



**KEVIN A. LINDSEY**

*Kevin A. Lindsey*

## Technical Memorandum

**To: Steven Patten**

**From: Kevin Lindsey, LHg, Jon Travis**

**Date: February 21, 2014**

**Re: Monitoring Well Completion Report, 2014 WWBWC Task Order No. 22**

Five monitoring wells were drilled and constructed by GSI Water Solutions, Inc. (GSI) under Task Order No. 22 with the Walla Walla Basin Watershed Council (WWBWC). Well drilling and construction was done between 02/4/2014 and 02/5/2014. The well drilling contractor was Environmental West Exploration, Inc.

Well locations were selected by WWBWC personnel based on proximity to existing and planned AR sites. The 5 well locations are referred to as MW-SP2, MW-SP3, MW-SP4, MW-LWW1, and MW-LWW2 (Attachment 1). Each well was constructed to Washington monitoring well standards (WAC 173-160) and has a nominal inside diameter of approximately 2-inches. The wells were built in 6-inch nominal diameter boreholes drilled using a reverse air rotary Tubex<sup>®</sup> system. All wells were completed with flush mount surface monuments.

Geologic logs for each well were constructed from field notes and samples taken during borehole drilling (Attachment 2). As-built diagrams for each monitoring well are included on the corresponding geologic log (Attachment 2).

Location information for each well is listed in Table 1. Table 2 summarizes well construction information.

**Table 1. Borehole Locations**

<b>Name</b>	<b>Ground Surface Elevation</b>	<b>Latitude</b>	<b>Longitude</b>
MW-SP2	644	46.049064	-118.470142
MW-SP3	638	46.049460	-118.471858

<b>Name</b>	<b>Ground Surface Elevation</b>	<b>Latitude</b>	<b>Longitude</b>
MW-SP4	652	46.053309	-118.461534
MW-LWW1	657	46.023787	-118.451570
MW-LWW2	641	46.028767	-118.457125

Note: latitude and longitude are NADD 83. Ground surface elevations were obtained using Google Earth.

**Table 2. Monitoring Well Construction**

<b>Name</b>	<b>Total Depth (feet)</b>	<b>Screened Interval (feet)</b>	<b>DTW (feet)</b>
MW-SP2	40	20-40	25.52
MW-SP3	33	13-33	15.15
MW-SP4	35	15-35	18.11
MW-LWW1	25	5-25	4.71
MW-LWW2	21	6-21	1.12

DTW = depth to water.

Note: depths are below top of PVC casing.

Basic well characteristics are summarized below.

### **MW-SP2**

MW-SP2 was drilled to a total depth of 40 feet below ground surface (bgs) on February 4, 2014. Groundwater was first observed when starting to drill at 25 feet bgs. The well was advanced another 15 feet to accommodate a 20 foot screened interval with approximately 5 feet of screen above the water level. On February 5, 2014 the well was developed for about 1 hour by raising and lowering a small pump within the screened interval. Depth to water following well completion was 25.52 feet bgs.

### **MW-SP3**

MW-SP3 was drilled to a total depth of 33 feet bgs on February 4, 2014. Groundwater was first observed when starting to drill at 16 feet bgs. The well was advanced another 15 feet to accommodate a 20 foot screened interval with approximately 5 feet of screen above the water level. On February 5, 2014 the well was developed for about 1 hour by raising and lowering a small pump within the screened interval. Depth to water following well completion was 15.15 feet bgs.

### **MW-SP4**

MW-SP4 was drilled to a total depth of 35 feet bgs on February 4, 2014. Groundwater was first observed when starting to drill at 20 feet bgs. The well was advanced another 15 feet to accommodate a 20 foot screened interval with approximately 5 feet of screen above the water level. On February 5, 2014 the well was developed for about 1 hour by raising and lowering a small pump within the screened interval. Depth to water following well completion was 18.11 feet bgs.

**MW-LWW1**

MW-LWW1 was drilled to a total depth of 25 feet bgs on February 5, 2014. Groundwater was first observed when starting to drill at 10 feet bgs. The well was advanced another 15 feet to accommodate a 20 foot screened. About 1.5 hours after drilling the well was developed for about 1 hour by raising and lowering a small pump within the screened interval. Depth to water following well completion was 4.71 feet bgs.

**MW-LWW2**

MW-LWW2 was drilled to a total depth of 20 feet bgs on February 4, 2014. While drilling 0-10 feet no cuttings were coming up the temporary steel casing. Instead air was blowing out of several holes in the area around the drill rig. After adding another drill rod the air was turned back on and an air/water mix was blowing out of the same holes. Groundwater was first observed when starting to drill at 10 feet bgs. The well was advanced another 10 feet to accommodate a 15 foot screened interval. On February 5, 2014 the well was developed for about 1.5 hours by raising and lowering a small pump within the screened interval. Depth to water following well completion was 1.12 feet bgs.

