APPENDIX A: BORING AND CPT LOGS

Appendix A

Boring and CPT Logs

CONTENTS

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

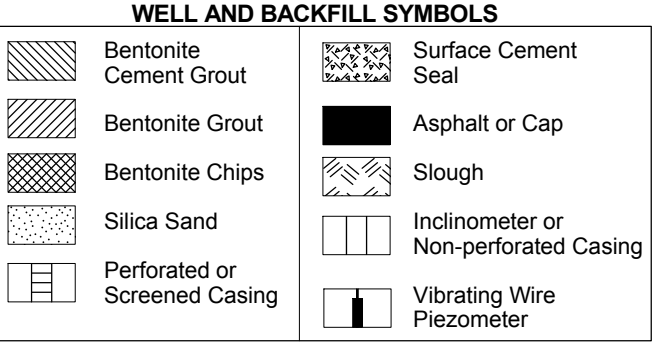
PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS



PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Potash Export Terminal
Grays Harbor
Hoquiam, Washington

SOIL DESCRIPTION AND LOG KEY

March 2019 101575-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 3

SOIL_CLASS_KEY_PG1 21-22276.GPJ SHAN_WIL.GDT 5/21/18

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

Potash Export Terminal
Grays Harbor
Hoquiam, Washington

SOIL DESCRIPTION AND LOG KEY

March 2019 101575-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 2 of 3

SOIL_CLASS_KEY_PG2 21-22276.GPJ SHAN_WIL.GDT 5/21/18

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICITY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It takes considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Potash Export Terminal
Grays Harbor
Hoquiam, Washington

SOIL DESCRIPTION AND LOG KEY

March 2019 101575-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 3 of 3

SOIL_CLASS_KEY_PG3 21-22276.GPJ SHAN_WIL.GDT 5/21/18

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense to very dense, dark gray, *Silty Gravel with Sand GM)*; wet; fine to coarse, angular gravel and rock chips; fine to coarse, subangular sand; low plasticity fines; trace organics.
Fill (Hf)

1.98

Very soft, dark gray interior with brown exterior, *Organic Silt (OH)* interbedded with *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity fines; trace fine roots; readily oxidizes.
Estuarine Deposits (He)

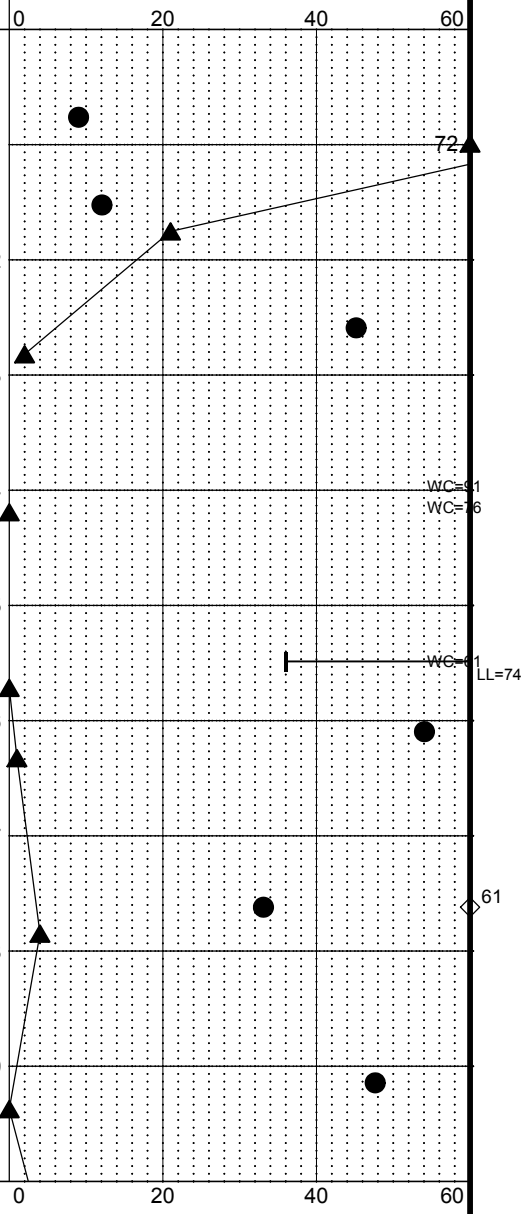
5.70

Soft, gray, *Sandy Elastic Silt (MH)* grading to very loose to loose, gray, *Silty Sand (SM)*; moist; fine sand; low to medium plasticity fines; trace fine organics, roots, and fibrous mats; laminated.
Estuarine Deposits (He)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water Depth, m

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-01-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 1 of 6

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC Rev: EAB Typ: LKN

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

Medium dense, blue-gray grading to gray, *Silty Sand (SM)*; moist to wet; fine sand; low plasticity fines; trace to few organics and shell fragments; trace silt laminations.
Alluvium (Ha)

11.28

Dense, gray, *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; nonplastic fines; trace fine gravel; trace organics and shell fragments.
Alluvium (Ha)

16.76

17.68

Medium dense, gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace to few organics and shell fragments.
Alluvium (Ha)

19.20

Medium dense, gray, *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; nonplastic fines;

CONTINUED NEXT SHEET

11 12 13 14 15 16

During Drilling ▽

11 12 13 14 15 16 17 18 19

0 20 40 60

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3.0" O.D. GUS Sample
▽ Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-01-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 2 of 6

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC Rev: EAB Typ: LKN

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

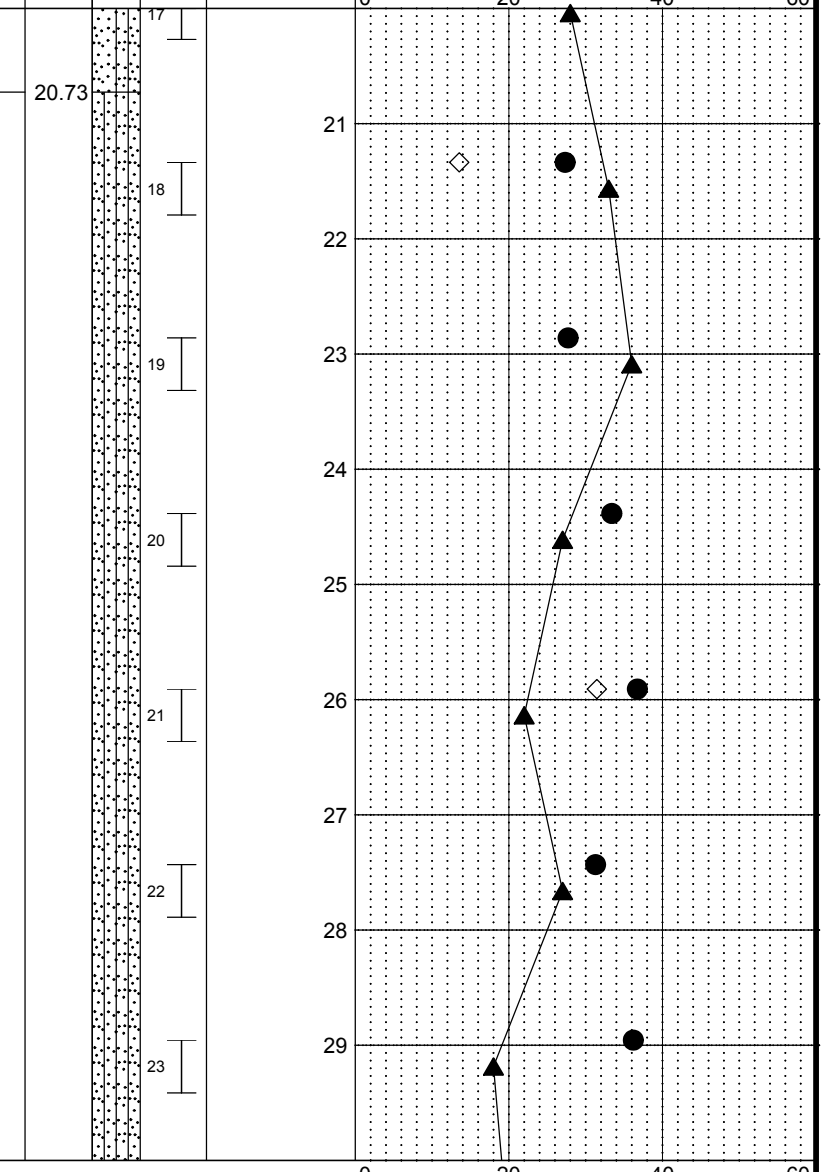
trace organics and shell fragments.
Alluvium (Ha)

20.73

Medium dense to dense, blue-gray to gray, *Silty Sand (SM)*; moist; fine sand; low to medium plasticity fines; trace fine organics, roots and shell fragments; laminated.
Alluvium (Ha)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m



PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

0 20 40 60

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3.0" O.D. GUS Sample
Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-01-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 3 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC Rev: EAB Typ: LKN

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

Medium dense, gray, *Silty Sandy (SM)* interbedded with medium stiff, gray, *Elastic Silt with Sand (MH)*; moist; fine sand; trace to few fine organics and shell fragments; laminated. Estuarine Deposits (He)

32.92

Medium stiff to stiff, gray, *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity fines; trace organics; fine sand partings. Estuarine Deposits (He)

34.44

- 6 cm thick lens of silty fine sand at 37.19 meters.

39.01

Dense, gray, *Silty Sand (SM)*; moist; fine sand; low to medium plasticity fines; trace organics. Alluvium (Ha)

CONTINUED NEXT SHEET

LL=65

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-01-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 4 of 6

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC Rev: EAB Typ: LKN

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Stiff to very still, gray, *Elastic Silt (MH) with Sand* to *Silty Clay (CH) with Sand*; moist; trace fine sand; medium plasticity fines; trace organics; silt partings.
Estuarine Deposits (He)

40.54

Stiff, gray and brown, *Organic Silt (OH)*; trace fine sand; low to medium plasticity fines; trace to few woody and fine organics; 6 mm thick peat interbeds.
Estuarine Deposits (He)

43.59

Stiff, gray, *Elastic Silt with Sand (MH)*; moist; fine sand; medium plasticity fines; trace organics; silt partings.
Estuarine Deposits (He)
- Lens of silty sand between 46.0 and 46.2 meters.

