PanGEO Copy

PanGEO
INCORPORATED
Geotechnical & Earthquake
Engineering Consultants

January 9, 2008
File No. 08-004

Mr. James M. Kuntz, Executive Director
Port of Walla Walla
310 A Street
Walla Walla, WA 99362

Re: **Summary Geotechnical Overview**
Wallula Gap Business Park
Walla Walla County, Washington

Dear Mr. Kuntz,

PanGEO, Inc. (PanGEO) prepared this letter report summarizing our knowledge and understanding of the geotechnical conditions in the vicinity of the Wallula Gap Business Park. Specifically, the following discussion and enclosed factual data are pertinent to the parcels of land that include Sections 2 and 11 of Township 7 North, Range 31 East (see the enclosed Basalt Surface Elevation Map, which serves as a site and vicinity map for the discussion in this report).

At this time, subsurface information on the above referenced parcels is limited to well data, as geotechnical borings and investigations have yet to be performed in these areas. However, based on the stratigraphy described in the well logs and our extensive knowledge of the geotechnical conditions in Section 34, Township 8 North, Range 31 East, which is located just to the northwest of Section 2, it is possible to extrapolate the geotechnical knowledge base from that site to the subject parcels.

EXISTING INFORMATION

This summary is based primarily on the following sources of information:

- Draft Geotechnical Report, Wallula Power Project, prepared by PanGEO, Inc., dated September 4, 2001.
- Draft Geologic Logs and As-built Well information for wells WERC-A, WERC-As, WERC-B, WERC-C and WERC-D, drilled for Wallula Energy Resource Center, prepared by Pacific Groundwater Group, dated April, 2007 (enclosed).
- Fiber Farm Road Monitoring Wells CW-3, CW-4 and CW-5, logs prepared by EGR & Associates, Inc., dated, June/July 1996 (enclosed).

2021A Minor Avenue E
Seattle, WA 98102
(206) 262-0370
FAX (206) 262-0374

SITE STRATIGRAPHY & GEOTECHNICAL CHARACTERIZATION

The natures of the subsurface materials are described below along with pertinent geotechnical properties that describe the behavior of the materials. The subsurface materials are described in their general stratigraphic sequence, starting with the near surface materials, downward.

Loess & Sand – The surface of the general region surrounding and including the Wallula Gap Business Park is covered with aeolian (wind-blown) deposits of sand and silt collectively referred to as loess and sand dunes. Based on the available subsurface information as shown on the enclosed Hydrogeologic Cross Section, this unit ranges from about 50 to 100 feet in thickness on the subject parcels and is therefore the most important soil unit from a site development perspective. By correlation with geotechnical borings from the neighboring site (Draft Geotechnical Report, PanGEO), these soils are likely to be:

- Medium dense, locally loose, with average standard penetration test (SPT) blowcounts of about 15.
- Well drained to excessively drained and therefore mostly unsaturated except at depth where groundwater may be perched on underlying strata.
- Generally suitable as an earthwork material, provided moisture conditioning and compaction effort is appropriate.
- Generally suitable for support of foundations in either native or embanked conditions, except for supporting heavy, vibrating equipment (such as turbine generators), in which case these soils are marginal for support of such machinery on shallow spread footings or mat foundations.
- Highly erodible to both wind and water forces in either native or embanked conditions, especially if denuded of vegetation.
- Unlikely to be susceptible to liquefaction, due to the generally unsaturated nature of the soils and the relatively low seismicity of the area (refer to the enclosed IBC 2003 Response Spectra).

Pasco Gravel – This unit underlies the loess and sand dunes, but may be locally absent where it has been eroded away prior to deposition of the wind-blown soils. Based on the available subsurface information as shown on the enclosed Hydrogeologic Cross Section, this unit ranges from a few feet to about 25 feet in thickness beneath the subject parcels. By correlation with geotechnical borings from the neighboring site (Draft Geotechnical Report, PanGEO), these soils are likely to be:

- Medium dense to dense, with average standard penetration test (SPT) blowcounts in the range of about 20 to 50.
- Saturated, as the strata underlying this layer typically form an aquitard upon which groundwater perches.
- Of variable sorting and gradation; may include particle sizes from sand to boulders.
- Suitable as an earthwork material, but unlikely to be exposed except in large cuts greater than at least 50 feet in depth.

- Suitable for support of deep foundations, although low-displacement driven piles (e.g., H-piles) are apt to "run" to depth and end-bearing on underlying formations.
- Unlikely to be susceptible to liquefaction, due to the dense nature of the soils and the relatively low seismicity of the area.

Ringold Formation – This unit underlies either the loess and sand dunes or the Pasco Gravels, or both, but may be locally absent where it has been eroded away prior to deposition of the younger soils. On the subject parcels, this unit ranges from zero to over 100 feet in thickness and generally thickens to the east. With the exception of possibly serving as a bearing stratum for deep foundations, it is unlikely that this unit will be important with respect to site development.

Saddle Mountains Basalt – This is the basal bedrock unit in the area. It is generally 100 to 200 feet below the existing ground surface of the subject parcels. With the exception of possibly serving as a bearing stratum for deep foundations, it is unlikely that this unit will be important with respect to site development.

CLOSURE

In summary, from a geotechnical standpoint the subject parcels are well-suited for light to heavy industrial development. The area is generally free of many of the geologic hazards that occur in other parts of Washington State. Site seismicity is low and therefore the risks associated with earthquake hazards such as strong ground motion, liquefaction, ground rupture, tsunami, sieche, etc., are comparatively low or non-existent. Landslide and mass wasting hazards, with the exception of erosion due to wind or water forces, present a generally low risk for the area. The site soils are generally suitable for both embankment and foundation support purposes, except as noted above. The subject parcels are located topographically above the potential for flooding due to dam failure scenarios on the Columbia and Snake River systems.

PanGEO appreciates the opportunity to be of service to the Port of Walla Walla and its tenants. Please contact our offices if you have any questions at (206) 262-0370.

Sincerely,

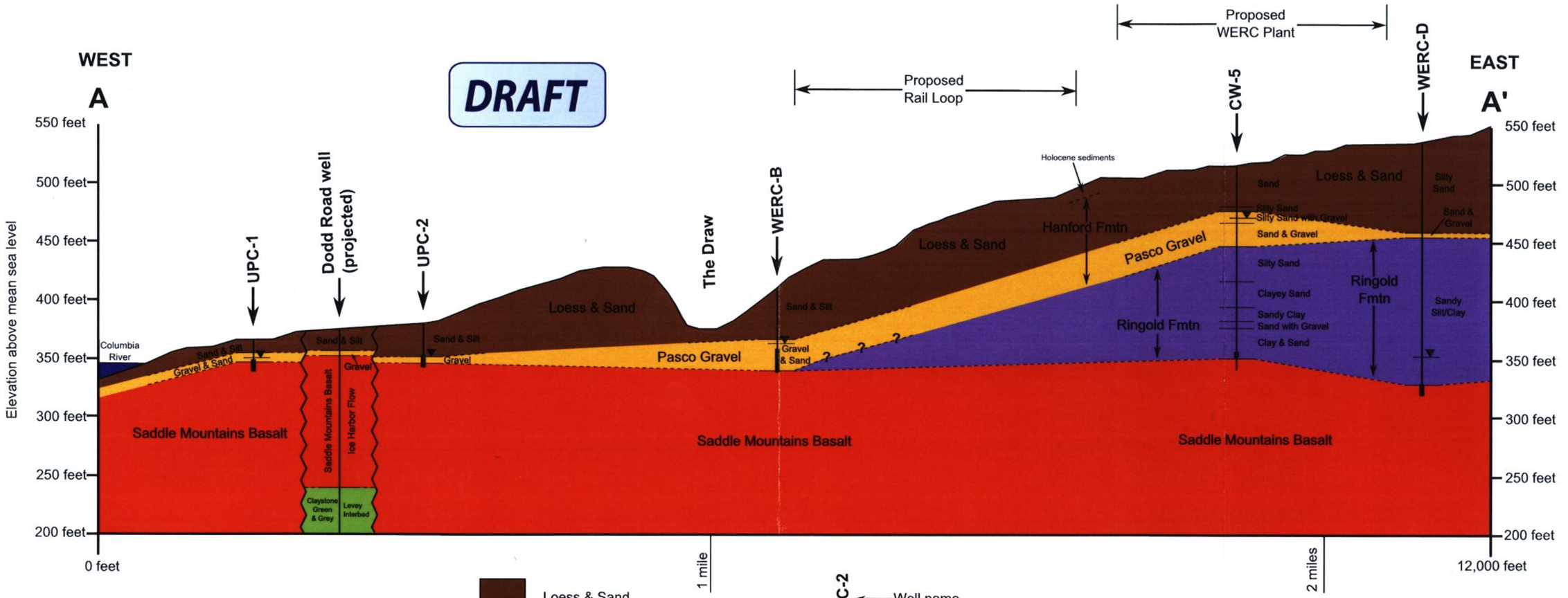
Robert E. Kimmerling, P.E.
Principal Geotechnical Engineer

Enclosures: Basalt Surface Elevation Map (site and vicinity information)
Hydrogeologic Cross Section
Draft Geologic Logs: Wells WERC-A, WERC-As, WERC-B, WERC-C & WERC-D
Boring Logs: Fiber Farm Road Monitoring Wells CW-3, CW-4 & CW-5
IBC 2003 Response Spectra, 2475 Year Event

Figure 3.3.1.3-3
Basalt Surface Elevation Map

Wallula Energy Resource Center
JE0701

PgG



0 1000

Horizontal Scale (feet)

Vertical Scale = 10X Horizontal Scale

Geologic contact, dashed where inferred

?- - - Uncertain geologic contact

- Loess & Sand
- Pasco Gravel
- Ringold Formation
- Saddle Mountains Basalt
- Levey Interbed

