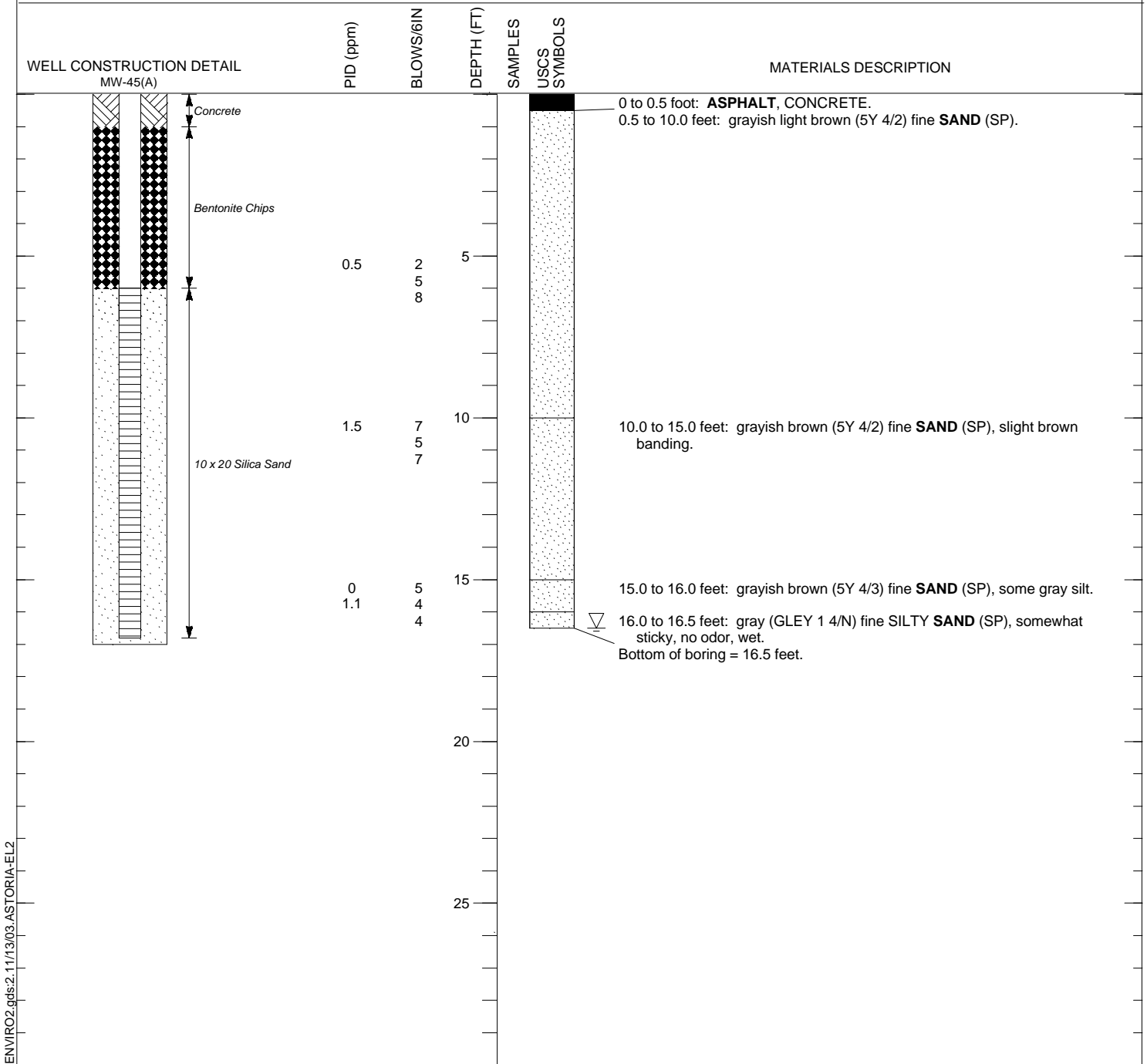
**FIGURE A-28**

**LOG OF  
SOIL BORING SB-627(N)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 17 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/28/2003