45.11

Very dense, gray, *Silty Gravel with Sand (GM)*; moist to wet; fine to coarse, subangular to subrounded gravel; fine to coarse sand; lenses of silt and clay.
Advance Outwash (Qva)

47.09

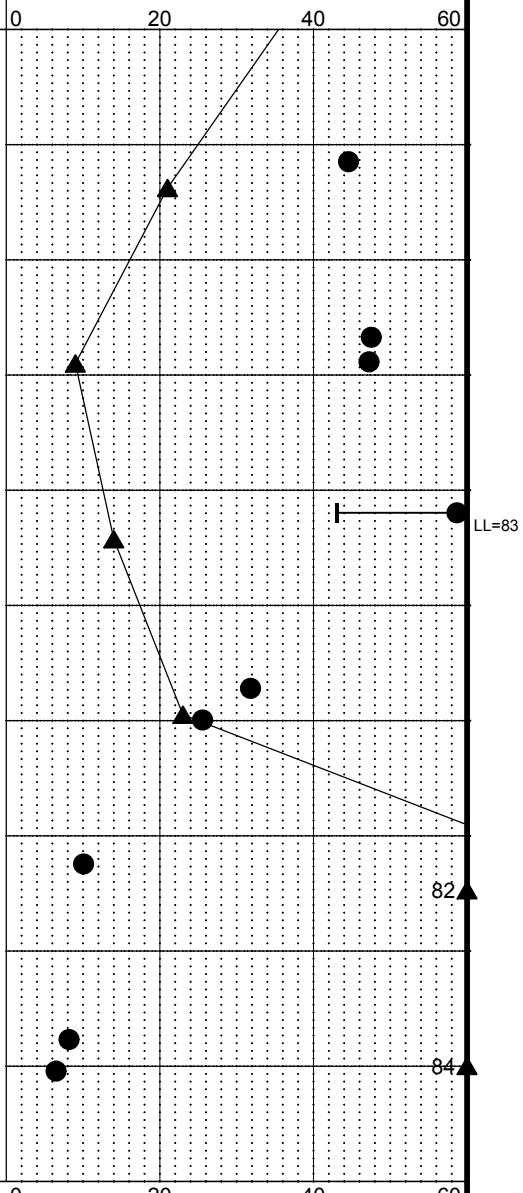
CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

32 | 33 | 34 | 35 | 36 | 37

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

- * Sample Not Recovered
- 2.0" O.D. Split Spoon Sample
- 3" O.D. Thin-Walled Tube
- 3.0" O.D. GUS Sample
- ▽ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit ⊢●⊣ Liquid Limit
- Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-01-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 5 of 6

REV 3

Log: BMC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

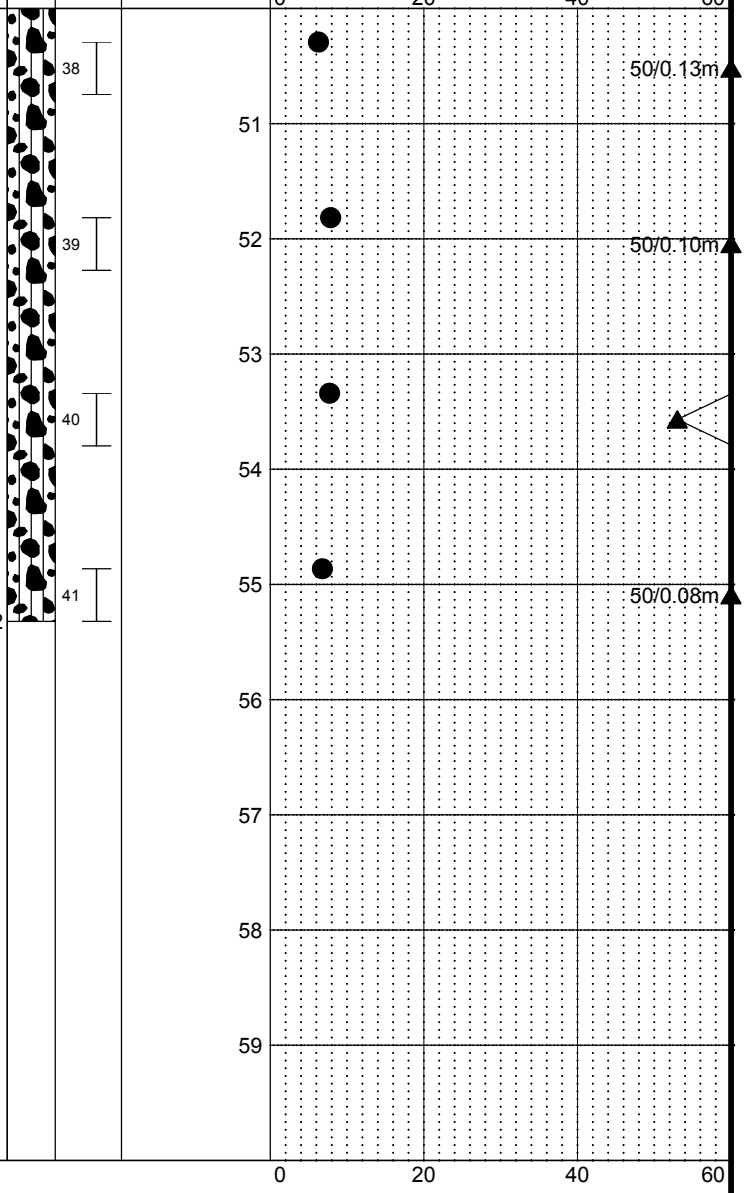
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



55.32

BOTTOM OF BORING
COMPLETED 11/13/2018

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-01-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 6 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC Rev: EAB Typ: LKN

Total Depth:	*5.79 m*	Northing:		Drilling Method:	*Hollow Stem Auger*	Hole Diam.:	*0.20 m*
Top Elevation:	*~ 4.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*4-1/4" ID*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Drilled to 2.7 meters to push undisturbed tube samples.

2.74

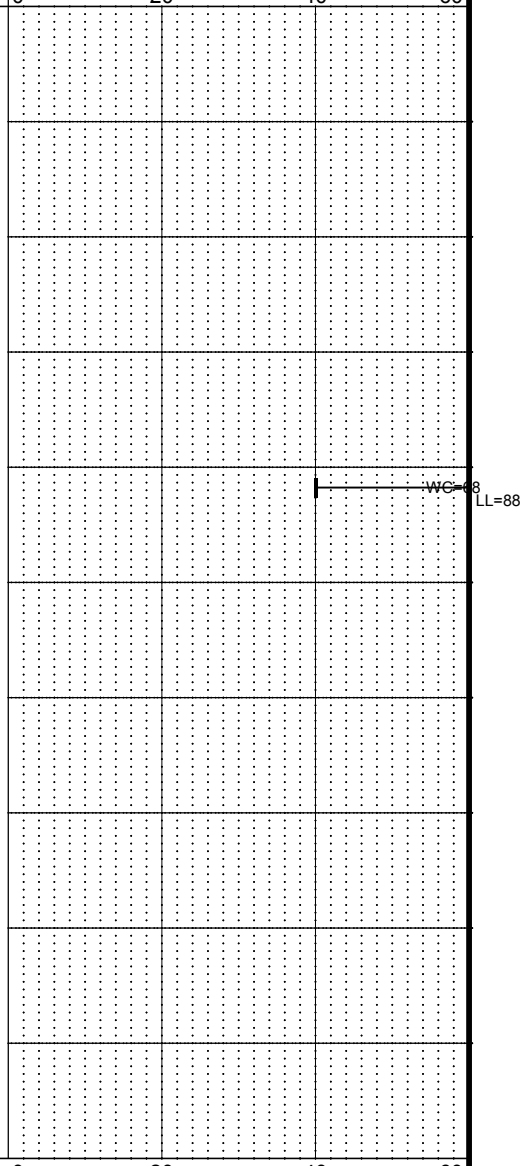
Light gray brown to dark gray, *Elastic Silt (MH)*; moist; trace fine sand and fine sand partings; traces lenses of elastic silt with sand; trace to few organics; low plasticity; laminated.
- 3 cm thick lens of elastic silt with a black interior and gray rind, readily oxidizes.
- 9 cm thick lens of silty sand at 3.0 meters.

5.79

BOTTOM OF BORING
COMPLETED 11/13/2018

Depth, m | Symbol | Samples | Ground Water Depth, m

None Observed During Drilling



LEGEND

* Sample Not Recovered

3.0" O.D. GUS Sample

◇ % Fines

Plastic Limit — Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-01A-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3

REV 3

Log: RJS Rev: BMC Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*53.80 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 6.0 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Asphalt pavement. — 0.15

Dense, gray to brown, *Silty Gravel with Sand (SM)*; moist; fine to coarse, subangular gravel; medium to coarse sand; trace fine sand.
Fill (Hf) — 1.37

Very stiff, reddish-brown, *Sandy Clay with Gravel (CL)*; wet; fine to coarse, subangular gravel; fine to coarse sand; low plasticity fines; iron oxide staining. — 1.80
Fill (Hf) — 2.13

Medium dense, reddish-brown, *Silty Sand (SM)*; moist; trace coarse sand; fine to medium sand; nonplastic fines; abundant iron oxide staining. — 3.66
Fill (Hf)

Loose, gray-brown with orange staining, *Silty Sand (SM)* interbedded with medium stiff, reddish-brown, *Sandy Silt (ML)*; wet; fine sand; low plasticity fines; trace organics; laminated. — 4.57
Estuarine Deposits (He) / Fill (Hf)

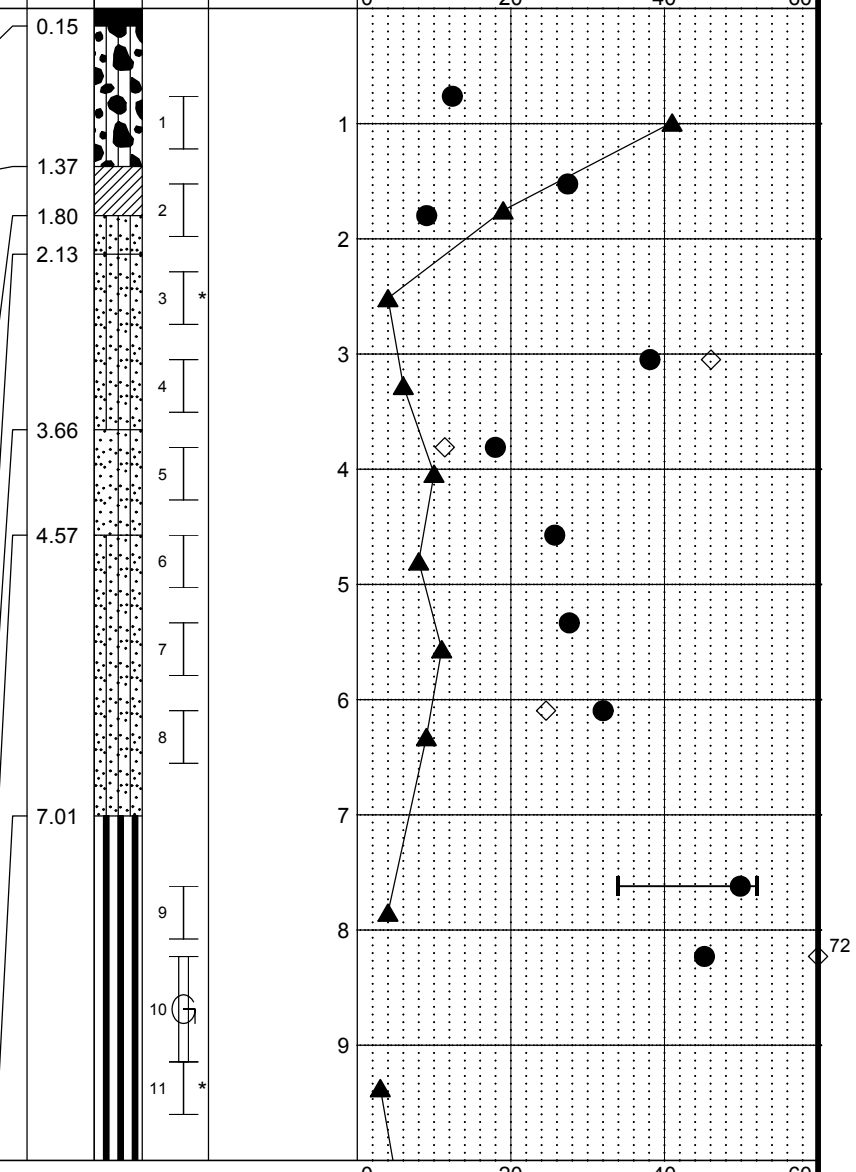
Medium dense, gray and brown, *Sand with Silt (SP-SM)*; wet to moist; trace fine, subangular gravel; fine sand; low plasticity fines; trace organics; readily oxidizes; sulferous odor.
Alluvium (Ha)

Loose to medium dense, gray and brown, *Silty Sand (SM)*; wet to moist; fine sand; low plasticity fines increasing with depth; trace organics; readily oxidizes; sulferous odor. — 7.01
Alluvium (Ha)
- 3 cm thick lens of black organic silt at 5.3 meters.
- Few lenses of sandy silt from 6.1 to 6.6 meters.