UPC-2 ← Well name

← Cased portion of well

← Static Water Level

← Screened portion of well

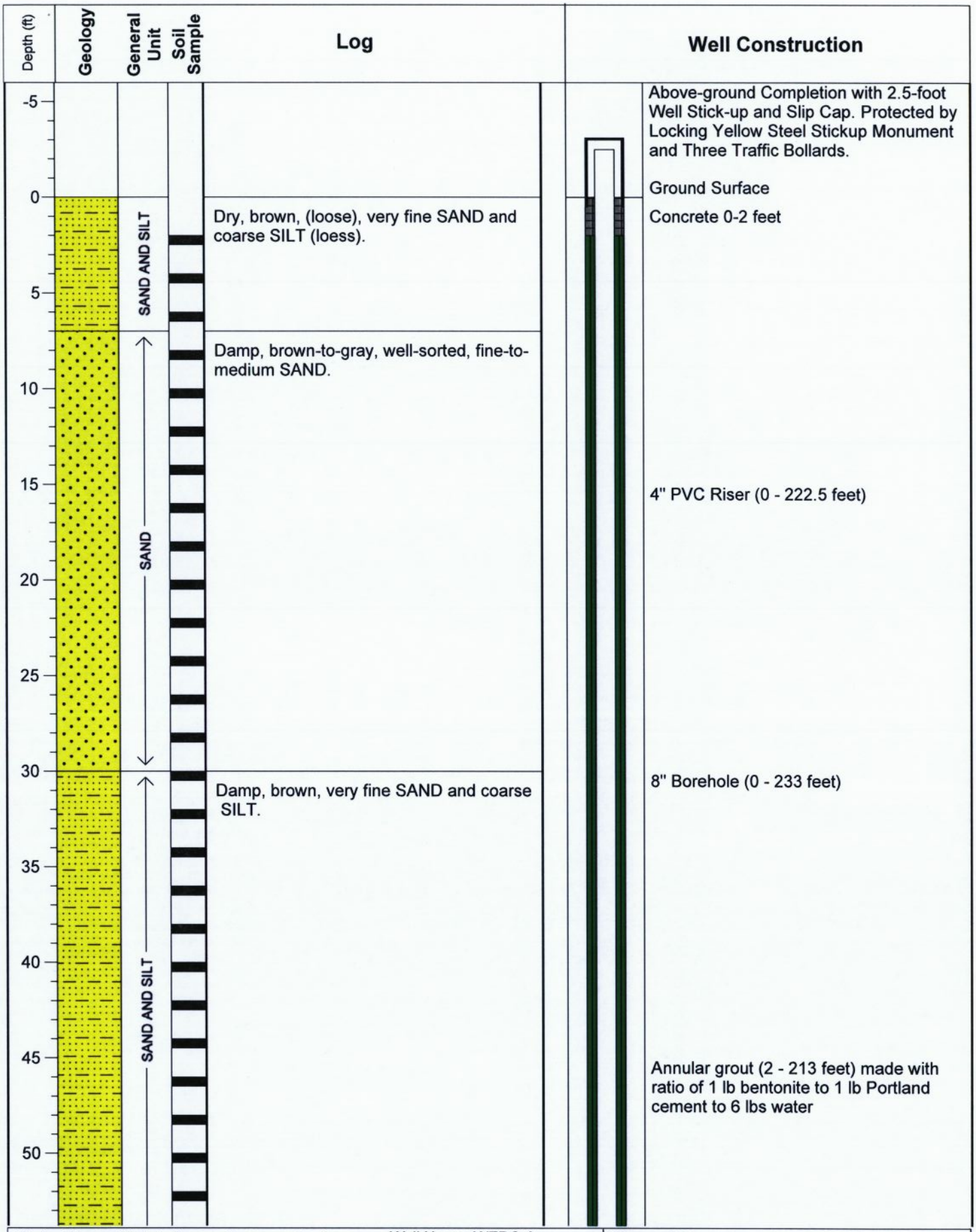
Notes:

1) The geologic contact between surficial Holocene sediments (silt and fine sand) and the underlying Hanford Formation (fine sands) is difficult to pinpoint. Therefore, the location of this contact is not demarcated and surficial Holocene sediments are not shown on this cross-section.

2) The direction of groundwater flow is coming out of the page.

Figure 3.3.1.3-2
Hydrogeologic Cross Section

Wallula Energy Resource Center
JE0701

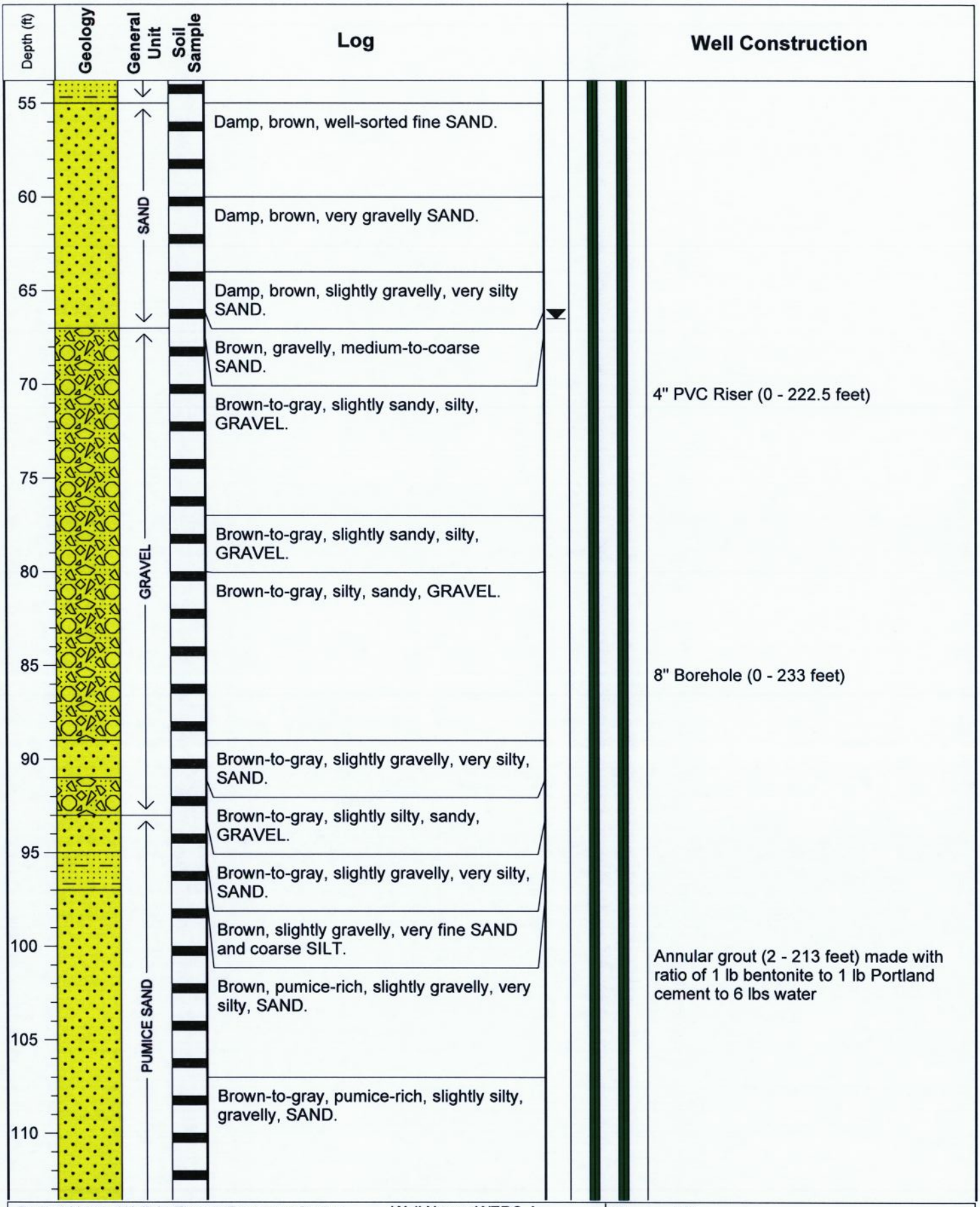


Project Name: Wallula Energy Resource Center
Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Jeff Witter
Location: SE1/4 of NE1/4 Section 2 T07N R31E

Well Name: WERC-A
Ecology ID: APA 363
MP Elevation: ??
Datum: -
Installed: 4/20/2007
DTW: 66.5' BGS on 4/20/2007

Figure XX
DRAFT GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-A
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

PgG



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Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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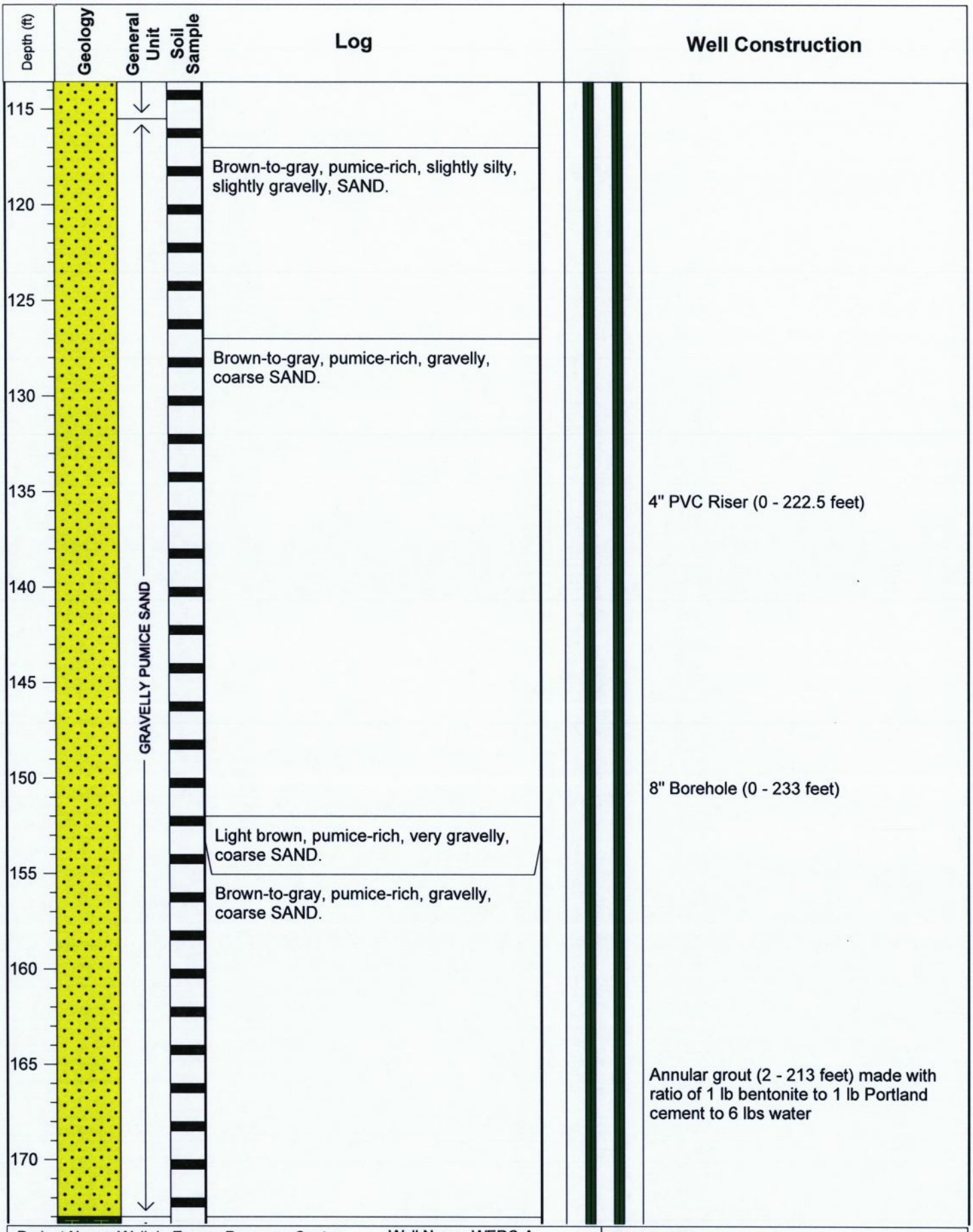