**FIGURE A-29**

**LOG OF  
 SOIL BORING SB-628(N)**

**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 08/28/2003

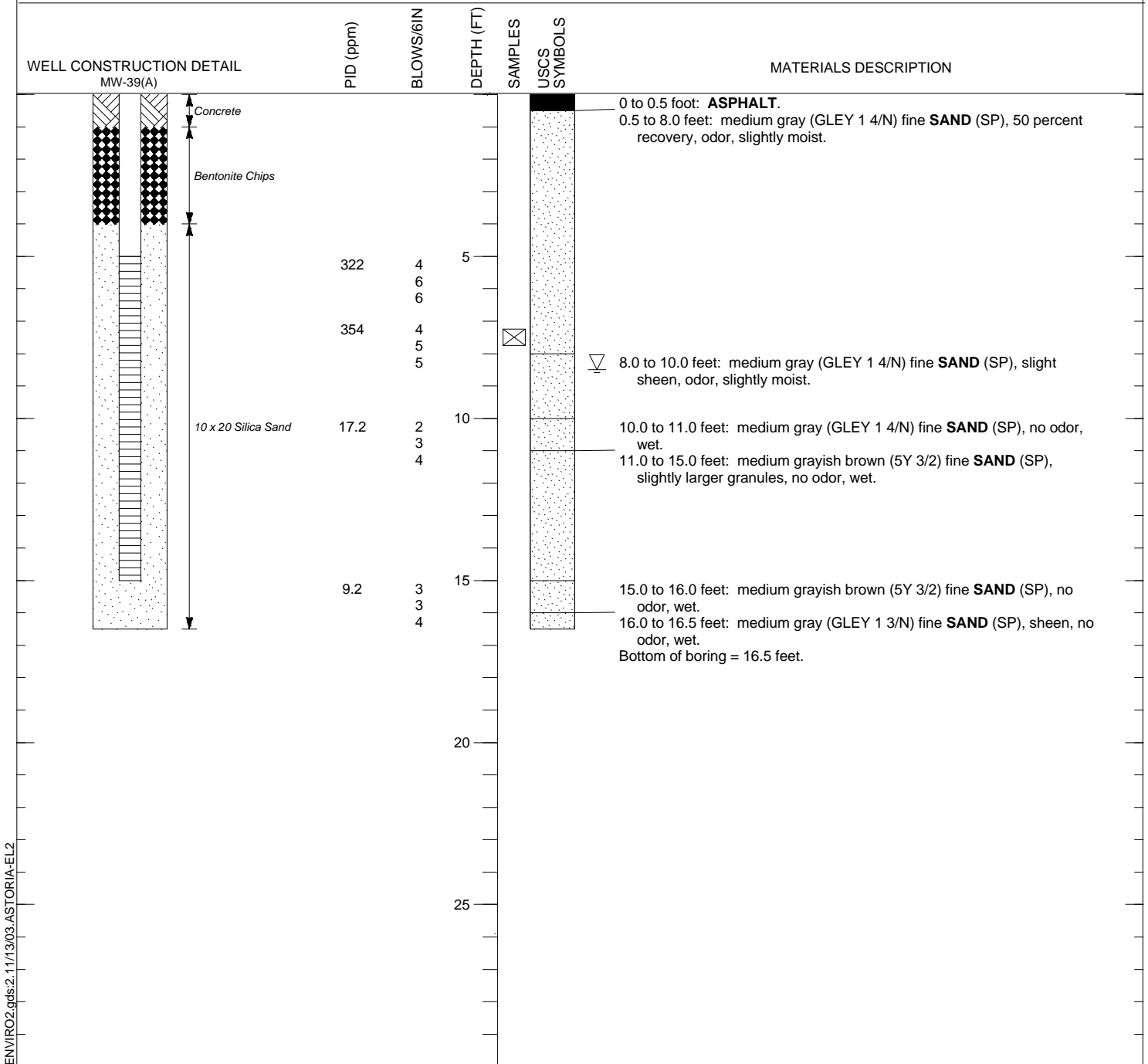


FIGURE A-30

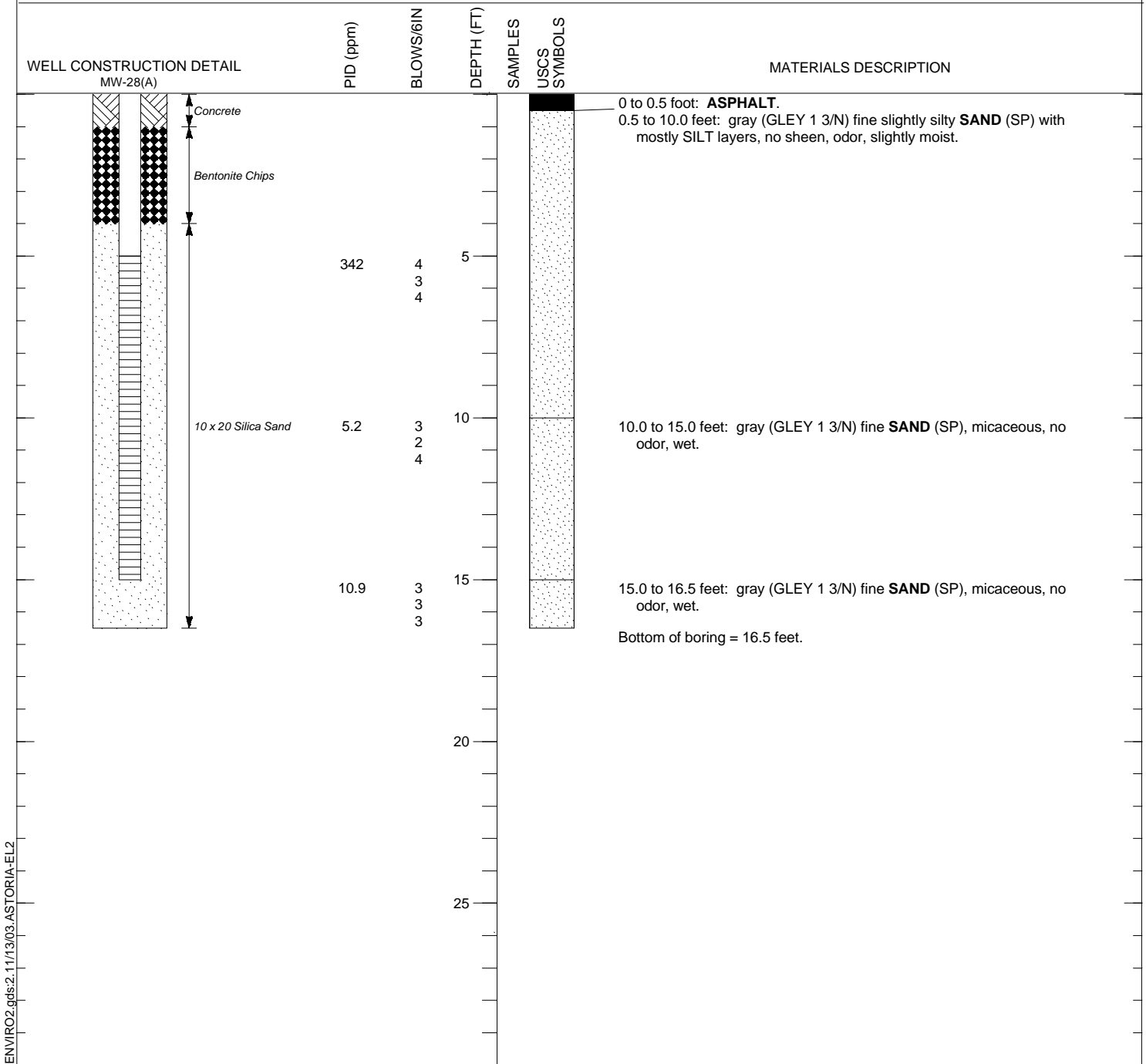
LOG OF SOIL BORING SB-629(N)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon



PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/08/2003



ENVIRO2.gds:2.11/13/03.ASTORIA-EL2

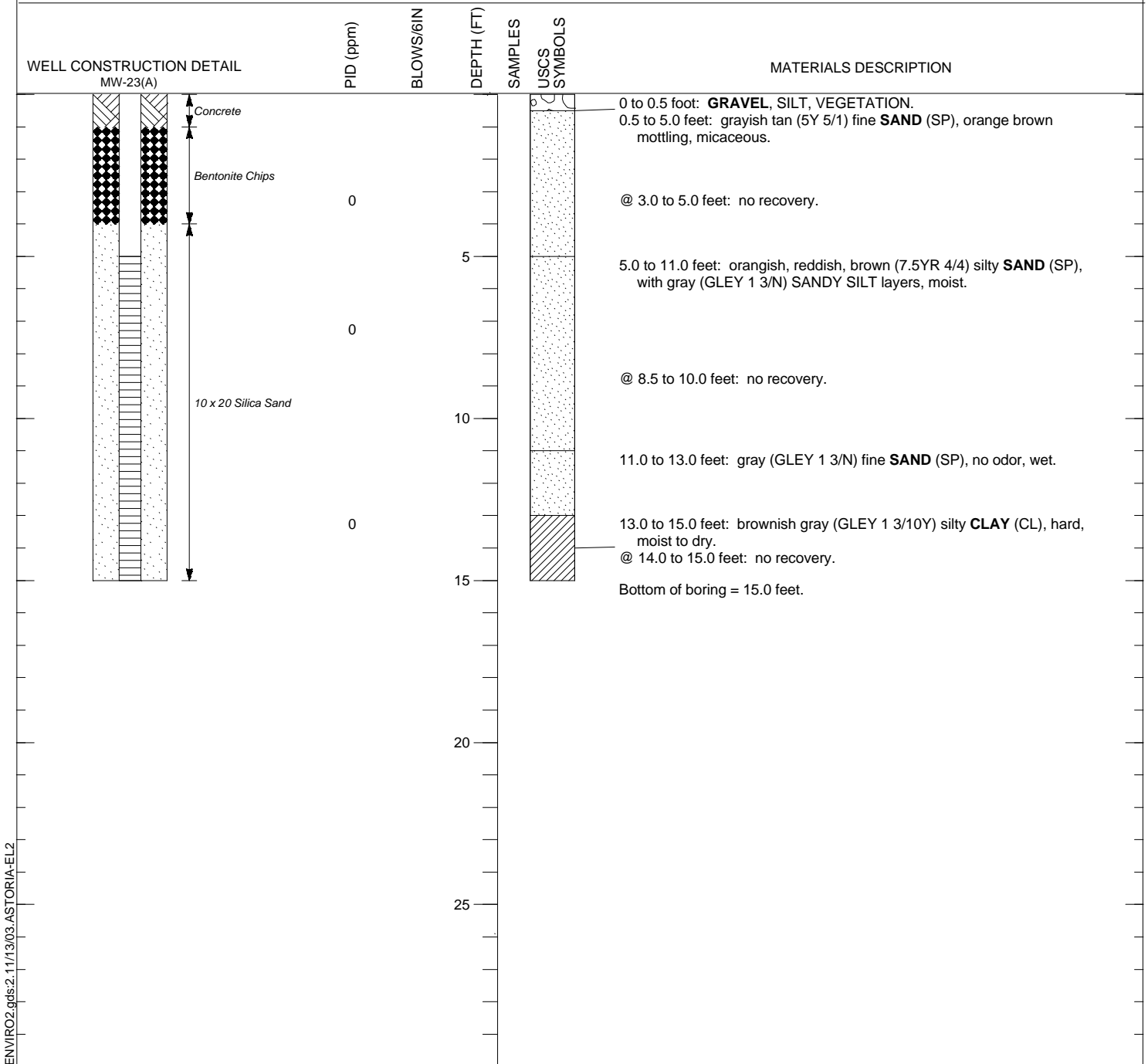
**FIGURE A-31**

**LOG OF  
SOIL BORING SB-630(N)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Geoprobe  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 15 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/10/2003