Soft, gray, *Elastic Silt with Sand (MH)*; wet; trace fine sand; low to medium plasticity; trace

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-02-18

March 2019 — 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 1 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RJS Rev: BMC Typ: LKN

Total Depth:	*53.80 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 6.0 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

to little organics.
Estuarine Deposits (He)

Loose, gray, *Silty Sand (SM)*; wet; fine to medium sand; nonplastic fines; trace organics.
Alluvium (Ha)

10.06

Loose to medium dense, gray, *Silty Sand (SM)* interbedded with medium stiff to stiff, gray, *Silt with Sand (ML)*; moist; fine to medium sand; low plasticity fines; trace organics; laminated.
Estuarine Deposits (He)

11.58

Medium dense, gray, *Silty Sand (SM)*; wet; fine sand; trace lenses silt; trace organics.
Alluvium (Ha)

14.63

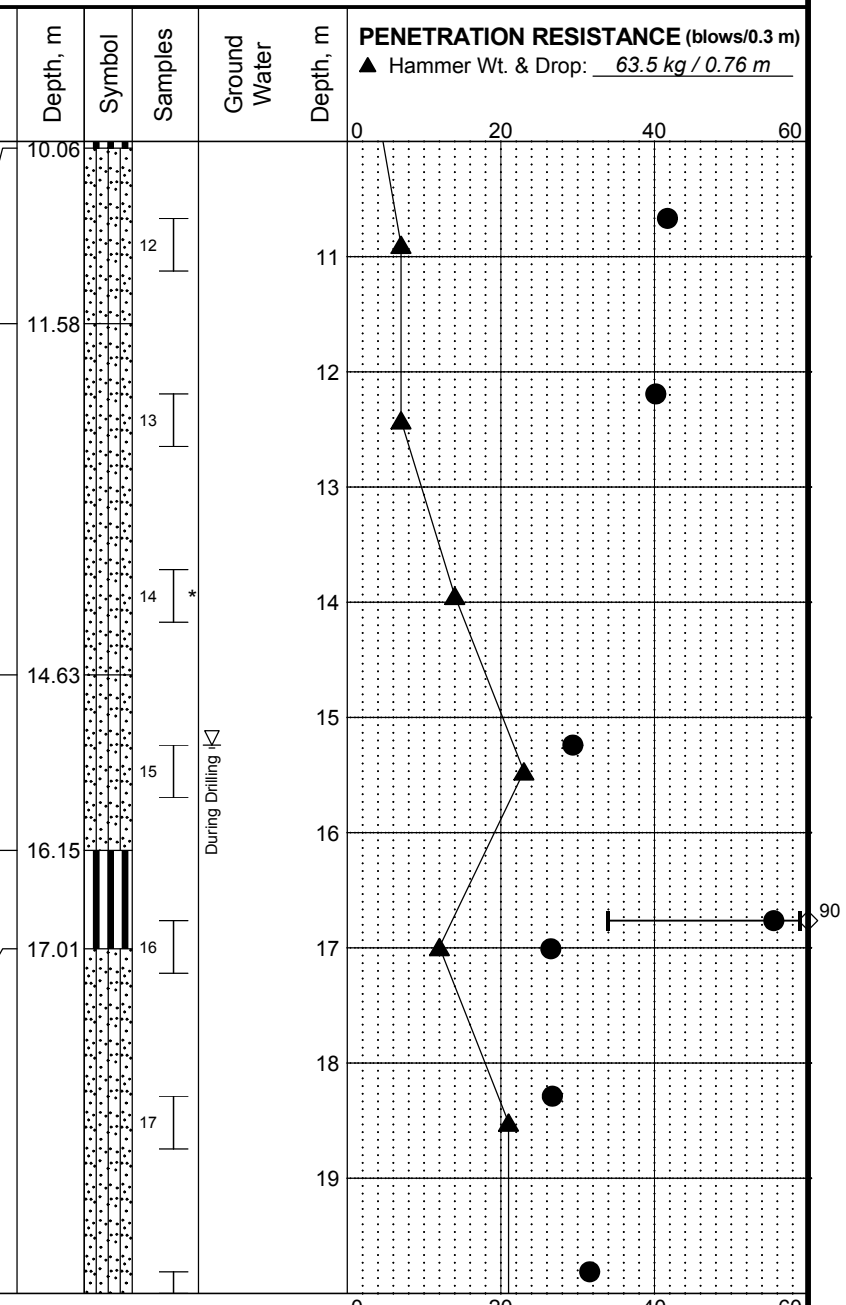
Stiff, gray, *Elastic Silt (MH)*; moist; trace fine sand; low plasticity fines; trace organics; laminated.
Estuarine Deposits (He)

16.15

17.01

Medium dense, gray, *Silty Sand (SM)*; wet; fine sand; nonplastic fines; trace organics.
Alluvium (Ha)

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-02-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 2 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RJS Rev: BMC Typ: LKN

Total Depth:	*53.80 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 6.0 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

- Trace silt lenses from 19.8 to 20.3 meters.

20.73

Loose to medium dense, gray, *Silty Sand (SM)* interbedded with stiff to very stiff, gray, *Silt (ML)*; wet; fine sand; low plasticity fines; trace organics and shell fragments; laminated.
Estuarine Deposits (He)

23.77

Medium dense, gray, *Silty Sand (SM)*; wet; fine sand; low plasticity fines; trace lenses silt; trace organics.
Alluvium (Ha)

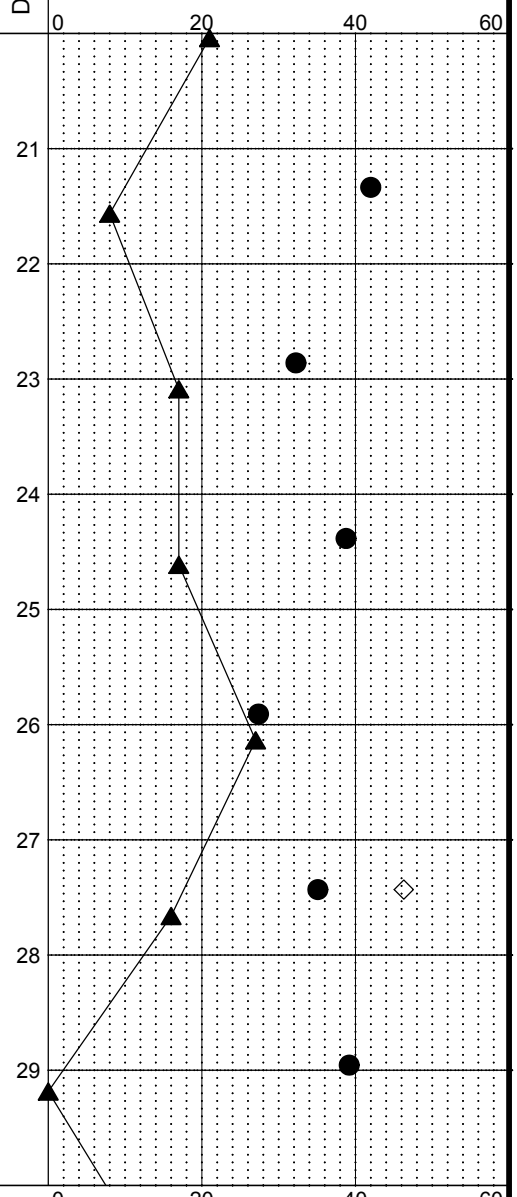
28.35

Very soft, gray, *Sandy Silt (ML)*; wet; fine sand; low plasticity fines; trace organics and shell fragments; laminated.
Estuarine Deposits (He)

CONTINUED NEXT SHEET

29.87

Depth, m | Symbol | Samples | Ground Water | Depth, m



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-02-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 3 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RJS Rev: BMC Typ: LKN

Total Depth:	*53.80 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 6.0 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense, gray, *Silty Sand (SM)*; wet to moist; fine sand; low plasticity fines; trace organics; laminated.
Estuarine Deposits (He)

32.92

Soft, light gray-brown, *Silty Clay (CH)* and *Elastic Silt (MH)*; moist; trace fine sand; medium plasticity fines; trace to little organics including roots, peat laminations throughout with slight platy and crumbly texture.
Estuarine Deposits (He)

- Becomes very soft from 35.1 to 35.5 meters.

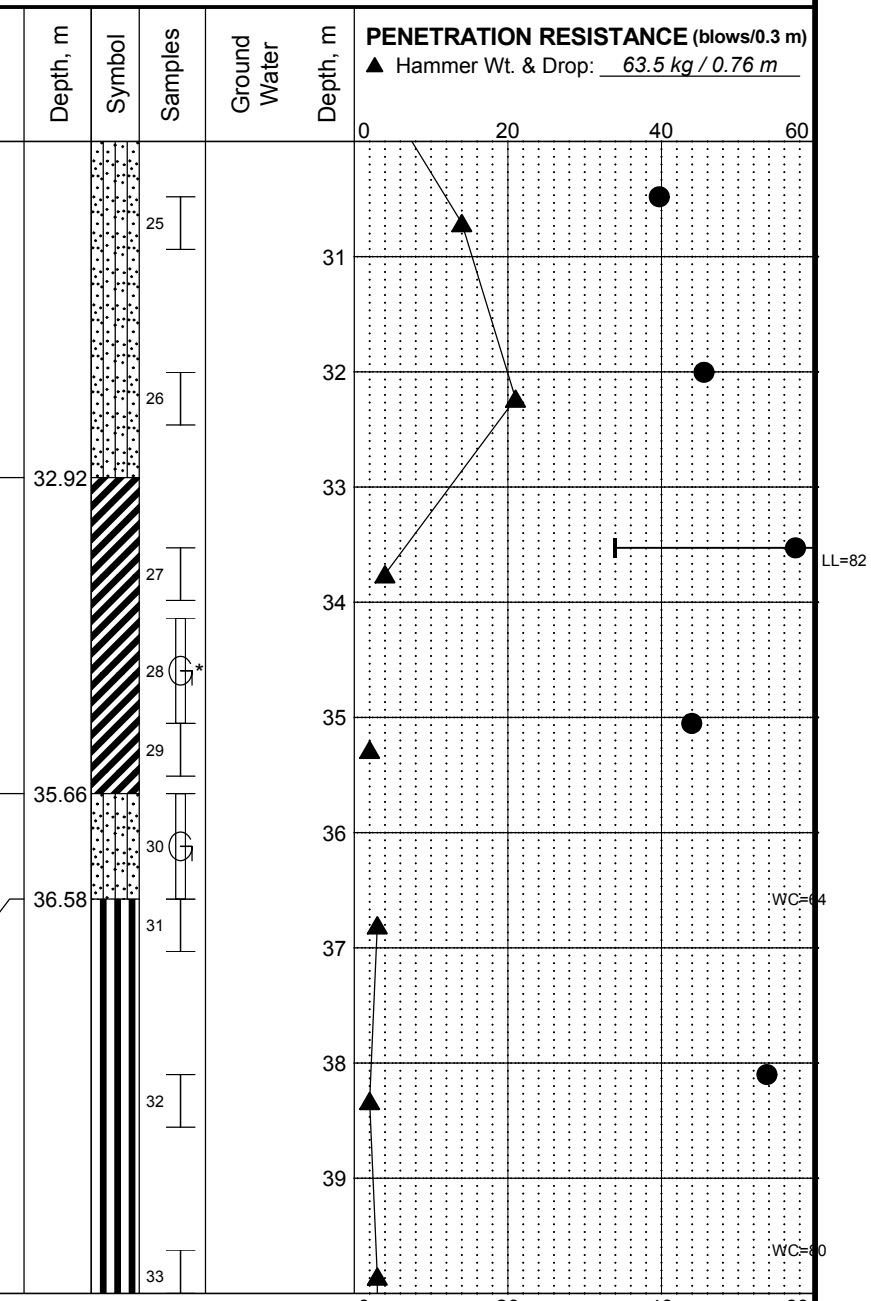
35.66

Loose, dark gray, *Silty Sand (SM)*; wet; fine sand; low plasticity fines; trace organics.
Alluvium (Ha)
- Pocket of silt at 35.8 meters.

