HWA GeoSciences Inc.
DBE/MWBE

May 1, 2020
HWA Project No. 98165-675

City of Everett Public Works Department
3200 Cedar Street
Everett, WA 98201

Attention: Mark Sadler

Subject: **Gas Monitoring Probes, Northwest West Area of Landfill / LG-77 Area**
Everett Landfill/Tire Fire Site
Everett, Washington

Dear Mark,

This letter describes the rationale for location of a new replacement landfill gas probe along the northwest edge of the Everett Landfill/Tire Fire Site (Landfill Site). Landfill gas probes are a component of long-term monitoring to assess the potential for landfill gas to be exiting the footprint of the Landfill Site.

Figure 1 shows the location of past and current gas monitoring probes in the northwest corner of the Landfill Site. Prior to 2007 the City of Everett (City) had installed and monitored a continuous line of gas monitoring probes along the western boundary of the landfill, spaced at around 200-foot centers (LG-21 through LG-40). Prior to construction of the western landfill gas extraction trench in 2004, three of these probes (LG-36, LG-37, and LG-38) had methane exceeding the 5% action level. After mid 2005, following construction of the perimeter gas collection system, only LG-38 had methane exceeding 5%. The City then installed LG-56 and LG-57 further west and uphill of the landfill, and neither had any methane exceeding 5%. In 2007, the Burlington Northern Santa Fe (BNSF) Railroad constructed new rail lines west of the landfill, and the northern five (western perimeter) gas probes (LG-36 through LG-40) had to be decommissioned in August 2007 to make way for the new rail lines. The City then added two new probes (LG-77 and LG-78) in 2008, further west and uphill of the landfill and railroad tracks to provide replacement compliance monitoring points for the probes removed along the rail alignment. Of these probes, only LG-77 ever exhibited methane above 5%. LG-56 located north of LG-77 was damaged in 2015 but was not replaced because it never had any methane exceedances.

Gas probe LG-77 began showing consistent methane concentrations exceeding 5% in 2011. The LG-77 boring encountered fill with wood down to 15 feet depth, and the probe was screened from 14 to 35 feet. This screen interval was meant to correspond to the elevation of refuse within the Landfill, but was screened across a portion of the of the surficial fill (not associated with the landfill) that included wood

21312 30th Drive SE
Suite 110
Bothell, WA 98021-7010
Tel: 425.774.0106
Fax: 425.774.2714
www.hwageo.com

materials. The methane detected in LG-77 was likely coming from wood-containing fill beneath the property, and not migration of landfill gas from the Landfill Site.

LG-77 was decommissioned in December 2019 during a soil cleanup excavation in the area. LG-77 was located on a property which is a listed Washington State Department of Ecology (Ecology) Model Toxic Control Act (MTCA) site, the former Smith Street Sawmill Site, VCP Number NW3188. The cleanup was performed to address minor isolated detections of polynuclear aromatic hydrocarbons in the fill soils. The remedial excavation removed much of the fill around LG-77 and replaced it with clean imported fill. As part of the 2020 new landfill gas probe installation, a replacement probe (LG-95) was installed in close proximity to the former LG-77 location. LG-95 did not contain methane exceeding the Landfill Site perimeter action level of 5% by volume when monitored in April 2020 (1.6% methane by volume was measured on April 17, and 0% methane was measured on April 23, after more extended purging of the probe).

LG-95 was screened only in the deeper sand (not the fill), which is at the same elevation as landfill waste. Appendix A contains boring and completion logs for probes LG-36, 37, 38, 56, 57, 58, 77, 78 and 95. Figures 2 and 3 show a location map and cross section through the northwestern corner of the landfill and uphill to LG-77 and LG-95.

The landfill is located at the western edge of the Snohomish River valley, which is underlain by recent (Holocene) alluvial sediments. Areas further west and uphill are underlain by older (Pleistocene) glacial deposits. The cross section illustrates that the fill encountered at LG-77, some of which was removed during the 2020 cleanup, is above the elevation of landfill waste, and physically separated from the landfill by the 10 foot deep gas extraction trench, highly permeable railroad ballast under three sets of railroad tracks, and a 10 foot layer of silt encountered in both LG-77 and LG-95. The absence of methane in LG-95 compared to LG-77 further confirms that the methane previously detected in LG-77 was locally derived, from fill soils, and not connected to the landfill.

The former Smith Street Sawmill property, on which LG-77 was located and new probe LG-95 is located, is a Designated Potential Methane Hazard Zone Parcel, under the City's "methane hazard zone" permit requirement for properties near the landfill, which requires methane hazard assessment and mitigation for all development in this area (https://everettwa.gov/DocumentCenter/View/24125/Construction-within-a-potential-methane-hazard-zone-PDF). Methane assessment and mitigation measures are modelled after the City of Los Angeles Mitigation Standards, which include detailed procedures and plans for assessment and mitigation.

In conclusion, the northwest corner of the landfill is in compliance for perimeter landfill gas monitoring, and no further action other than continued quarterly monitoring of existing probes is recommended in this area.