ENVIRO2.gds:2.11/13/03.ASTORIA-EL2

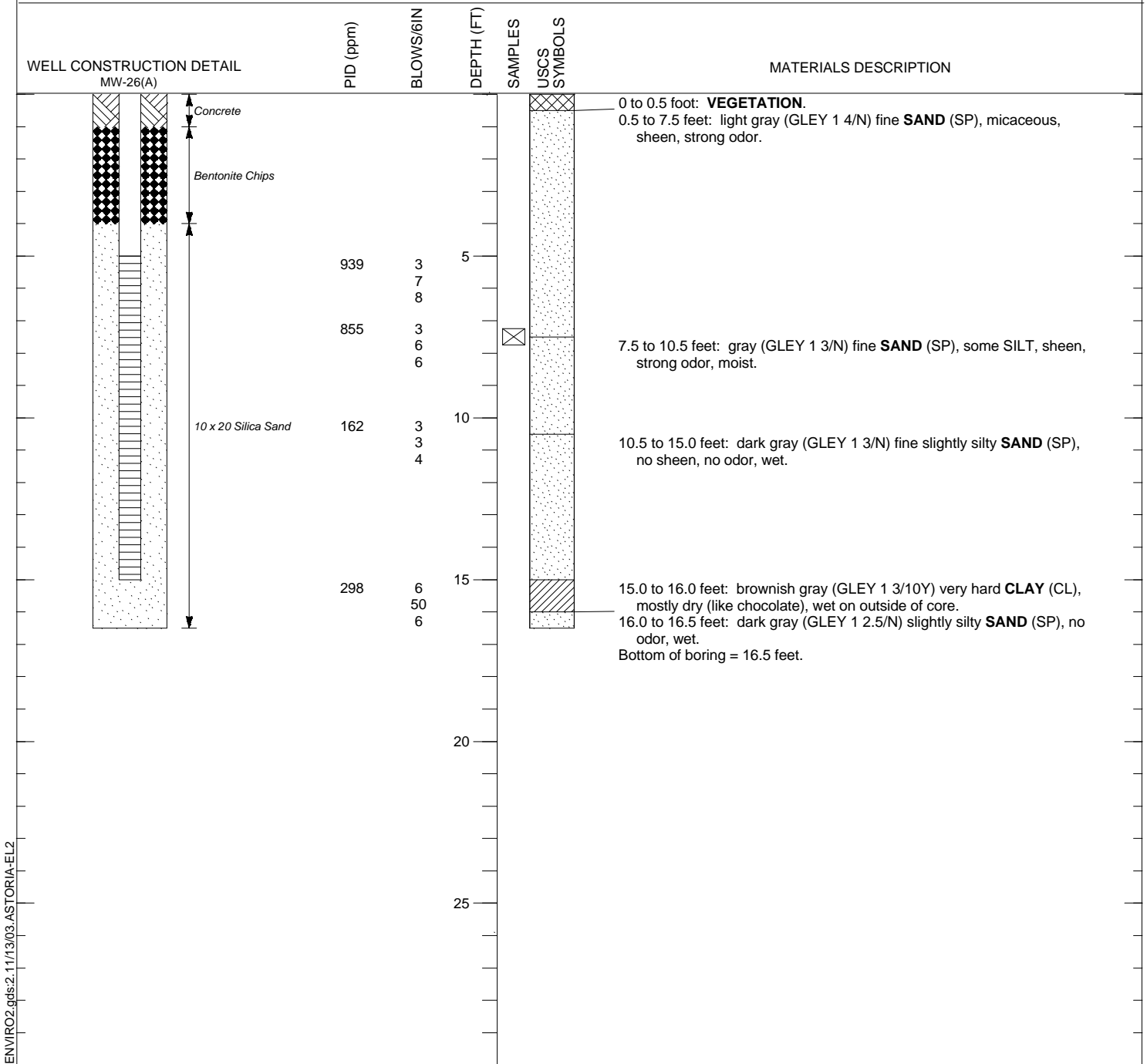
FIGURE A-32

LOG OF SOIL BORING SB-631(N)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/08/2003