36.58

Soft, light gray-brown, *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity fines; trace to little organics including roots, peat laminations with slight platy and crumbly texture.
Estuarine Deposits (He)

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-02-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 4 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RJS Rev: BMC Typ: LKN

Total Depth:	*53.80 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 6.0 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

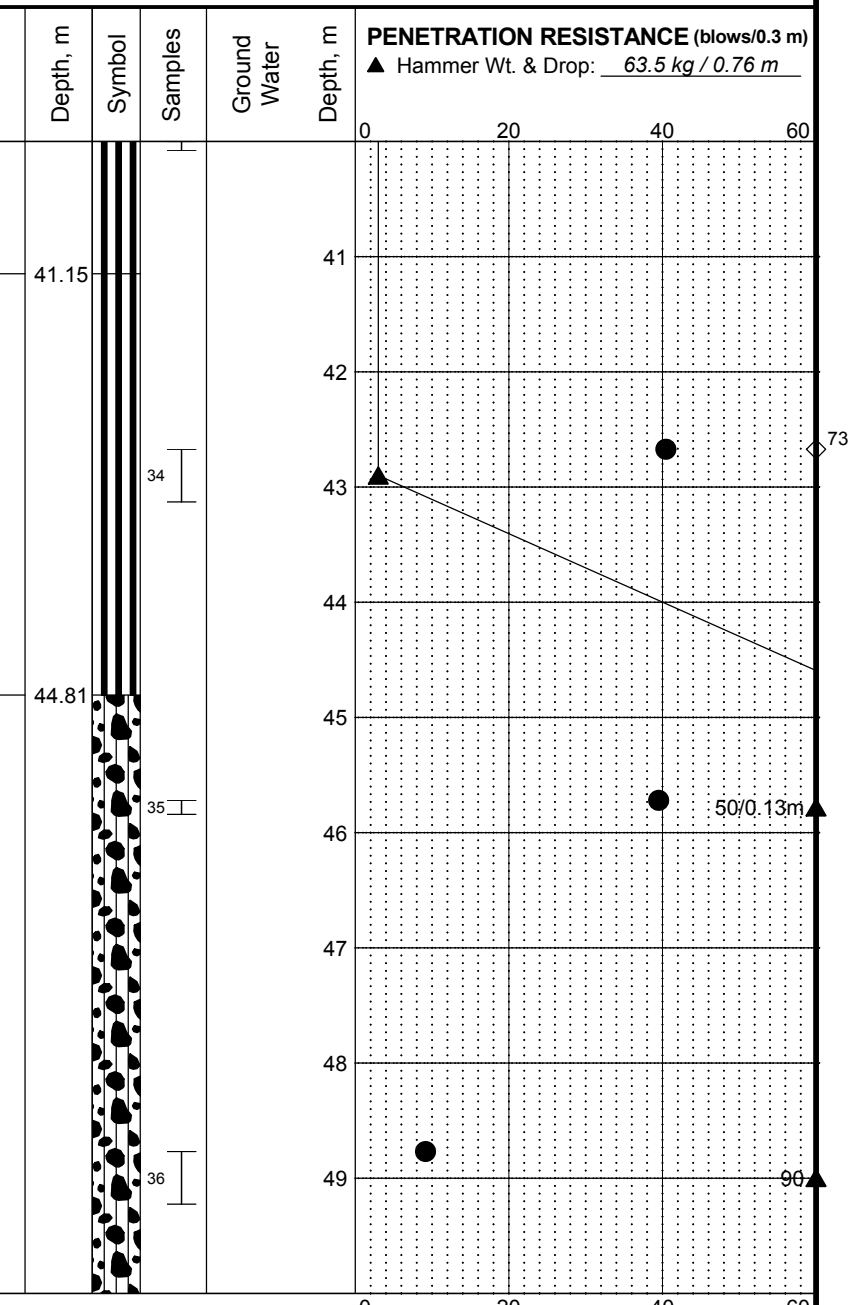
Soft, light gray-brown, *Elastic Silt with Sand (MH)* to *Sandy Elastic Silt (MH)*; moist to wet; fine sand; low plasticity fines; trace organics.
Estuarine Deposits (He)

41.15

Very dense, dark gray-brown, *Silty Gravel with Sand (GM)*; wet; mostly fine to coarse, subrounded gravel; little, fine to coarse sand; little silt.
Advance Outwash (Qva)

44.81

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-02-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 5 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RJS Rev: BMC Typ: LKN

Total Depth:	*53.80 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 6.0 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

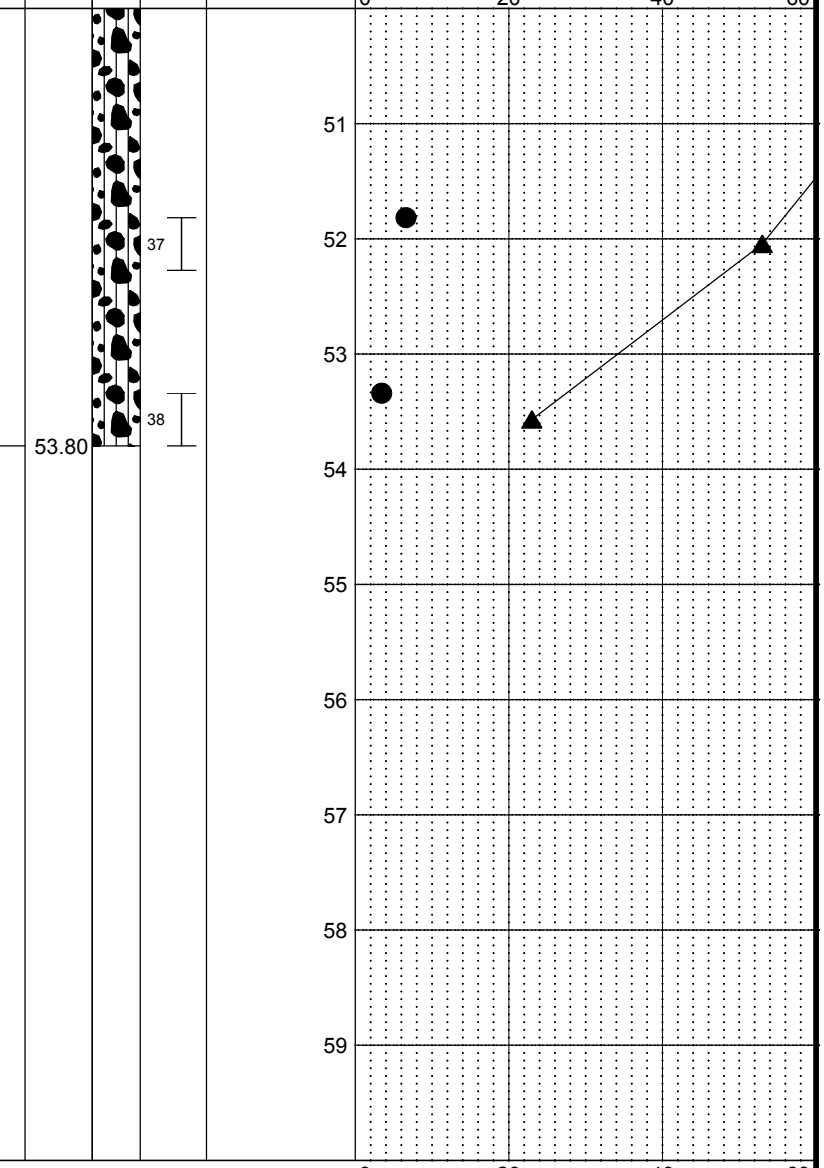
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

3.0" O.D. GUS Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-02-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 6 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RJS Rev: BMC Typ: LKN

Total Depth:	*50.57 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -2.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Very soft to soft, gray, *Silt with Sand (ML)* interbedded with very loose, gray, *Silty Sand (SM)*; moist to wet; trace subrounded fine gravel; fine sand; low plasticity fines; trace woody organics and shell fragments.
Estuarine Deposits (He)

2.44

Dense, dark gray, *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; low plasticity fines; trace woody organics.
Alluvium (Ha)

3.96

Very soft, gray-brown, *Sandy Elastic Silt (MH)* to *Elastic Silt with Sand (MH)*; moist; fine sand; medium plasticity fines; trace to few organics, including 6 mm thick peat lenses.
Estuarine Deposits (He)

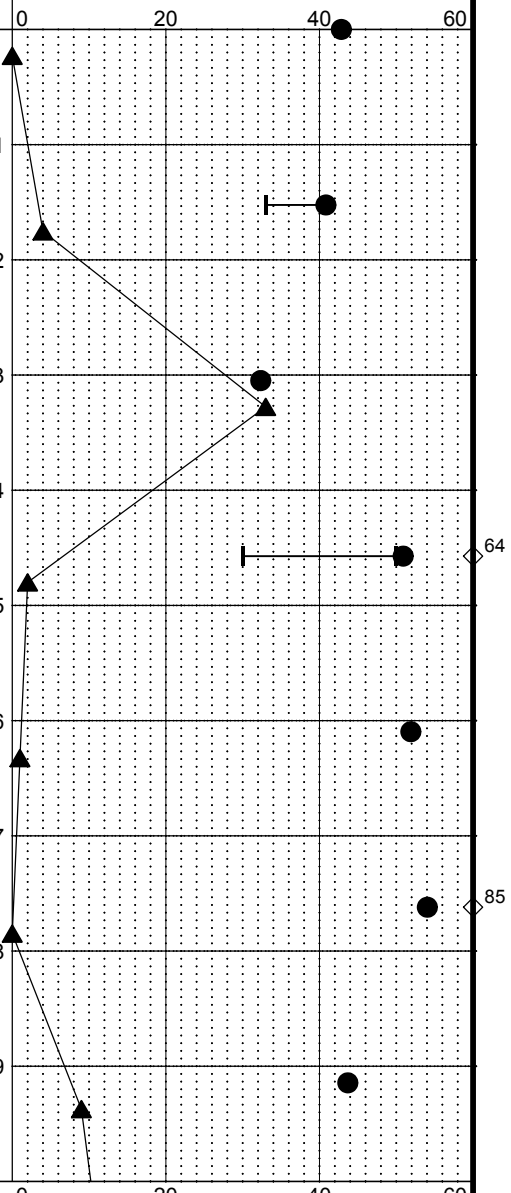
8.53

Loose to medium dense, gray, *Silty Sand (SM)* interbedded with stiff to very stiff, gray, *Elastic Silt with Sand (MH)*; moist; fine sand; low to medium plasticity fines; trace organics, including 6 mm thick peat lenses and shell

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-03-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 1 of 6

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC/RB Rev: EAB Typ: LKN

Total Depth:	*50.57 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -2.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

fragments.
Estuarine Deposits (He)