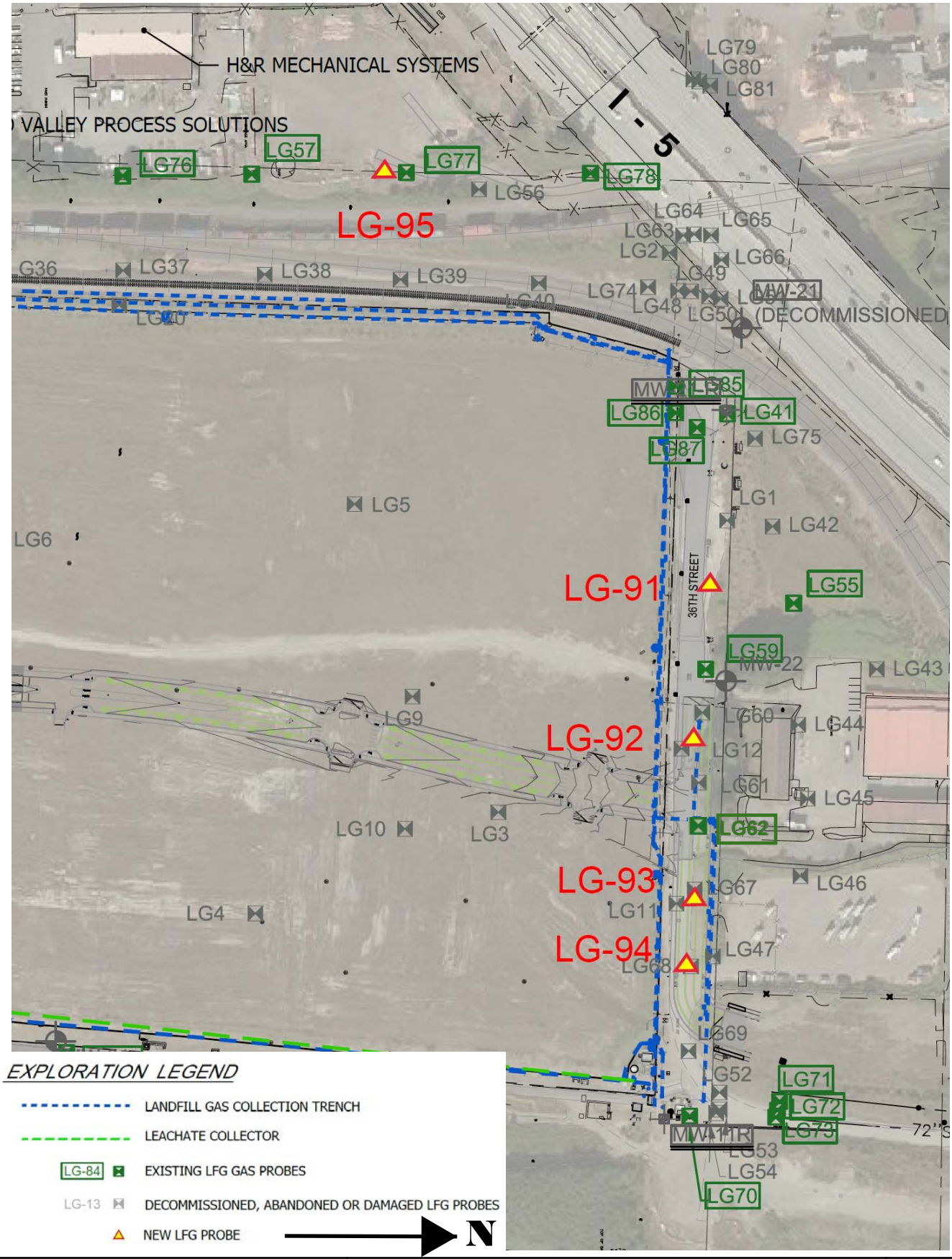
May 1, 2020
HWA Project No. 98165-670

We appreciate the opportunity to provide our services. Please feel free to call if you have any questions or need more information.

Sincerely,
HWA GEOSCIENCES INC.

Arnie Sugar, LG, LHG
Principal Hydrogeologist

Attachments:
Figure 1 Gas Probe Locations
Figure 2 Cross Section Location Map
Figure 3 Cross Section A – A"
Attachment A - Selected boring logs (LG-36, 37, 38, 56, 57, 77, 78, and 95)



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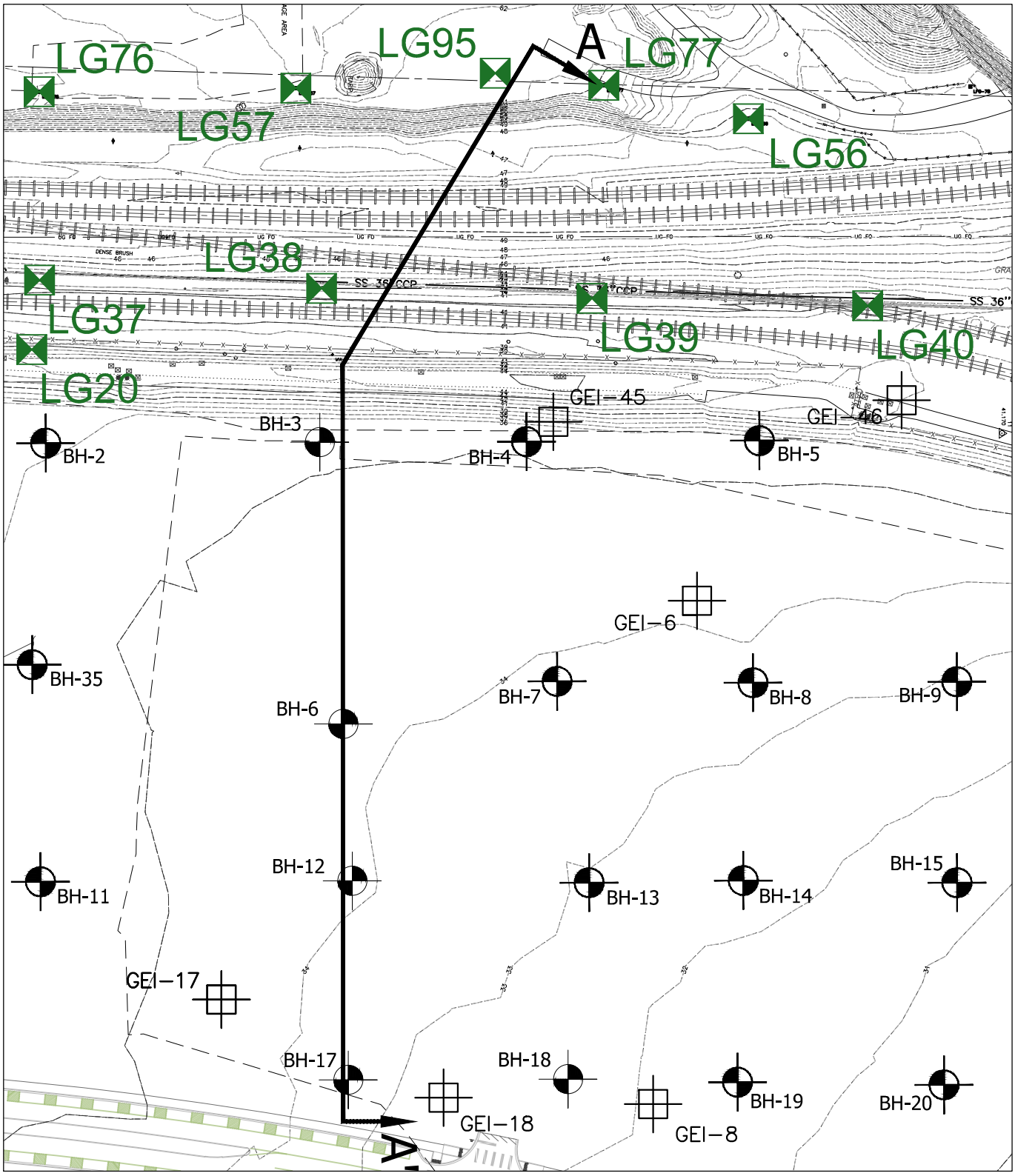
NEW GAS PROBES, NORTH BOUNDARY

EVERETT LANDFILL
EVERET, WASHINGTON

FIGURE NO.
1

PROJECT NO.
1998-165



EVERETT LANDFILL

A A' GEOLOGIC CROSS SECTION

0 50' 100' 150' 200'

SCALE: 1" = 100'

N

SITE AND EXPLORATION PLAN

EVERETT LANDFILL
EVERETT, WASHINGTON

FIGURE NO.: 2

DRAWN BY: CF

CHECK BY: AS

PROJECT # 1998-165-675

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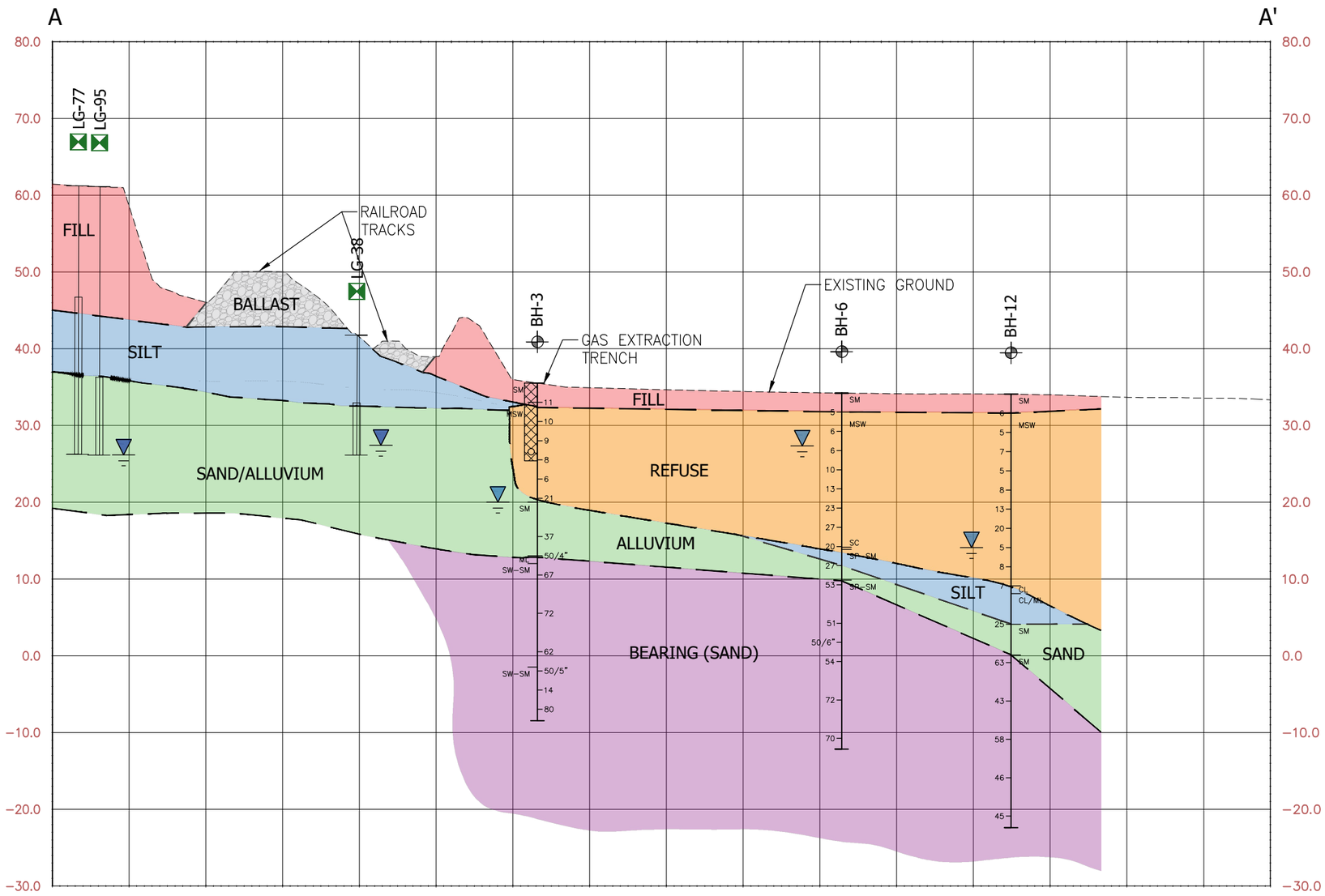
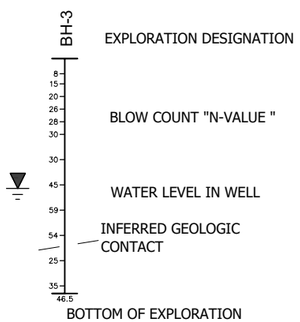
S:\2015 PROJECTS\2015-061-21 EVERETT RIVERFRONT SETTLEMENT CALCULATIONS\CAD 2015-061\EVERETT LANDFILL (1998-165-275)\2015-061 EVERETT RIVERFRONT - LANDFILL (EAST-WEST).DWG <1> Plotted: 4/30/2020 2:37 PM



BORE LEGEND



SOILS LEGEND

- FILL
- SILT
- REFUSE
- ALLUVIUM
- BEARING (SAND)
- BALLAST

0 40 80 120 160
HORIZ. SCALE: 1" = 80'

0 8 16 24 32
VERT. SCALE: 1" = 16'

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EVERETT LANDFILL
EVERETT, WASHINGTON

GEOLOGIC CROSS SECTION A-A'

DRAWN BY:	FIGURE NO.:
CF	3
CHECK BY:	PROJECT NO.:
AS	1998-165-675

S:\2015 PROJECTS\2015-061-21 EVERETT RIVERFRONT SETTLEMENT CALCULATIONS\CAD 2015-061\EVERETT LANDFILL (1998-165-275)\2015-061 EVERETT LANDFILL CROSS SECTIONS 04.13.2020.DWG <2> Plotted: 4/30/2020 3:07 PM

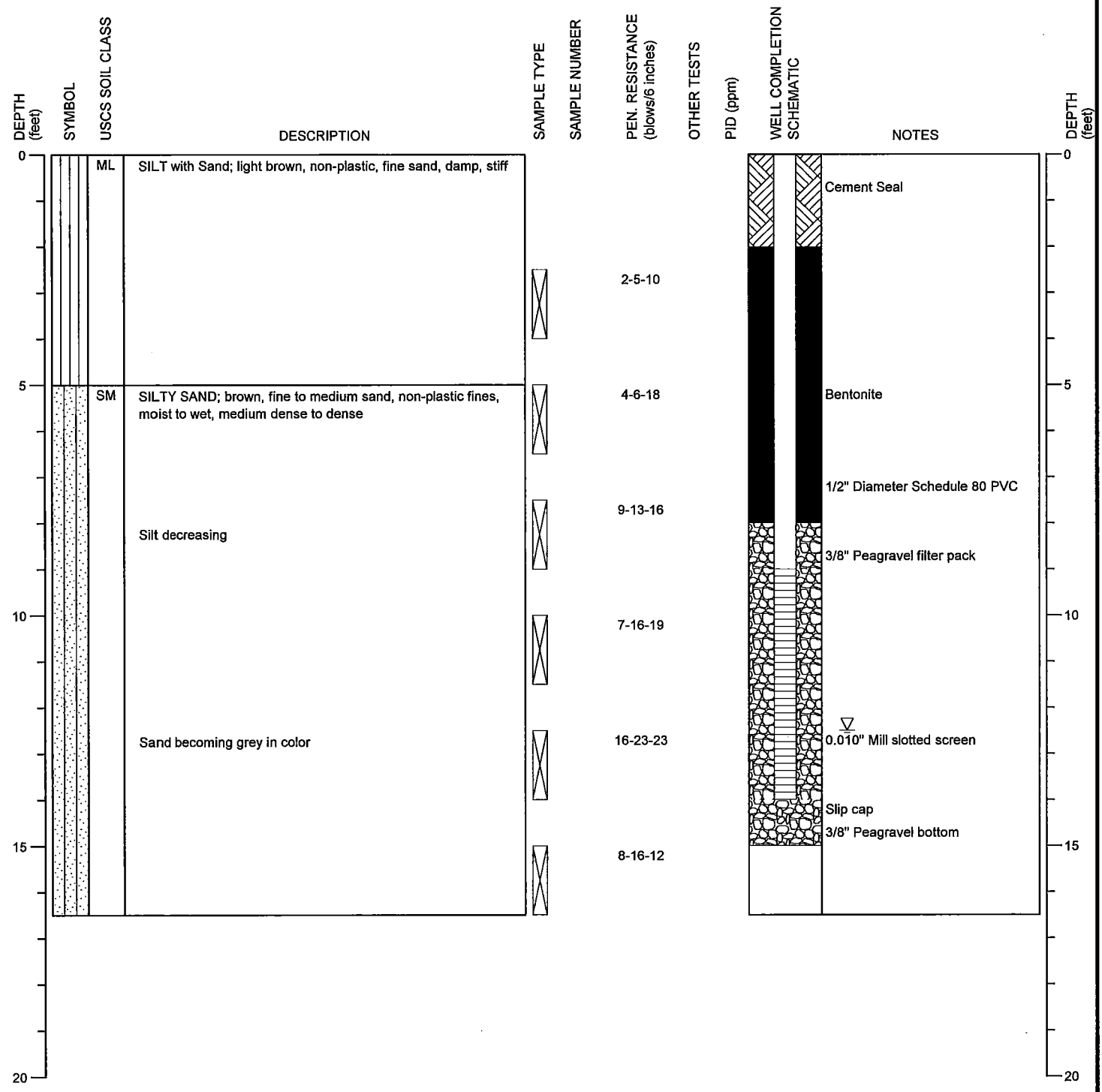
ATTACHMENT A

SELECTED BORING LOGS

DRILLING COMPANY: Cascade Drilling, Inc.
DRILLING METHOD: HSA, 8.25" O.D., Track Rig
SAMPLING METHOD: SPT on Winch Line
LOCATION: Everett, Washington

SURFACE ELEVATION: ± feet

DATE STARTED: 4/25/2001
DATE COMPLETED: 4/25/2001
LOGGED BY: S. Zorn



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-36

PAGE: 1 of 1

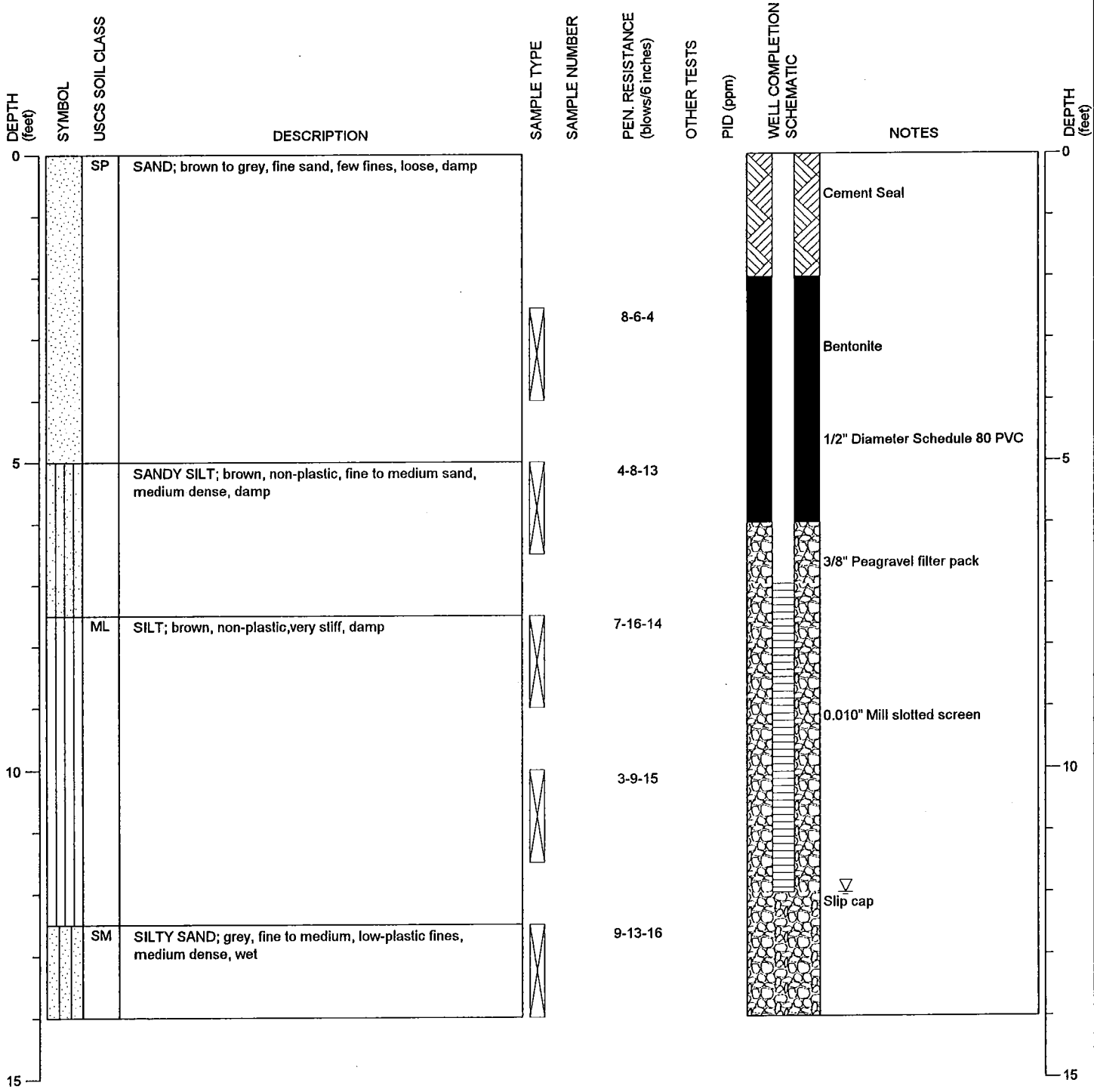
PROJECT NO.: 98165

FIGURE: A-25

MWELL 98165.GPJ 1/30/07

DRILLING COMPANY: Cascade Drilling, Inc.
DRILLING METHOD: HSA 8.25" O.D., Track rig
SAMPLING METHOD: SPT on winch line
SURFACE ELEVATION: ± feet

LOCATION: Everett, Washington
DATE STARTED: 4/25/2001
DATE COMPLETED: 4/25/2001
LOGGED BY: S. Zorn



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EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-37

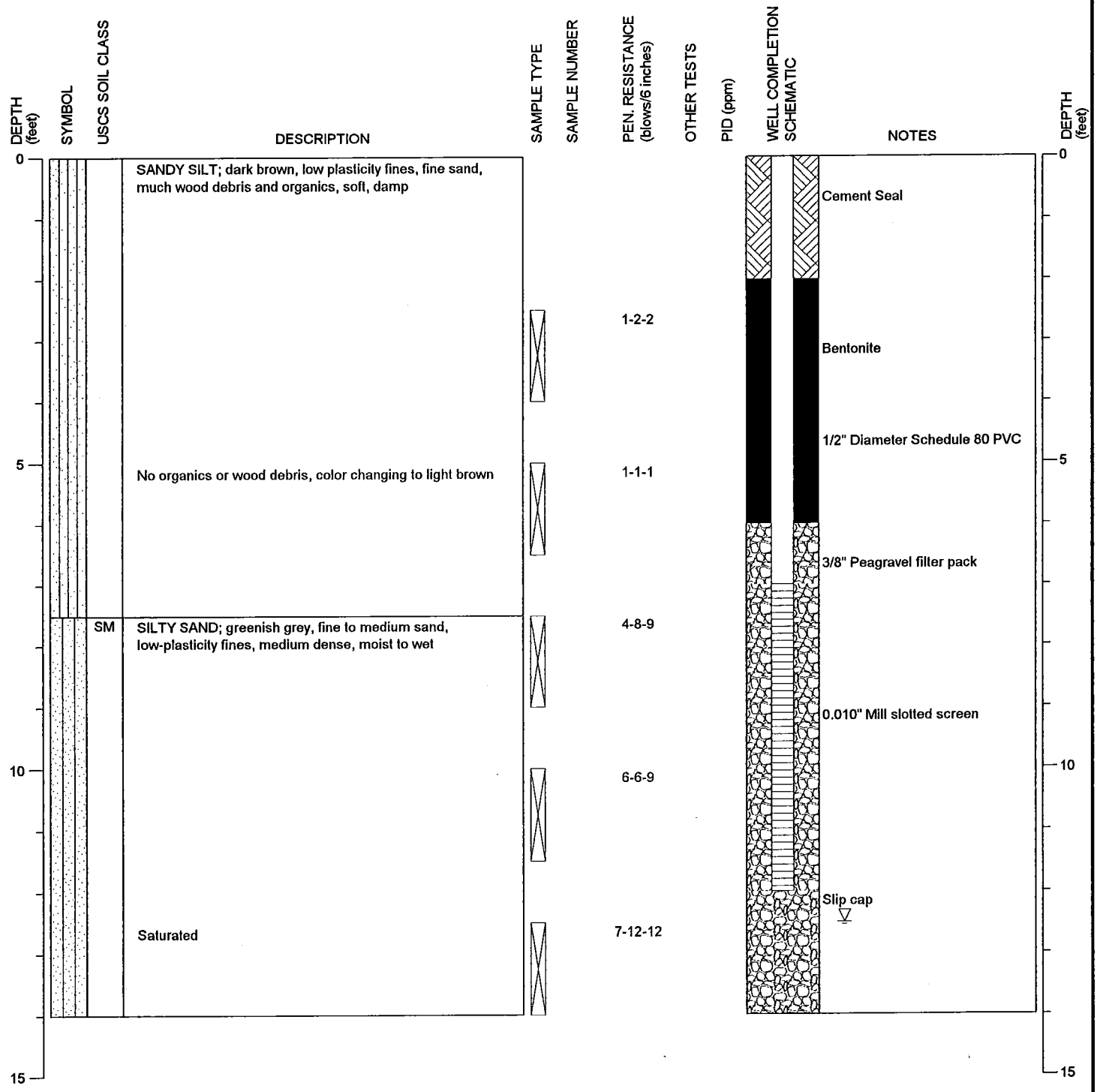
PAGE: 1 of 1

PROJECT NO.: 98165 FIGURE: A-26

MWELL 98165.GPJ 4/18/03

DRILLING COMPANY: Cascade Drilling, Inc.
DRILLING METHOD: HSA, 8.25" O.D., Track rig
SAMPLING METHOD: SPT on winch line
SURFACE ELEVATION: ± feet

LOCATION: Everett, Washington
DATE STARTED: 4/26/2001
DATE COMPLETED: 4/26/2001
LOGGED BY: S. Zorn



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EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-38

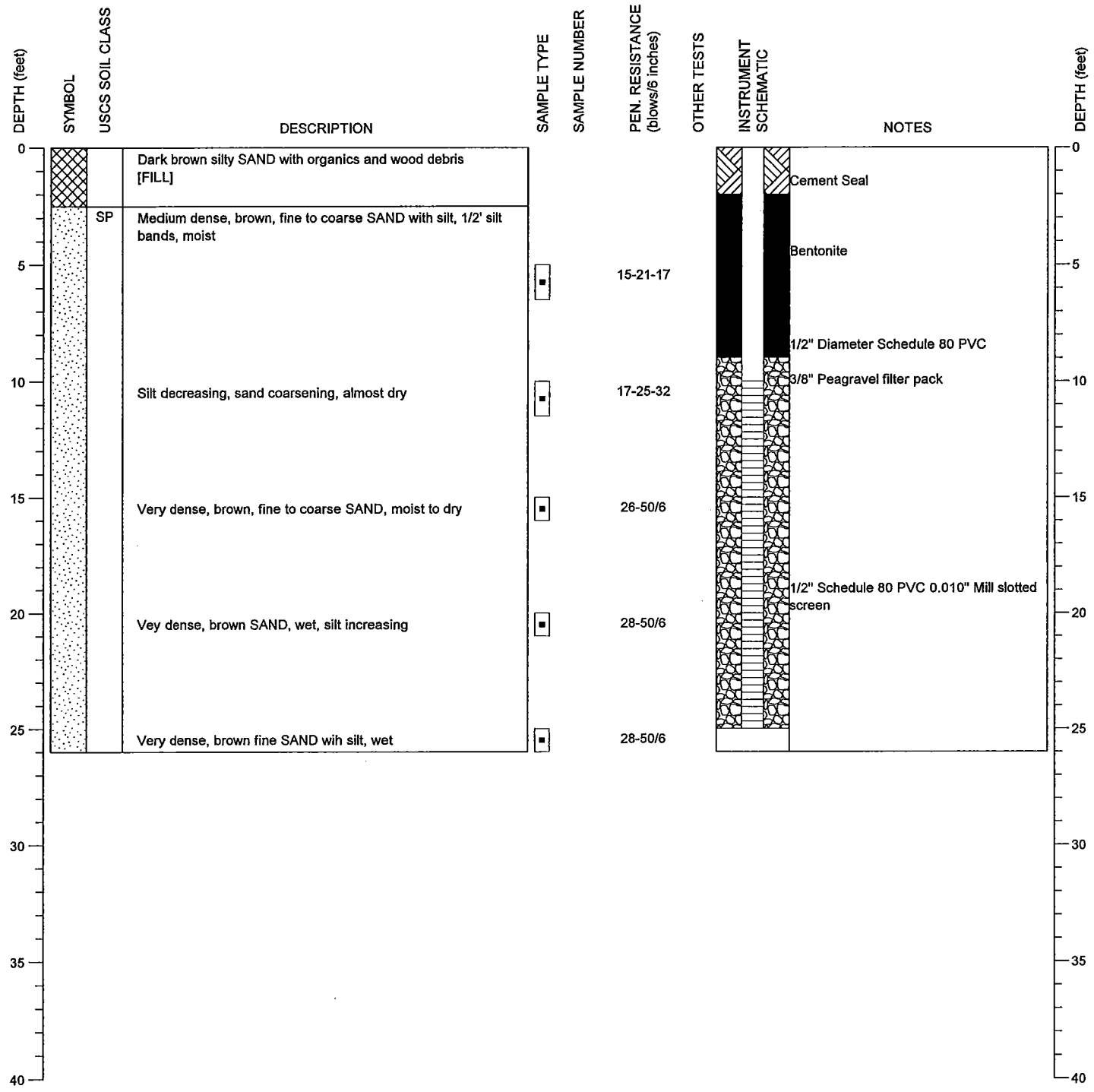
PAGE: 1 of 1

PROJECT NO.: 98165 FIGURE: A-27

MWELL 98165.GPJ 4/18/03

DRILLING COMPANY: Cascade Drilling, Inc.
DRILLING METHOD: HSA, 8.25" OD
SAMPLING METHOD: 3" D&M on winch line
SURFACE ELEVATION: ± feet

LOCATION: Everett, Washington
DATE STARTED: 10/22/01
DATE COMPLETED: 10/22/01
LOGGED BY: S. Zorn



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EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-56

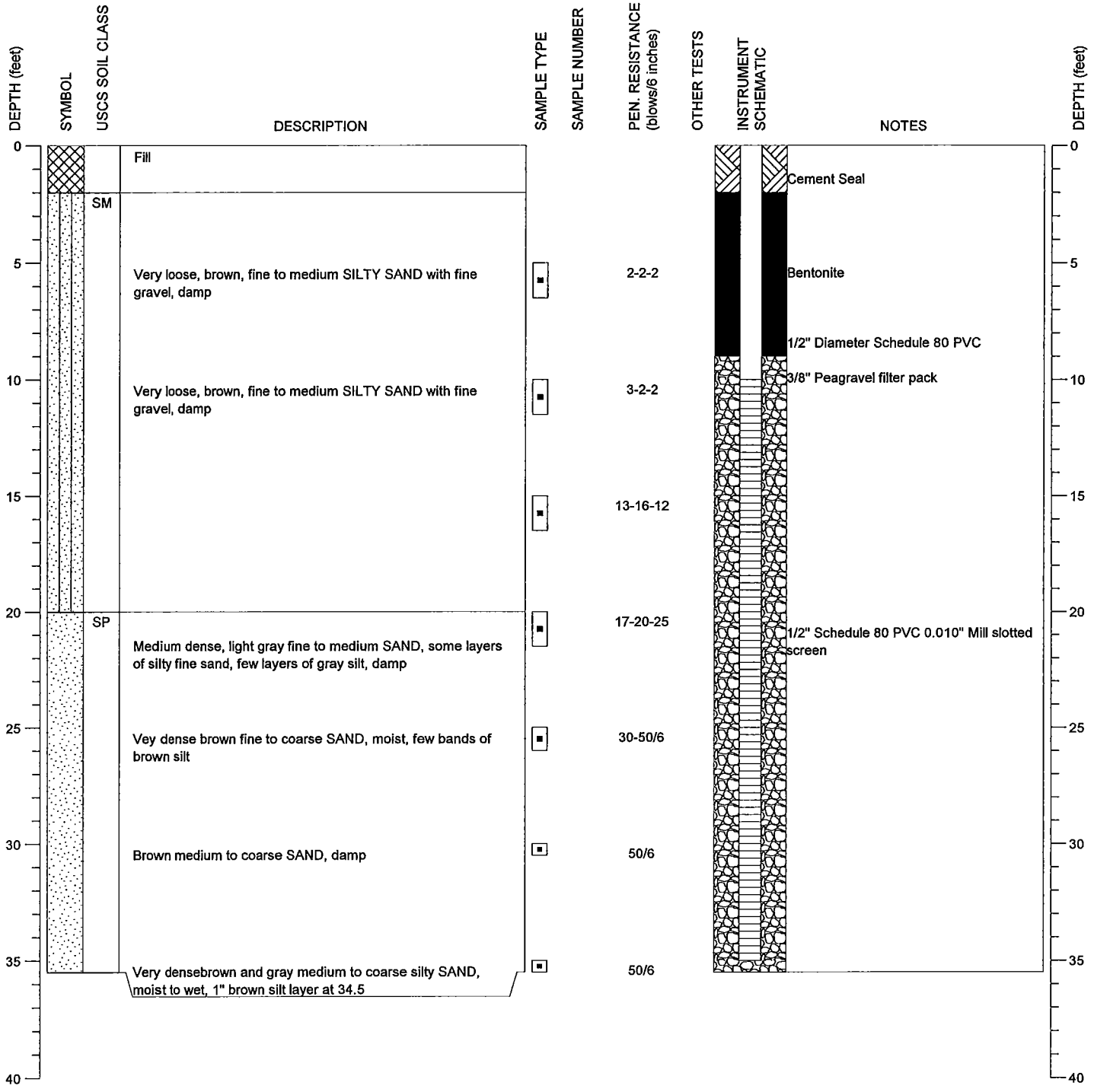
PAGE: 1 of 1

PROJECT NO.: 98165 FIGURE: A-

INST 98165.GPJ 2/19/02

DRILLING COMPANY: Cascade Drilling, Inc.
DRILLING METHOD: HSA, 8.25" OD
SAMPLING METHOD: 3" D&M on winch line
SURFACE ELEVATION: ± feet

LOCATION: Everett, Washington
DATE STARTED: 10/22/01
DATE COMPLETED: 10/22/01
LOGGED BY: S. Zorn



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EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-57

PAGE: 1 of 1

PROJECT NO.: 98165 FIGURE: A-

INST 98165.GPJ 2/19/02

DRILLING COMPANY: Holocene Drilling
DRILLING METHOD: HSA, 6" ID, Autohammer
SAMPLING METHOD: SPT, Split Spoon
LOCATION: 47 58 08.0 122 11 42.7

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 2/29/2008
DATE COMPLETED: 2/29/2008
LOGGED BY: J. Speck

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	PID (ppm)	WELL COMPLETION SCHEMATIC	NOTES
0		CM	Crushed rock fill at surface.							Cement Seal Bentonite 1/2" Diameter Schedule 80 PVC
		ML	Medium stiff, dark brown, sandy SILT with gravel, moist. Gravel is fine to medium, sub-angular to sub-rounded. Some construction debris (brick, glass). Trace organic material (rootlets).		S-1	1-2-2				
5					S-2	0-1-1				
					S-3	2-2-1				
10		ML SM	Soft, dark brown, to dark gray, sandy SILT to silty, fine to medium SAND with gravel. Gravel is fine, sub-angular to sub-rounded. Trace construction debris (decomposing asphalt). Trace decomposing wood at 10.3 and 11.1 feet below ground surface (less than 0.1 feet thickness). Trace dark brown organic silt lenses at 11.0 and 11.2 (less than 0.1 feet thickness).		S-4	2-1-2				
15		ML	Soft, dark yellow brown, sandy SILT, moist.		S-5	0-1-1				3/8" Peagravel filter pack 1/2" Schedule 80 PVC 0.010" Mill slotted screen
20			Grades to stiff silt. Trace fine sand lenses (less than 0.1 feet thickness).		S-6	2-5-7				
25		SP	Medium dense, yellow brown, fine to medium SAND, moist. Trace silt in top 0.25 feet of sample. Two inches of sandy silt from 30.1 to 30.2 feet below ground surface.		S-7	2-5-13				
30					S-8	18-15-13				
35					S-9	13-18-18				
40			Exploration completed at 36.5 feet below ground surface. No ground water noted during exploration. No organic vapors detected with photoionization detector. No elevated LEL readings. Landfill gas monitoring well installed. Formation screened from 15 to 35 feet below ground suface.							
45										

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-77

PAGE: 1 of 1

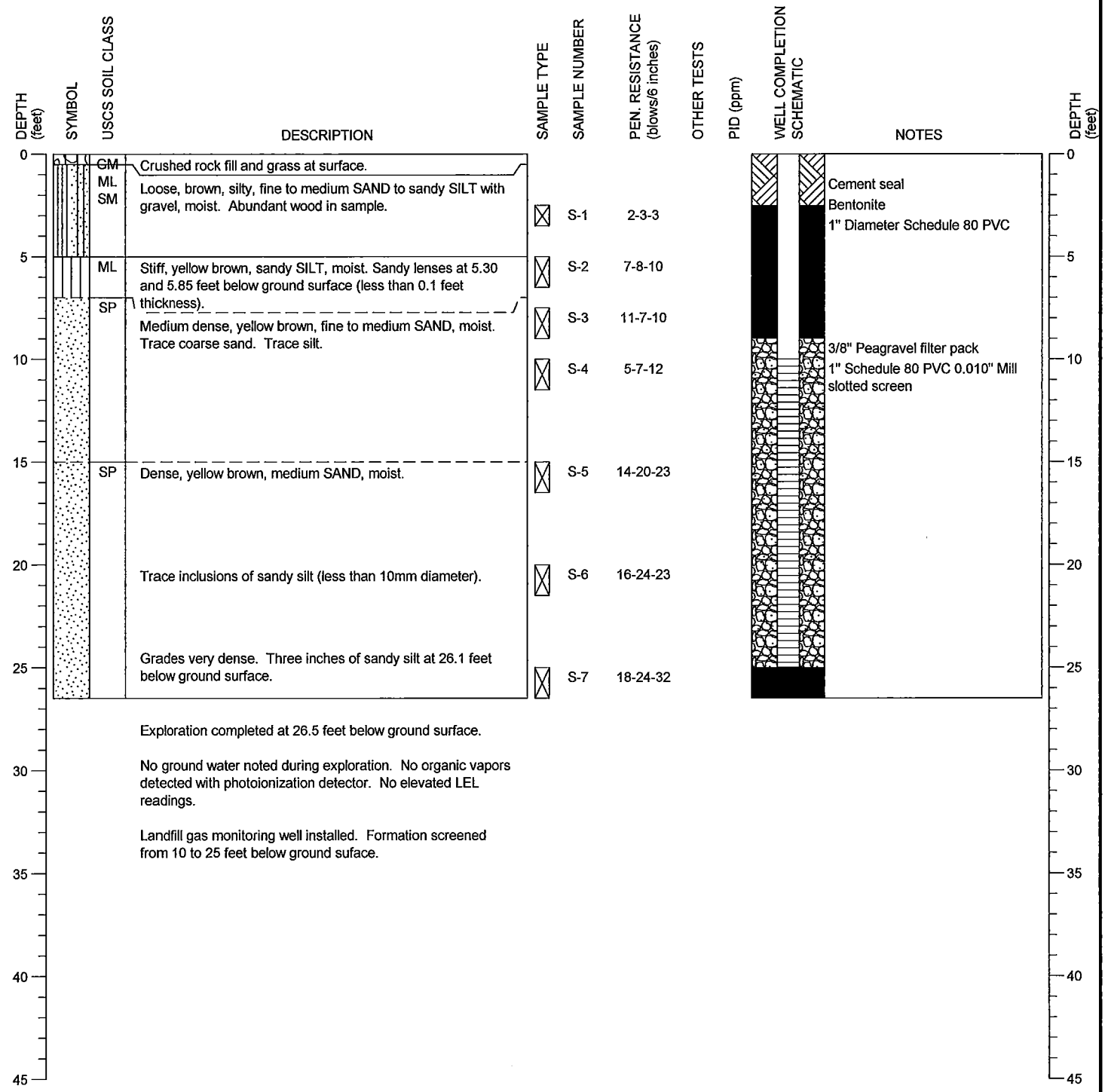
PROJECT NO.: 98165 FIGURE: A-3

MWELL 98165.GPJ 2/15/11

DRILLING COMPANY: Holocene Drilling
DRILLING METHOD: HSA, 6" ID, Autohammer
SAMPLING METHOD: SPT, Split Spoon
LOCATION: 47 58 10.2 122 11 42.6

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 2/29/2008
DATE COMPLETED: 2/29/2008
LOGGED BY: J. Speck



Exploration completed at 26.5 feet below ground surface.

No ground water noted during exploration. No organic vapors detected with photoionization detector. No elevated LEL readings.

Landfill gas monitoring well installed. Formation screened from 10 to 25 feet below ground suface.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-78

PAGE: 1 of 1

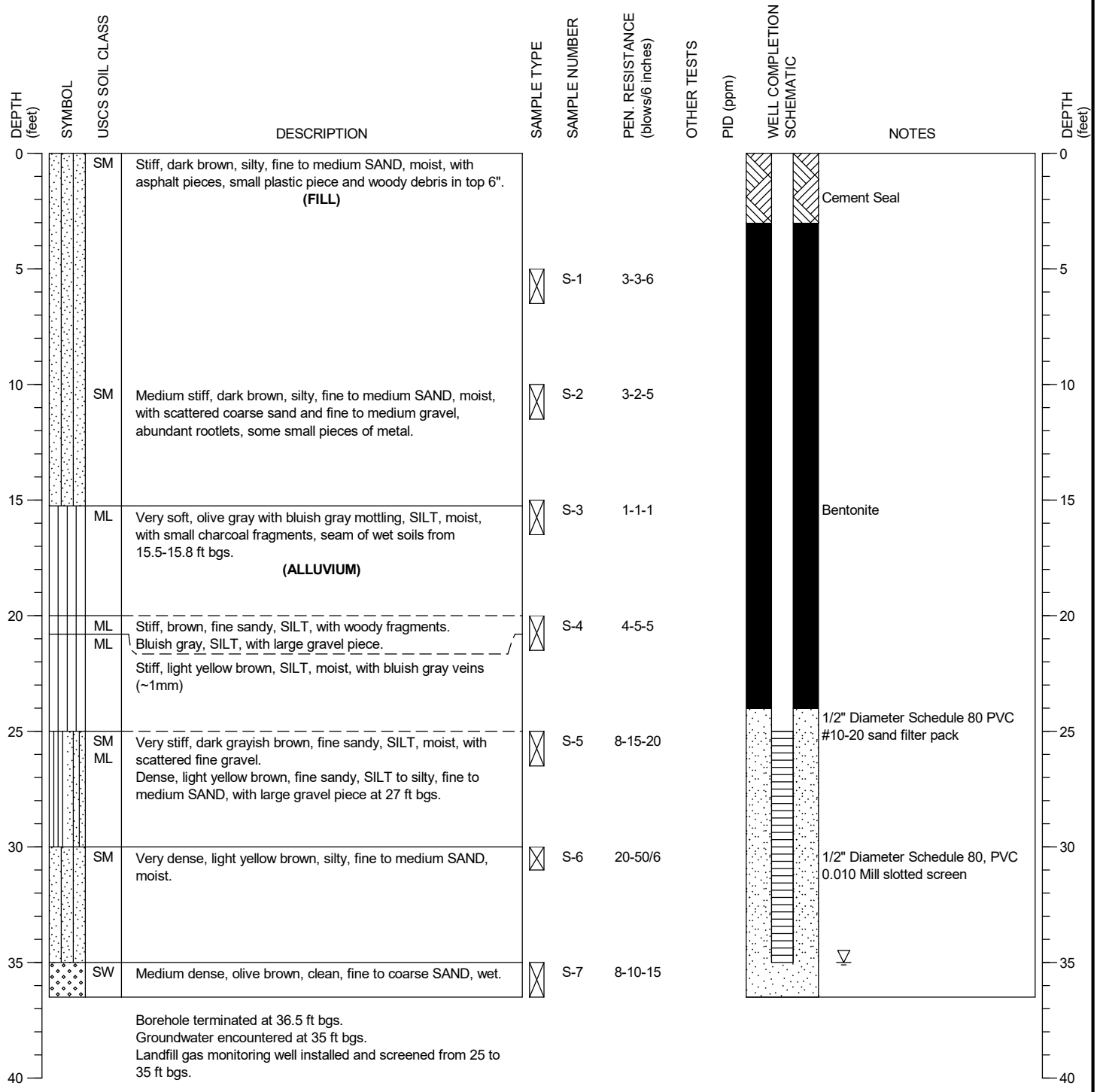
PROJECT NO.: 98165 FIGURE: A-4

MWELL 98165.GPJ 2/15/11

DRILLING COMPANY: Cascade Drilling, Inc.
DRILLING METHOD: HSA, Truck Mounted CME-75
SAMPLING METHOD: 3" D&M on winch line
LOCATION: Everett, Washington

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 3/5/2020
DATE COMPLETED: 3/5/2020
LOGGED BY: A. York



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HWA GEOSCIENCES INC.

EVERETT LANDFILL
EVERETT, WASHINGTON

Landfill Gas Probe:
LFG-95

PROJECT NO.: 98165 FIGURE: A-