**FIGURE A-33**

**LOG OF  
 SOIL BORING SB-632(N)**

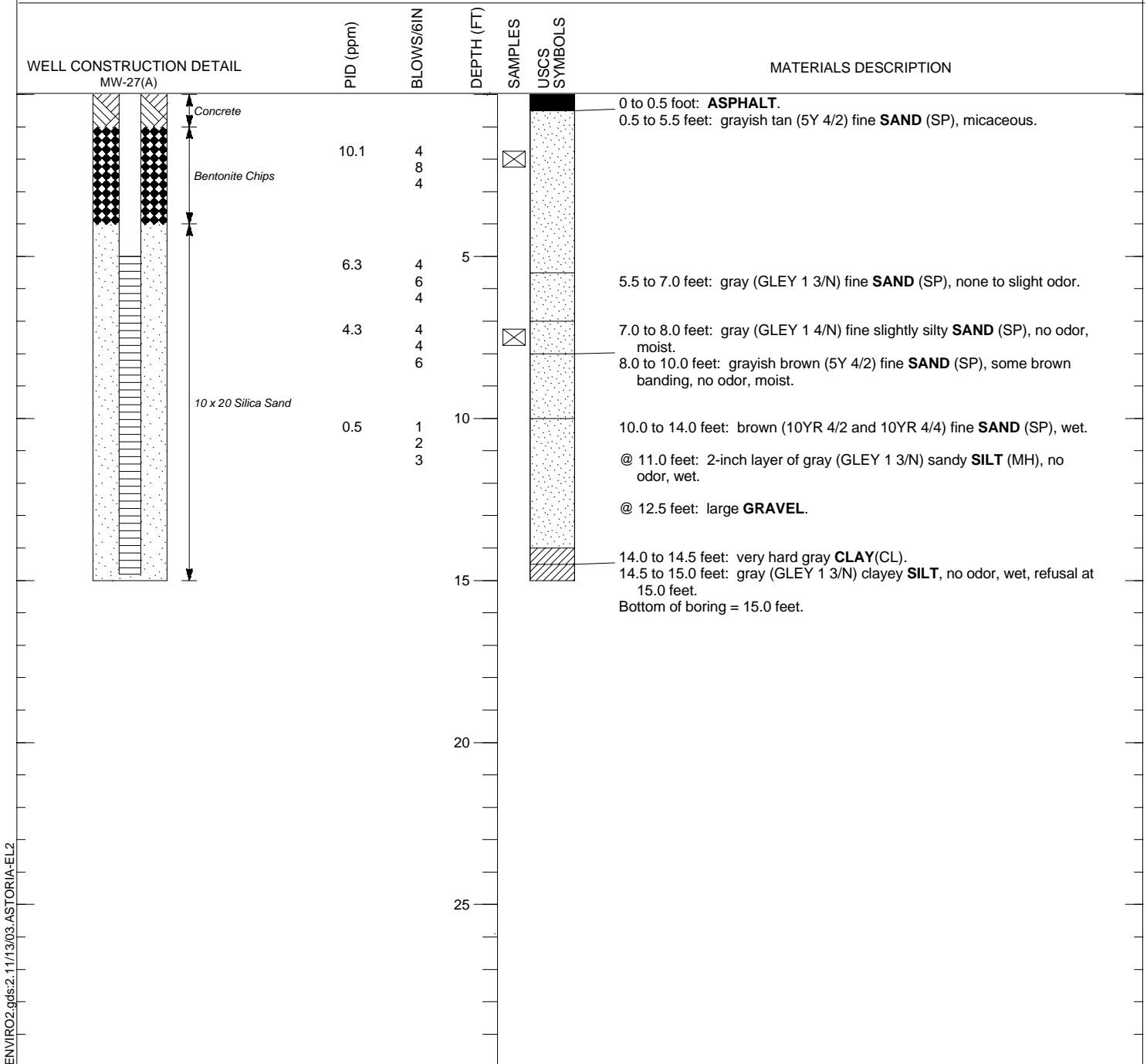
**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

**EnviroLogic Resources, Inc.**

Consulting Environmental & Water Resources Scientists

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 15 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/05/2003



