Aspect consulting
IN-DEPTH PERSPECTIVE

MEMORANDUM

Project No.: 020030

November 21, 2003

To: Norm Peck, Department of Ecology

cc: Al Jacobson, A&B Jacobson

From: Doug Hillman, LHG. and Jeremy Porter, P.E.

Re: **Jacobson Terminals Cleanup Action Plan Follow-up**

The purpose of this memorandum is to provide Ecology with additional information related to the investigation and remediation of impacted groundwater quality at the Jacobson Terminals property. We are proceeding with the planned voluntary remedial action discussed in our meeting at Ecology's offices on September 4, 2003 and as conceptually documented in the Cleanup Action Plan prepared by Aspect Consulting (2003). Additional site data and remedial action design details are discussed in this memorandum to keep you informed of the planned actions. Construction of the reactive/sorptive wall is scheduled to begin on December 1, 2003 and continue for approximately three weeks.

The following information is submitted:

- **Point of compliance well installation**—As suggested in our meeting, we installed an additional shoreline compliance well (JT-12) about 35 feet northeast of the prior compliance point (JT-6). An updated site plan showing the shoreline compliance well locations is included on the plate in the design memorandum (Attachment A). A copy of the JT-12 boring log is included in Attachment B of this memorandum.
- **Shoreline area groundwater quality sampling**—A round of groundwater quality samples was collected on November 3, 2003 and tested for volatile organics and PCBs. Wells included in the testing round were JT-3, JT-6, JT-7, JT-10, and JT-12. These data are compiled in Tables 1 and 2. Note that at the two shoreline compliance wells (JT-6 and JT-12), only a 10 µg/L detection of p-dichlorobenzene in JT-6 exceeded the current screening criteria (4.86 µg/L).
- **Pre-construction probe borings**—11 probe borings were advanced along the general path of the planned treatment wall to confirm physical soil conditions and assess chemical conditions in soil and groundwater in advance of material handling during construction. These data are compiled in Table 3 and they indicate that wall construction will occur outside the primary area of soil contamination and that chlorinated benzenes and volatile organic compounds persist in groundwater.
- **Treatment wall design details**—Enclosed as Attachment A in this memorandum is a second document that provides design details for construction of the reactive/sorptive groundwater treatment wall. The design memorandum includes a plate with plan and profile views of the planned construction effort, showing that the treatment wall spans the

Table 1 - Summary of Volatile Organics Detected in Groundwater

Location	Depth in Feet	Date	Concentration of Chlorinated Ethene Compounds in ug/L						Concentration of Chlorinated Benzene Compounds in ug/L								Concentration of Other Detected Volatile Organic Compounds in ug/L							
			Vinyl Chloride	1,1-DCE	trans-DCE	cis-DCE	TCE	PCE	CB	m-DCB	p-DCB	o-DCB	1,2,4-TCB	1,2,3-TCB	Chloromethane	1,1,2-TCA	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,3,5-TMB	1,2,4-TMB
Cleanup Level (1)			*2.92*	*1.93*	*32,800*	*na*	*55.6*	*4.15*	*5,030*	*na*	*4.86*	*4,200*	*227*	*na*	*133*	*25.3*	*23*	*48,500*	*6,910*	*na*	*12,300*	*na*	*na*	*na*
JT-3	11.5 to 16.5	3/15/1996	12	4 U	4 U	10 U	4 U	10 U	160	190	180	16	5 U	–	–	–	–	–	–	–	–	–	–	–
		3/22/1999	88	5 U	5 U	5 U	1 U	1 U	140	77	44	10	5 U	–	5 U	1 U	41	–	–	1 U	17	–	–	–
		7/30/1999	64	5 U	5 U	7.2	1 U	1 U	240	140	140	16	–	–	5 U	1 U	2.6	4	1 U	2.7	–	–	–	–
		10/15/1999	7	5 U	3	1 U	1 U	1 U	–	110	93	6.8	–	–	5 U	1 U	3.4	1 U	1 U	1.4	–	–	–	–
		10/18/1999	10	5 U	5 U	2.1	1 U	1 U	–	97	88	3.3	–	–	5 U	1 U	2.1	1 U	1 U	1 U	–	–	–	–
		1/27/2000	69	5 U	5 U	6.5	1 U	1 U	140	150	150	9.1	–	–	5 U	1 U	2	1.6	1.3	1.9	–	–	–	–
		4/7/2000	48	5 U	5 U	5 U	1 U	1 U	140	120	110	6.7	–	–	5 U	1 U	1 U	1 U	1 U	1 U	–	–	–	–
		7/7/2000	14	10 U	10 U	6.7	2 U	2 U	200	140	200	10	–	–	5 U	2 U	4.6	2 U	2 U	2 U	–	–	–	–
		10/11/2000	31	5 U	5 U	5 U	1 U	1 U	190	90	110	5.3	–	–	5 U	1 U	2.4	1 U	1 U	1 U	–	–	–	–
		1/16/2001	5 U	5 U	5 U	5 U	1 U	1 U	26	20	22	1 U	–	–	5 U	1 U	1 U	1 U	1 U	1 U	–	–	–	–
		4/10/2001	50	1 U	1 U	2.3	1 U	1 U	180	77	82	4.1	1 U	1 U	1 U	1 U	1.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
		7/10/2001	45	5 U	5 U	16	1 U	1 U	240	98	130	7.8	–	–	5 U	1 U	1 U	1 U	1 U	1 U	–	–	–	–
		10/22/2001	32	5 U	5 U	5 U	1 U	1 U	150	42	74	5.0	–	–	5 U	1 U	1 U	1 U	1 U	1 U	–	–	–	–
		12/17/2001	30	1 U	1 U	1 U	1 U	1 U	170	86	91	4.7	2.8	1 U	15	1 U	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U
		4/15/2002	90	5 U	5 U	5 U	1 U	1 U	140	140	170	5.6	–	–	5 U	1 U	1 U	1.4	1.3	1 U	1 U	1 U	1 U	1 U
		6/4/2002	37	1 U	1 U	1 U	1 U	1 U	150	73	82	3.7	85	17	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
		10/1/2002	29	1 U	1 U	1 U	1 U	1 U	200	57	71	6.5	–	–	5 U	1 U	1 U	1.8	1.7	6.3	–	–	–	–
		5/1/2003	25	1 U	1 U	1 U	1 U	1 U	113	33	40	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
		11/3/2003	32	1 U	1 U	1 U	1 U	1 U	160	49	64	1 U	1.1	1 U	1 U	1 U	1 U	1.8	1 U	1 U	1 U	–	–	1 U
JT-10	18 to 19	11/3/2003	13	1 U	1 U	28	1 U	1 U	580	53	38	4.5	1.4	1 U	1 U	1 U	17	1 U	2.4	3.0	250	1 U	1 U	3.1
JT-12	14 to 19	11/3/2003	0.2 U	1 U	1 U	1 U	1 U	1 U	9.4	4.0	2.3	1 U	1 U	1 U	1 U	1 U	2.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U
JT-6	14 to 19	3/22/1999	390	5 U	7	140	2.2	1.3	300	570	360	47	–	–	5 U	1 U	8.8	1.2	1 U	2.5	–	–	–	–
		6/17/1999	430	5 U	9.5	160	1.4	1.2	5 U	580	300	31	–	–	5 U	1 U	16	1.4	1 U	1	–	–	–	–
		7/30/1999	400	5 U	11	160	1.5	1 U	410	400	270	24	–	–	5 U	1 U	20	1.1	1 U	1	–	–	–	–
		10/15/1999	24	5 U	1 U	58	1 U	1 U	–	240	120	19	–	–	5 U	1 U	20	1 U	1 U	1 U	–	–	–	–
		10/18/1999	41	5 U	1 U	61	1 U	1 U	–	250	130	9.2	–	–	5 U	1 U	24	1.7	1 U	1 U	–	–	–	–
		1/27/2000	150	5 U	5 U	49	1 U	1 U	840	260	180	13	–	–	5 U	1 U	37	2.8	1 U	1 U	–	–	–	–
		4/7/2000	230	5 U	6.4	84	1 U	3.1	610	270	170	17	–	–	5 U	1 U	29	2.8	1 U	3	–	–	–	–
		7/7/2000	52	20 U	12	120	4 U	4 U	300	220	190	18	–	–	5 U	4 U	18	4 U	4 U	4 U	–	–	–	–
		10/11/2000	78	5 U	5 U	65	1 U	1 U	550	330	250	1 U	–	–	5 U	41	29	1 U	1 U	1 U	–	–	–	–
		1/16/2001	94	5 U	5 U	31	1 U	1 U	1100	230	190	18	–	–	5 U	1 U	26	2	1 U	5.9	–	–	–	–
		4/10/2001	77	1 U	1 U	54	1 U	1 U	660	260	170	16	1 U	1 U	1 U	1 U	27	1 U	1 U	1 U	1 U	1 U	1 U	1 U
		7/10/2001	20	5	5 U	25	4.8	62	480	220	260	19	–	–	5 U	1 U	18	2.4	1 U	1 U	–	–	–	–
		7/17/2001	5 U	5 U	5 U	18	1 U	6.8	500	310	220	20	–	–	5 U	1 U	20	2.9	1 U	4.1	–	–	–	–
		10/22/2001	8.6	5 U	5 U	2.2 J	1 U	1 U	550	130	140	10	–	–	5 U	1 U	36	1 U	1 U	6.9	–	–	–	–
		12/17/2001	9.4	5 U	5 U	5 U	1 U	1 U	930	28	20	2.5	–	–	5 U	1 U	26	1.7	1 U	3.8	–	–	–	–
		1/30/2002	5 U	5 U	5 U	5 U	1 U	1 U	1000	28	32	1 U	–	–	5 U	1 U	24	2.6	1 U	1 U	–	–	–	–
		4/15/2002	5 U	5 U	5 U	5 U	1 U	1 U	720	55	40	1 U	–	–	5 U	1 U	18	1 U	1 U	1 U	–	–	–	–
		6/4/2002	20	1 U	1 U	1 U	1 U	1 U	650	100	68	5.5	54	8.4	1 U	1 U	23	2	1 U	1 U	1 U	1 U	1 U	1 U
		3/13/2003	0.2 U	1 U	1 U	1 U	1 U	1 U	1100	36	25	1 U	–	1 U	1 U	1 U	22	1.3	1.9	2.6	1 U	–	–	–
		5/1/2003	0.2 U	1 U	1 U	1 U	1 U	1 U	740	15	12	1 U	–	1 U	1 U	1 U	20	1 U	1 U	1 U	63	1 U	1 U	1.7
		11/3/2003	0.2 U	1 U	1 U	1 U	1 U	1 U	580	11	10	1 U	1 U	1 U	1 U	1 U	17	1.3	2.2	4.5	170	1.4	1 U	3

Notes:

(1) Cleanup level based on Draft Cleanup Action Plan (Aspect, 2003)

J Estimated value

U Not detected at indicated detection limit

– Not analyzed

CB Chlorobenzene

m-DCB m-Dichlorobenzene

p-DCB p-Dichlorobenzene

o-DCB o-Dichlorobenzene

1,2,3-TCB 1,2,3-Trichlorobenzene

1,2,4-TCB 1,2,4-Trichlorobenzene

1,2,4-TMB 1,2,4-Trimethylbenzene

Table 3 - Soil and Groundwater Quality in Direct-Push Borings

Summary of Volatile Organic Concentrations Detected in Groundwater

Location	Date	Sample Depth in Feet	Concentration of Chlorinated Aliphatic Compounds in ug/L						Concentration of Chlorinated Benzenes in ug/L						Concentration of Other Detected VOCs in ug/L				
			Vinyl Chloride	1,1-DCE	trans-DCE	cis-DCE	TCE	PCE	CB	m-DCB	p-DCB	o-DCB	1,2,4-TCB	1,2,3-TCB	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
SP-50	10/3/2003	15 to 17	0.2 U	1 U	1 U	1.6	1 U	1 U	310	5.6	5.6	1 U	1 U	1 U	5.9	1 U	1 U	1 U	1 U
SP-51	10/3/2003	18 to 20	41	1 U	1 U	83	1 U	1 U	260	180	130	1 U	4.6	1 U	5.8	1 U	1 U	1 U	1 U
SP-52	10/3/2003	18 to 20	15	1 U	1 U	40	1 U	1 U	560	57	45	4.2	1 U	1 U	17	1.2	1.5	3	1 U
SP-54	10/3/2003	16 to 18	1.8	1 U	1 U	1 U	1 U	1 U	45	13	11	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SP-55	10/3/2003	16 to 18	0.2 U	1 U	1 U	1 U	1 U	1 U	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SP-59	11/3/2003	15 to 20	54	1 U	1 U	280	1.8	1 U	98	33	60	2.7	2.6	1 U	1.7	1 U	1 U	1 U	1.5
SP-60	11/3/2003	14 to 19	55	1 U	1 U	420	1.2	1 U	36	90	100	7.7	20	1 U	1.5	1 U	1 U	1 U	1 U

Notes:

J Estimated value
U Not detected at indicated detection limit
-- Not analyzed
CB Chlorobenzene
m-DCB m-Dichlorobenzene
p-DCB p-Dichlorobenzene
o-DCB o-Dichlorobenzene
1,2,3-TCB 1,2,3-Trichlorobenzene
1,2,4-TCB 1,2,4-Trichlorobenzene
1,2,4-TMB 1,2,4-Trimethylbenzene

Summary of Chemical Concentrations Detected in Soil

Location	Date	Sample Depth in Feet	PCB Concentration in mg/kg Aroclor 1260	Concentration of Chlorinated Aliphatic Compounds in ug/kg						Concentration of Chlorinated Benzenes in ug/kg					
				Vinyl Chloride	1,1-DCE	trans-DCE	cis-DCE	TCE	PCE	CB	1,3-DCB	1,4-DCB	1,2-DCB	1,2,4-TCB	1,2,3-TCB
October 2003 Wall Design Investigation															
SP-51	10/3/2003	18 to 21	0.2 U	50 U	50 U	50 U	50 U	20 U	20 U	50 U	110	95	50 U	50 U	50 U
SP-53	10/3/2003	4 to 8	0.2 U	50 U	50 U	50 U	50 U	20 U	20 U	50 U	50 U	50 U	50 U	50 U	50 U
SP-53	10/3/2003	16 to 19	0.2 U	50 U	50 U	50 U	50 U	20 U	20 U	50 U	830	350	50 U	50 U	50 U

Notes:

J Estimated value
U Not detected at indicated detection limit
-- Not analyzed
CB Chlorobenzene
m-DCB m-Dichlorobenzene
p-DCB p-Dichlorobenzene
o-DCB o-Dichlorobenzene
1,2,3-TCB 1,2,3-Trichlorobenzene
1,2,4-TCB 1,2,4-Trichlorobenzene
1,2,4-TMB 1,2,4-Trimethylbenzene

Table 2 - PCB Concentrations in Groundwater

Sample Location	Sampling Date	Total Suspended Solids in mg/L	PCB Concentration in ug/L (Aroclor 1260)
JT-3			
	4/10/2001	--	0.4 U
	12/17/2001	--	0.017 U
	6/4/2002	7.4	1.5
	10/1/2002	1 U	0.033 U
JT-6			
	4/10/2001	--	0.4 U
	12/17/2001	1.4	0.017 U
	6/4/2002	23	0.2
	10/1/2002	3.1	0.056
	6/12/2003	25	0.089
	11/3/2003	5.2	0.03 U
JT-12			
	11/3/2003	3.8	0.03 U

Aspect consulting
IN-DEPTH PERSPECTIVE

MEMORANDUM

Project No.: 020030

November 11, 2003

To: Al Jacobson, A&B Jacobson LLC

From: Jeremy Porter and Doug Hillman

Re: **Design, Construction and Soil Management Plan**
Reactive/Sorptive Wall Groundwater Treatment System
Jacobson Terminals Site

This memorandum provides the design and construction details of the reactive/sorptive groundwater treatment wall described in the Jacobson Terminals Draft Cleanup Action Plan (Draft CAP: Aspect 2003). Several chemicals in groundwater at the Jacobson Terminals site have been detected above screening levels based on protection of the adjacent surface water body, the Lake Washington Ship Canal. Chemicals of concern at the site include PCE, TCE, vinyl chloride, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, and PCBs. The proposed wall is intended to prevent groundwater containing chemicals of concern from discharging to the Lake Washington Ship Canal at concentrations above site screening levels.

The proposed cleanup action, as described in the draft CAP, involves installing a permeable wall across the plume of impacted groundwater upgradient of the Ship Canal. The permeable wall will contain three media:

- **Granular Iron**, to destroy chlorinated ethenes;
- **Granular Activated Carbon (GAC)**, to adsorb chlorinated benzenes and PCBs; and
- **Sand**, a non-reactive, permeable material to make up the balance of the wall volume.

Groundwater flowing through the wall will be treated by reacting with or adsorbing to the above materials. Because the wall materials will have a greater hydraulic conductivity than surrounding soils, it is unlikely groundwater will be diverted around, over, or under the wall. Below we outline design criteria, describe proper construction practices at the site, and outline procedures for handling and disposal of excavated soils. We understand that construction contracting and permitting activities will be handled directly by A&B Jacobson.

Design Criteria

Preliminary design criteria were provided in the Draft CAP. These criteria have been adjusted based on soil and groundwater data collected during the Design Field Investigation on October 3 and November 3, 2003. Updated design criteria are provided in Table 1. The planned layout, dimensions, and composition of the wall are shown on Plate 1.

General Construction Requirements

Health and Safety

A site-specific health and safety plan has been prepared for Aspect Consulting employees. The Contractor may elect to adopt the Aspect Consulting plan, but remains solely responsible for his or her employees' health and safety.

Access to the site is controlled 24 hours by security fencing around the site and an entrance gate that is locked at night. Access to the construction area by on-site personnel will be controlled using cones, barricades, and/or barricade tape. Protection shall be placed over open trenches or borings not actively worked.

Environmental Protection

Spill Control. The Contractor is responsible for control, cleanup, and disposal of soil, water, fuel, lubrication oil, or other material resulting from spills, accidents, or other events during this work that are not associated with existing site conditions. Spill response materials shall be kept on site. As soon as a vehicle or equipment leak is detected, the equipment shall be stopped immediately and cleanup commenced as soon as safety permits.

Equipment Decontamination. Equipment that has contacted potentially contaminated soil (see Soil Management section) shall be decontaminated with a pressure washer. Wash water form equipment decontamination shall be contained, collected into a temporary wastewater holding tank, and legally disposed of by the Contractor.

Groundwater Containment. Groundwater removed from the work shall be collected into a temporary wastewater holding tank and legally disposed of by the Contractor. The Contractor shall not allow groundwater to flow off the site or to enter storm drains.

Monitoring Well Protection. Existing groundwater monitoring wells shall be protected and maintained during the remedial action. Monitoring wells that would significantly interfere with the remedial action shall be abandoned in accordance with Chapter 173-360 WAC.

Environmental Emergency Notification. For environmental emergencies not covered by this plan or the Contractor's health and safety plan, the Contractor will stop work and notify:

Contact	Contact Name	Phone Number
Site Owner	Al Jacobson	206-669-4300
Aspect Consulting	Doug Hillman	206-328-7443 (office) 206-399-0318 (cell)
Aspect Consulting	Jeremy Porter	206-328-7443 (office) 206-790-2129 (cell)
Seattle Fire Department		911

Dust and Erosion Control

The Contractor shall prevent fugitive emissions of soil or solid materials during on-site activities. No visible dust shall be generated. Soil erosion due to precipitation runoff or run-on to or from excavations, stockpiles, paving areas, or other soil areas exposed or disturbed by Contractor activities shall be controlled using berms, surface water control, straw bales, temporary visqueen covers, or other appropriate control measures. All active storm water catch basins shall be lined with filter fabric.

Wall Construction

Site Preparation

Utility Protection

The Contractor shall field verify the locations and elevations of existing utilities within 50 feet of the planned excavation area prior to commencing work and take precautionary measures as necessary to protect active utilities. Note in particular that the intended excavation crosses one water line and closely borders water, power, and sewer lines.

Utilities for Construction

Limited water shall be provided by the site owner. The Contractor shall obtain a permit to use a fire hydrant for tasks requiring large amounts of water.

Excavation

Soil shall be excavated in the following manner:

- Adjacent 13-inch O.D. pipe piles shall be driven to the design depth (minimum 6-inch embedment into the silt or clay layer) in two offset rows. Pipe piles shall be installed to minimize void space between piles. We expect that sets of up to 40 pipe piles shall be driven at one time.
- Soil shall be removed from within each pile to the design depth using an auger with a bucket to contain the cuttings. Cuttings will be loaded directly into a truck or appropriate

shipping container. Any free-standing water that collects in the soil shipping container shall be removed before the soil leaves the site.

- Free water in the casing shall be pumped out into a wastewater holding tank.

Before backfilling, the depth of the boring and contact with the confining layer shall be confirmed. The design depth for each station along the wall is included on Plate 1.

Soil Handling

All soil excavated during construction of the wall from depths below 3 feet shall be considered Potentially Contaminated Soil. Potentially Contaminated Soil shall be handled in a manner as to minimize spills and the release of dust. Potentially Contaminated Soil shall be loaded directly into trucks or shipping containers and disposed of at a proper disposal facility. Any soil left on site overnight shall be covered to prevent stormwater accumulation in the storage container. Any water accumulating in the storage container will be removed before the container is shipped off site. Chemical data from soil samples collected from the proposed wall footprint are provided in Appendix A.

Water in Excavations

The Contractor shall prevent surface flow from entering the excavations. Free water in excavations shall be pumped into a temporary wastewater holding tank and legally disposed of.

Wall Placement

Excavations shall be backfilled to a depth of 3 feet using the iron/GAC/sand mixture specified on Plate 1. The mixture shall be prepared and placed as follows:

- A cement truck shall arrive at the site containing a 1/3 load of sand. Equal amounts of iron and GAC shall be added to the truck along with sufficient water to make a thick slurry.
- The media shall be mixed in the cement truck.
- If the mixture contains free water, it will be placed on a conveyor belt or an equivalent method shall be used to drain free water before emplacement.
- The boring shall be filled to ground surface.
- The casing shall be removed after the boring is completely backfilled. The casing void space should allow the material to settle to a depth of about 3 feet below ground surface. The depth shall be verified and material added or removed, if necessary.

No free water shall be present in the excavation while the mixture is placed to avoid segregation of the media based on differences in density.

Wall Cap Placement

Excavations shall be backfilled from a depth of 3 feet to the existing surface grade according to Plate 1 using suitable material. Backfill shall be compacted to the satisfaction of the Owner.

The wall shall be capped in such a manner as to support heavy truck traffic. The Contractor shall complete the trench backfill to the existing grade. An asphalt cap will be provided by the owner.

Monitoring Well Placement

The contractor shall install three monitoring wells in the wall at locations shown on Plate 1. Construction specifications are included on Plate 1. These wells shall be placed in the excavated borings at each location before the treatment material mixture is emplaced.

Quality Control and Reporting

Aspect Consulting will use methods outlined in the following sections to document field practice, review quality assurance data, and interpret the information for reporting purposes.

Field Measures and Documentation

The field personnel will use consistent sampling techniques and documentation protocol while executing this work. Field documents will include health and safety monitoring data and a narrative field report. In particular, the field personnel will verify the following parameters:

- Location of the wall relative to the construction plan;
- Depth of each boring reaches the confining layer. This will be confirmed by measuring the total depth of the boring and by visually confirming soil removed from the bottom of boring;
- Placement of well-mixed media. A sample from each truckload shall be collected and visually inspected for composition;
- Final depth to the top of the reactive media; and
- That no free water is present in the borings while material is emplaced.

Reporting

Field observations and measurements will be used to produce a construction report documenting the as-built dimensions and composition of the wall. Included will be an updated site survey including the location of the wall and monitoring wells.

References

Aspect 2003. Draft Cleanup Action Plan, Jacobson Terminals. Prepared for A&B Jacobson. August 27, 2003.

Attachments:
Table 1 – Final Design Criteria
Plate 1 – Jacobson Terminals Reactive/Sorptive Wall

V:\020030 Jacobson Terminals\Design Memo.doc

Table 1 - Final Design Criteria
Sorptive/Reactive Wall

Parameter	Value	Units
Plume Dimensions		
Width	90	ft
Vertical Thickness	15	ft
Cross-Sectional Area	1350	ft^2
Treatment Wall		
Reactive Media	Zero-valent Iron Filings	
Sorptive Media	Liquid-phase Granular Activated Carbon	
Porosity	0.4	
Minimum Width	2	ft
Length	150	ft
Average Treatment Height	16	ft
Maximum Groundwater Velocity	0.4	ft/day
Iron Composition Calculations		
Wall Residence Time	5	days
Half-life of Vinyl Chloride with Iron	2.8	hr
Maximum Vinyl Chloride Concentration	650	ug/L
Target Vinyl Chloride Concentration	5	ug/L
Required Residence Time (100% Iron)	19.7	hrs
Iron Safety Factor	2	
Percentage of Iron	33	percent
Carbon Compositions Calculations		
Carbon Usage Rate (Treatability Study)	0.00035	ft^3 GAC/ft^3 water
Site Groundwater Velocity	0.40	ft/day
Porosity	0.40	
Site Groundwater Flowrate	0.16	ft^3/ft^2/day
Wall Width	2	ft
GAC Composition	100	percent
Volume of GAC in Wall	2	ft^3/ft^2
Time to Breakthrough	98	years
Target Lifetime	30	years
Design GAC Composition	31	percent
Earthwork Calculations		
Average Width	2.1	ft
Average Depth	19	ft
Volume of Soil Excavated	222	cy
Volume Iron	61	cy
Volume GAC	57	cy
Volume Sand	68	cy
Volume Structural Fill	35	cy
Mass of Soil Excavated	377	tons
Mass Iron	135	tons
Mass GAC	29	tons
Mass Sand	109	tons
Mass Structural Fill	56	tons

V:\020030 Jacobson Terminals\[Design Table 2.xls]Design Criteria

Aspect consulting
IN-DEPTH PERSPECTIVE

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
020030	JT-12	1 of 1

Project Name	Jacobson Terminal	Top of Casing Elev. (ft mllw)	
Location	Seattle, Washington	Depth to Water (ft bgs)	
Drilling Method	HSA ; Holt Drilling	Start Date	October 1, 2003
Sampling Method	2" split spoon	Finish Date	October 1, 2003

Depth feet	Well Construction	Tests\Remarks	Blows/ 6"	Sample ID	Mtl. Graphic	Description
	Concrete surface seal 0'-1'					7.5" Concrete, 8" void beneath
			1 1 1	S-1		Very loose, moist, tan, silty, fine SAND, trace organics
5						•Becomes gray at 5' (sampled from cuttings)
	Bentonite chip seal 1'-11'					
			0 1 0	S-2		•Very loose, wet, gray, silty, fine to medium SAND
10	2-inch diameter PVC casing 0' - 14'					
			4 7 6	S-3		Medium dense, wet, gray to brown, fine to medium SAND, trace silt; few silt laminae up to 1/4" thick
15			7 8 14	S-4		•Brown, changing to gray at 16'
	10-20 Filter pack 11'-19', 20-slot, 2-inch diameter PVC screen 14'-19'		6 10 14	S-5		•Gray, fine sandy silt layer 16.3'-16.5'
			8 17 21	S-6		
	Slip cap 19'-19.2'					Gray, fine, sandy SILT to silty SAND
20						Bottom of boring at 19.5 feet.

Sampler Type (ST):

- 3.25" OD D & M Split-Spoon Ring Sampler
- No Recovery
- 2" OD Split-Spoon Sampler

PID - Photoionization Detector

- Water Level (ATD)
- Static Water Level

Logged by: JJP

Approved by: DLH

Figure No.

MW_GEOLG_JACOBSON TERMINAL.GPJ November 10, 2003

LOG OF SOIL PROBE NO. SP-50

Location:

Depth, ft	Samples collected for lab analysis	Sample Type	PID	Remarks	Graphic Symbol	DESCRIPTION
						This log is part of the report prepared by Aspect Consulting, LLC, for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this boring at the time of installation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.
						4" Asphalt
						(Medium dense), moist, brown, silty SAND with gravel, trace wood
						(Loose to medium dense), moist, gray SAND, trace wood and shells
						(Medium dense), moist, brown to gray-brown, silty, fine SAND with organics, wood
5			▼			(Loose), wet, gray to gray-brown SAND, trace wood
						Olive green SILT 7.9' tp 8.0'
						(Loose), wet, gray-brown, fine to medium SAND, trace organics, occasional fine silty sandy laminae
10						(Soft), wet, brown sandy SILT, with 70% wood
						(Medium dense), wet, brown, fine to medium SAND, trace wood; olive gray sandy silt lamination at 14.8'
15	SPW-50/15			Water sample SPW-50/15 at 15' collected for chemical analysis		•Iron oxide staining 16'-17'
						•White, chalky substance 17'-18'
						(Stiff), wet, gray, SANDY SILT to SILT
20						Bottom of boring at 21 feet. Backfilled with bentonite chips.

Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- ▼ Water Level ATD

Jacobson Terminal

Seattle, Washington

Project No.

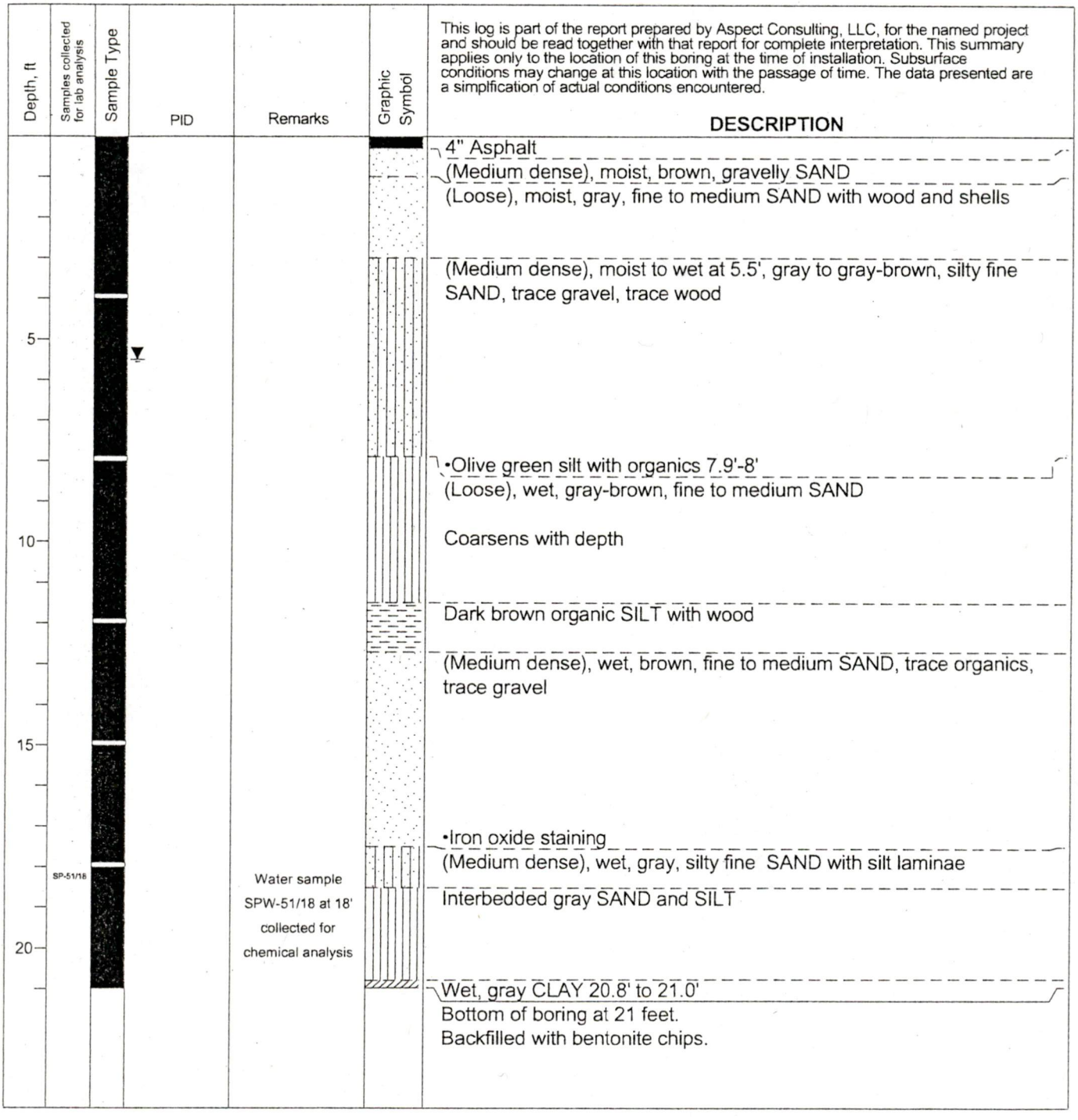
020030

Aspect consulting
IN-DEPTH PERSPECTIVE

CTSP1 JACOBSON TERMINAL.GPJ November 10, 2003

LOG OF SOIL PROBE NO. SP-51

Location:



Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jacobson Terminal

Seattle, Washington

Project No.

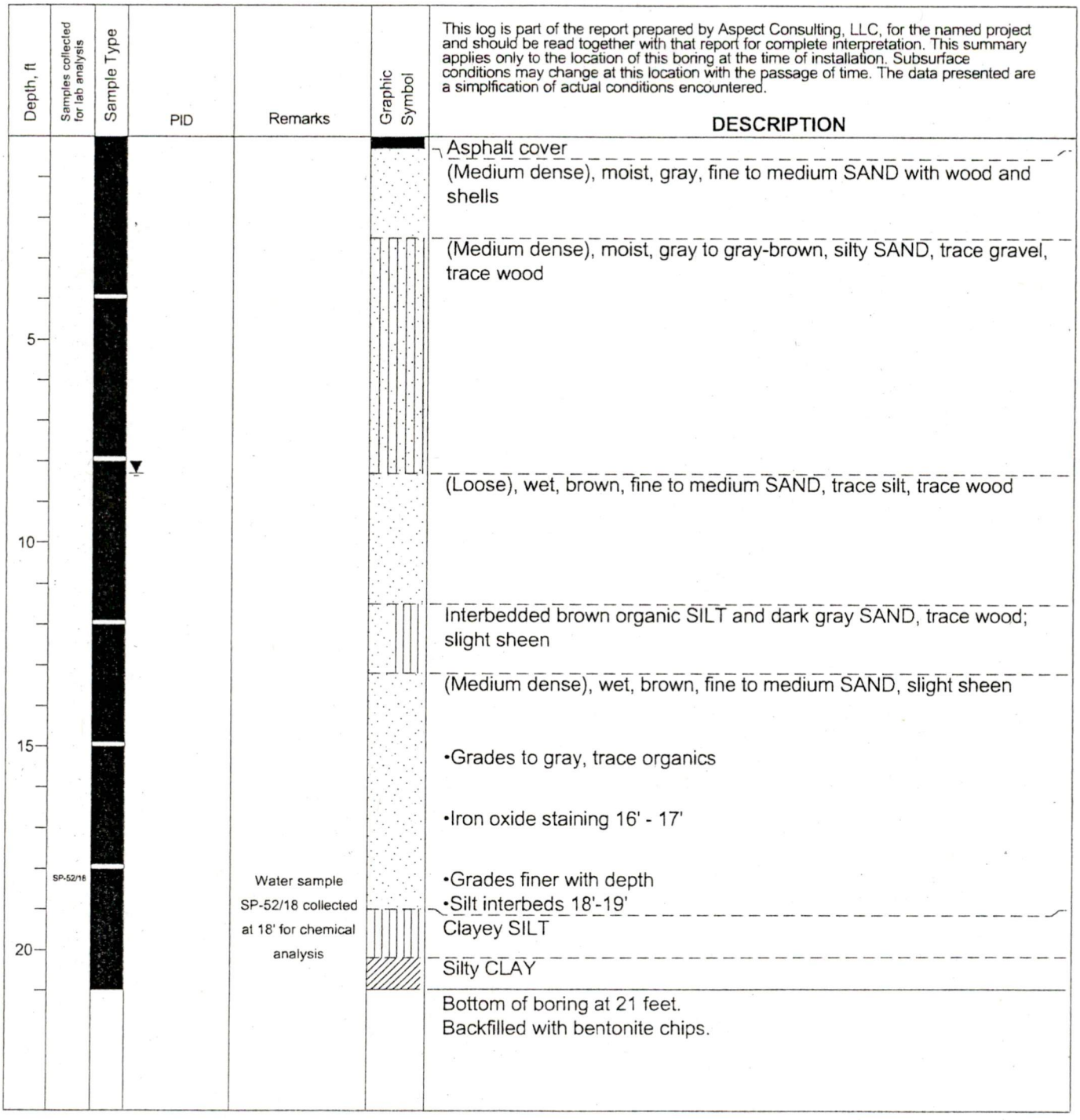
020030

Aspect consulting
IN-DEPTH PERSPECTIVE

CTSP1 JACOBSON TERMINAL.GPJ November 10, 2003

LOG OF SOIL PROBE NO. SP-52

Location:



Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jacobson Terminal

Seattle, Washington

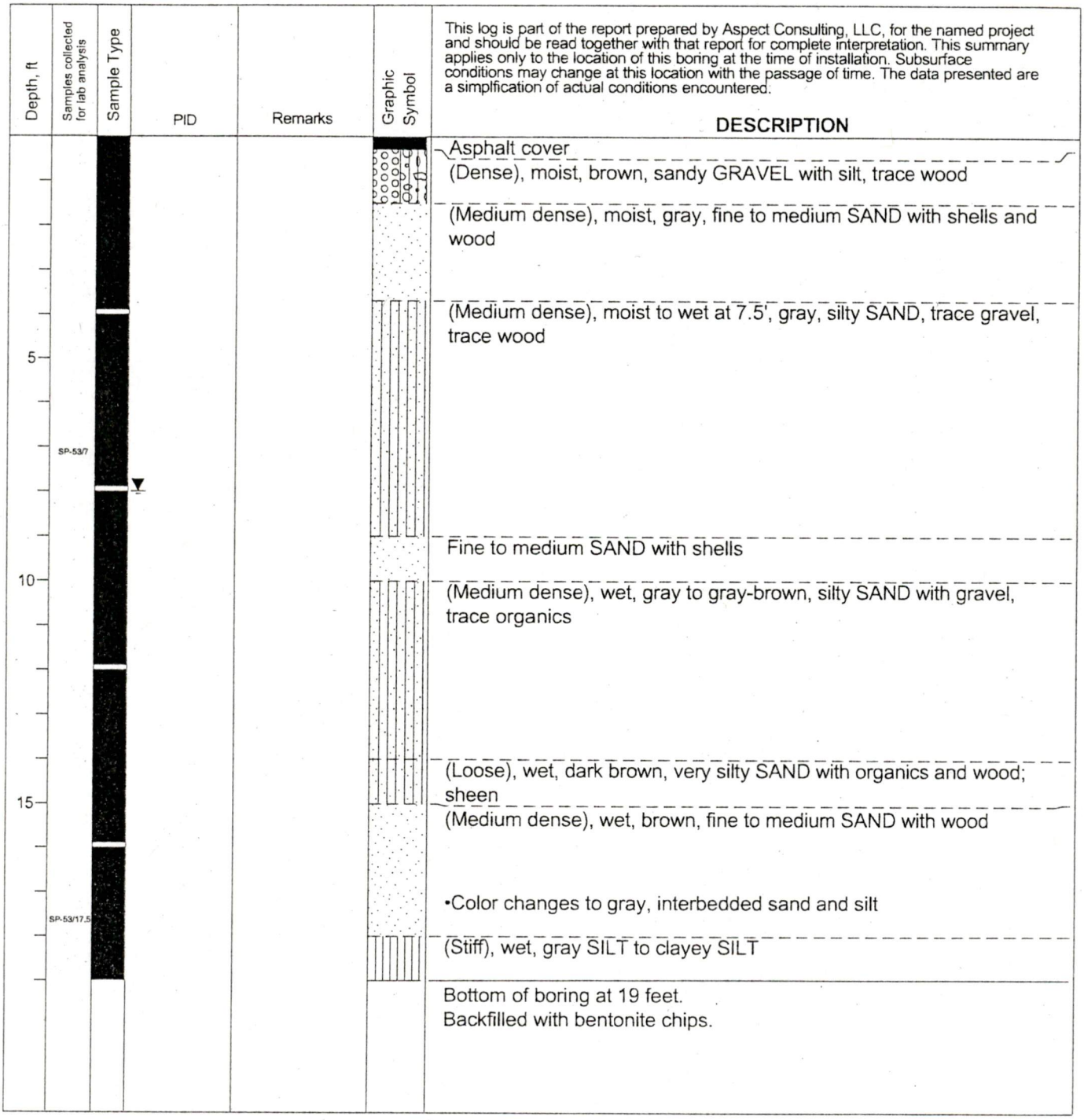
Project No.

020030

Aspect consulting
IN-DEPTH PERSPECTIVE

LOG OF SOIL PROBE NO. SP-53

Location:



Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jacobson Terminal

Seattle, Washington

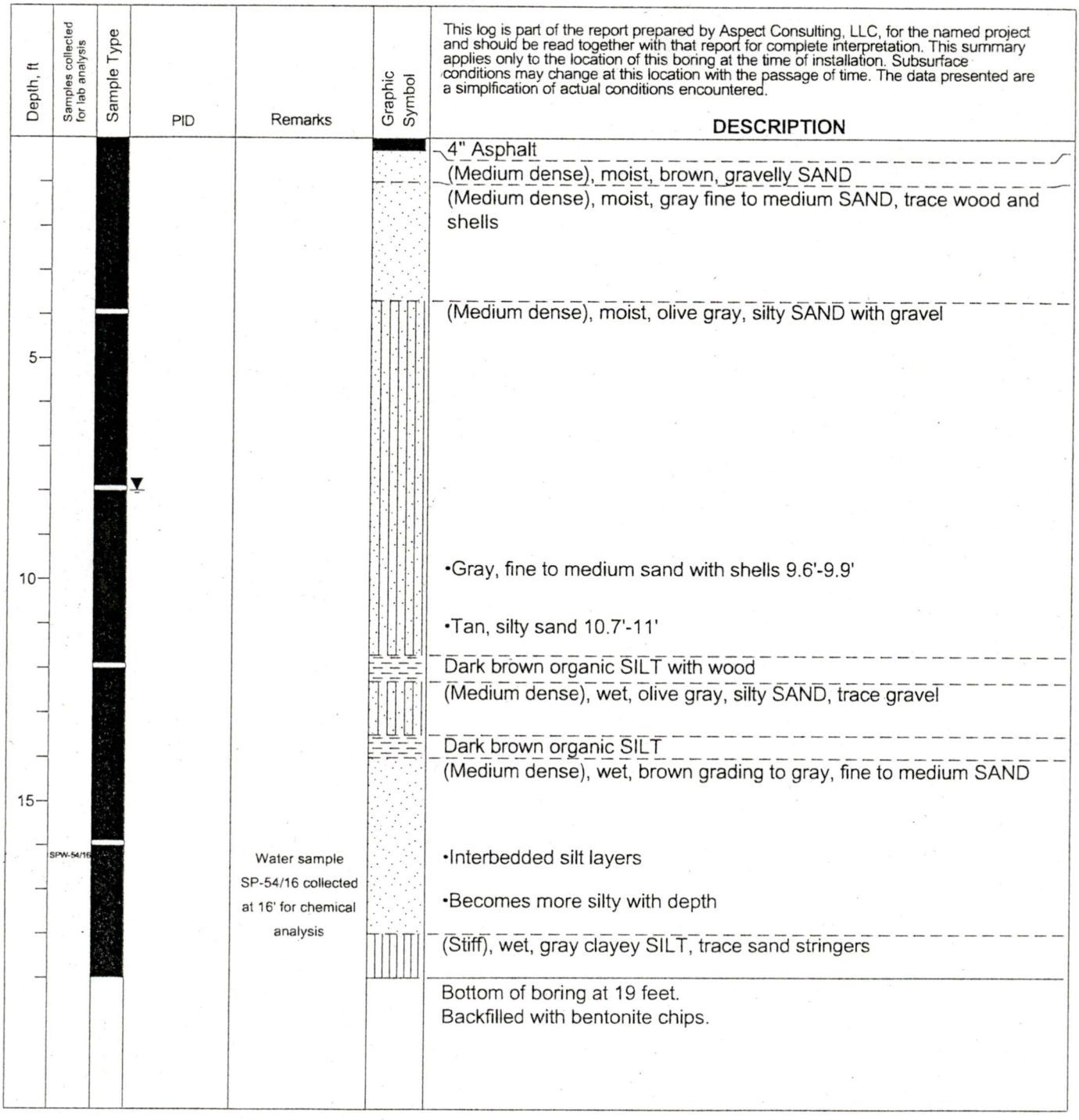
Project No.

020030

Aspect consulting
IN-DEPTH PERSPECTIVE

LOG OF SOIL PROBE NO. SP-54

Location:



Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jacobson Terminal

Seattle, Washington

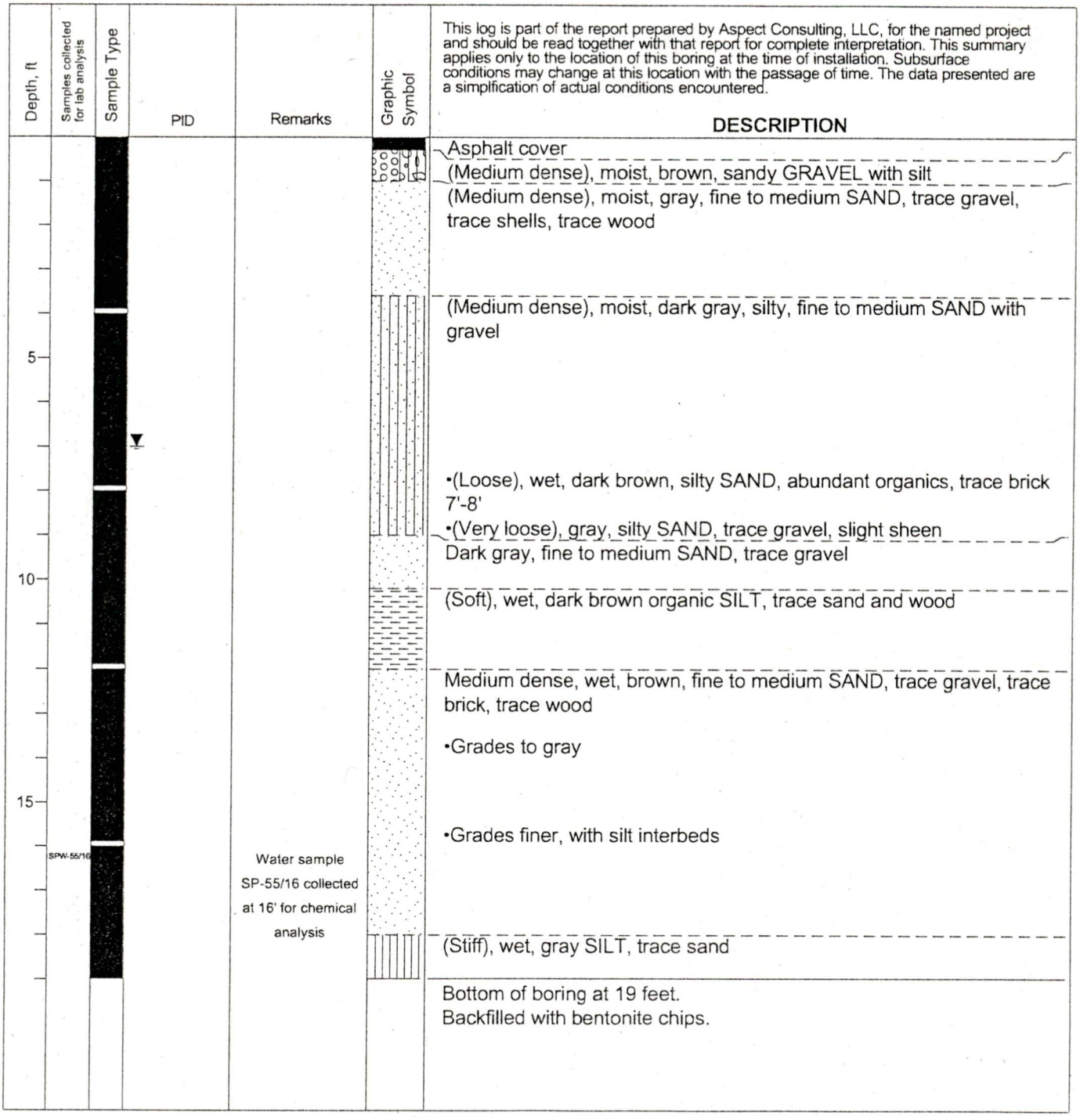
Project No.

020030

Aspect consulting
IN-DEPTH PERSPECTIVE

LOG OF SOIL PROBE NO. SP-55

Location:



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DESCRIPTION

Asphalt cover

(Medium dense), moist, brown, sandy GRAVEL with silt

(Medium dense), moist, gray, fine to medium SAND, trace gravel, trace shells, trace wood

(Medium dense), moist, dark gray, silty, fine to medium SAND with gravel

•(Loose), wet, dark brown, silty SAND, abundant organics, trace brick 7'-8'

•(Very loose), gray, silty SAND, trace gravel, slight sheen

Dark gray, fine to medium SAND, trace gravel

(Soft), wet, dark brown organic SILT, trace sand and wood

Medium dense, wet, brown, fine to medium SAND, trace gravel, trace brick, trace wood

•Grades to gray

•Grades finer, with silt interbeds

(Stiff), wet, gray SILT, trace sand

Bottom of boring at 19 feet.
Backfilled with bentonite chips.

Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jacobson Terminal

Seattle, Washington

Project No.

020030

Aspect consulting
IN-DEPTH PERSPECTIVE

LOG OF SOIL PROBE NO. SP-56

Location:

Depth, ft	Samples collected for lab analysis	Sample Type	PID	Remarks	Graphic Symbol	DESCRIPTION
						This log is part of the report prepared by Aspect Consulting, LLC, for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this boring at the time of installation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.
						4" Asphalt
						(Medium dense), moist, gray to brown, gravelly SAND, trace silt
						(Medium dense), brown to gray, fine to medium SAND, trace gravel, trace shell, trace wood
						(Medium dense), moist, gray, silty SAND, trace gravel, trace wood
						•Dark brown organic silt layer 3.8'-4'
5						(Medium dense), moist, light brown, fine to medium SAND, trace gravel
						(Medium dense), moist to wet at 7.5', dark gray, gravelly, fine to medium SAND
						•Coarsens with depth
10						(Loose), wet, dark brown, silty SAND with organics and wood, trace gravel
						(Medium dense), wet, brown, fine to medium SAND
						•Grades to gray, increasing silt content
15						(Stiff), wet, gray SILT, with sand interbeds
						•(Soft), clayey
						Bottom of boring at 19 feet. Backfilled with bentonite chips.

Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jacobson Terminal

Seattle, Washington

Project No.

020030

Aspect consulting
IN-DEPTH PERSPECTIVE

LOG OF SOIL PROBE NO. SP-57

Location:

Depth, ft	Samples collected for lab analysis	Sample Type	PID	Remarks	Graphic Symbol	This log is part of the report prepared by Aspect Consulting, LLC, for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this boring at the time of installation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
						Asphalt cover
						(Medium dense), gravelly SAND with silt, trace wood
						(Medium dense), moist, gray, fine to medium SAND, trace wood, shell fragments
						(Medium dense), moist, olive gray, silty SAND, trace gravel
						•Organic silt layer 4'-4.2'
5						Tan, fine SAND
						Dark brown, fine to medium SAND 5'-5.5'
						(Medium dense), wet, dark gray, gravelly SAND
10						Dark brown, ORGANIC SILT, trace sand
						Dark brown, slightly silty SAND with organics
						Medium dense, wet, brown, fine to medium SAND, trace wood
						•Coarsens with depth to 14'
						•Gray
15						•Grades finer with depth
						Interbedded SILT and fine SAND
						Gray SILT, trace sand stringers
						(Soft), gray CLAY
						Bottom of boring at 19 feet. Backfilled with bentonite chips.

Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jacobson Terminal

Seattle, Washington

Project No.

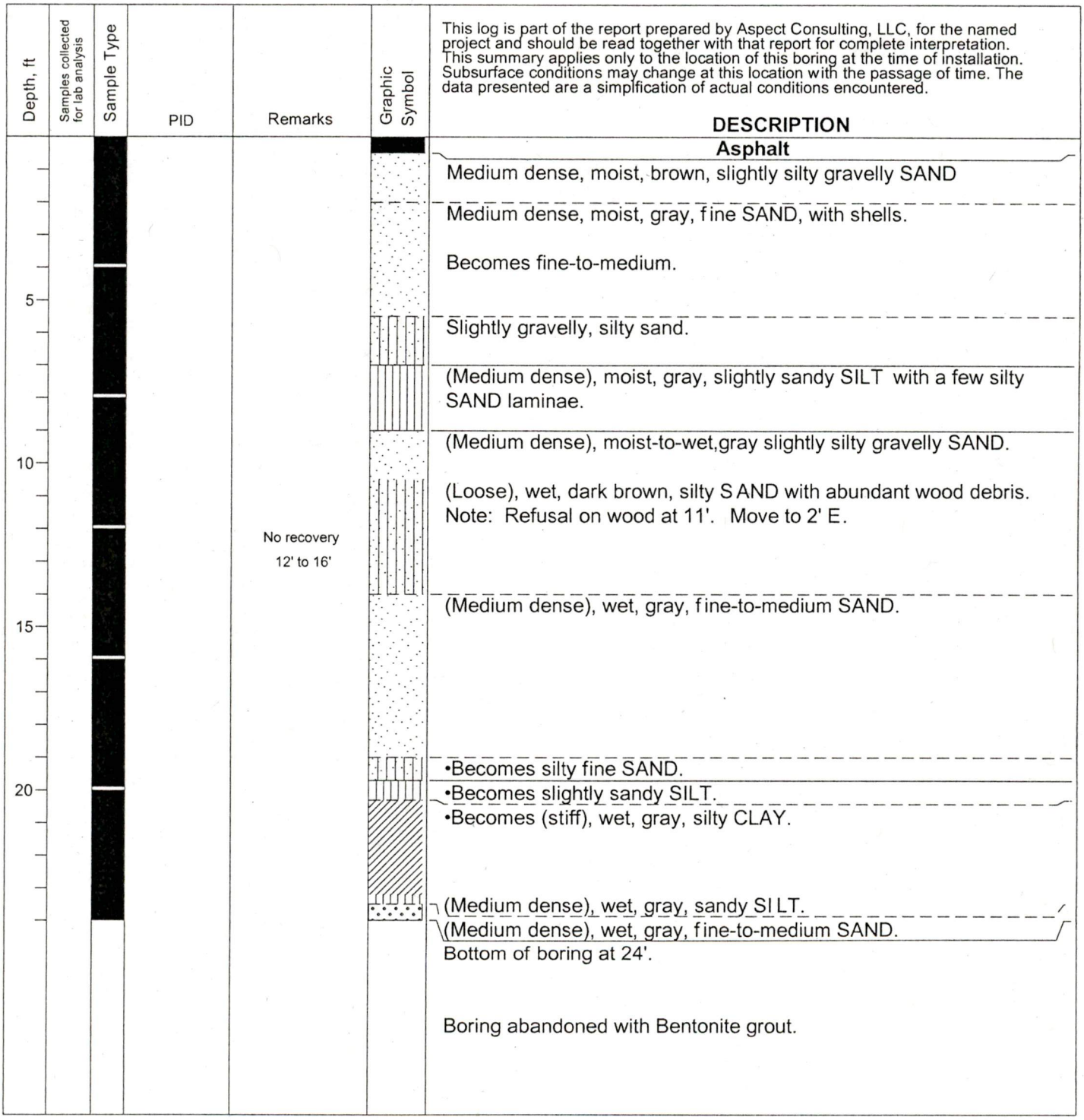
020030

Aspect consulting
IN-DEPTH PERSPECTIVE

:CTSP1 JACOBSON TERMINAL.GPJ November 10, 2003

LOG OF SOIL PROBE NO. SP-58

Location:



This log is part of the report prepared by Aspect Consulting, LLC, for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this boring at the time of installation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

DESCRIPTION

Asphalt

Medium dense, moist, brown, slightly silty gravelly SAND

Medium dense, moist, gray, fine SAND, with shells.

Becomes fine-to-medium.

Slightly gravelly, silty sand.

(Medium dense), moist, gray, slightly sandy SILT with a few silty SAND laminae.

(Medium dense), moist-to-wet,gray slightly silty gravelly SAND.

(Loose), wet, dark brown, silty SAND with abundant wood debris.
Note: Refusal on wood at 11'. Move to 2' E.

(Medium dense), wet, gray, fine-to-medium SAND.

•Becomes silty fine SAND.

•Becomes slightly sandy SILT.

•Becomes (stiff), wet, gray, silty CLAY.

(Medium dense), wet, gray, sandy SILT.

(Medium dense), wet, gray, fine-to-medium SAND.

Bottom of boring at 24'.

Boring abandoned with Bentonite grout.

Sampler Type (ST):

Continuous sample Geoprobe, 4-ft. long, 2-in. dia.

Water Level ATD

Jaconson Terminal

Seattle, Washington

Project No.

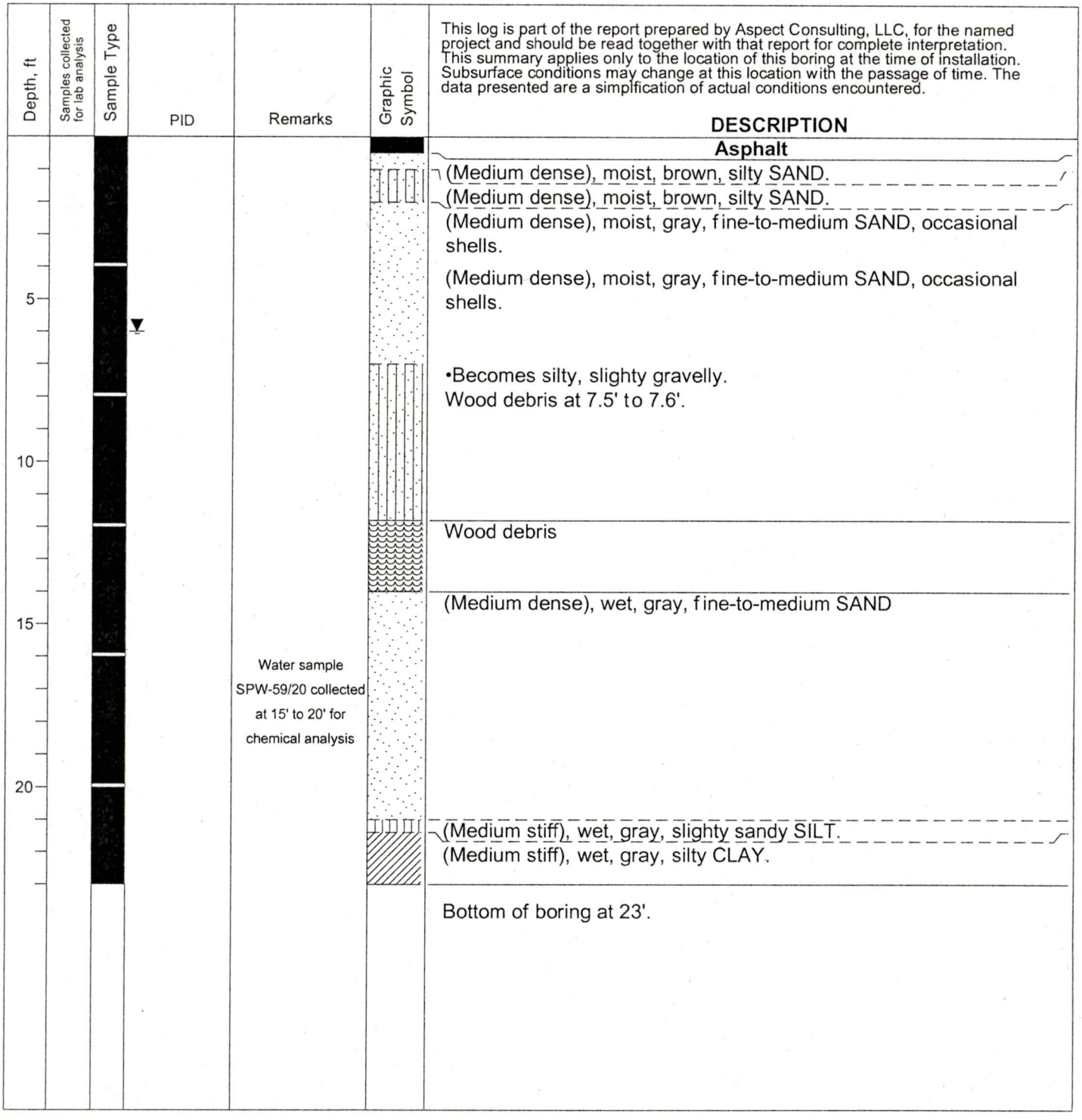
020030

Aspect consulting
IN-DEPTH PERSPECTIVE

SPECTSP1 JACTERMBORINGS.GPJ November 19, 2003

LOG OF SOIL PROBE NO. SP-59

Location:



This log is part of the report prepared by Aspect Consulting, LLC, for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this boring at the time of installation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

DESCRIPTION

Asphalt

(Medium dense), moist, brown, silty SAND.

(Medium dense), moist, brown, silty SAND.

(Medium dense), moist, gray, fine-to-medium SAND, occasional shells.

(Medium dense), moist, gray, fine-to-medium SAND, occasional shells.

•Becomes silty, slighty gravelly.
Wood debris at 7.5' to 7.6'.

Wood debris

(Medium dense), wet, gray, fine-to-medium SAND

(Medium stiff), wet, gray, slighty sandy SILT.

(Medium stiff), wet, gray, silty CLAY.

Bottom of boring at 23'.

Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jaconson Terminal

Seattle, Washington

Project No.

020030

Aspect consulting
IN-DEPTH PERSPECTIVE

SPECTSP1 JACTERMBORINGS.GPJ November 19, 2003

LOG OF SOIL PROBE NO. SP-60

Location:

Depth, ft	Samples collected for lab analysis	Sample Type	PID	Remarks	Graphic Symbol	DESCRIPTION
						This log is part of the report prepared by Aspect Consulting, LLC, for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this boring at the time of installation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.
						Asphalt
						(Medium dense), moist, brown, gravelly SAND.
5						(Medium dense), moist, brown to gray, fine-to-medium SAND. •Becomes silty.
						(Medium dense), wet, brown to gray, slightly silty fine-to-medium SAND.
10						Wood debris.
						(Medium dense), wet, brown to gray, SAND. •Becomes slightly gravelly SAND.
						(Medium stiff), wet, dark brown, organic SILT with abundant wood debris.
15						(Medium dense), wet, gray, gravelly SAND.
				Water sample SPW-60/19 collected at 16' to 19' for chemical analysis		(Medium dense), wet, gray, fine-to-medium SAND.
						(Medium dense), wet, gray, silty fine SAND.
						Interbedded silty SAND.
20						(Medium stiff), wet, gray SILT.
						Bottom of boring at 20'.

Sampler Type (ST):

- Continuous sample Geoprobe, 4-ft. long, 2-in. dia.
- Water Level ATD

Jaconson Terminal

Seattle, Washington

Project No.

020030

Aspect consulting
IN-DEPTH PERSPECTIVE

SPECTSP1 JACTERMBORINGS.GPJ November 19, 2003

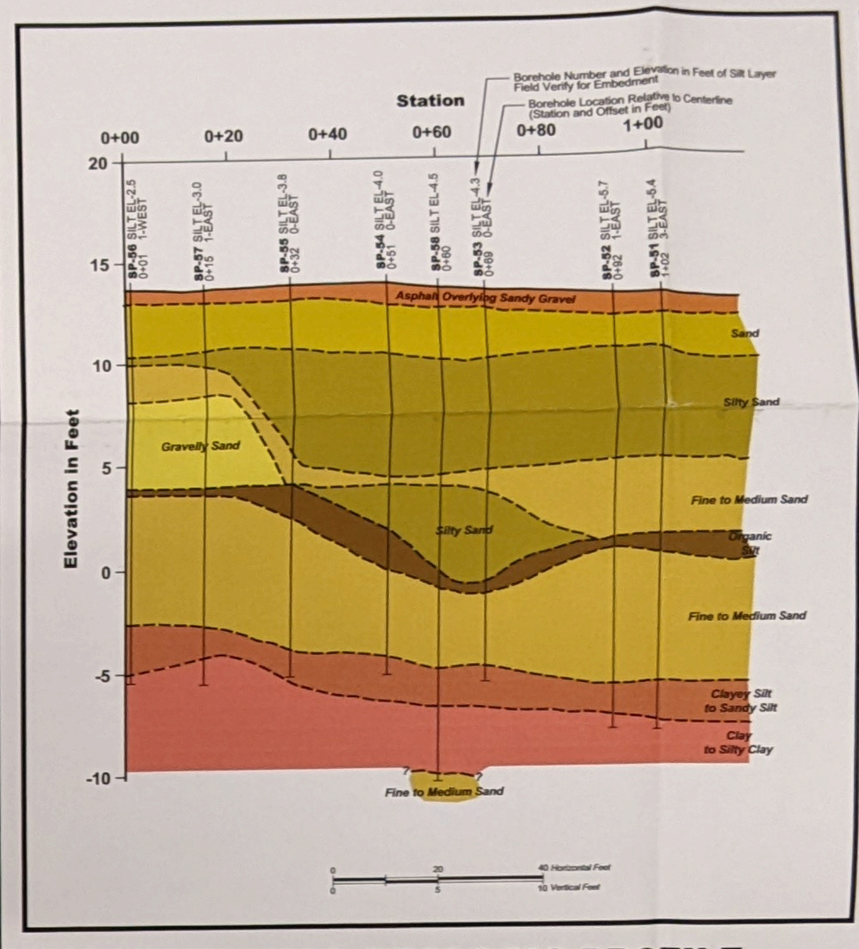
Legend

- Monitoring Well
- Compliance Monitoring Program Well
- Proposed Monitoring Well
- Geoprobe Boring
- Injection Point
- Property Boundary
- A A' Line of Cross-Section
- Concrete Surface
- Cement-Bentonite Slurry Wall
- Permeable Iron/Sand Treatment Gate
- Iron/GAC/Sand Permeable Sorptive/Reactive Wall
- Overhead Power
- Sanitary Sewer Line
- Utility Trench
- Water Line
- Vinyl Chloride *-estimated extent above screening level*
- 1,4-Dichlorobenzene *estimated extent in ground water above screening levels*

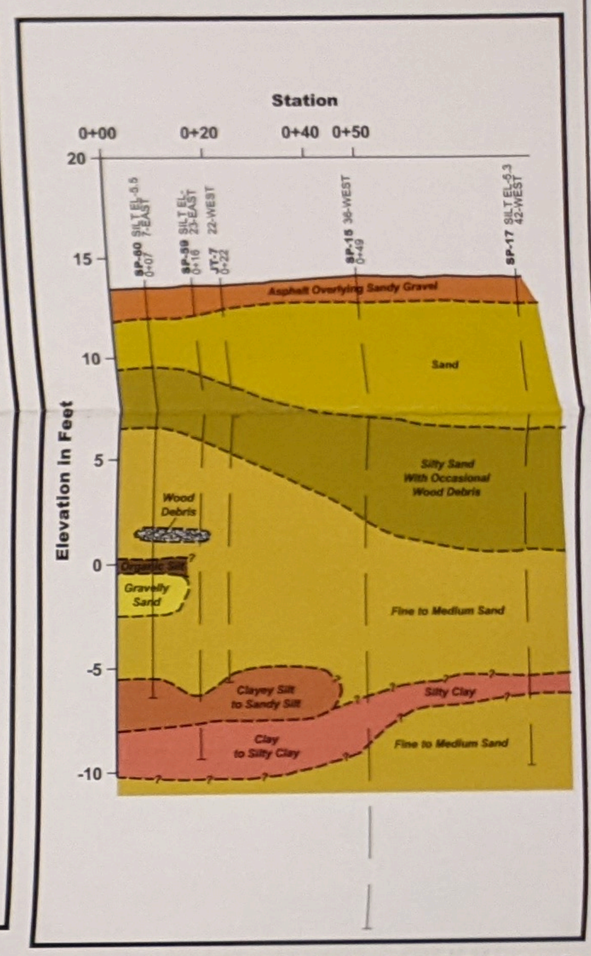
Note: Ground water screening levels based on MTCA Method B surface water cleanup levels-

Vinyl Chloride: 2.92 µg/L
1,4-Dichlorobenzene: 4.86 µg/L

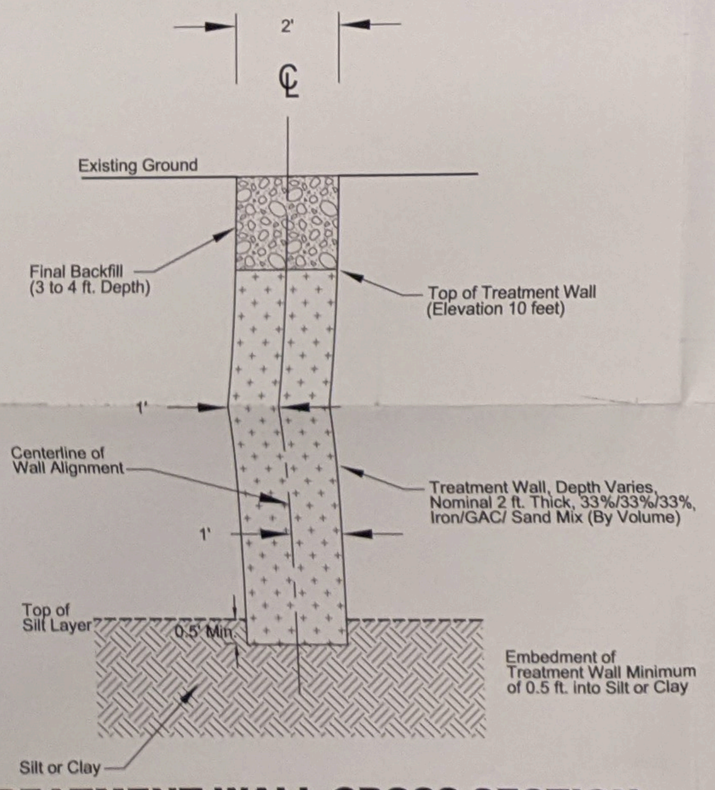
SITE PLAN



MAIN WALL GEOLOGIC PROFILE (0+00 - 1+00)

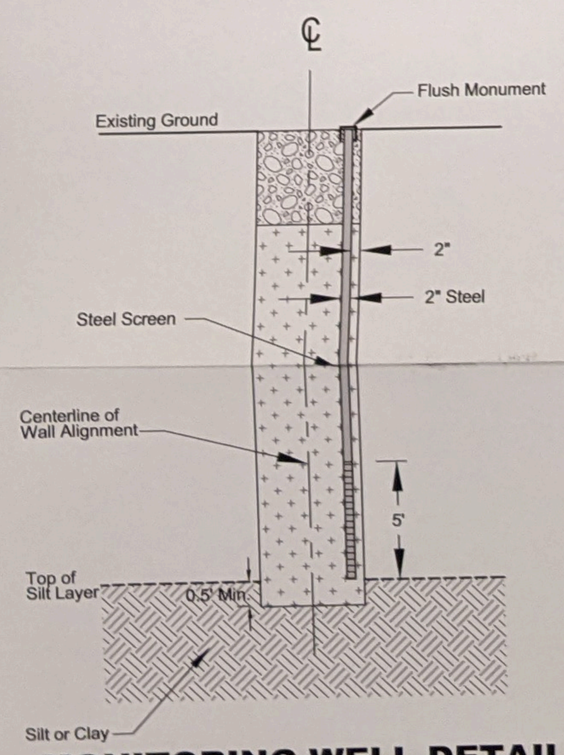


SOUTHWEST WING GEOLOGIC PROFILE (0+00 - 0+50)



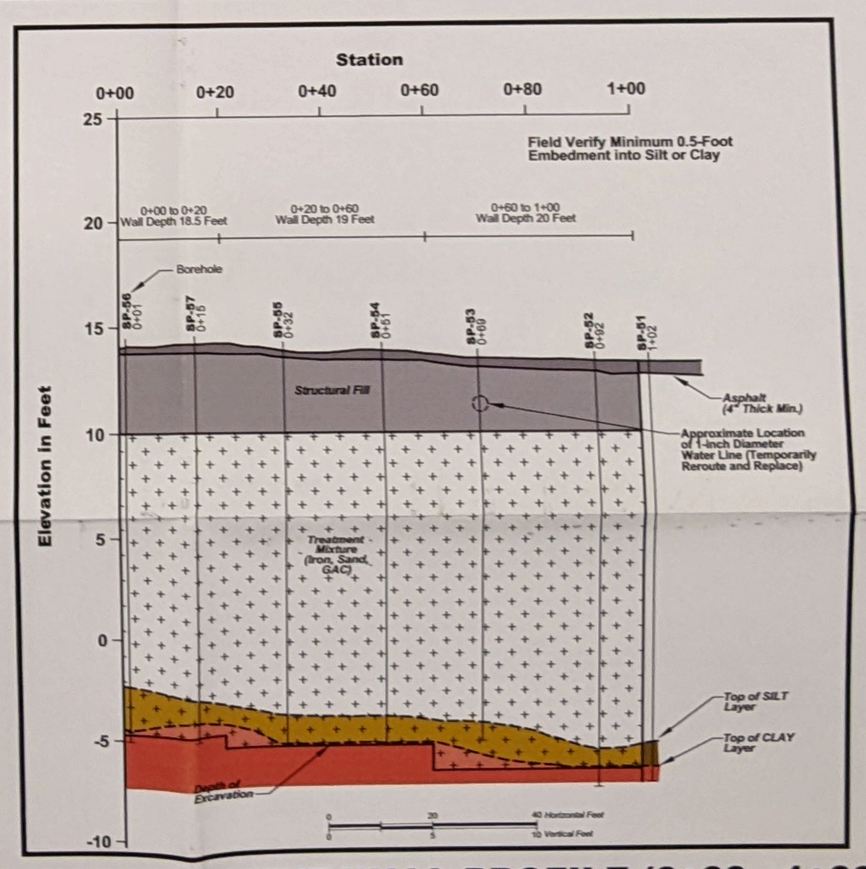
TREATMENT WALL CROSS SECTION

N.T.S.

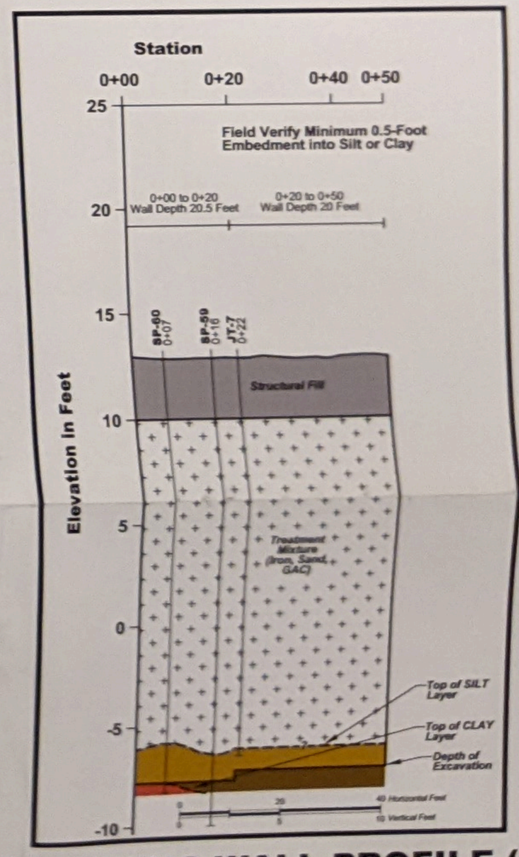


MONITORING WELL DETAILS

N.T.S.



MAIN TREATMENT WALL PROFILE (0+00 - 1+00)



SOUTHWEST WING WALL PROFILE (0+00 - 0+50)

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IN-DEPTH PERSPECTIVE
179 Madrone Lane North, Bainbridge Island, WA 98110, (206) 780-9370
811 First Avenue #480, Seattle, WA 98104, (206) 328-7443

Reactive/Sorptive Wall Conceptual Layout

Jacobson Terminals
Seattle, Washington

DATE: 11/2003	PROJECT NO. 020030
DESIGNED BY: JJP	
DRAWN BY: JRS	FIGURE NO. 1
APPROVED BY: -	

Q:\Jacobson\020030 Market Street\2003-11\020030-02.dwg