NORTHWEST
Land & Water, INC.
Consulting in Hydrogeology

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REGISTERED OREGON JAMES T. MATHIEU G2389 GEOLOGIST
Expires: 5/31/2016

Memorandum

Date: June 30, 2015

To: Steven Patten, Environmental Scientist, Walla Walla Basin Watershed Council (WWBWC)

From: Jim Mathieu, RG, Northwest Land & Water, Inc. (NLW)

Re: Drilling and Monitoring Well Construction, Aquifer Storage and Recovery (ASR) Feasibility Investigation, Eastside Milton-Freewater, OR

INTRODUCTION

This memorandum documents initial ASR work conducted to investigate the relatively shallow (70 to 130 feet below ground) hydrostratigraphy and the construction of long-term monitoring wells in the "Eastside" area of Milton-Freewater. The area of investigation shown on **Figure 1** occupies the flat and locally undulating topography east of the mainstem Walla Walla River. The WWBWC would like to better understand the subsurface hydraulic properties and groundwater flow conditions of the Eastside area; we understand the goal is to store "surplus" river water in the subsurface and eventually recover it to use for irrigation and affect groundwater conditions for river baseflow augmentation.

The Eastside pipeline that is currently used by irrigators would serve as the conveyance line to deliver water from the river to potential aquifer storage sites.

DRILLING METHODOLOGY & RESULTS

Five boreholes were drilled by Holt Services, Inc., in October 2014 and June 2015. They were completed as 2-inch ID monitoring wells in accordance with Oregon's monitoring well standards (OWRD, *OAR 690-240*). These wells will allow WWBWC to monitor groundwater levels and temperature over the long term and to sample water quality (as needed) at locations within the shallow unconfined aquifer and other water-bearing zones.

Sonic Drilling

Methodology. One borehole was drilled at each of three sites (GW_152, _160, _161) and two boreholes were drilled at one additional site (GW_162, _163). To investigate the stratigraphy and occurrence of groundwater at these sites, the sonic drilling method — specifically, a Terra Sonic International 150 Compact Crawler — was used. This machine cores a 4-inch continuous sample while casing a 6-inch diameter borehole. As such, the core sample, which is extruded in 5- or 10-foot sections, provides information about the stratigraphy and relative moisture conditions from ground to the total borehole depth. During drilling, the water level was measured frequently to observe changes as different water-bearing or low-permeable zones were penetrated. The samples were placed in core boxes and stored by WWBWC. We anticipate having a geology student review the core samples in more detail at a later date.

Results. The results of drilling and logging are shown on the detailed geologic logs **in Figures 2–6**. In general, the hydrostratigraphy encountered from ground to depth at each of the four sites included the following:

- An upper layer of soil consisting of silt, locally with gravels, 2–6 feet thick
- An unsaturated zone of loose, and locally compact, silt and gravel, 20–60 feet thick
- An saturated zone of loose, and locally compact, silt, sand, and gravel, 5–35 feet thick
- A dry to damp layer of very compact silt and gravel, over 20 feet thick

Two water-bearing zones were encountered at the GW_162/163 site (**Figure 1**). They are separated by an 11-foot thick, soft, clayey silt. This clayey silt is competent and extensive enough at this location to cause a difference in groundwater levels.

Monitoring Well Construction

Methodology. Standard practices were used to construct the monitoring wells. Each of the five boreholes was screened (0.020-inch slot) within water-bearing zones. An annular filter pack (10-20 silica sand) was placed as each 6-inch casing was extracted and seal materials were subsequently installed. Each well was finished with a flush-grade steel monument. The wells were developed for 1–2.5 hours using a DC purge pump.

Results. The five monitoring wells are being equipped with Solinst Levelogger Edge water level / temperature sensors to collect data that will provide important information about the groundwater system:

- Localized and seasonal fluctuations of the shallow (water table) aquifer at each of the four sites

- The relationship between the shallow aquifer and underlying water-bearing zone at the GW_162/163 site
- The direction and magnitude of the hydraulic gradient in this area

The initial groundwater water level data (**Figures 2 – 6**) suggest that sites GW_152 and GW_160, which have larger unsaturated thicknesses, could accept more water than sites GW_161 and GW_162/163, which lie to the northeast and northwest, respectively. The infiltration capacity would need to be tested at these sites to confirm this observation.

RECOMMENDATIONS

Monitoring & Baseline Data Collection

We recommend that WWBWC conduct the following tasks:

- Survey the elevations and locations of the monitoring wellheads to provide an accurate datum for water-level measurements.
- Collect continuous water-level data at a high frequency (for example, hourly) for 2 weeks; then download and review the data to confirm that the sensor is functioning properly and assess whether the collection frequency should be modified.
- Measure water levels manually during each visit to the monitoring wells (quarterly, at a minimum) and compare these measurements to the sensor data.
- Collect groundwater samples prior to infiltration activities in the Eastside area, whether at the LeFore infiltration facility or elsewhere (pilot or permanent infiltration/recharge), to provide "baseline" water quality data.

Investigation of ASR Feasibility

The WWBWC should consider conducting the following future work:

- Identify existing irrigation wells that could be pumped for aquifer testing. The five monitoring wells should be used as observation wells during testing. This would allow WWBWC to calculate hydraulic parameters for the shallow water-table aquifer.
- If existing wells are unsuitable, as an alternative, approach a landowner about constructing a high-capacity well that could be used for aquifer testing.
- Develop a better understanding of the Eastside hydrostratigraphy in the vicinity of the five monitoring wells by creating a conceptual model using software such as Viewlog. This would entail incorporating select digitized wells (from the OWRD database, shown in **Appendix A**) into the model and using it to construct several cross-sections that illustrate subsurface conditions in the Eastside groundwater

system. The conceptual model framework should be compatible with pre-processing software for creating layers for a future numerical model.

- Engage with landowners in the area between and near GW_152 and GW_160 who would be amenable to allowing the WWBWC to construct a pilot or permanent infiltration facility (basin/pond or gallery) or the construction/operation of an injection well.