# **Attachment 1**

## **Aerial Photographs Showing Monitoring Well Locations**



Stiller Pond Site



West Little Walla Walla River Site

**Attachment 2**

**Geologic Wells and As-Built Diagrams**

# Geologic Log of: MW-SP2

Project: WWBWC 2014 Drilling

State Well ID: BHW-823

Logged By: Jon Travis

Location: Stiller Pond



Water Solutions, Inc.

8019 W. Quinault Ave, Suite 201  
 Kennewick, WA 99336  
 Phone: 509.735.7135  
 Fax: 509.735.7067

Depth (ft. bgs)	Lithology Symbol	Lithologic Description	Elevation (ft. amsl)	Well Construction
0		Ground Surface	0.0	
0 - 10		Silty Very Fine SAND 10YR 5/2 grayish brown, vigorous HCl reaction, micaceous, trace of caliche fragments >5mm	0.0	3/8" bentonite chips - 1-18 ft.
10 - 22		Very Fine SAND 10YR 5/3 brown, moderate HCl reaction, micaceous	-10.0 10.0	2-inch SCH 40 PVC casing - 0-20 ft. Flushmount Monument - 0-1ft.
22 - 25		medium to coarse SAND 10YR 5/3 brown, NO HCl reaction, micaceous	-22.0 22.0	
25 - 40		Silty Fine Sandy GRAVEL GRAVEL is sub-rounded to rounded small to medium sized basalt pebbles, some are weathered Matrix is a very fine sandy SILT, 10YR 5/3 brown, NO HCl reaction,		10/20 Sand Filter Pack - 18-40 ft.
40 - 50		<b>TD 40 ft.</b> Ground Elevation: Top of Casing Elevation:  *BTOC = Below Top Of Casing	-40.0 40.0	2-inch SCH 40 PVC 0.020 slotted casing - 20-40 ft.

Drilled By: Environmental West Exploration  
 Drilling Method: Tubex Air Rotary  
 Static Water Level: 25.52' ft. BTOC\* (2-5-2014)

Total Depth: 40 ft.  
 Date Completed: 2-4-2014  
 Page: 1 of 1



# Geologic Log of: MW-SP3

Project: WWBWC 2014 Drilling

State Well ID: BHW-824

Logged By: Jon Travis

Location: Stiller Pond



Water Solutions, Inc.

8019 W. Quinault Ave, Suite 201  
 Kennewick, WA 99336  
 Phone: 509.735.7135  
 Fax: 509.735.7067

Depth (ft. bgs)	Lithology Symbol	Lithologic Description	Elevation (ft. amsl)	Well Construction
0		Ground Surface	0.0	
0 - 10		Very Fine Sandy <b>SILT</b> 10YR 5/2 grayish brown, micaceous	0.0	
10 - 22		Very Fine <b>SAND</b> 10YR 5/2 grayish brown, minor HCl reaction, micaceous	-10.0 10.0	3/8" bentonite chips - 1-11 ft. 2-inch SCH 40 PVC casing - 0-13 ft. Flushmount Monument - 0-1 ft.
22 - 25		Medium to Coarse <b>SAND</b> 10YR 5/3 brown, moderate HCl reaction, micaceous	-22.0 22.0	
25 - 33		Silty Fine Sandy <b>GRAVEL</b> <b>GRAVEL</b> is sub-rounded to rounded small to medium sized basalt pebbles, some are weathered Matrix is a very fine sandy <b>SILT</b> , 10YR 5/3 brown, NO HCl reaction,		10/20 Sand Filter Pack - 11-33 ft. 2-inch SCH 40 PVC 0.020 slotted casing - 13-33 ft.
33		<b>TD 33 ft.</b> Ground Elevation: Top of Casing Elevation:  *BTOC = Below Top Of Casing	-33.0 33.0	
35 - 50				

Drilled By: Environmental West Exploration  
 Drilling Method: Tubex Air Rotary  
 Static Water Level: 15.15' ft. BTOC\* (2-5-2014)

Total Depth: 33 ft.  
 Date Completed: 2-4-2014  
 Page: 1 of 1

# Geologic Log of: MW-SP4

Project: WWBWC 2014 Drilling

State Well ID: BHW-822

Logged By: Jon Travis

Location: Stiller Pond



Water Solutions, Inc.