ENVIRO2.gds:2.11/13/03.ASTORIA-EL2

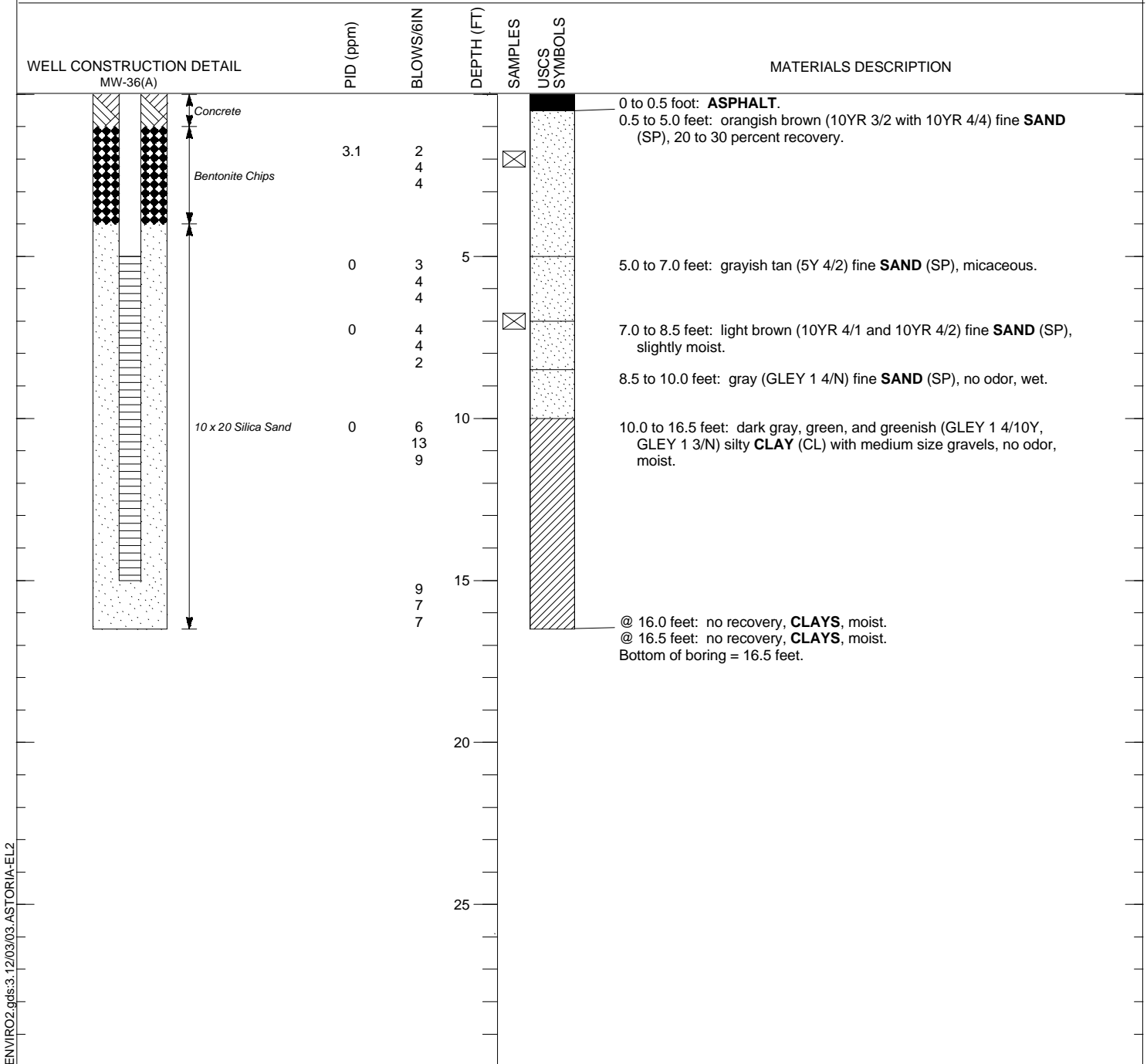
**FIGURE A-34**

**LOG OF  
SOIL BORING SB-834(Q)**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/05/2003



ENVIRO2.gds:3.12/03/03.ASTORIA-EL2

**FIGURE A-35**

**LOG OF  
 SOIL BORING SB-835(Q)**