SUPPORTING INFORMATION

List of Figures & Appendix

Figure 1: Well Location Map, Eastside Milton-Freewater

Figure 2: GW_152 Geologic Log & Monitoring Well As-Built

Figure 3: GW_160 Geologic Log & Monitoring Well As-Built

Figure 4: GW_161 Geologic Log & Monitoring Well As-Built

Figure 5: GW_162 Geologic Log & Monitoring Well As-Built

Figure 6: GW_163 Geologic Log & Monitoring Well As-Built

Appendix A: Supplemental OWRD Database Well Logs

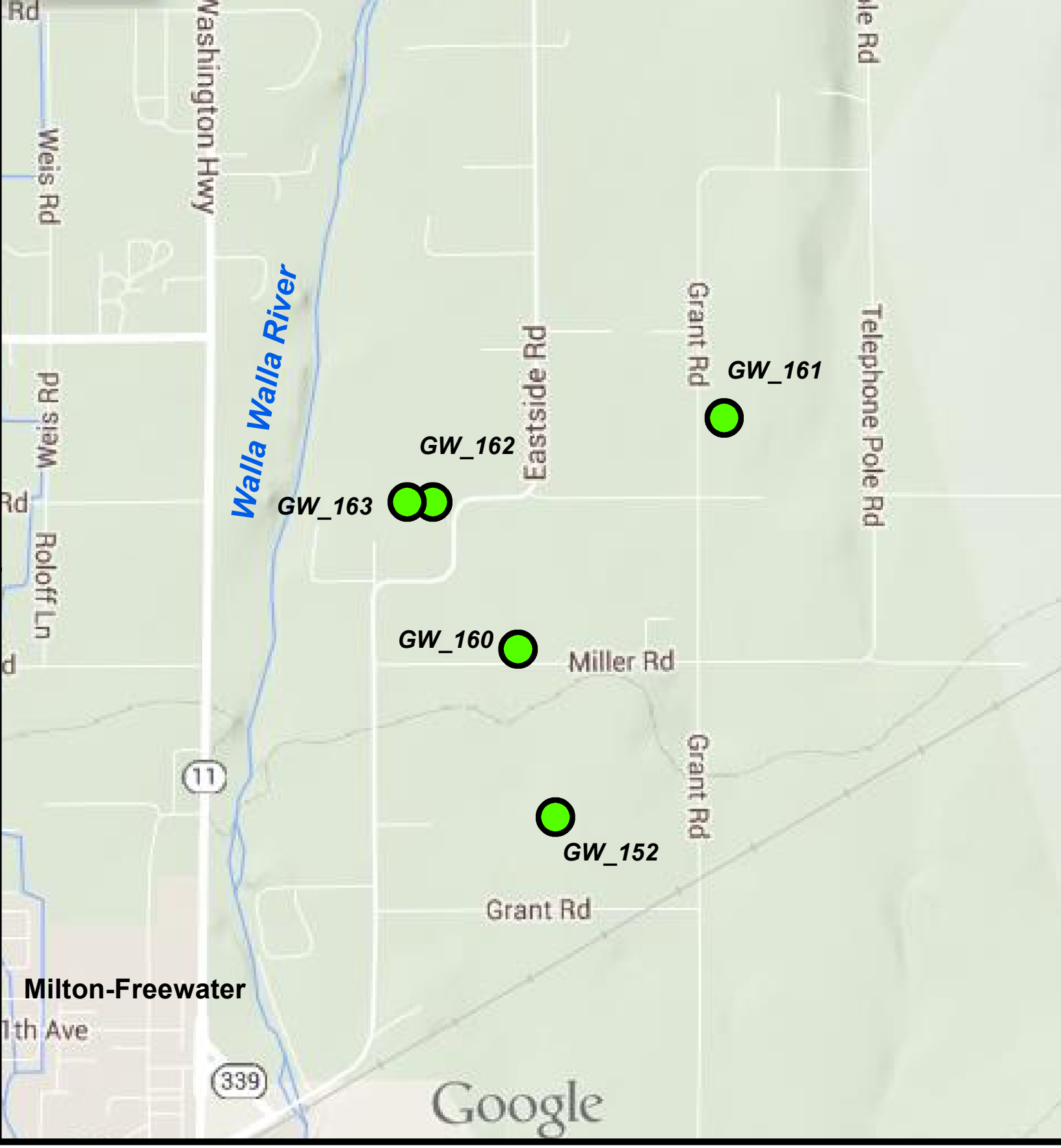
Reference

Oregon Water Resources Department, *OAR 690-240, Construction, Maintenance, Alteration, Conversion and Abandonment of Monitoring Wells, Geotechnical Holes and Other Holes in Oregon.*

Warranty / Disclaimer

Our professional services were performed, our findings obtained, and this memorandum prepared in accordance with generally accepted hydrogeologic practices at this time and in this area, exclusively for the use of the WWBWC. This warranty is in lieu of all other warranties, expressed, or implied.