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Wallula, Washington
JE0701, 4/2007

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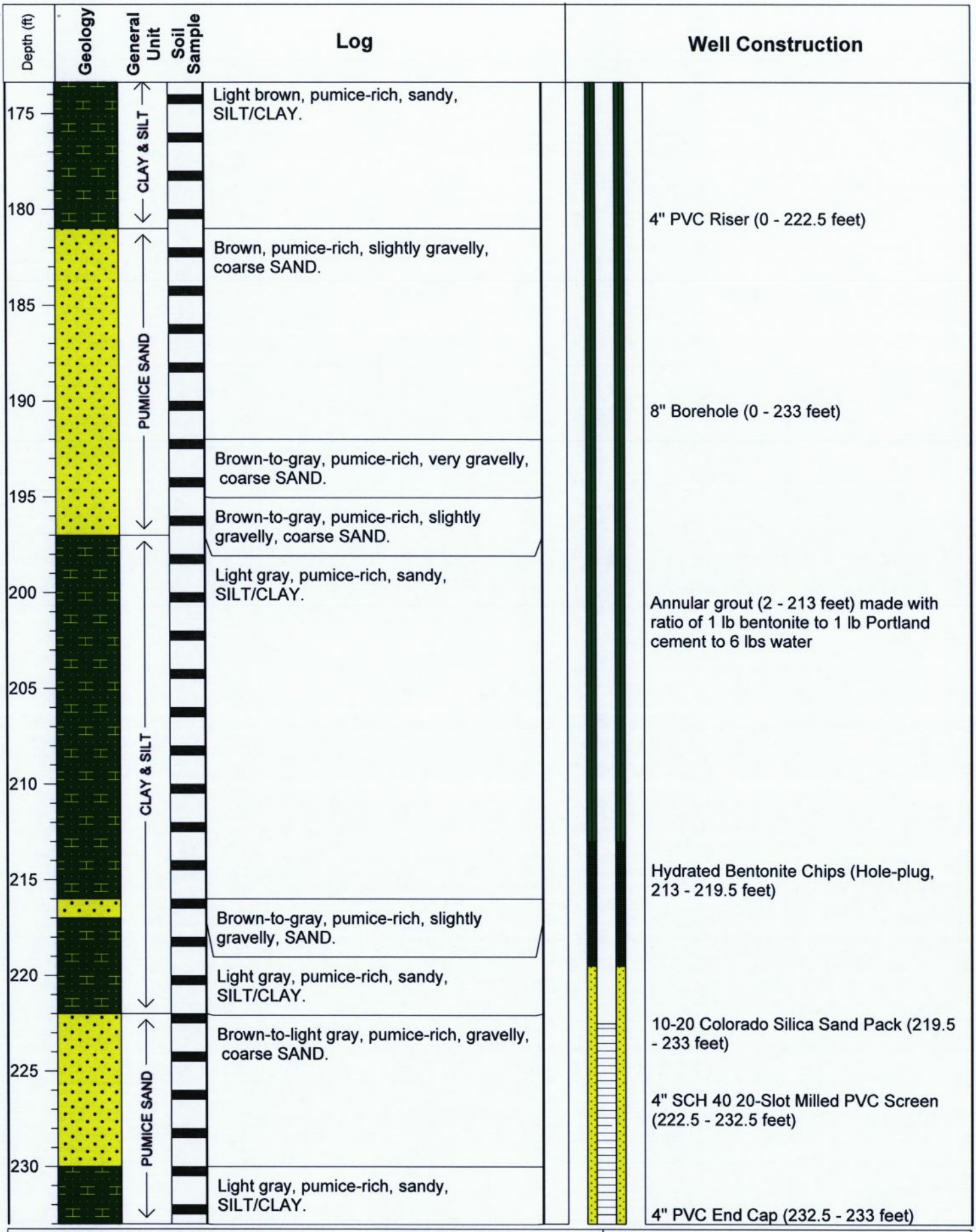

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Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Jeff Witter
Location: SE1/4 of NE1/4 Section 2 T07N R31E

Well Name: WERC-A
Ecology ID: APA 363
MP Elevation: ??
Datum: -
Installed: 4/20/2007
DTW: 66.5' BGS on 4/20/2007
Page 4 of 4

Figure XX
DRAFT GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-A
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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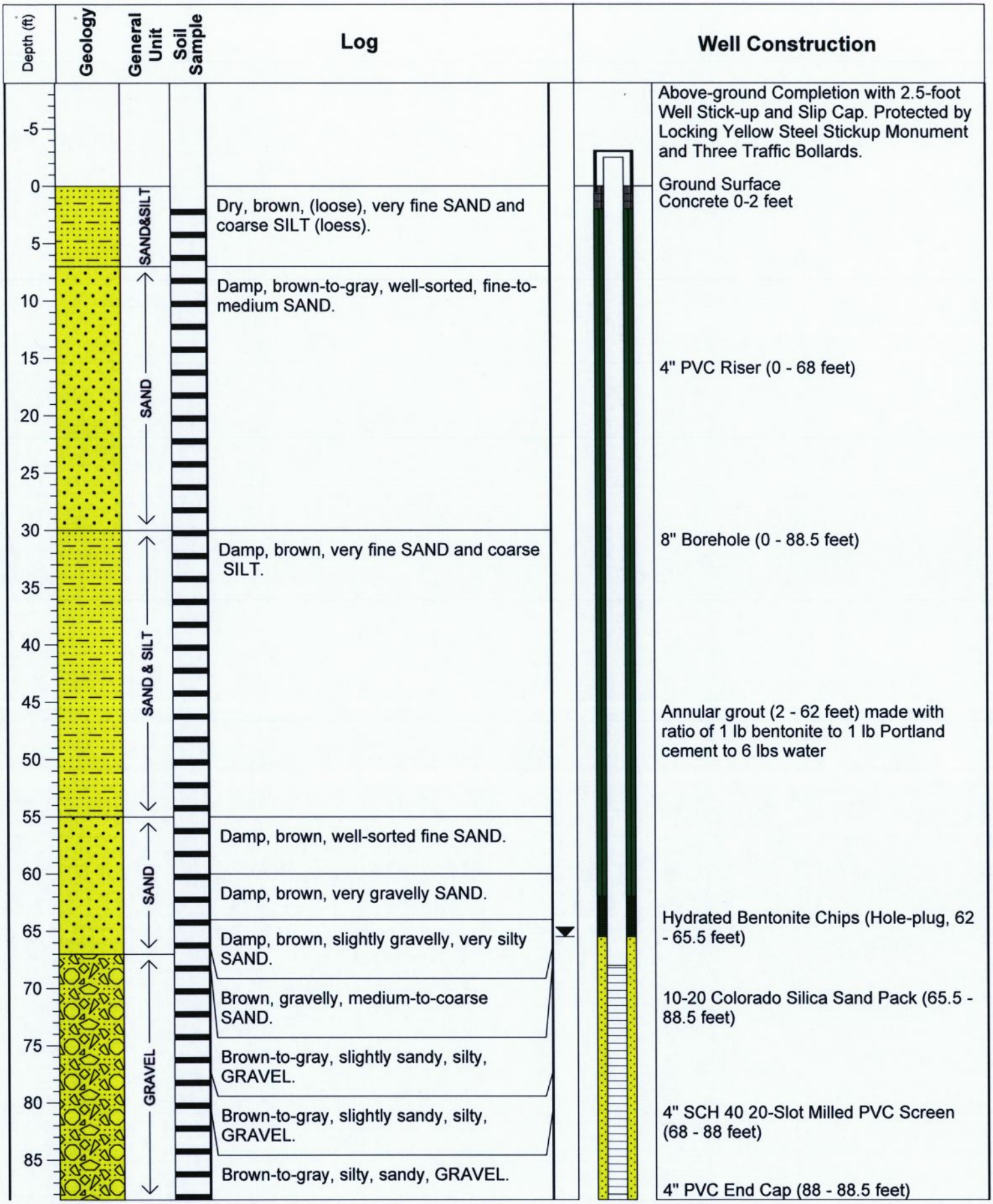

Project Name: Wallula Energy Resource Center
Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: assumed log is same as WERC-A
Location: SE1/4 of NE1/4 Section 2 T07N R31E

Well Name: WERC-As
Ecology ID: APA 364
MP Elevation: ??
Datum: -
Installed: 4/25/2007
DTW: 65.5' BGS on 4/26/2007
Page 1 of 1