14.63

Very soft, gray-brown, *Sandy Silt (ML)*; moist; fine sand; low plasticity fines; trace organics and shell fragments; laminated.
Estuarine Deposits (He)

16.15

Very soft, gray-brown, *Elastic Silt with Sand (MH)*; moist; fine sand; low to medium plasticity fines; trace organics and shell fragments; laminated.
Estuarine Deposits (He)

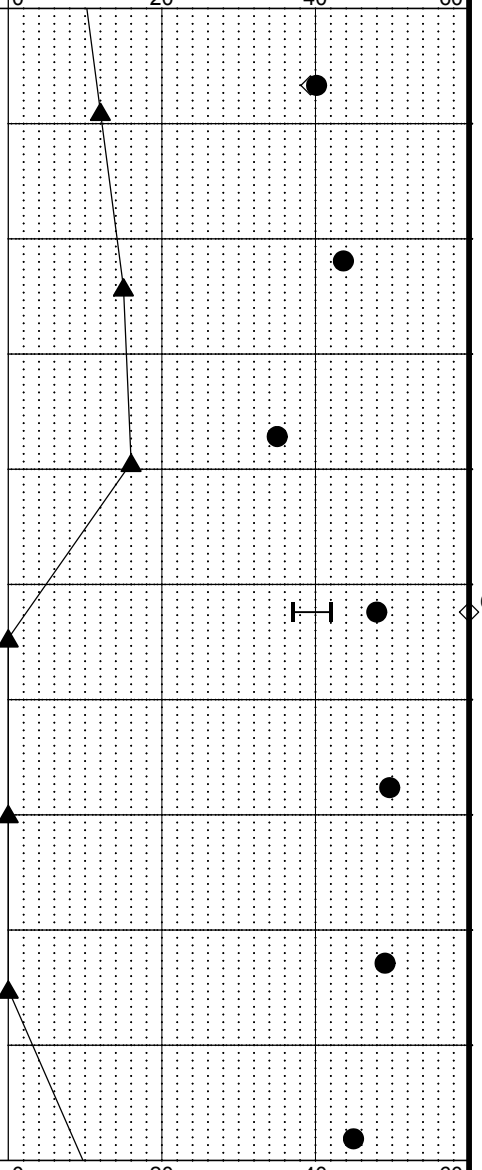
19.20

Medium dense, gray-brown, *Silty Sand (SM)*; moist; fine sand; low to medium plasticity fines; trace organics. CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water Depth, m

8
9
10
11
12
13

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-03-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 2 of 6

REV 3

Log: BMC/RB Rev: EAB Typ: LKN
MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*50.57 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -2.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Estuarine Deposits (He)

20.73

Soft to medium stiff, gray-brown, *Elastic Silt (MH)* and *Silty Clay (CH)*; moist; trace fine sand; low to medium plasticity fines; peat and fine organic laminations throughout with slight platy and crumbly texture, trace to few wood fragments, roots, and shell fragments; weakly to moderately oxidizes.

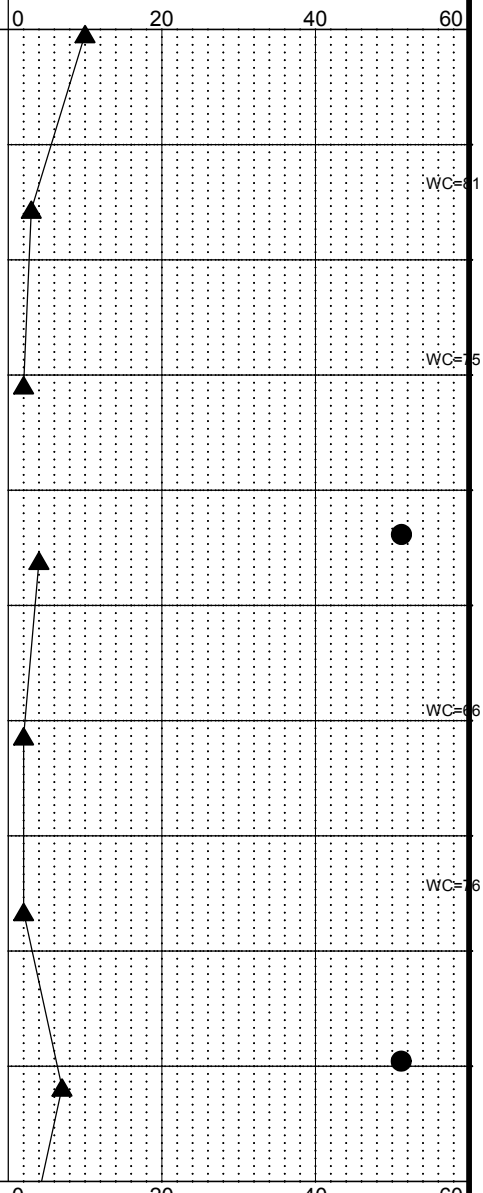
Estuarine Deposits (He)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

3.0" O.D. GUS Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-03-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 3 of 6

REV 3

Log: BMC/RB Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*50.57 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -2.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

Medium stiff, gray-brown, *Sandy Elastic Silt (MH)*; moist; fine sand; low to medium plasticity fines; peat and fine organic laminations throughout with slight platy and crumbly texture, trace to few wood fragments, roots, and shell fragments; weakly to moderately oxidizes.
Estuarine Deposits (He)

31.39

Medium dense, gray, *Silty Sand (SM)* interbedded with very stiff, gray, *Silt with Sand (ML)*; wet; fine sand; low plasticity fines; trace fibrous organics.
Alluvium (Ha)

34.44

Very dense, gray, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; wet; fine to coarse, subangular to subrounded gravel; fine to coarse sand.
Alluvium (Ha)

38.10
38.37

Very dense, gray, *Silty Sand with Gravel (SM)*; wet; fine, subrounded gravel; fine to coarse

39.01

22 23 24 25 26 27 28

31 32 33 34 35 36 37 38 39

WC=72

65

0 20 40 60

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-03-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 4 of 6

REV 3

Log: BMC/RB Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*50.57 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -2.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

sand; nonplastic fines.
Alluvium (Ha)

Very dense, gray, *Poorly Graded Gravel with Sand and Silt (GP-GM)*; wet; fine to coarse, subangular to subrounded gravel; fine to coarse sand; nonplastic fines.
Alluvium (Ha)

41.51

Hard, gray *Sandy Silt (ML)*; moist; fine sand; low plasticity.
Alluvium (Ha)

42.73

Very dense, gray, *Silty Sand with Gravel (SM)*; wet; fine, subangular to subrounded gravel; fine to coarse sand; nonplastic fines.
Advance Outwash (Qva)

43.59

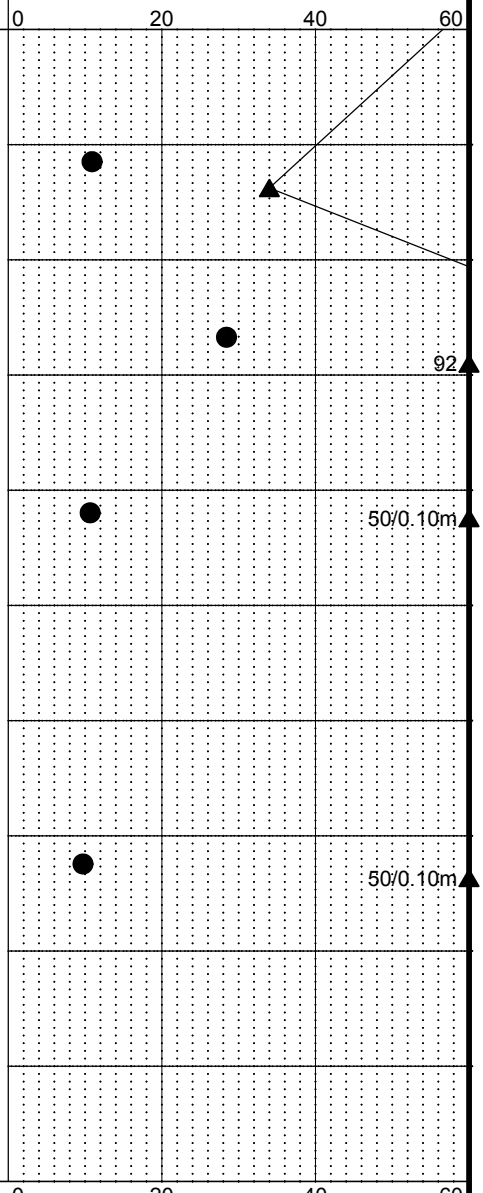
Very dense, gray, *Silty Gravel with Sand (GM)*; wet; fine to coarse gravel; fine to coarse sand; nonplastic fines.
Advance Outwash (Qva)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

29 | 30 | 31 | 32

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-03-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 5 of 6

REV 3

Log: BMC/RB Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*50.57 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -2.9 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

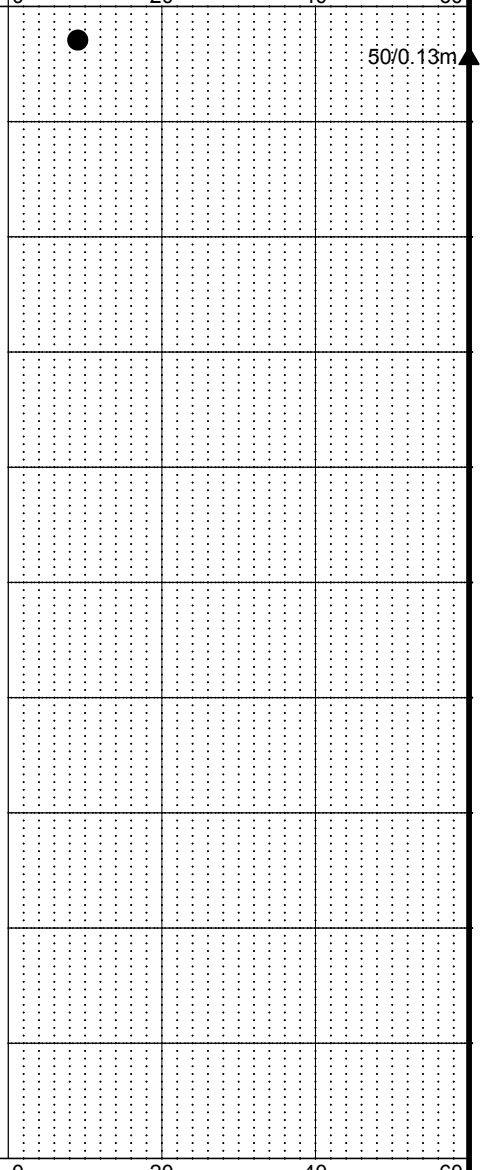
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



50.57

33

BOTTOM OF BORING
COMPLETED 11/9/2018

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

3.0" O.D. GUS Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-03-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 6 of 6

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC/RB Rev: EAB Typ: LKN

Total Depth:	*35.05 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -10.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense, gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace silt interbeds; trace organics.
Estuarine Deposits (He) / Alluvium (Ha)

1.07

Soft, gray, *Elastic Silt with Sand (MH)*; moist; fine sand; low plasticity fines; trace organics.
Estuarine Deposits (He)

2.13

Loose to medium dense, gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace silt lenses; trace organics.
Alluvium (Ha)

4.57

Medium stiff, gray, *Sandy Silt (ML)*; moist; fine sand; low plasticity; trace organics and shell fragments.
Estuarine Deposits (He)