Figures



Monitoring Well

N

0 0.5 mile

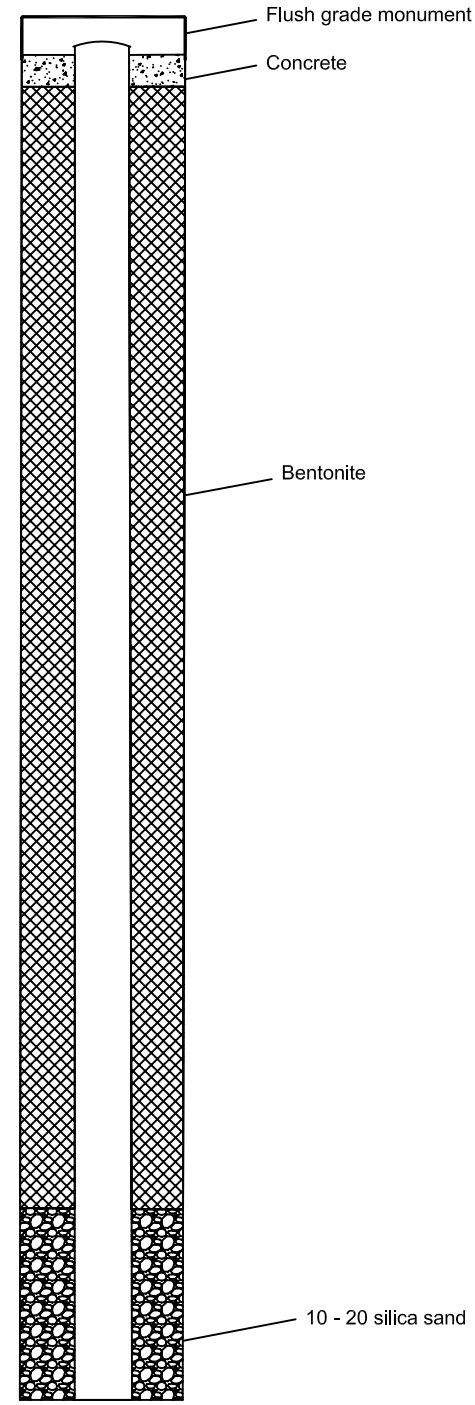
Figure 1.
Well Location Map

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

Depth Below Ground (feet)	GEOLOGIC LOG	HG unit or Zone	Sample
	Ground Elevation: Approx 970 feet msl		
0	*Pale to dk yel-brn, dry, ls, SILT; cemented? and friable from 3.5 to 4.5 feet*	*Soil*	
5			*tbd*
	Dk yel-brn, dry, very stiff, SILT with occ cbl	*Unsaturated*	
10			
15	*Dk to mod yel-brn, damp, soft to md stf, silty CLAY*		*tbd*
20			
	Lt to brn-gry, dry, ls, v silty, c SAND to f GRAVEL; pale orange layer		
25			*tbd*
	Md gry to ol blk, sli damp, ls, silty, c SAND to c GRAVEL; cbl from 31 to 32 ft		
30			
	Md gry to ol blk, sli damp, ls, silty, c SAND to COBBLE		
35			*tbd*
	Md gry to dk md gry, damp, ls, sli silty, c SAND to c GRAVEL; occ cbl		
	hard drilling 38 to 40 ft		
40	*Med gry to sli ol gry, damp, ls, v silty c SAND to c GRVL; occ cbl*		
45	*Sample from 43 - 50 ft was "mixed" during extrusion*		*tbd*
50			

Log continues on next page

WELL CONSTRUCTION DETAILS



Not to Horizontal Scale

PROJECT NAME: Eastside ASR Feasiblity
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka LF-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 1 of 3)
GW_152 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

version 06/30/15

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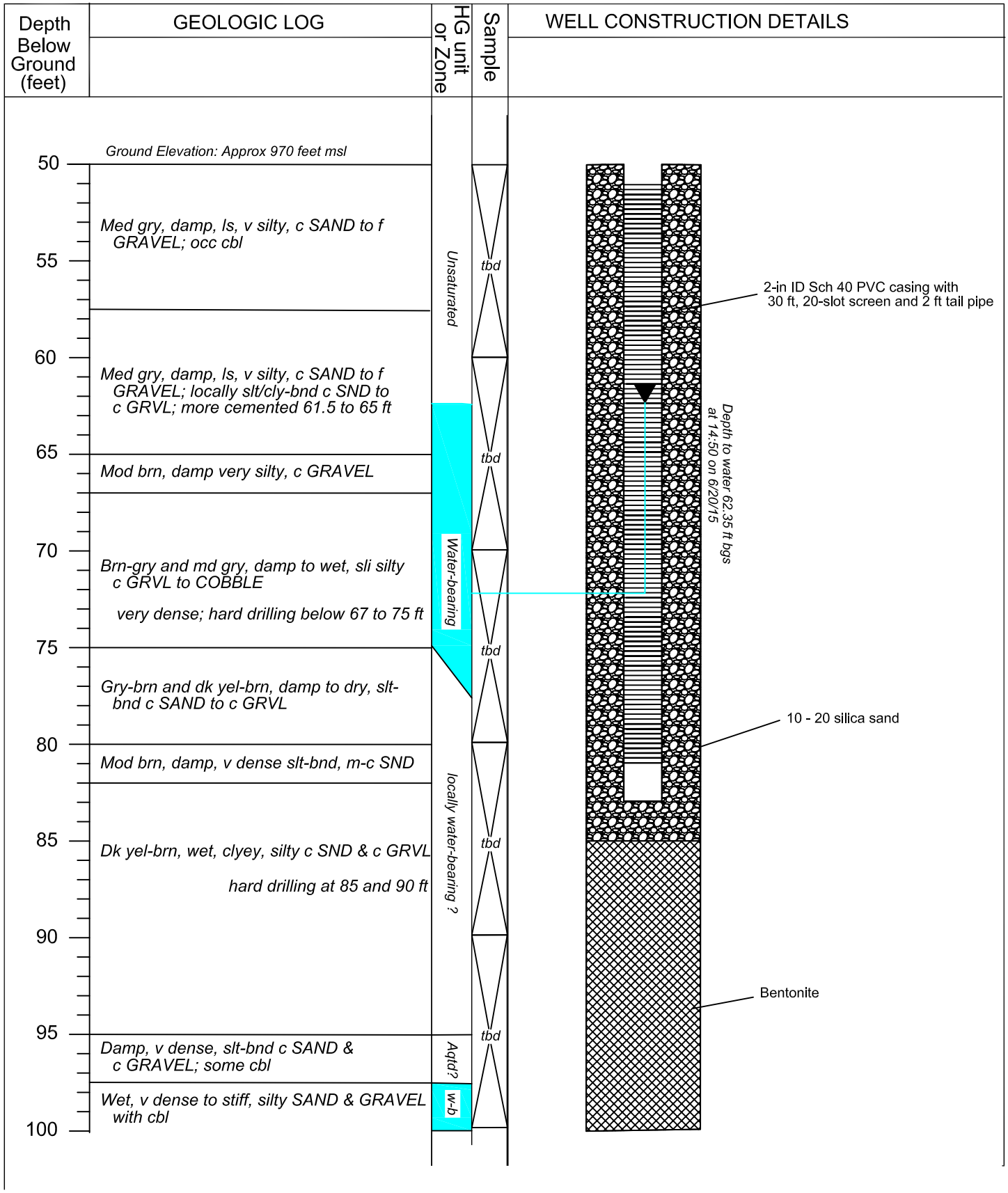

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Figure 2 (page 2 of 3)
GW_152 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