Figure XX
DRAFT GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-As
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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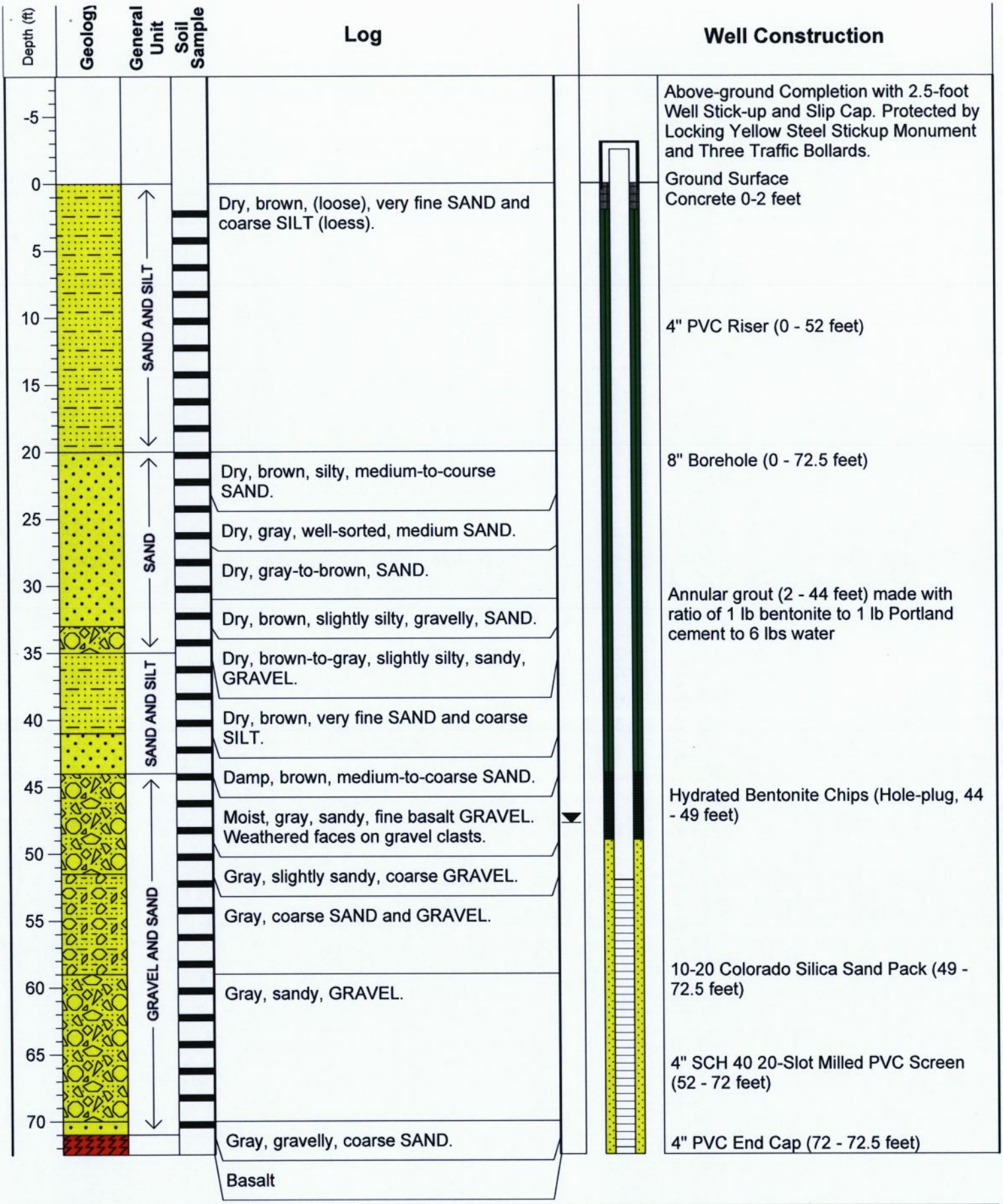

Project Name: Wallula Energy Resource Center
Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Jeff Witter
Location: NW1/4 of SW1/4 Section 2 T07N R31E

Well Name: WERC-B
Ecology ID: APA 361
MP Elevation: ??
Datum: -
Installed: 4/17/2007
DTW: 47.8' BGS on 4/17/2007
Page 1 of 1

Figure XX
DRAFT GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-B
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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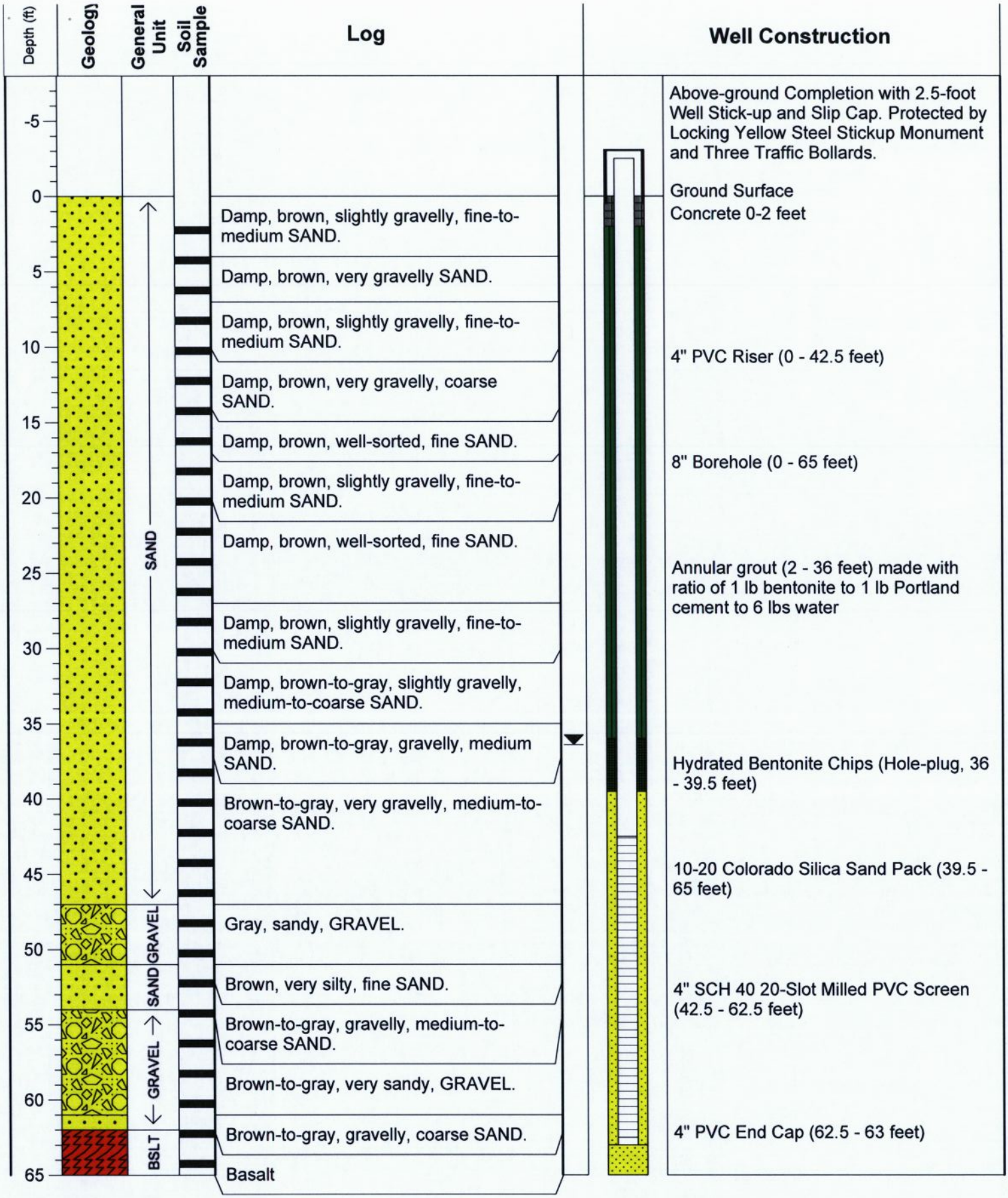

Project Name: Wallula Energy Resource Center
Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Jeff Witter
Location: NE1/4 of NW1/4 Section 2 T07N R31E

Well Name: WERC-C
Ecology ID: APA 362
MP Elevation: ??
Datum: -
Installed: 4/18/2007
DTW: 36.4' BGS on 4/18/2007
Page 1 of 1

Figure XX
DRAFT GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-C
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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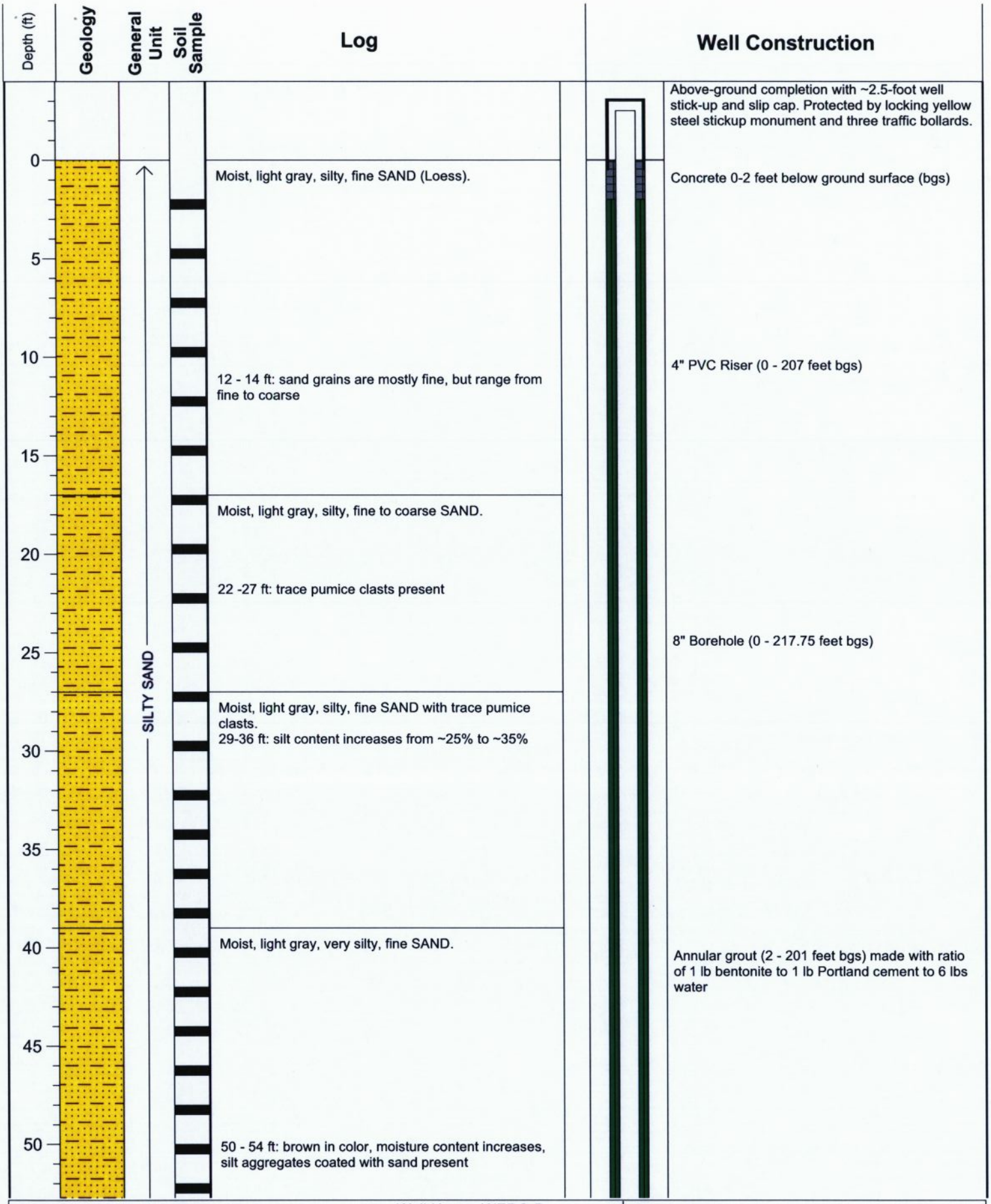

Project Name: Wallula Energy Resource Center
Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Glenn Mutti
Location: SE1/4 of SE1/4 Section 2 T07N R31E