6.40

Medium dense, gray, *Poorly Graded Sand with Silt (SP-SM)*; moist to wet; fine sand; low plasticity fines; trace lenses of silt; trace organics and shell fragments.
Alluvium (Ha)

8.23

Medium dense, gray, *Silty Sand (SM)*; moist; fine sand; trace organics.
Alluvium (Ha)

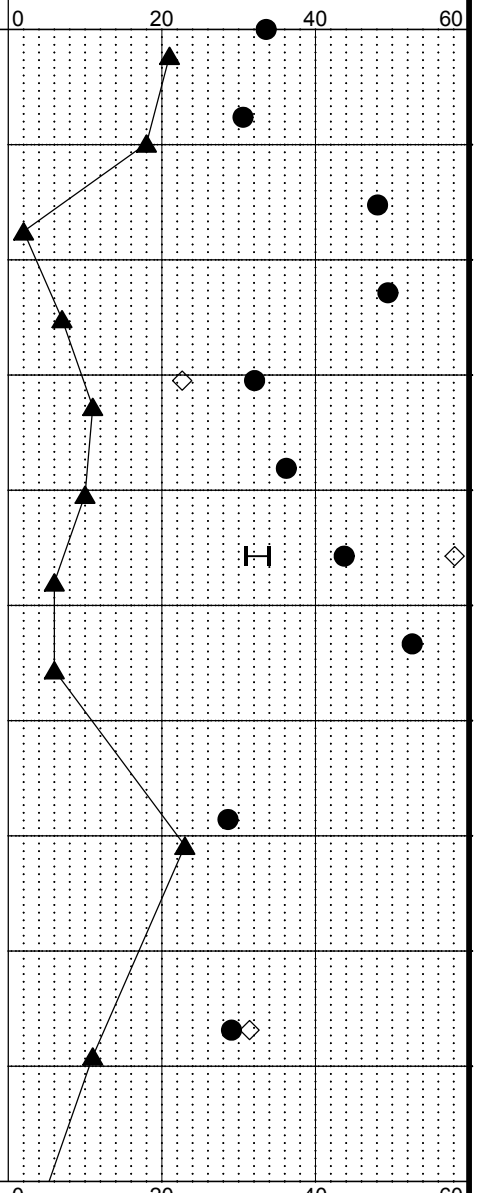
9.75

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-04-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 1 of 4

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RBP/BMK Rev: EAB Typ: LKN

Total Depth:	35.05 m	Northing:		Drilling Method:	Mud Rotary	Hole Diam.:	0.15 m
Top Elevation:	~ -10.5 m	Easting:		Drilling Company:	Holt Services, Inc.	Rod Diam.:	2-inch NWJ
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile Drill B-58	Hammer Type:	Automatic
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soft to medium stiff, gray, *Elastic Silt (MH)* grading to *Elastic Silt with Sand (MH)*; moist; fine sand; low to medium plasticity fines; few to little organics; laminated.
Estuarine Deposits (He)

14.33

Loose, gray, *Silty Sand (SM)*; moist to wet; fine sand; low plasticity fines; trace organics and shell fragments.
Estuarine Deposits (He)

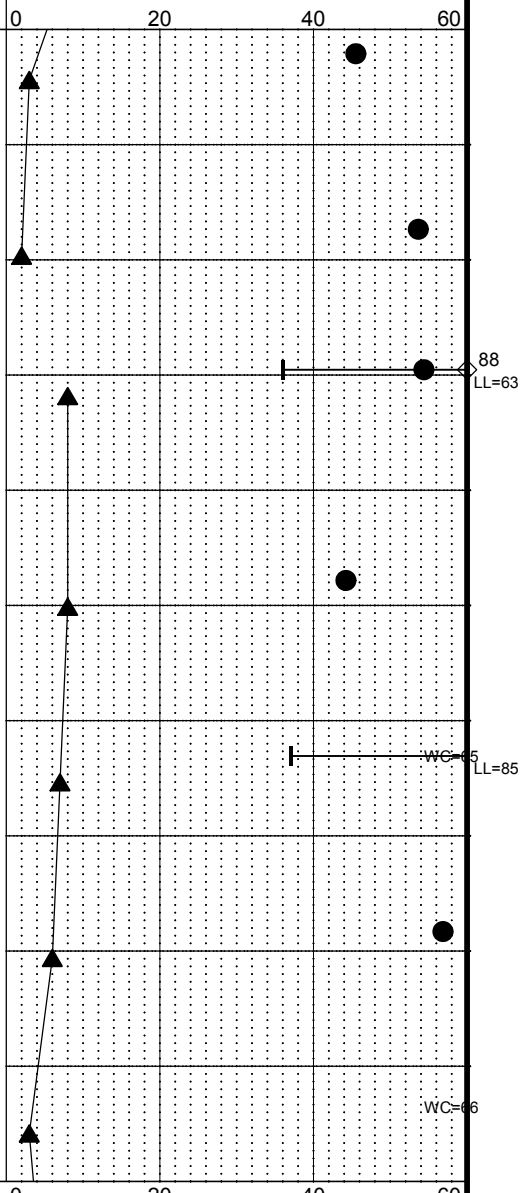
15.09

Soft to stiff, gray-brown, *Elastic Silt (MH)* and *Silty Clay (CH)*; moist; trace fine sand grading to few fine sand below 21 meters; low to medium plasticity fines; peat and fine organic laminations throughout with slight platy and crumbly texture, trace to few wood fragments, roots, and shell fragments.
Estuarine Deposits (He)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water Depth, m

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: 63.5 kg / 0.76 m



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-04-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 2 of 4

REV 3

Log: RBP/BMK Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*35.05 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -10.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

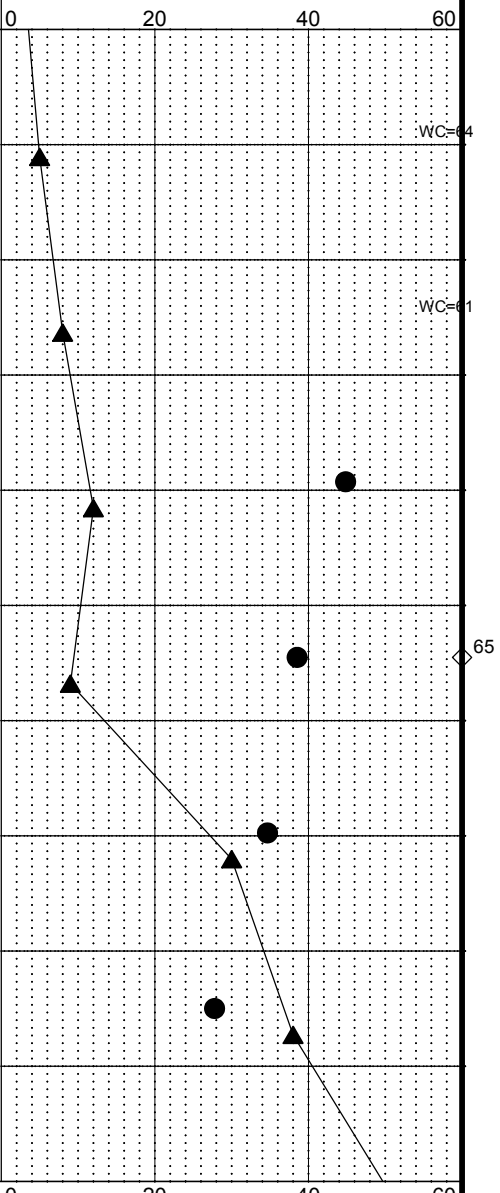
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



Stiff, gray-brown, *Elastic Silt with Sand (MH)*; moist; fine sand; low to medium plasticity fines; peat and fine organic laminations throughout with slight platy and crumbly texture, trace to few wood fragments, roots, and shell fragments.
Estuarine Deposits (He)

23.47

Medium dense to dense, gray, *Silty Sand (SM)*; moist; fine sand; low plastic plastic fines; trace organics; locally laminated.
Alluvium (Ha)

26.52

Dense, gray, *Gravel with Sand and Silt (GP-GM)*; wet; fine to coarse, subangular to subrounded gravel; medium to coarse sand.

29.26

CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-04-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 3 of 4

REV 3

Log: RBP/BMK Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*35.05 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -10.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Alluvium (Ha)

31.09

Very soft to medium stiff, gray, *Elastic Silt (MH)*; moist; trace fine sand; low plasticity fines; trace organics and fine roots.
Estuarine Deposits (He)

34.14

Very dense, gray, *Silty Gravel with Sand (GM)*; wet; fine to coarse, subangular to subrounded gravel; medium to coarse sand.
Advance Outwash (Qva)

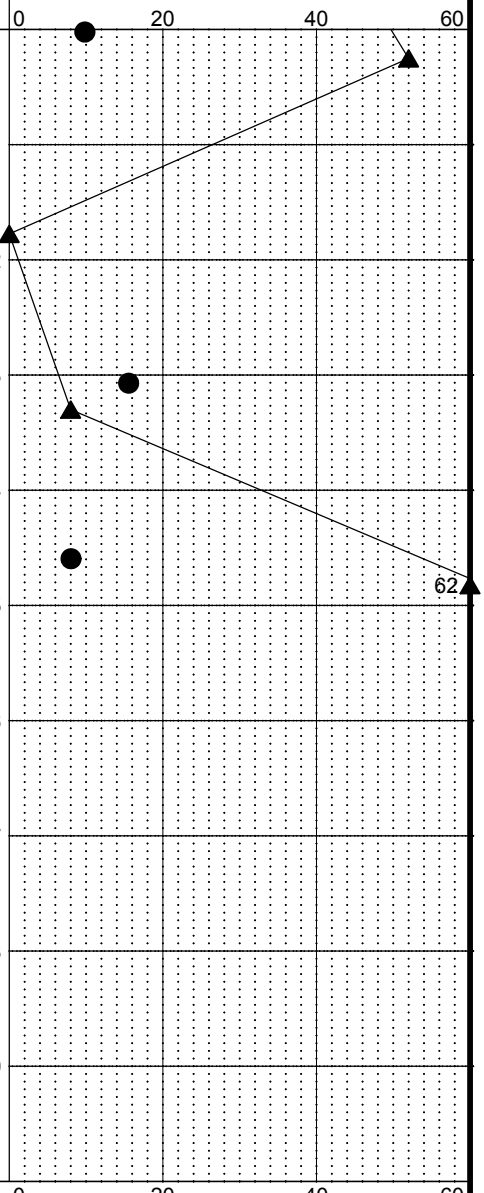
35.05

BOTTOM OF BORING
COMPLETED 11/7/2018

Depth, m | Symbol | Samples | Ground Water | Depth, m

Samples: 25; 26 *; 27; 28

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-04-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 4 of 4

REV 3

Log: RBP/BMK Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*42.31 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -8.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Very soft to soft, dark brown and dark gray, *Elastic Silt with Sand (MH)*; moist; fine sand; medium plasticity fines; trace organics and shell fragments; few lenses of silty, fine sand. Estuarine Deposits (He)

2.44

Medium dense, dark gray, *Silty Sand (SM)*; moist to wet; fine sand; low plasticity fines; trace organics and shell fragments. Alluvium (Ha)