version 06/30/15

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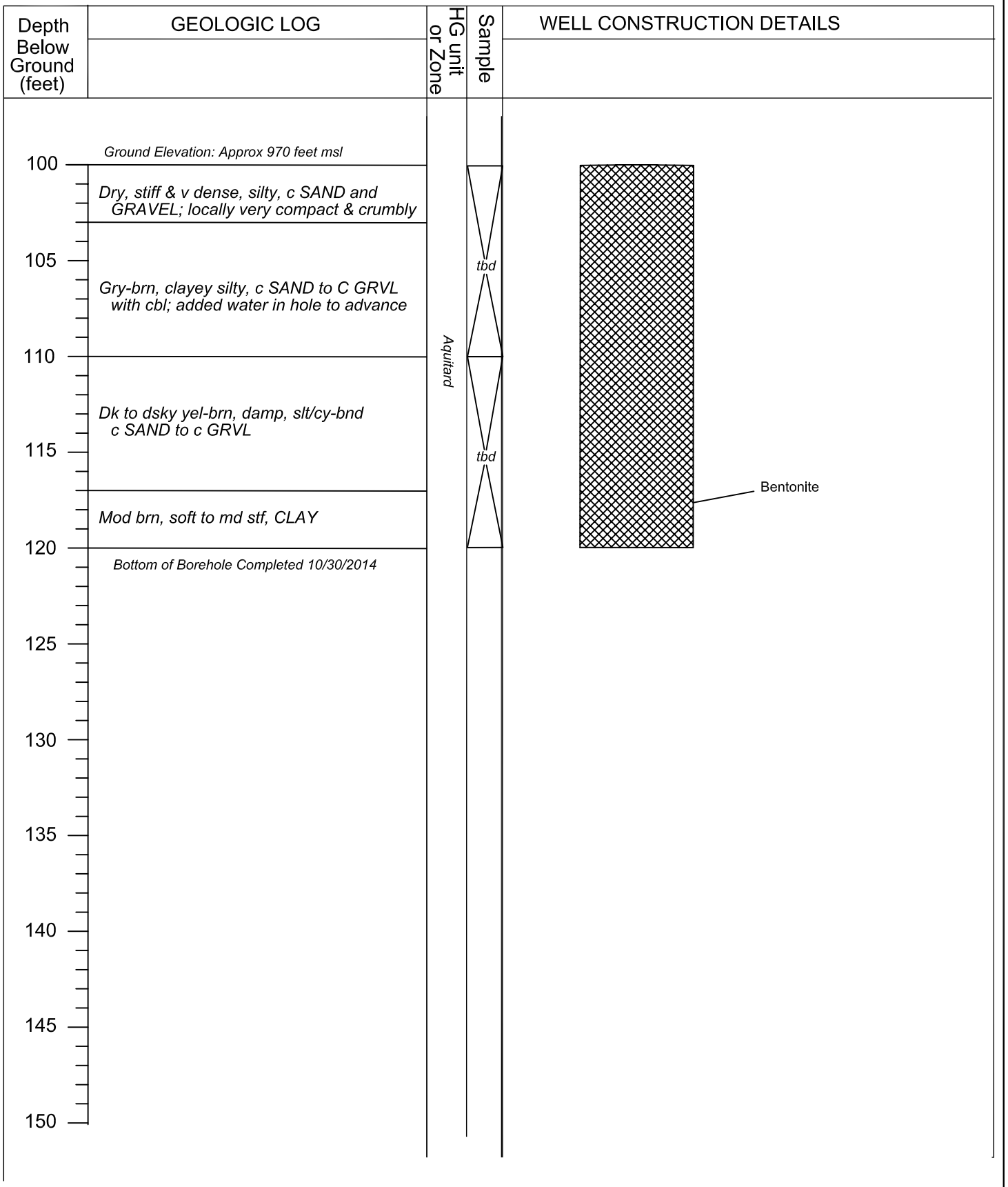

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FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka FL-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 3 of 3)
GW_152 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

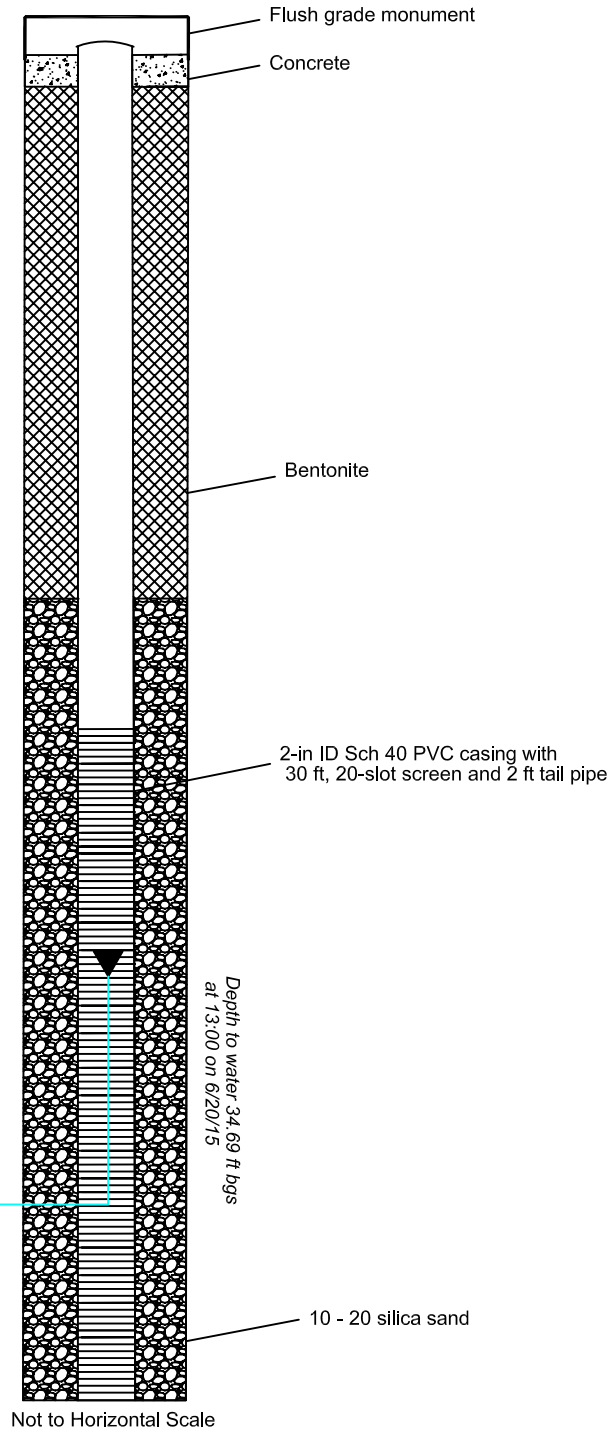
version 06/30/15

C:\Projects\WWB\WC\...\GeoLog&AsbuiltL_FL-1pg3of3.dwg

Depth Below Ground (feet)	GEOLOGIC LOG	HG unit or Zone	Sample
	Ground Elevation: Approx 950 feet msl		
0	*Dk yel-brn, dry, ls, v sli f grvlly SILT*	Soil	
	Dk yel-brn to gry-brn, dry, v ls, v sli slty f-c GRAVEL and COBBLE	Unsaturated	
5	*Brn-gry to dk yel-brn, dry, v ls, sli slty, c sandy, f-c GRAVEL; occ cbl*		8.5
10	*Brn-gry, dry, v ls, c sandy to f grvlly, SILT (slough?)*		
15	*Brn-gry to brn-blk, dry to damp, locally ls and md stf, c SND to c GRVL; locally slt-bnd*		8
20	*Dk yel-brn to dsky brn, damp, stf, cly/slt-bnd f GRAVEL to COBBLE*		
25	*Brn-gry, damp, ls & dnse, locally slt-coated, sli f-m sandy, f-c GRAVEL; occ cbl; looser than 21 - 24 feet*		10
	Brn-gry, dry, ls, f-m sndy, c SND - f GRVL		
30	*Brn-gry, damp, ls & dnse, locally slt-coated, c SAND to c GRAVEL; occ cbl*		
35	*Dk yel-brn to brn-gry, damp to wet, v dnse, cly/slt-bnd f GRAVEL to CBL; sandier at 37 ft*	Water-bearing	10
40	*Med gry to brn-gry, wet, md ls and v dense, slt-coated f GRAVEL and COBBLE*		
	Zones of mod brn, dk yel-brn, gry-brn, wet, slt-coated f-m sandy, c SND to c GRVL		
45	*Gry-brn, damp, dnse slt-bnd, c SND to CBL*	Aquitard?	10
50	*Zones of mod brn, gry-brn, wet to damp, locally slt-bnd & locally f-m sandy,*	w-b	

Log continues on next page

WELL CONSTRUCTION DETAILS



version 06/30/15

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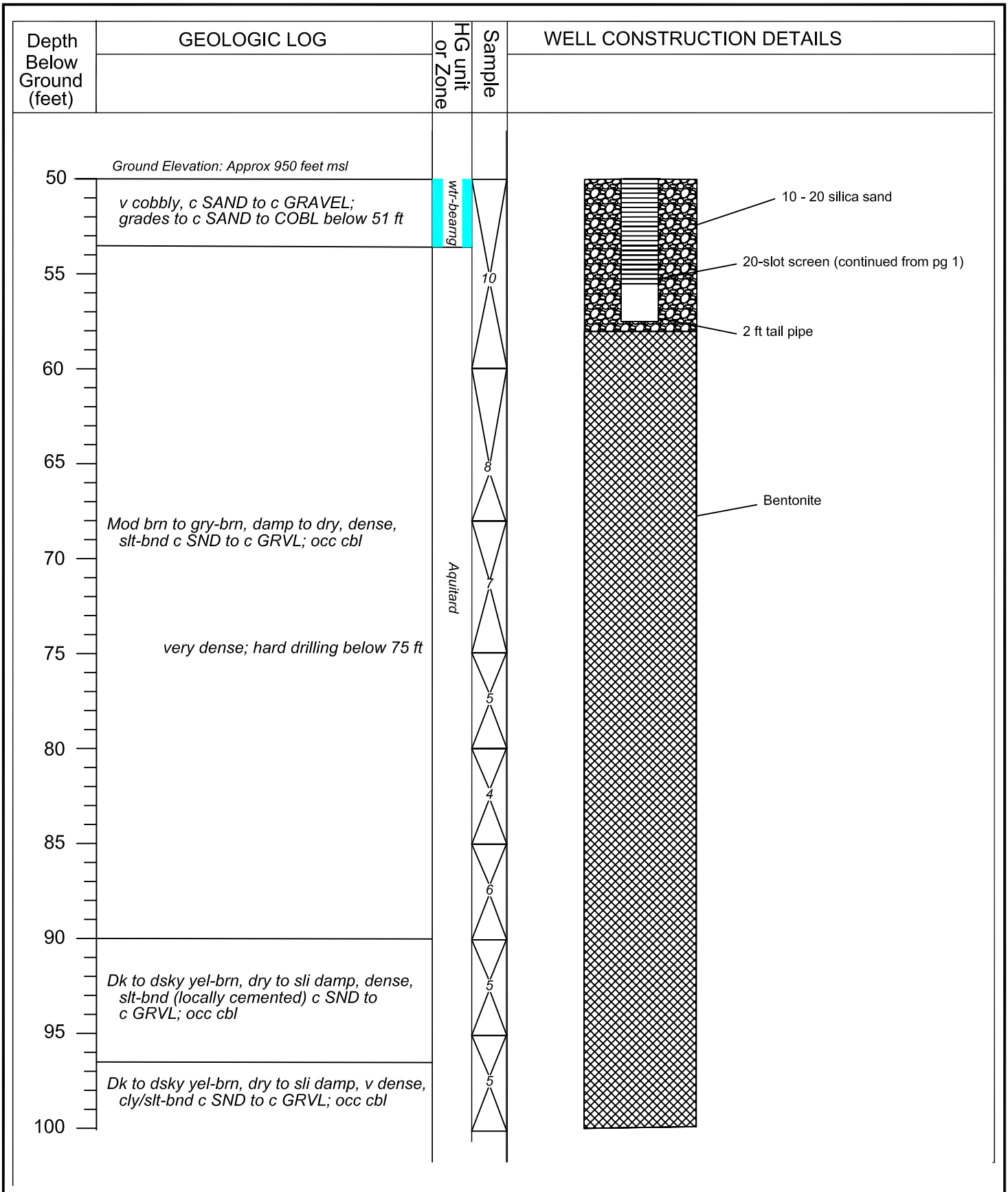
PROJECT NAME: Eastside ASR Feasiblity
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SE 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_160; aka CR-1
WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 1 of 3)

GW_160 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.



PROJECT NAME: Eastside ASR Feasiblity
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_160; aka CR-1
WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 2 of 3)
GW_160 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

version 06/30/15

C:\Projects\WWB\WC\...\GeoLog&AsbuiltL_CR-1pg2of3.dwg

Depth Below Ground (feet)	GEOLOGIC LOG	HG unit or Zone	Sample	WELL CONSTRUCTION DETAILS
	Ground Elevation: Approx 950 feet msl			
100	*Brn-gry to ol gry, dry, ls, f GRVL to CBL; cemented from 103 to 104 ft*		4	
105	*Mod brn to gry-brn, damp, stiff, f-c gravelly CLAY*		6	
	Dsky yel-brn grades to mod red, damp, v dense, slt-bnd f GRVL to COBL			
110	*Dk to dsky yel-brn, damp, slt-bnd f-c GRVL with cbl*	*Aquitard*	5	
115				Bentonite
120	*Dsky yel-brn, damp, slt/cly-bnd f-c GRVL & CBL*		10	
	Brn-gry & pale brn, dry, slt-bnd f GRVL-CBL			
125	*Brn-gry, dry to damp, v stf and v dnse, SILT and c GRAVEL to COBBLE*		5	
	Mod brn, damp, v stiff, silty CLAY			
130	*Bottom of Borehole Completed 06/17/2015*			
135				
140				
145				
150				

version 06/30/15

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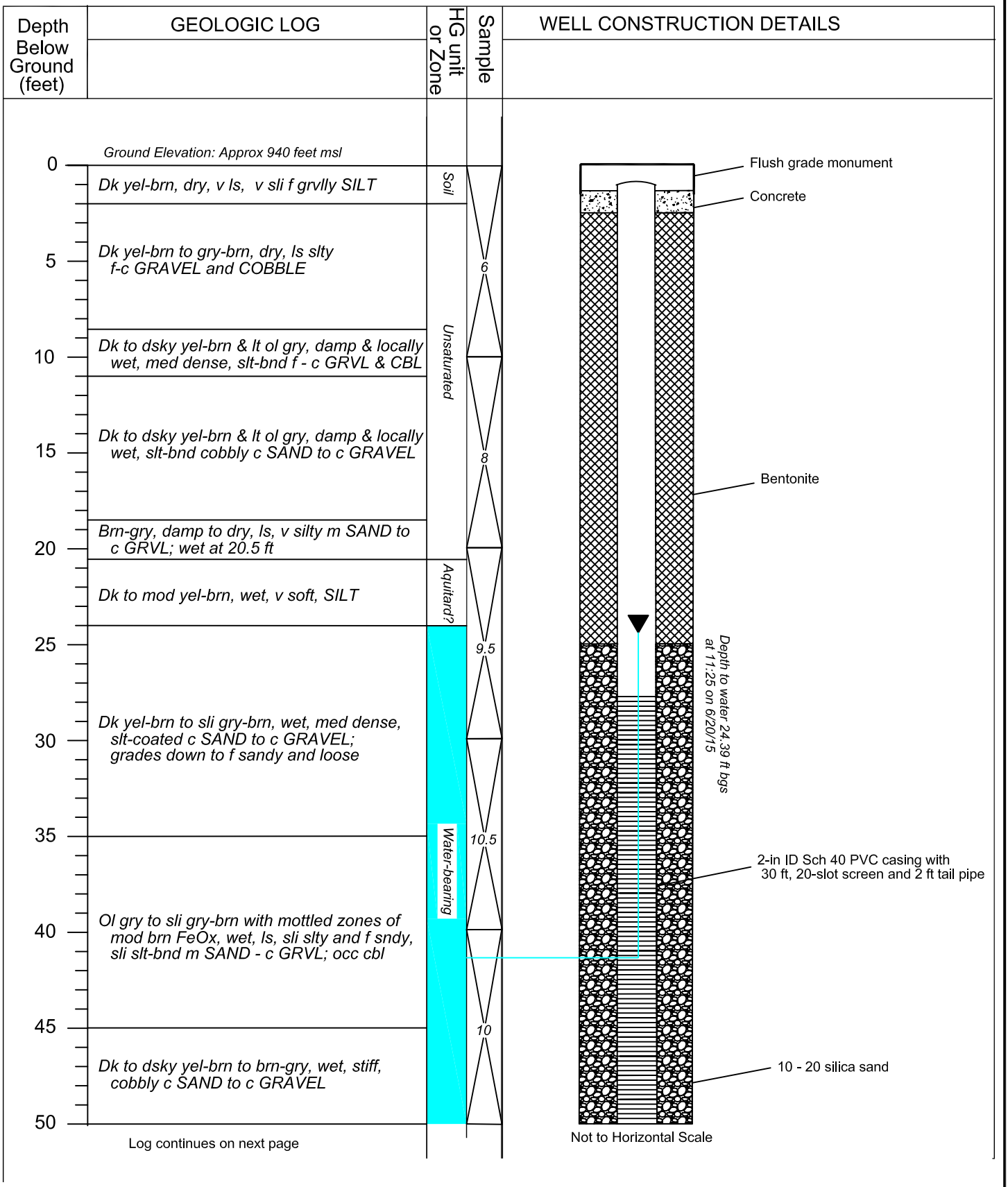
PROJECT NAME: Eastside ASR Feasiblity
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_160; aka CR-1
WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 3 of 3)

GW_160 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.



PROJECT NAME: Eastside ASR Feasiblity
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
WELL NAME: GW_161; aka JB-1
WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 1 of 2)
GW_161 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

version 06/30/15

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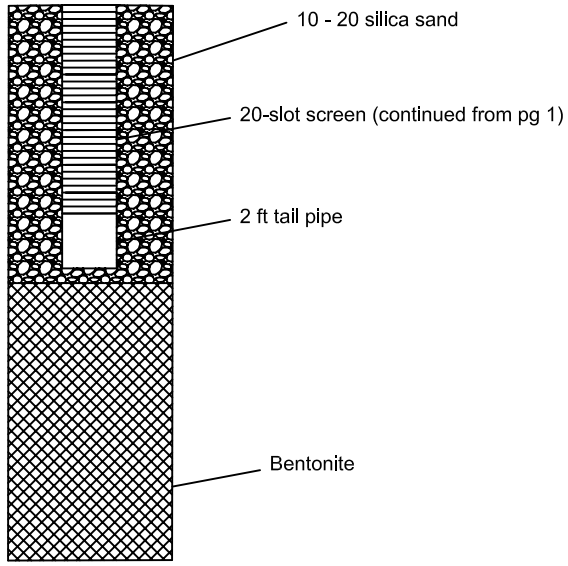
Depth Below Ground (feet)	GEOLOGIC LOG	HG unit or Zone	Sample
	Ground Elevation: Approx 940 feet msl		
50	*Dk to dsky yel brn to brn-gry, wet, stiff and dense, slt-bnd m SND to c GRVL; occ cbl*	*Water-bearing*	*10*
55	*Ol bry to dsky yel brn, wet to damp, v dense slt-bnd m SND to c GRVL; occ cbl*		
60	*Dsky yel brn, damp to wet, stiff, slt-bnd m SAND to c GRAVEL*	*Aquitard*	*10*
65	*Mottled mod brn & ol gry, dk to dsky yel-brn, dry to damp, v dnse & stf, c SND to CBL*		
70	*Bottom of Borehole Completed 06/18/2015*		
75			
80			
85			
90			
95			
100			

WELL CONSTRUCTION DETAILS



PROJECT NAME: Eastside ASR Feasiblity
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
WELL NAME: GW_161; aka JB-1
WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 2 of 2)
GW_161 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

version 06/30/15

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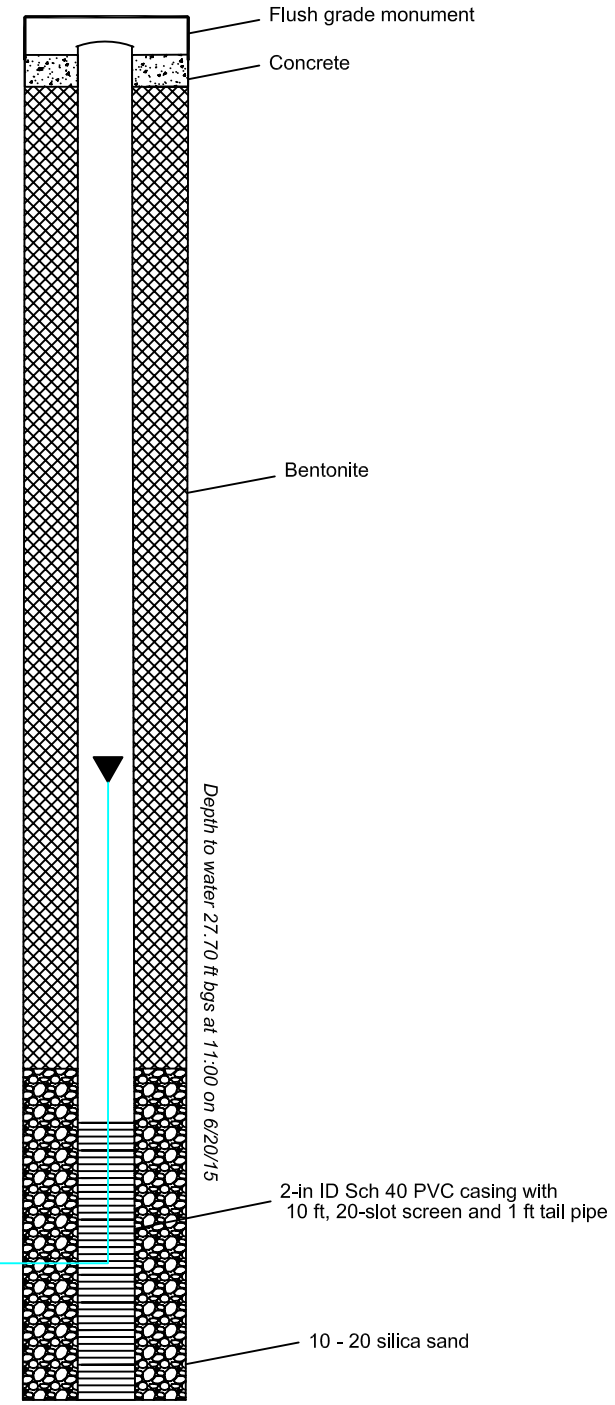
Depth Below Ground (feet)	GEOLOGIC LOG	HG unit or Zone	Sample
	Ground Elevation: Approx 940 feet msl		
0	*Dark to dsky yel-brn, dry, v ls, SILT; rootlets in upper 0.5 ft*	Soil	
	Drk to dsky yel-brn, dry, ls, v slty f G to CBL		
5	*Ol gry to dk yel-brn, dry, v ls, slty m SAND to COBBLE; more moisture at 6 ft*	Unsaturated	9
	Dsky brn & sli gry-brn, md dense to ls, sli slt-bnd (locally 'crumbly'), m SND to c GRVL; occ cbl		
10	*Dsky & dk yel-brn, damp (locally wet), v dense and md stf, slt-bnd sli c sndy, f - c GRVL*		
15	*Ol gry to dk yel-brn, damp, v dnse & md stf, slt-coated m SAND to c GRAVEL; occ cbl*		9
20	*Md dk gry & ol gry to gry-blk dry to wet, v slty and slt-bnd c SND to f GRVL*	Water-bearing	
	Brn-gry to sli dk yel-brn, wet, md ls, sli slt-bnd c grvlly, m SAND to f GRVL		10
25			
30	*Mod brn to dk yel-brn, dmp to wet, soft, v sli clayey, SILT; occ m-c sand and f-c grvl*	Aquitard	
	v pale orange to yel gray ash (?) layer 32.75 to 34 feet		
35			10
	Dk yel-brn to sli mod brn, wet, soft, slt-bnd f-c GRVL		
40		Water-bearing	
45	*Ol gry to ol blk, locally brn gry, wet, stf to med stf, slt-coated and locally slt-bnd c SAND to f GRAVEL*		10
	more slt-bnd 49.5 to 50 feet		
50			

Log continues on next page

WELL CONSTRUCTION DETAILS



Not to Horizontal Scale

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CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_162; aka MFS-1
WELL TAG & START CARD: L111673 & 1026828

Figure 5 (page 1 of 2)
GW_162 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

version 06/30/15

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Depth Below Ground (feet)	GEOLOGIC LOG	HG unit or Zone	Sample	WELL CONSTRUCTION DETAILS
	Ground Elevation: Approx 940 feet msl			
50	*Ol gry to sli dk yel brn, damp, md stf, v sli clayey, slt-bnd c SAND to c GRVL*	*Aqtd*		
	Mod brn, wet, ls, m SAND to c GRVL	*wb*		
55	*Ol gry to sli dk yel brn, damp, md stf, v sli clayey, slt-bnd c SAND to c GRVL*		*10*	
60	*Ol gry to brn-gry, damp, mottled zones of mod brn, stf, slt-bnd c SND to c GRVL; occ cobble*	*Aquitard*		
65	*drills very hard 68 to 70 feet*		*10*	
70	*Bottom of Borehole Completed 06/14/2015*			
75				
80				
85				
90				
95				
100				

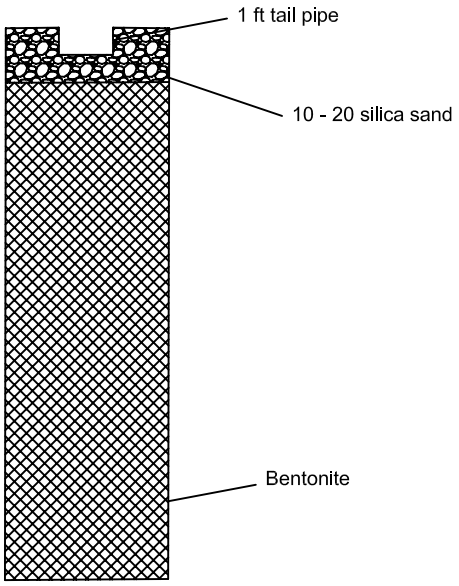

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Figure 5 (page 2 of 2)
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Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

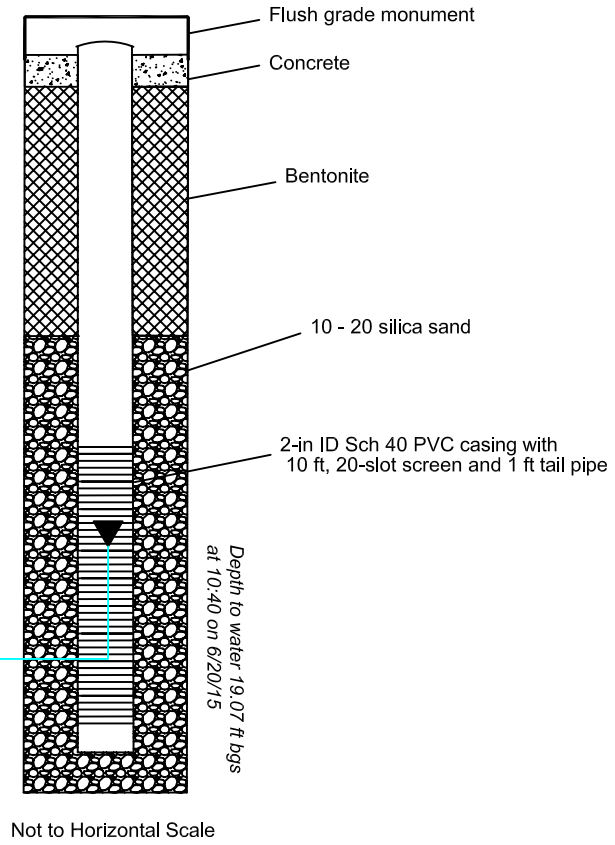
NORTHWEST Land & Water, INC.

version 06/30/15

C:\Projects\WWB\WC\...\GeoLog&Asbuilt_MFS-1(deep)_pg2of2.dwg

Depth Below Ground (feet)	GEOLOGIC LOG	HG unit or Zone	Sample
	Ground Elevation: Approx 940 feet msl		
0	*Dark to dsky yel-brn, dry, v ls, SILT; rootlets in upper 0.5 ft*	*Soil*	*Samples reviewed in loader for consistency with GW_162*
	Drk to dsky yel-brn, dry, ls, v slty f G to CBL		
5	*Ol gry to dk yel-brn, dry, v ls, slty m SAND to COBBLE; more moisture at 6 ft*	*Unsaturated*	
	Dsky brn & sli gry-brn, md dense to ls, sli slt-bnd (locally 'crumbly'), m SND to c GRVL; occ cbl		
10	*Dsky & dk yel-brn, damp (locally wet), v dense and md stf, slt-bnd sli c sndy, f - c GRVL*		
15	*Ol gry to dk yel-brn, damp, v dnse & md stf, slt-coated m SAND to c GRAVEL; occ cbl*		
20	*Md dk gry & ol gry to gry-blk dry to wet, v slty and slt-bnd c SND to f GRVL*	*Water-bearing*	
	Brn-gry to sli dk yel-brn, wet, md ls, sli slt-bnd c grvlly, m SAND to f GRVL		
25	*Mod brn , damp to wet, soft to med stiff, v sli clayey, SILT*	*Aquitard*	
	Bottom of Borehole Completed 06/14/2015		
30			
35			
40			
45			
50			

WELL CONSTRUCTION DETAILS



PROJECT NAME: Eastside ASR Feasiblity
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_163; aka MFS-2
WELL TAG & START CARD: L112703 & 1026829

Figure 6 (page 1 of 1)
GW_163 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council

NORTHWEST Land & Water, INC.

version 06/30/15

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Appendix A

T6NR35E-Section 25		T6NR35E-Section 36		T6NR36E-Section 31		T6NR36E-Section 30	
UMAT	4516	UMAT	6	UMAT	4846	UMAT	5192
UMAT	4517	UMAT	5116	UMAT	4848	UMAT	5197
UMAT	4518	UMAT	5117	UMAT	4849	UMAT	5198
UMAT	4519	UMAT	5118	UMAT	50068	UMAT	5199
UMAT	4520	UMAT	5119	UMAT	4847	UMAT	5200
UMAT	4521	UMAT	5121	UMAT	4850	UMAT	5201
UMAT	4523	UMAT	5122	UMAT	4851	UMAT	5202
UMAT	4524	UMAT	5123	UMAT	4852	UMAT	5204
UMAT	4525	UMAT	5124	UMAT	54770	UMAT	5205
UMAT	4526	UMAT	5125			UMAT	5206
UMAT	4527	UMAT	5126			UMAT	5211
UMAT	4528	UMAT	5127			UMAT	5221
UMAT	4529	UMAT	5128			UMAT	5222
UMAT	4531	UMAT	5130			UMAT	5223
UMAT	4532	UMAT	5131			UMAT	6457
UMAT	4533	UMAT	5132			UMAT	6458
UMAT	4534	UMAT	5133			UMAT	5203
UMAT	4536	UMAT	5136			UMAT	5207
UMAT	4537	UMAT	5137			UMAT	5208
UMAT	4538	UMAT	5141			UMAT	5209
UMAT	4539	UMAT	5144			UMAT	5210
UMAT	4540	UMAT	5147			UMAT	5212
UMAT	4541	UMAT	5148			UMAT	5213
UMAT	4543	UMAT	5149			UMAT	5214
UMAT	4544	UMAT	5151			UMAT	5216
UMAT	4549	UMAT	5155			UMAT	5217
UMAT	4550	UMAT	5156			UMAT	5218
UMAT	4551	UMAT	5157			UMAT	5219
UMAT	4552	UMAT	5158			UMAT	5220
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UMAT	4565	UMAT	5358			UMAT	55459
UMAT	4570	UMAT	5370			UMAT	55712
UMAT	4573	UMAT	5377			UMAT	56217
UMAT	4574	UMAT	5787				
UMAT	4576	UMAT	5805				
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UMAT	4579	UMAT	5965				
UMAT	4581	UMAT	6471				
UMAT	4585	UMAT	6475				
UMAT	4587	UMAT	6477				
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UMAT	4600	UMAT	5120				
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UMAT	4602	UMAT	5134				
UMAT	4603	UMAT	5138				
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UMAT	4606	UMAT	5142				
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UMAT	4610	UMAT	5150				
UMAT	4611	UMAT	5152				
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UMAT	4614	UMAT	5159				
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UMAT	4623	UMAT	54143				
UMAT	4624	UMAT	54144				
UMAT	4626	UMAT	54145				
UMAT	5269	UMAT	54325				
UMAT	5655	UMAT	54391				

T6NR35E-Section 25		T6NR35E-Section 36	
UMAT	5656	UMAT	54473
UMAT	5958	UMAT	54494
UMAT	6434	UMAT	54841
UMAT	6435	UMAT	55207
UMAT	6511	UMAT	55248
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UMAT	51072	UMAT	56201
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UMAT	4594		