8019 W. Quinault Ave, Suite 201  
 Kennewick, WA 99336  
 Phone: 509.735.7135  
 Fax: 509.735.7067

Depth (ft. bgs)	Lithology Symbol	Lithologic Description	Elevation (ft. amsl)	Well Construction
0		Ground Surface	0.0	
0 - 12.0		Very Fine Sandy <b>SILT</b> 10YR 5/3 brown, micaceous, moderate HCl reaction	0.0	
12.0 - 24.0		Silty Fine Sandy <b>GRAVEL</b> <b>GRAVEL</b> is sub-rounded to rounded small to medium sized basalt pebbles, some are weathered Matrix is a very fine sandy <b>SILT</b> , 10YR 5/3 brown, NO HCl reaction	-12.0 12.0	3/8" bentonite chips - 1-13 ft. 2-inch SCH 40 PVC casing - 0-15 ft. Flushmount Monument - 0-1ft.
24.0 - 35.0		Fine Sandy <b>SILT</b> 10YR 5/3 brown, NO HCl reaction, micaceous Silty Fine Sandy <b>GRAVEL</b> <b>GRAVEL</b> is sub-rounded to rounded small to medium sized basalt pebbles, some are weathered Matrix is a very fine sandy <b>SILT</b> , 10YR 5/3 brown, NO HCl reaction	-24.0 24.0	10/20 Sand Filter Pack - 13-35 ft. 2-inch SCH 40 PVC 0.020 slotted casing - 15-35 ft.
35.0 - 35.0		<b>TD 35 ft.</b> Ground Elevation: Top of Casing Elevation:	-35.0 35.0	
35.0 - 50		*BTOC = Below Top Of Casing		

Drilled By: Environmental West Exploration  
 Drilling Method: Tubex Air Rotary  
 Static Water Level: 18.11' ft. BTOC\* (2-5-2014)

Total Depth: 35 ft.  
 Date Completed: 2-4-2014  
 Page: 1 of 1

# Geologic Log of: MW-LWW1

Project: WWBWC 2014 Drilling

State Well ID: BHW-826

Logged By: Jon Travis

Location: West Little Walla Walla River



Water Solutions, Inc.

8019 W. Quinault Ave, Suite 201  
 Kennewick, WA 99336  
 Phone: 509.735.7135  
 Fax: 509.735.7067

Depth (ft. bgs)	Lithology Symbol	Lithologic Description	Elevation (ft. amsl)	Well Construction
0		Ground Surface	0.0	
0 - 10		Very Fine Sandy <b>SILT</b> 10YR 4/3 brown, micaceous, NO HCl reaction	0.0	
10 - 25		Silty Fine Sandy <b>GRAVEL</b> <b>GRAVEL</b> is sub-rounded to rounded small to medium sized basalt pebbles, some are weathered Matrix is a very fine sandy <b>SILT</b> , 10YR 4/3 brown, NO HCl reaction	-10.0 10.0	<p>3/8" bentonite chips - 1-3 ft.                      2-inch SCH 40 PVC casing - 0-5 ft. Flushmount Monument - 0-1ft.                      10/20 Sand Filter Pack - 3-25 ft.                      2-inch SCH 40 PVC 0.020 slotted casing - 5-25 ft.</p>
25		<b>TD 25 ft.</b> Ground Elevation: Top of Casing Elevation:	-25.0 25.0	
30		*BTOC = Below Top Of Casing		
35				
40				
45				
50				

Drilled By: Environmental West Exploration  
 Drilling Method: Tubex Air Rotary  
 Static Water Level: 4.71' ft. BTOC\* (2-5-2014)

Total Depth: 25 ft.  
 Date Completed: 2-5-2014  
 Page: 1 of 1

# Geologic Log of: MW-LWW2

Project: WWBWC 2014 Drilling

State Well ID: BHW-826

Logged By: Jon Travis

Location: West Little Walla Walla River



Water Solutions, Inc.

8019 W. Quinault Ave, Suite 201  
 Kennewick, WA 99336  
 Phone: 509.735.7135  
 Fax: 509.735.7067

Depth (ft. bgs)	Lithology Symbol	Lithologic Description	Elevation (ft. amsl)	Well Construction
0		Ground Surface	0.0	
0-8		No samples were recovered from 0-10 ft. Based on the way it drilled the material most likely is very fine sandy silt. The contact at 8 ft. is estimated	0.0	
8-21		Silty Fine Sandy <b>GRAVEL</b> <b>GRAVEL</b> is sub-rounded to angular granule to small sized basalt pebbles, some are weathered Matrix is a very fine sandy <b>SILT</b> , 10YR 4/3 brown, NO HCl reaction	-8.0 8.0	<p>3/8" bentonite chips - 1-4 ft.                      10/20 Sand Filter Pack - 4-21 ft.                      2-inch SCH 40 PVC 0.020 slotted casing - 6-21 ft.                      Flushmount Monument - 0-1ft.</p>
21		<b>TD 21 ft.</b> Ground Elevation: Top of Casing Elevation: *BTOC = Below Top Of Casing	-21.0 21.0	
25				
30				
35				
40				
45				
50				

Drilled By: Environmental West Exploration  
 Drilling Method: Tubex Air Rotary  
 Static Water Level: 1.12' ft. BTOC\* (2-5-2014)

Total Depth: 20 ft.  
 Date Completed: 2-5-2014  
 Page: 1 of 1