Well Name: WERC-D
Ecology ID: APA 365
MP Elevation: ??
Datum: -
Installed: 4/23/2007 - 4/25/2007
DTW: 57.08' BGS on 4/24/2007

Figure XX
GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-D
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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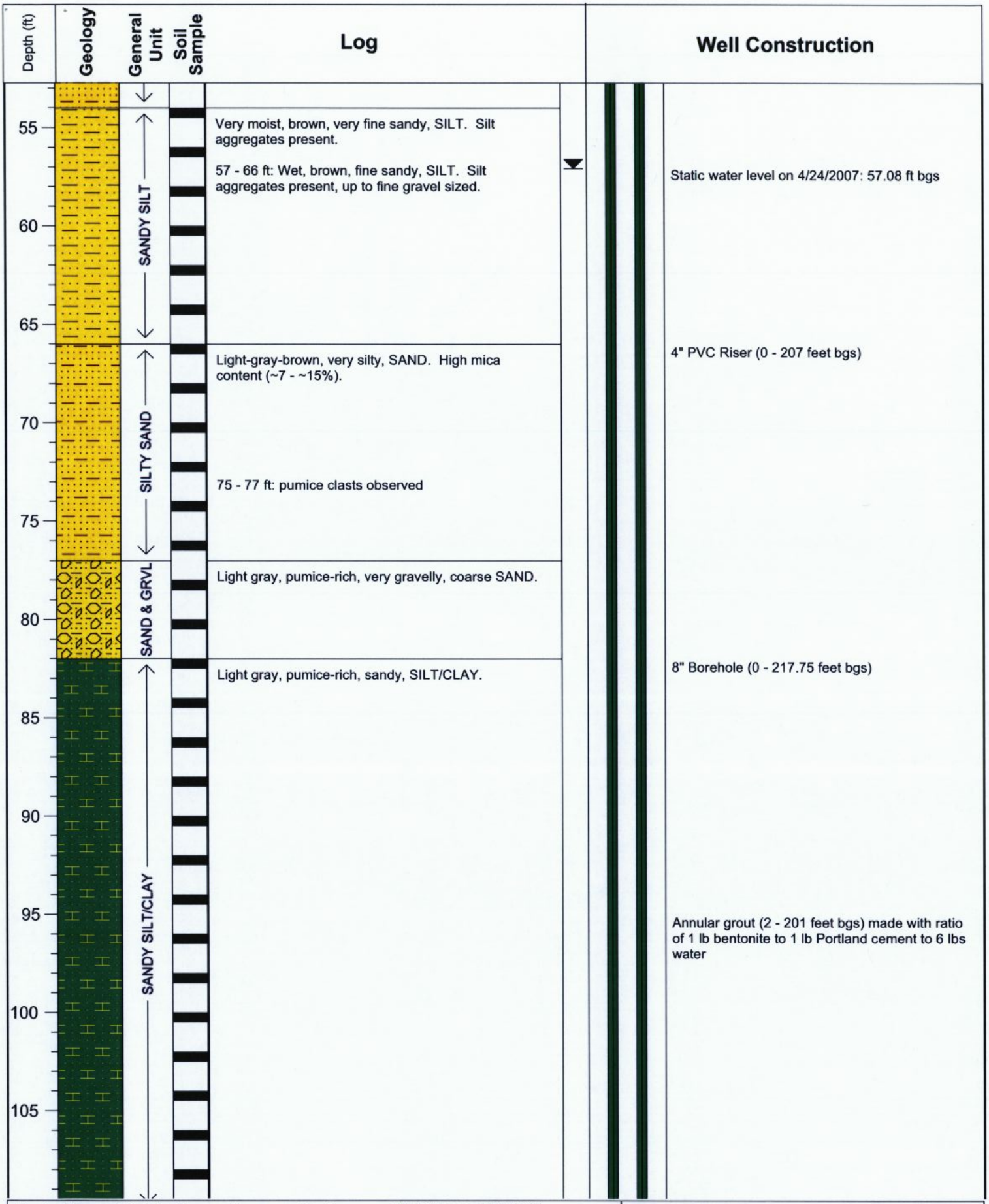

Project Name: Wallula Energy Resource Center
Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Glenn Mutti
Location: SE1/4 of SE1/4 Section 2 T07N R31E

Well Name: WERC-D
Ecology ID: APA 365
MP Elevation: ??
Datum: -
Installed: 4/23/2007 - 4/25/2007
DTW: 57.08' BGS on 4/24/2007

Figure XX
GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-D
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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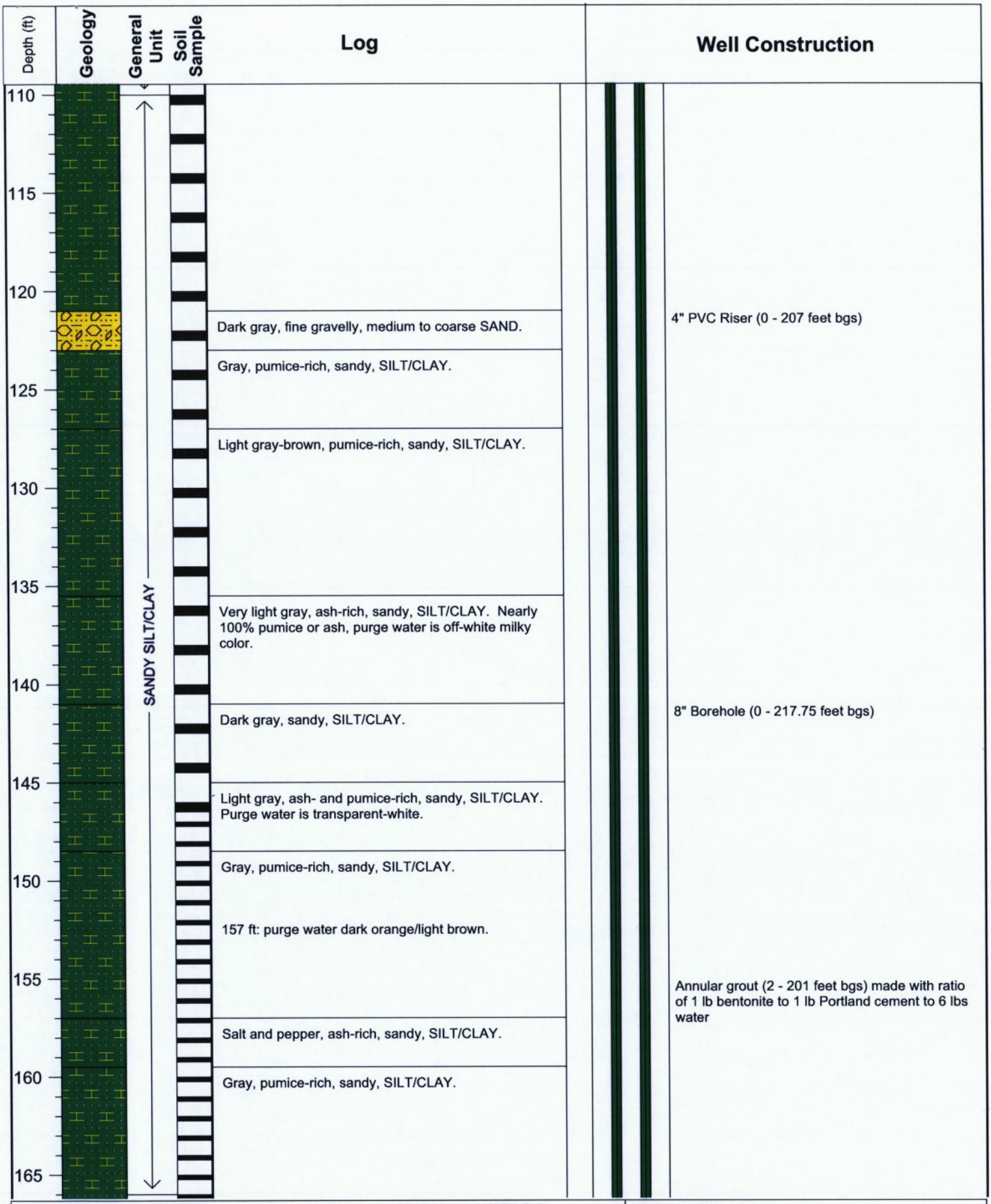

Project Name: Wallula Energy Resource Center
Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Glenn Mutti
Location: SE1/4 of SE1/4 Section 2 T07N R31E

Well Name: WERC-D
Ecology ID: APA 365
MP Elevation: ??
Datum: -
Installed: 4/23/2007 - 4/25/2007
DTW: 57.08' BGS on 4/24/2007

Figure XX
GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-D
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

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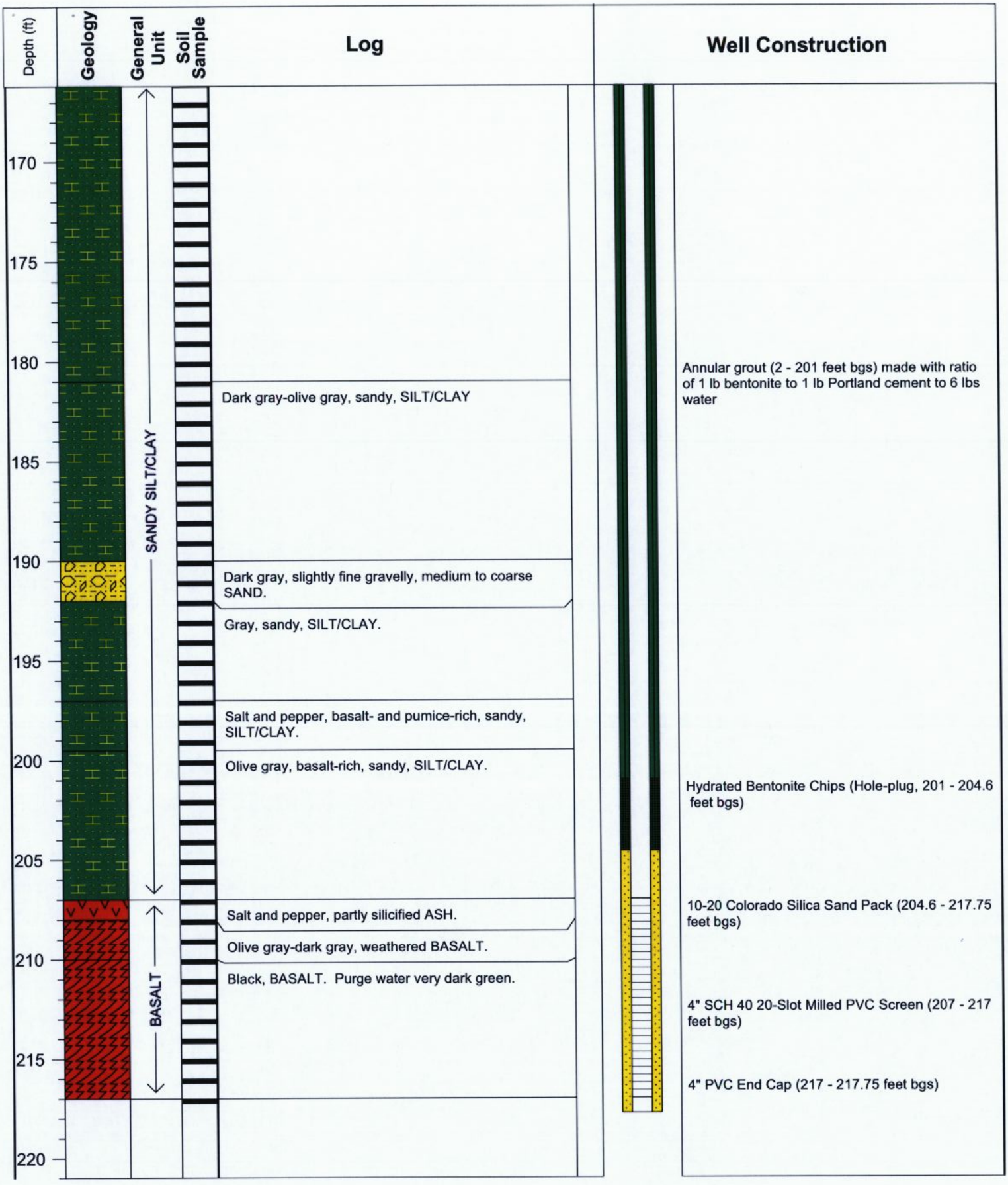