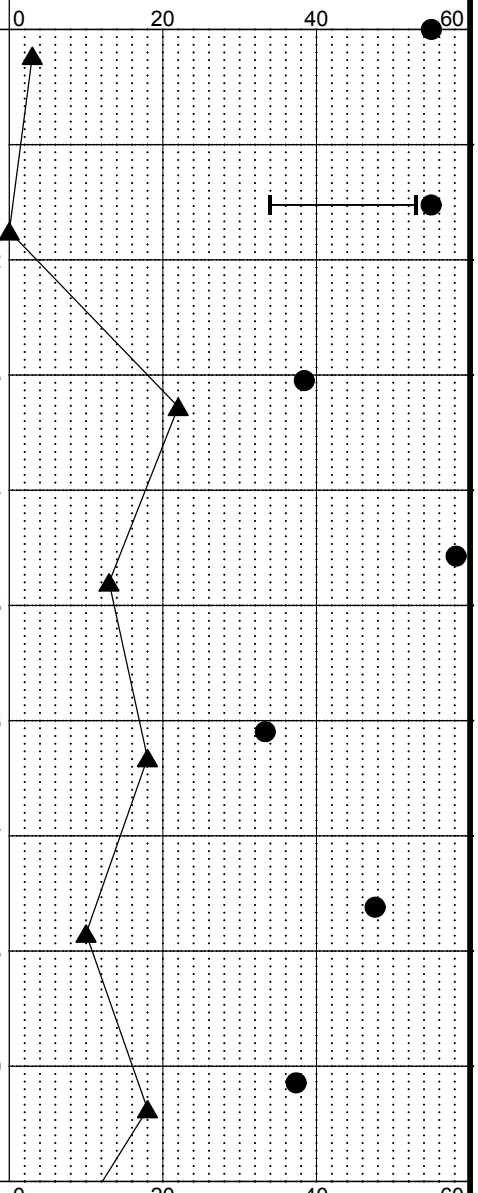
9.75

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

3.0" O.D. GUS Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-05-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 1 of 5

REV 3

Log: RBP/BMK Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*42.31 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -8.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium stiff, gray, *Sandy Elastic Silt (MH)*; moist; fine sand; low to medium plasticity fines; trace to few organics and shell fragments.
Estuarine Deposits (He) / Alluvium (Ha)

10.97

Very soft to soft, gray, *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity fines; trace to few organics and shell fragments; laminated with fine sand.
Estuarine Deposits (He)

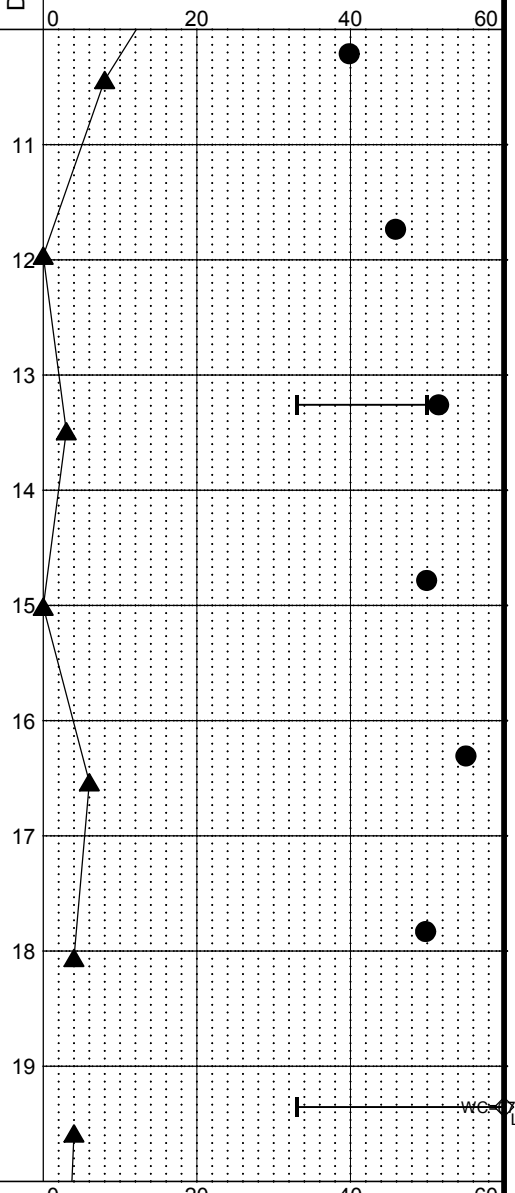
15.85

Soft to medium stiff, gray-brown, *Elastic Silt (MH)* and *Silty Clay (CH)*; moist; trace fine sand; low to medium plasticity fines; trace to few fine organics, wood and shell fragments, and roots in vertical growth position; peat laminations with slight platy and crumbly texture below 19 meters.
Estuarine Deposits (He)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water Depth, m

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-05-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 2 of 5

REV 3

Log: RBP/BMR Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*42.31 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -8.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium stiff to stiff, gray, *Elastic Silt (MH)* and *Silty Clay (CH)*; moist; trace to some fine sand; low to medium plasticity fines; trace organics and shell fragments.
Estuarine Deposits (He)

23.47

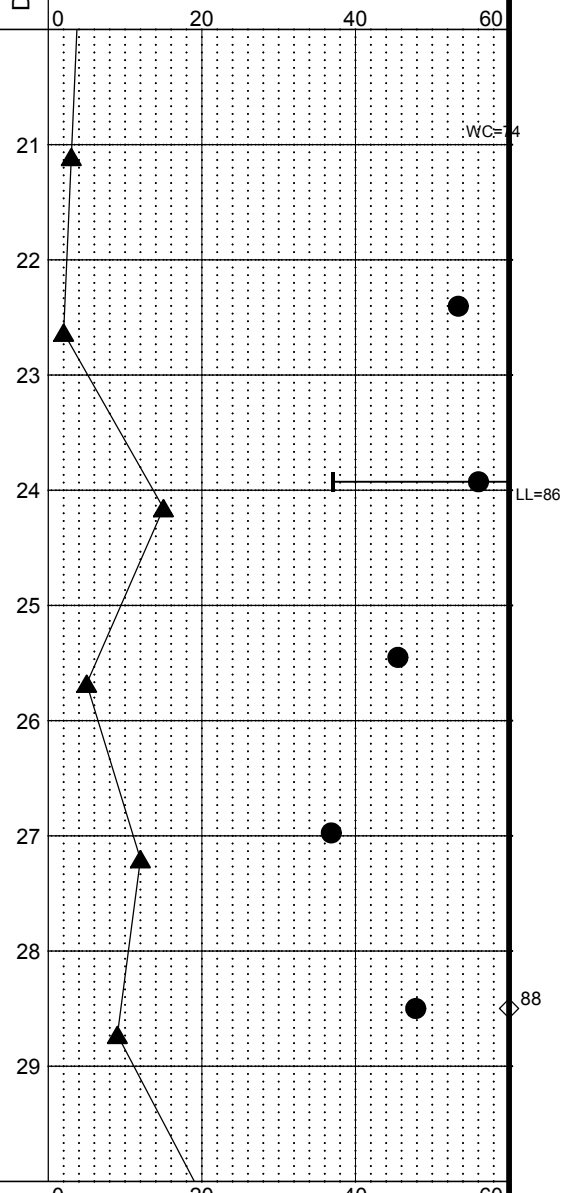
29.57

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-05-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 3 of 5

REV 3

Log: RBP/BMR Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*42.31 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -8.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense, gray, *Silty Sand (SM)* interbedded with *Sandy Elastic Silt (MH)*; moist to wet; fine sand; low to medium plasticity fines.
Alluvium (Ha)

31.09

Very dense, gray, *Silty Gravel with Sand (GM)*; wet; fine to coarse, subrounded gravel; medium to coarse sand; nonplastic fines.
Alluvium (Ha)

32.61

Very stiff, blue-gray to gray, *Elastic Silt (MH)*; moist; trace fine sand; medium plasticity fines; trace oxidized woody organics and roots above 34.0 meters depth; surface moderately oxidizes.
Estuarine Deposits (He)

34.81

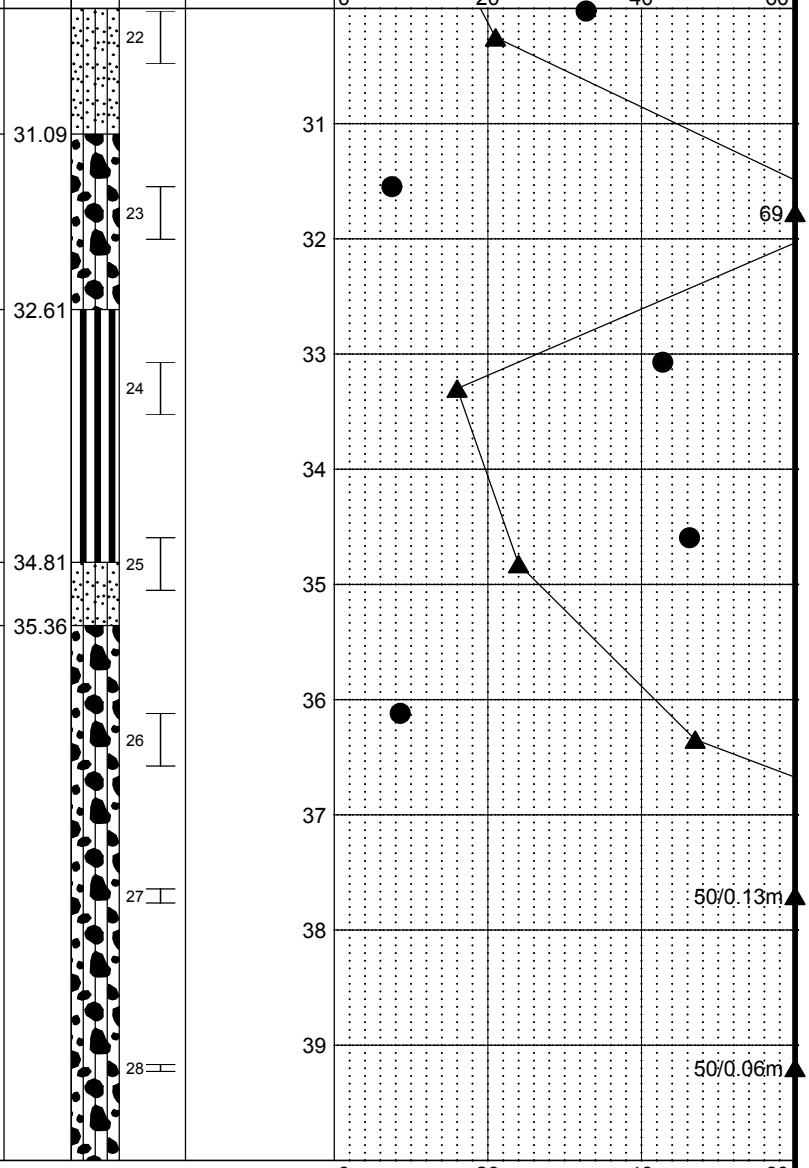
Medium dense, gray, *Silty Sand (SM)*; wet; fine to medium sand; nonplastic fines; trace organics.
Alluvium (Ha)

35.36

Dense to very dense, gray grading to brown, *Silty Gravel with Sand (GM)*; wet; fine to coarse, subrounded gravel; fine to coarse sand; low plasticity fines.
Advance Outwash (Qva)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m



PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-05-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 4 of 5

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RBP/BMK Rev: EAB Typ: LKN

Total Depth:	*42.31 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ -8.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

40.23

Very dense, yellow, *Poorly Graded Gravel with Sand (GM)*; moist; fine to coarse, subrounded gravel; fine to coarse sand; low plasticity fines. Advance Outwash (Qva)

29

42.37

BOTTOM OF BORING
COMPLETED 11/8/2018

41 42 43 44 45 46 47 48 49

50/0.08m ▲

0 20 40 60

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-05-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 5 of 5

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RBP/BMK Rev: EAB Typ: LKN

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.7 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Gray, *Silty Gravel (GM)*; moist; fine to coarse, subangular gravel; nonplastic fines.
Fill (Hf)

0.61

Loose to medium dense, brown to gray, *Silty Sand (SM)*; moist to wet; few to little, fine to coarse, subangular gravel; fine to medium sand; trace organics; strong iron oxide staining.
Alluvium (Ha) / Fill (Hf)

2.90

Very soft, dark gray to black, *Organic Silt (OH)*; wet; trace fine sand; trace organics.
Estuarine Deposits (He)

4.42

Very soft, gray brown, *Elastic Silt (MH)* to *Organic Silt (OH)*; wet; trace fine sand; low to medium plasticity fines; trace organics and shell fragments; laminated.
Estuarine Deposits (He)

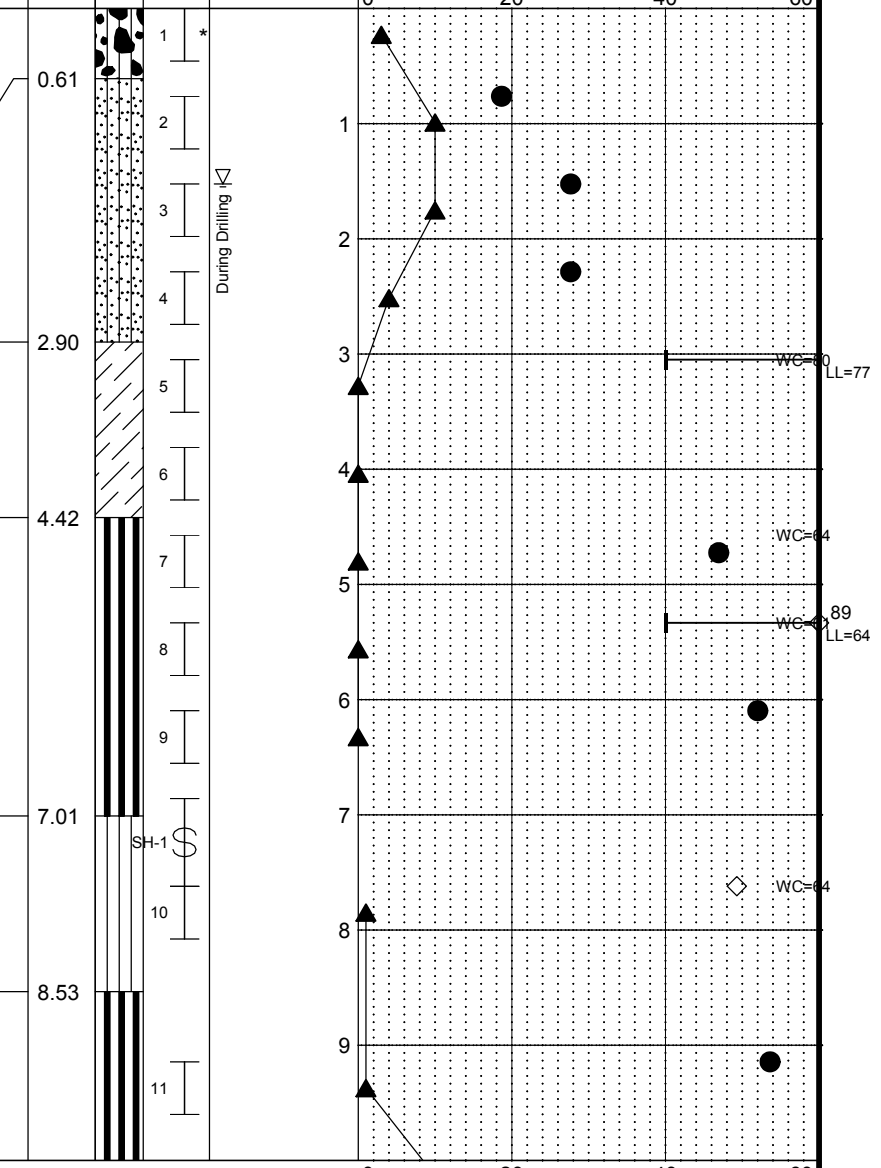
7.01

Soft, dark gray, *Sandy Silt (ML)* to very loose, dark gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace organics and wood fragments; laminated.
Alluvium (Ha)

8.53

Very soft, gray brown, *Elastic Silt with Sand (MH)*; wet; fine sand; low to medium plasticity fines; trace shell fragments; trace fine sand laminations.
Estuarine Deposits (He)

CONTINUED NEXT SHEET



LEGEND

- * Sample Not Recovered
- 2.0" O.D. Split Spoon Sample
- 3" O.D. Thin-Walled Tube
- 3" O.D. Split Spoon Sample
- Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit ⊢●⊣ Liquid Limit
- Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-06-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 1 of 6

REV 3

Log: CTC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.7 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

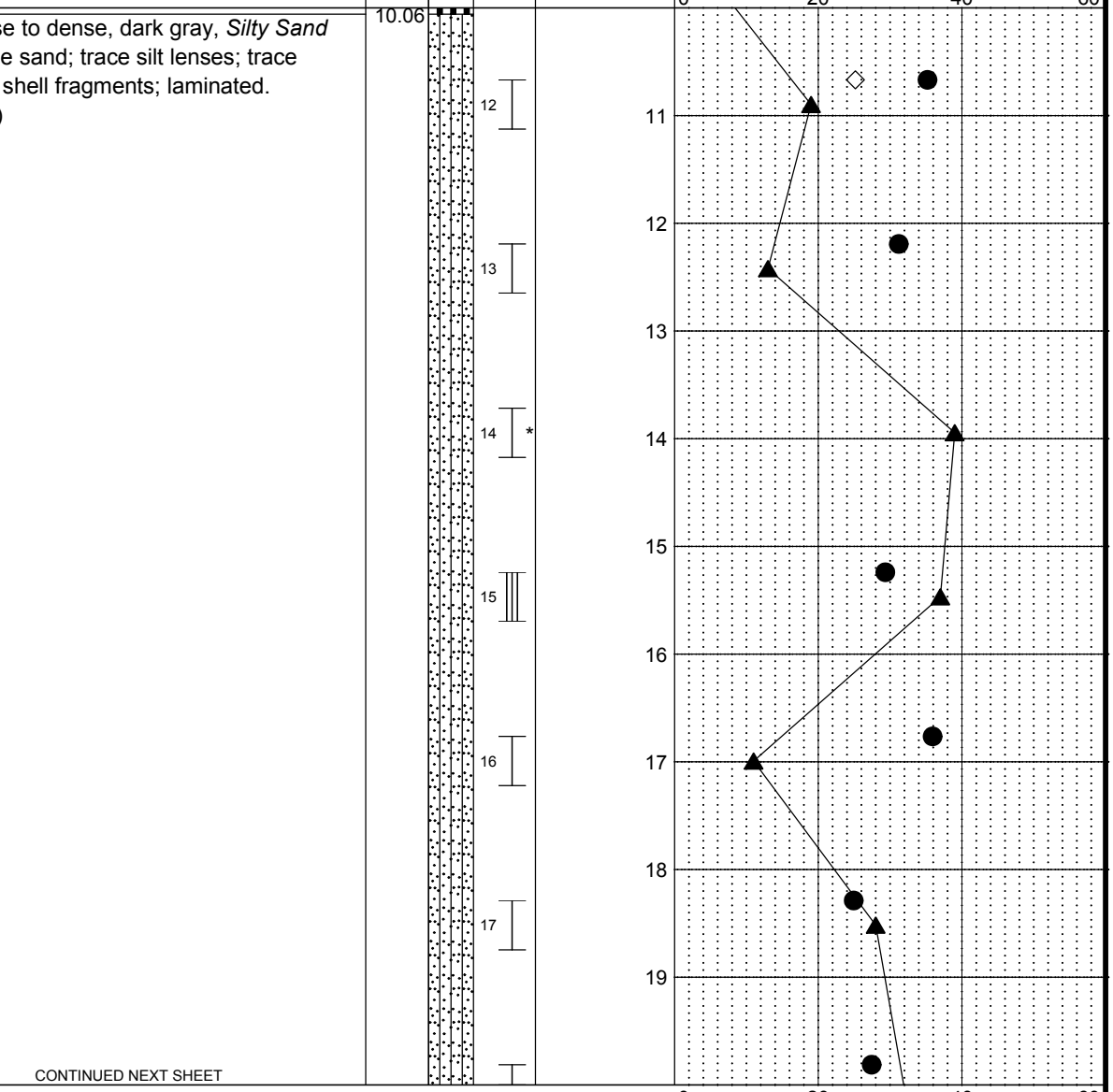
Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

10.06

Medium dense to dense, dark gray, *Silty Sand (SM)*; wet; fine sand; trace silt lenses; trace organics and shell fragments; laminated. Alluvium (Ha)



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3" O.D. Split Spoon Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-06-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 2 of 6

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: CTC Rev: EAB Typ: LKN

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.7 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense, dark gray, *Silty Sand (SM)* interbedded with stiff, gray brown, *Silt (ML)*; wet; fine sand; nonplastic; trace organics. Alluvium (Ha)

23.77

Medium dense, dark gray, *Silty Sand (SM)*; wet; fine sand; trace organics and shell fragments; nonplastic; laminated. Alluvium (Ha)

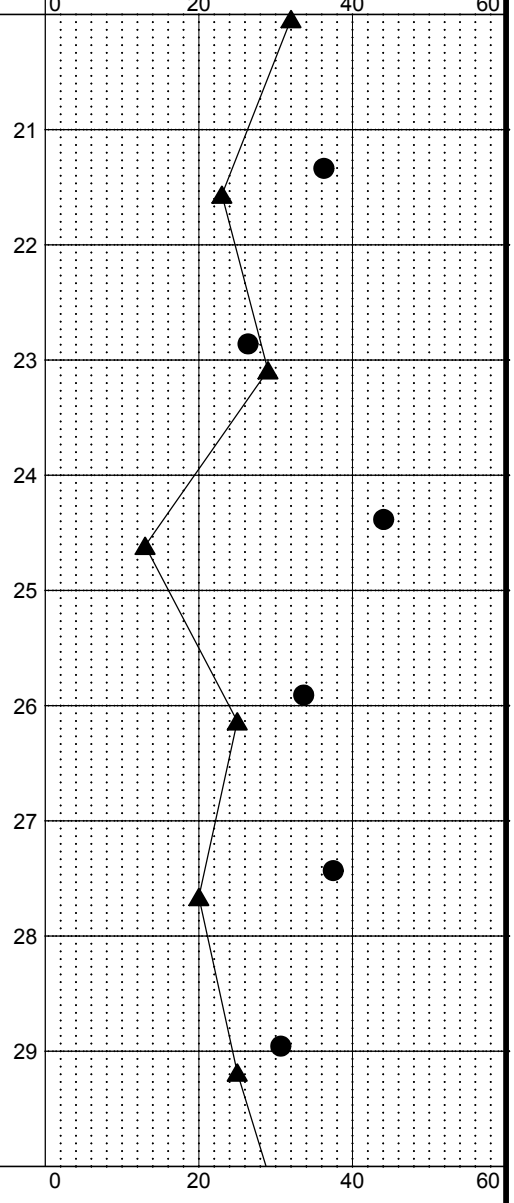
25.30

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

- * Sample Not Recovered
- 2.0" O.D. Split Spoon Sample
- 3" O.D. Thin-Walled Tube
- 3" O.D. Split Spoon Sample
- ▽ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit ⊢●⊣ Liquid Limit
- Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-06-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 3 of 6

REV 3

Log: CTC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19