**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/03/2003

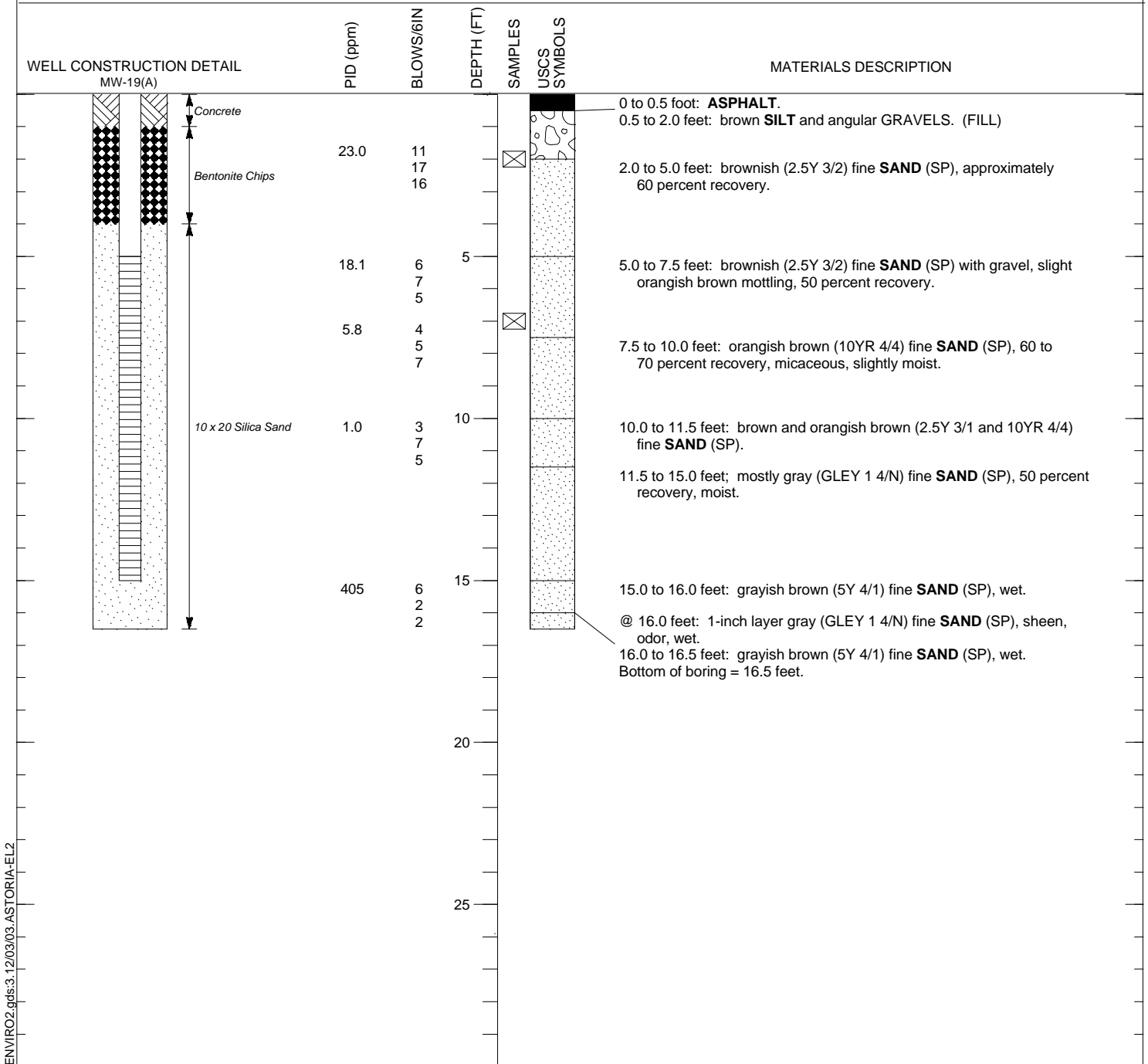


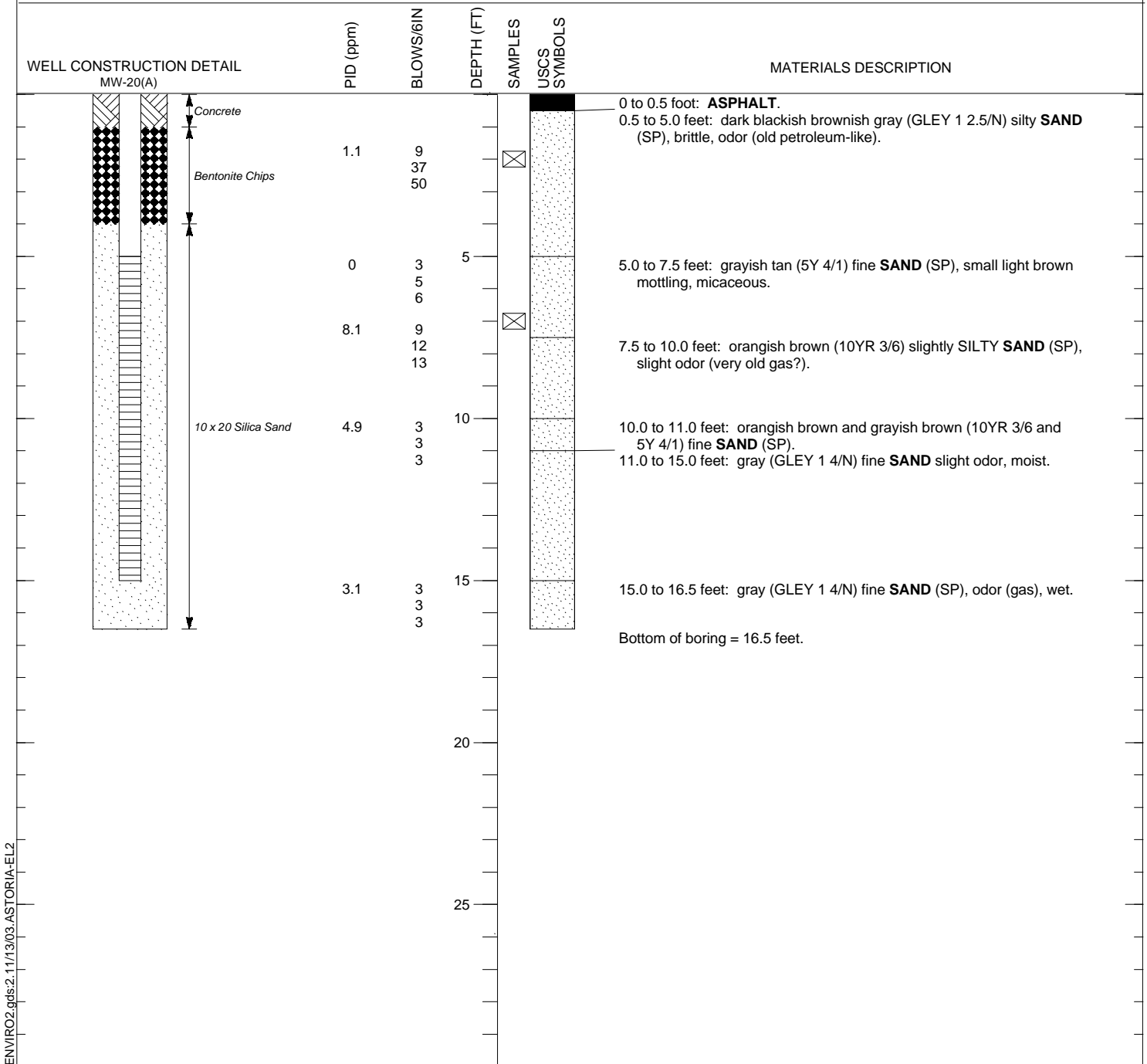
FIGURE A-36

LOG OF  
 SOIL BORING SB-912(S)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/03/2003