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Drilling Method: Air Rotary
Driller: Ron Sink
Firm: Environmental West Exploration
Consulting Firm: Pacific Groundwater Group
Logged by: Glenn Mutti
Location: SE1/4 of SE1/4 Section 2 T07N R31E

Well Name: WERC-D
Ecology ID: APA 365
MP Elevation: ??
Datum: -
Installed: 4/23/2007 - 4/25/2007
DTW: 57.08' BGS on 4/24/2007

Figure XX
GEOLOGIC LOG AND AS-BUILT FOR WELL WERC-D
Wallula Energy Resource Center
Wallula, Washington
JE0701, 4/2007

PgG

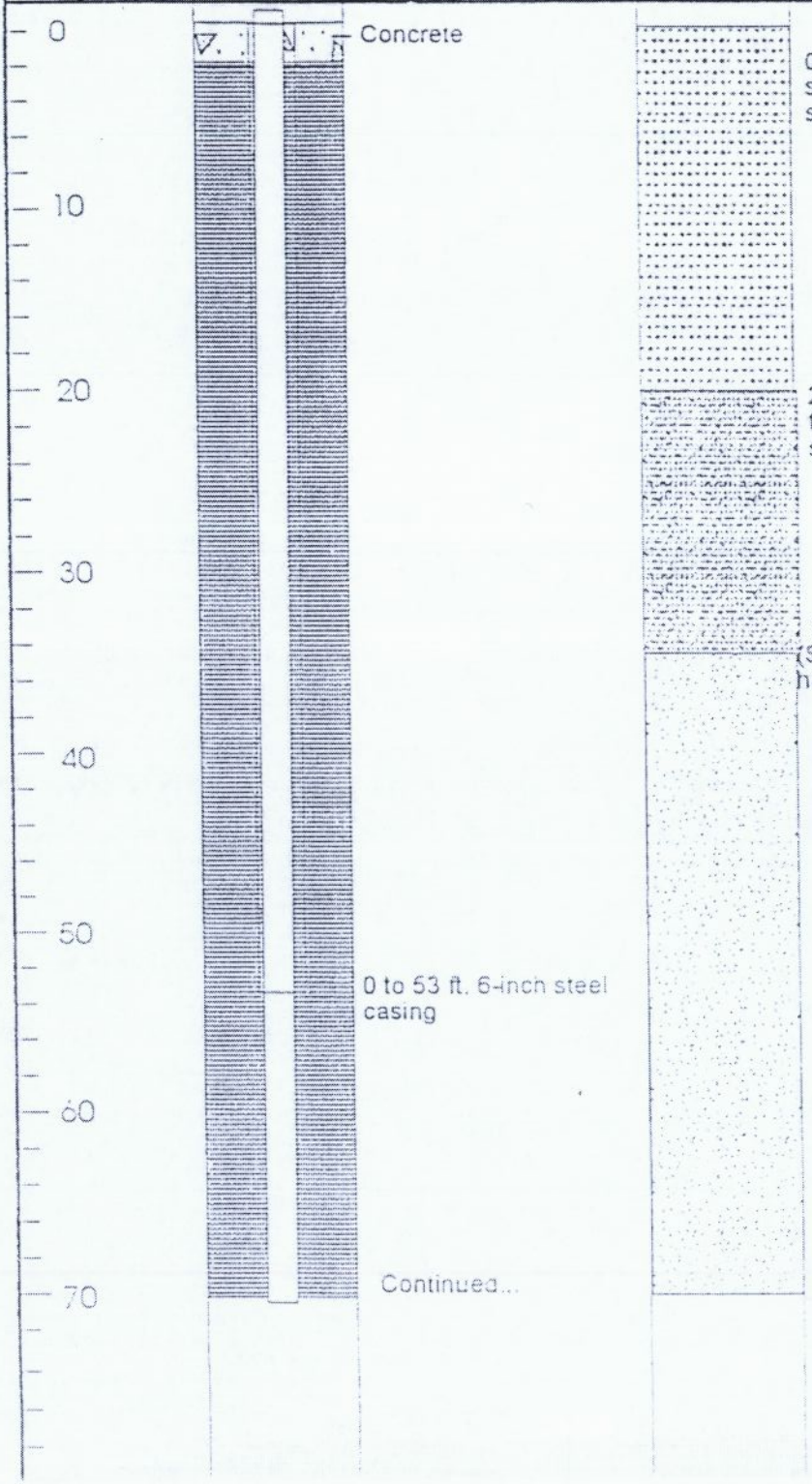
BORING LOG

Project: Boise Cascade - Wallula Page 1 of 2 Date: 7/3/96

Location: Fiber Farm Road Monitoring Well CW-3 Drilling Method: 6-inch air rotary

Drilled By: Ponderosa Drilling & Development, Inc. Logged By: Steven R. Ames

Start Date: 4/29/96 Total Depth: 73 feet TOC Elevation: 405.24 feet AMSL DTW: 100 ft. BGS



EGR & Associates, Inc.
Engineers, Geologists and Surveyo
2545 K Prairie Road
Eugene, Oregon 97402
(503) 688-8022

BORING LOG

Project: Boise Cascade - Wallula Page 2 of 2 Date: 7/3/96

Location: CW-3 Drilling Method: 6-inch air rotary

Drilled By: Ponderosa Drilling & Development, Inc. Logged By: Steven R. Ames

Start Date: 4/29/96 Total Depth: 100 ft. TOC Elevation: 405.24 feet AMSL DTW: 73 ft. BGS

Depth (ft)	As-Built	Lithology	Lithologic Description
70 DTW	Bentonite 30-bags		Ground water encountered at 75 ft.
			75 to 78 ft. GRAVEL WITH SAND (GP): About 80% fine, subrounded, elongated, wet dark gray gravel, maximum size, 3 cm.; about 20% dark grey sand.
80	8, 12 Colorado Silica Sand		78 to 88 ft. GRAVELLY SAND (SP-GP): About 65% poorly sorted, angular, hard, wet, dark grey sand; about 35% fine, angular, flat, dark grey gravel; maximum size, 1cm.
	4-Bags		
	WELL CONSTRUCTION		
90	87 feet-2" Solid PVC Casing		88 to 90 ft. CLAYEY GRAVEL (GC): About 65% fine angular, flat, dark grey gravel, maximum size 1 cm. about 35% plastic fines, medium dry strength, low toughness, slow dilancy, wet, blue-green clay.
	5 feet-2'-0.010 Slotted PVC Casing		90 to 100 ft. BASALT: Coarse, hard, angular, black bedrock; maximum size, 2 cm., wet.
100	Centeralizers Inserted at 52 and 92 feet.		
	One Monument		
	Three Guard Posts		
110			
120			

EGR & Associates, Inc.
Engineers, Geologists and Surveyors
2545 K Prairie Road,
Eugene, Oregon 97402
(503) 688-8322

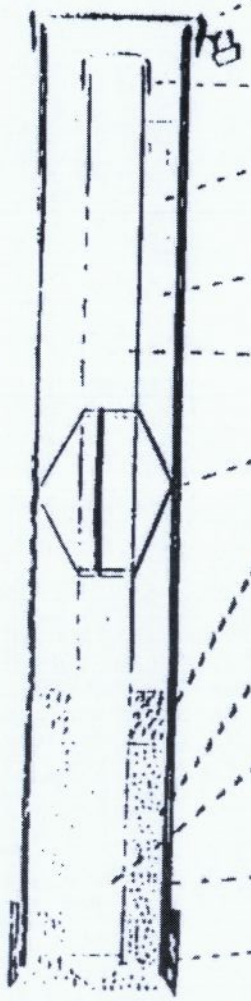
RESOURCE PROTECTION WELL REPORT

START CARD No. R02736

FACILITY NAME: BOISE CASCADE
WELL IDENTIFICATION NO. ABW-282 CW3
DRILLING METHOD: ROTARY DRILLING
DRILLER: MARTY JENSEN
FIRM: PONDEROSA DRILLING & DEVELOPMENT
ORIENTATION:
CONSULTING FIRM: EGR & ASSOCIATES
REPRESENTATIVE: RALPH CHRISTIANSEN

COUNTY: WALLA WALLA
LOCATION: SW SE SE Sec 16 Twn 7 N 31
STREET ADDRESS OF WELL:
WATER LEVEL ELEVATION: 73
GROUND SURFACE ELEVATION:
INSTALLED: 29 APRIL/1 MAY 1996
DEVELOPED:

AS BUILT



WELL DATA

CAP OR VAULT
TYPE: LOCKING
SIZE: 6"
LOCK: YES
PVC CAP: YES

CEMENT:
DEPTH: 0 TO 82.5
GWGS:

GROUT TYPE: BENTONITE
DEPTH: 0 TO 82.5
GWGS:

PVC TYPE: SCH 40
PVC SIZE: 6"
DEPTH: ±3 TO 53
CENTRALIZERS:
PELLETS SIZE:
DEPTH: TO
BUCKETS:

SILICA SAND: 8/12
DEPTH: 82.5 TO 100
GWGS:

SCREEN TYPE: PVC
DEPTH: 85 TO 90
SIZE: .010

CASING SIZE: 6"
DRIVE SHOE:

BOTTOM: 100

GUARD POSTS:

MISC:

FORMATION DESCRIPTION

FINE SAND & SILT — 0
25
50
STATIC LEVEL — 73
75
GRAVEL, SAND & WATER — 76
CLAY — 88
HARD BLACK BASALT — 89
100

MAP #: _____ PAGE _____ OF _____

FORM 12 (Rev. 11/88)

BORING LOG

Project: Boise Cascade - Wallula | Page 1 of 2 | Date: 7/5/96

Location: CW-4 | Drilling Method: 6-inch air rotary

Drilled By: Ponderosa Drilling & Development, Inc. | Logged By: Steven R. Ames

Start Date: 5/1/96 | Total Depth: 118 feet | TOC Elevation: 434.50 feet AMSL | DTW: 97 ft. BGS

Depth (ft)	As-Built	Lithology	Lithologic Description
0			0 to 33 feet (ft.) SILT(ML): Non-plastic, no dry strength, medium dilancy, low toughness, dry to moist, light brown silt.
10			
20			
30			
40			33 to 40 ft. SILT WITH SAND (ML): About 85% non-plastic, low dry strength, low toughness, rapic dilancy, moist, light brown silt; about 15% fine, subrounded, brown sand.
			40 to 53 ft. SAND WITH SILT(SP-SM): About 85% fine, subrounded to sub angular, moist, brown sand: about 15% non-plastic silt.
50			53 to 60 ft. POORLY SORTED SAND (SP): Fine, subrounded to sub angular, hard, dry to moist, da grey and brown sand.
60			60 to 88 ft. POORLY SORTED SAND WITH GRAVEL (SP): About 65% fine, subrounded to su angular, hard, dry to moist, dark brown and grey sand; about 35% fine to coarse subrounded to su angular gravel; maximum size, 1 cm.
70			

Continued...

EGR & Associates, Inc.
Engineers, Geologists and Surveyor
2545 K Prairie Road,
Eugene, Oregon 97402
(503) 688-8322

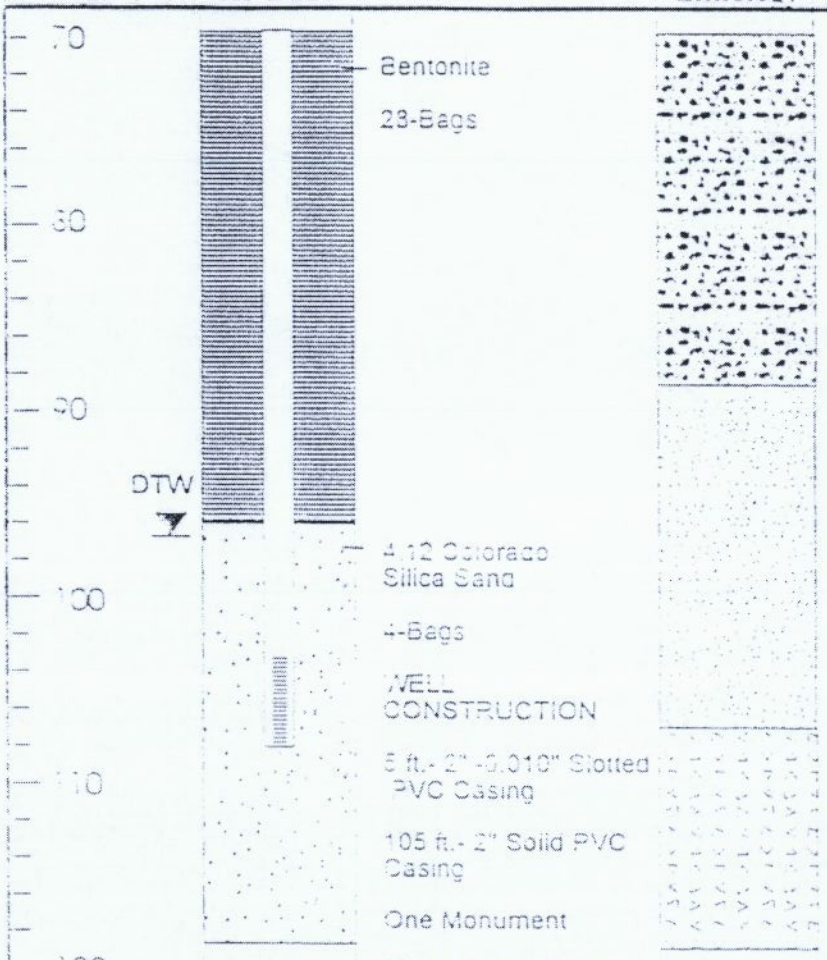
BORING LOG

Project: Boise Cascade - Wallula Page 2 of 2 Date: 7/5/96

Location: CW-4 Drilling Method: 8-inch air rotary

Drilled By: Ponderosa Drilling & Development, Inc. Logged By: Steven R. Ames

Start Date: 5/1/96 Total Depth: 118 feet TOC Elevation: 435.50 feet AMSL DTW: 97 feet BGS



88-95 ft. POORLY SORTED SAND (SP): Fine, subrounded, hard, moist, brown sand; about 5% fine, sub rounded gravel, maximum size 1cm.

95 to 108 ft. MODERATELY SORTED SAND (SP/SW): Medium to fine, subrounded to subangular, hard, wet, dark grey sand.

Ground Water Encountered at 97 ft.

108 to 118 ft. BASALT: Fine to coarse, angular, hard, black bedrock particles.

Depth to Casing Bottom = 90 ft.

Top of Concrete Elevation = 433.35

EGR & Associates, Inc.
Engineers, Geologists and Surveyo
2545 K Prairie Road
Eugene, Oregon 97402
(503) 688-8322

RESOURCE PROTECTION WELL REPORT

START CARD NO. R02736

PROJECT NAME: BOISE CASCADE

WELL IDENTIFICATION NO. ABW-283 CW4

DRILLING METHOD: ROTARY DRILLING

DRILLER: MARTY JENSEN

FIRM: PONDEROSA DRILLING & DEVELOPMENT, INC

AFFILIATION:

CONSULTING FIRM: EGR & ASSOCIATES

REPRESENTATIVE: RALPH CHRISTIANSEN

COUNTY: WALLA WALLA

LOCATION: SE¼ SE ¼ Sec 16 Twn 7 N 31

STREET ADDRESS OF WELL:

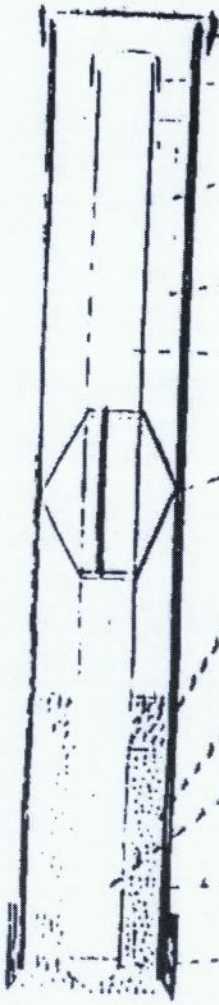
WATER LEVEL ELEVATION: 95'

GROUND SURFACE ELEVATION:

INSTALLED: MAY 1-3, 1996

DEVELOPED:

AS BUILT



WELL DATA

CAP OR VAULT
TYPE: LOCKING
SIZE: 6"
LOCK: YES
PVC CAP: YES

CEMENT:
DEPTH: 0 TO 97
BAGS:

GROUT TYPE: BENTONITE
DEPTH: 0 TO 97
BAGS:

PVC TYPE: SCH 40
PVC SIZE: 4"
DEPTH: +2.5 TO 108
CENTRALIZERS:
PELLETS SIZE:
DEPTH: TO
BUCKETS:

SILICA SAND: 8/12
DEPTH: 97 TO 118
BAGS:

SCREEN TYPE: PVC
DEPTH: 103 TO 108
SIZE: .010

CASING SIZE: 4"
DRIVE SHOE:

BOTTOM: 118

GUARD POSTS:

MISC:

FORMATION DESCRIPTION

SAND, SILT, CLAY	0
	25
	50
	75
GRAVEL & SAND	85
	88
SAND & SILT	
STATIC LEVEL	95
	100
GRAVEL, SAND & WATER	108
HARD BLACK BASALT	118
	125

PAGE ___ OF ___

ENG 12 (Rev. 11/88)

BORING LOG

Project: Boise Cascade - Wallula Page 1 of 3 Date: 6/17/96

Location: Fiber Farm Road Monitoring Well CW-5 Drilling Method: 6-inch air roatary

Drilled By: Ponderosa Drilling and Development, Inc. Logged By: Steven R. Ames

Start Date: 5/3/96 Total Depth: 175 feet TOC Elevation: 518.24 feet AMSL DTW: 134 ft. BGS

Depth (ft)	As-Built	Lithology	Lithologic Description
0			0 to 37 feet (ft.) SAND (SP): fine, hard, subangula to subrounded, moist to wet, brownish-grey sand.
10			
20	Bentonite 42-Bags		
30			
40			37 to 41 ft. SILTY SAND (SM): About 60% fine, subangular to subrounded, moist, brown sand; about 35% plastic fines; about 5% fine to coarse gravel; maximum size 3 centimeters (cm.). 41 to 45 ft. SILTY SAND WITH GRAVEL (SM): About 50% sand; about 25% silt, about 25% grave
50			45 to 50 ft. SAND WITH SILT AND GRAVEL (SP) About 40% sand; about 25% silt; about 25% grave 50 to 56 ft. GRAVEL WITH SAND (GP): About 85% fine to medium, hard, sub angular gravel; maximum size 30 cm; about 15% fine to medium sand.
60			56 to 60 ft. POORLY GRADED GRAVEL WITH SAND (GP): About 50% fine to coarse, rounded gravel; maximum size 30 cm.; About 30 % fine, subrounded, moist to dry, brown sand. 60 to 70 ft. POORLY GRADED SAND WITH GRAVEL (SP): About 50% fine to coarse, subrounded, hard, moist to wet, brown sand; abou 40% fine, angular gravel; maximum size 10 cm; about 10% non-plastic fines.
70	Continued...		

EGR & Associates, Inc.
Engineers, Geologists and Surveyors
2545 K Prairie Road
Eugene, Oregon 97402
(503) 688-8322

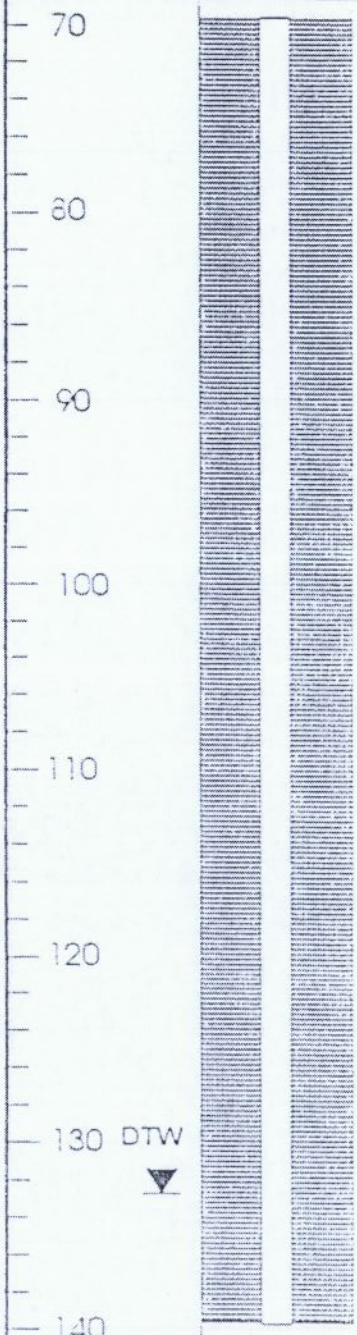
BORING LOG

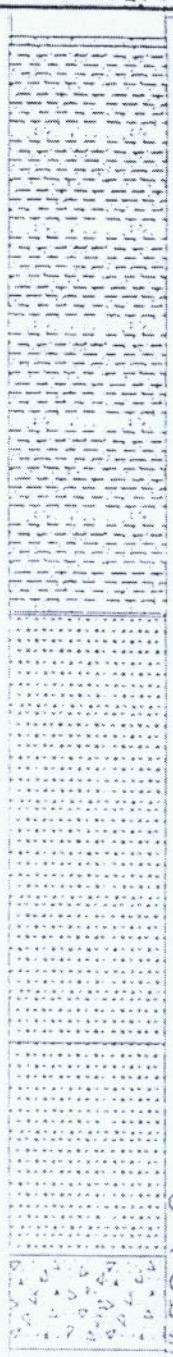
Project: Boise Cascade - Wallula | Page 2 of 3 | Date: 6/17/96

Location: Fiber Farm Road Monitoring Well CW-5 | Drilling Method: 6-inch air rotary

Drilled By: Ponderosa Drilling & Development, Inc. | Logged By: Steven R. Ames

Start Date: 5/3/96 | Total Depth: 175 feet | TOC Elevation: 518.24 feet AMSL | DTW: 134 ft. BGS





Lithologic Description

70 to 101 ft. SILTY SAND (SM): About 80% very fine, subrounded, moist, brown sand; about 20% non-plastic silt

101 to 122 ft. CLAYEY SAND (SC): About 75% sand; about 25% plastic, medium dry strength, slow dilancy, high tougnness, brown, wet clay.

122 to 135 ft. SANDY LEAN CLAY (CL): About 60% medium plastic, medium dry strength, no dilancy, medium to high toughness, light brown, wet clay; about 40% fine, subangular sand.

Ground water encountered at 134 ft.

135 to 140 ft. POORLY GRADED SAND WITH GRAVEL (SP): About 70% very fine, dry, light brown sand; about 30% fine, subrounded, hard, subrounded gravel; maximum size 5 mm.

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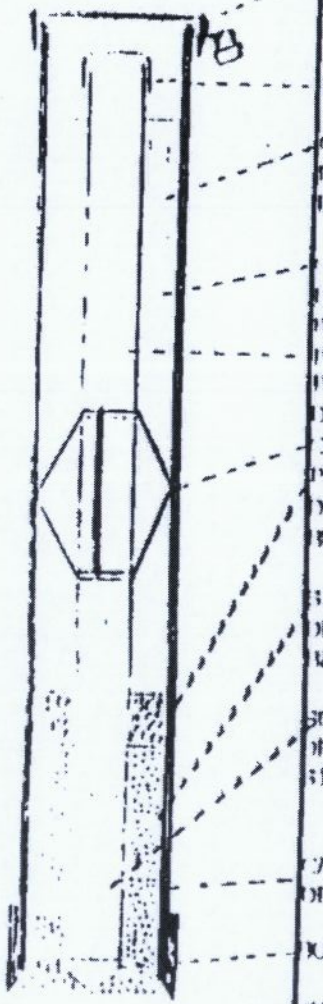
RESOURCE PROTECTION WELL REPORT

START CARD NO. RQ2736

OWNER: BOISE CASCADE
WELL IDENTIFICATION NO. ABW-284 CW5
DRILLING METHOD: ROTARY DRILLING
DRILLER: MARTY JENSEN
FIRM: PONDEROSA DRILLING & DEVELOPMENT
ADDRESS:
CONSULTING FIRM: EGR & ASSOCIATES
REPRESENTATIVE:

COUNTY: WALLA WALLA
LOCATION: SW SE ¼ Sec 16 Twn 7 N 31
STREET ADDRESS OF WELL:
WATER LEVEL ELEVATION:
GROUND SURFACE ELEVATION:
INSTALLED: MAY 3-7, 1996
DEVELOPED:

AS BUILT



WELL DATA

CAP OR VAULT
TYPE: LOCKING
SIZE: 6"
LOCK: YES
PVC CAP: YES

CEMENT:
DEPTH: 0 TO 155
BAGS:

GROUT TYPE: BENTONITE
DEPTH: 0 TO 155
BAGS:

PVC TYPE: SCH 40
PVC SIZE: 2"
DEPTH: +2.5 TO 165
CENTRALIZERS:
PELLETS SIZE:
DEPTH: TO
BUCKETS:

SILICA SAND: 8/12
DEPTH: 155 TO 175
BAGS:

SCREEN TYPE: PVC
DEPTH: 160 TO 165
SIZE: .010

CASING SIZE: 2"
DRIVE SHOE:

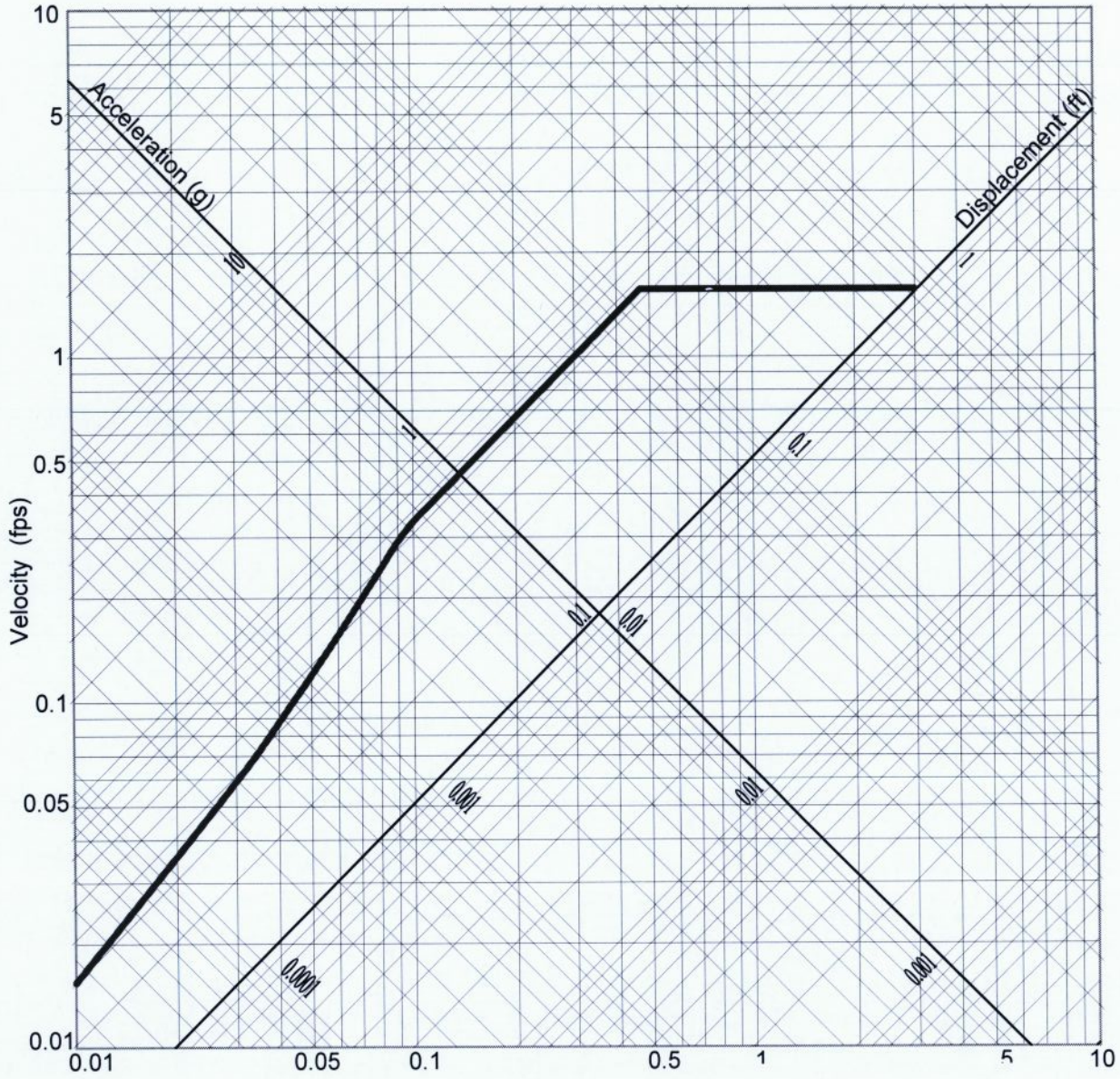
BOTTOM: 175

QUAD POSITION:
MISC:

FORMATION DESCRIPTION

0	
SAND & SILT	
22	
25	
GRAVEL	
50	
60	
CLAY & SILT	
75	
80	
CLAY	
100	
115	
125	
CLAY & SAND	
150	
160	
CLAY, SILT, TRACE OF WATER	
165	
HARD BLACK BASALT	
175	

AUG 1-



Ss = 0.452	Fa = 1.43864	Sds = 0.433
S1 = 0.135	Fv = 2.25952	Sdi = 0.204
Site Class = D		PGA= 0.17329

1. Spectra correspond to free field motions at the foundation level for 5% damping
2. Vertical motions correspond to 2/3 of the horizontal values.
3. Rock UHS PSA from USGS 2002 Hazard Maps.

PanGEO INCORPORATED	**Wallula Resource Recovery** **Wallula, Washington**	**IBC 2003 Response Spectra** **2475 Year Event**	
		Project No. **07-017**	Figure No.