**FIGURE A-37**

**LOG OF  
 SOIL BORING SB-913(S)**

**Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon**

**EnviroLogic Resources, Inc.**

Consulting Environmental & Water Resources Scientists

PROJECT Astoria Area-Wide Petroleum Site  
 LOCATION Astoria, Oregon  
 JOB NUMBER 10077.004  
 LOGGED BY Melanie Bocianowski  
 DRILLING METHOD Hollow-stem Auger  
 DRILLING COMPANY Geo-Tech Explorations, Inc.

TOTAL DEPTH 16.5 feet  
 SURFACE ELEVATION  
 REFERENCE POINT ELEVATION  
 REFERENCE POINT DESCRIPTION  
 DATUM  
 DATE STARTED 09/03/2003

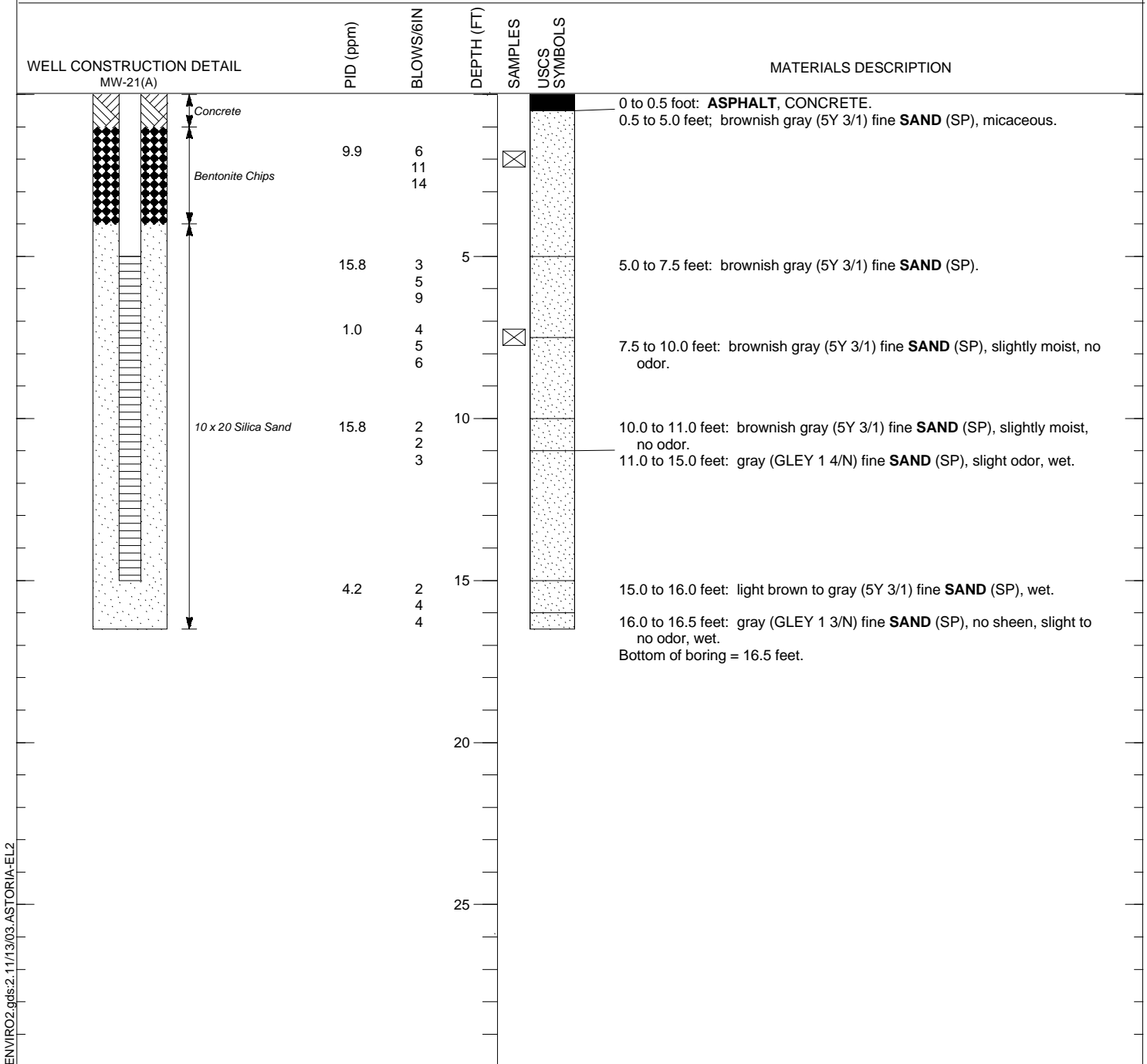


FIGURE A-38

LOG OF  
 SOIL BORING SB-914(S)

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon