Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/27/2020	Surface Elevation:	551.34 ft amsl	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	553.64 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	553.60 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	6/10/2020		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
0					(+2.3 - 93.0') 2" PVC Sch 80 Casing; (+2.3 - 137.0') 2" PVC Sch 80 Casing; (+2.8 - 5.0') Surface completion		Note: 12x12-inch Lockable Steel Monument painted desert sand; (+1.0 - 5.2') 42 bags Note: 30" diameter concrete pad, King Kon-Crete 4000 PSI with Buff concrete dye.
1–4		Topock - Fluvial Deposits	SW		(0.0 - 9.0') 12.0" Borehole		
4–5		Topock - Fluvial Deposits	SM				
5–9		Topock - Alluvium Deposits	SM				
9–10		Topock - Alluvium Deposits	GW				
10–11		Topock - Alluvium Deposits	SW-SM		(5.0 - 34.5') Portland Cement 5% Bentonite Type I, II and V with Hydrogel	(5.0 - 34.5') 117.9 gallons	(5.0 - 34.5') 150 gallons (127%) Note: Grout seal, used >20% of the calculated volume due to potential voids forming. Installed on 3/30/2020.
11–14		Topock - Alluvium Deposits	SW				
14–15		Topock - Alluvium Deposits	SW-SM				
15–16		Topock - Alluvium Deposits	SM				
16–17		Topock - Alluvium Deposits	SM		(9.0 - 188.0') 10.0" Borehole		

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-95

Well Construction Log

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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
18			SM		(+2.3 - 93.0') 2" PVC Sch 80 Casing; (+2.3 - 137.0') 2" PVC Sch 80 Casing		
19		Topock - Alluvium Deposits	SW-SM				
20		Topock - Alluvium Deposits	SM				
21		Topock - Alluvium Deposits	GW				
22		Topock - Alluvium Deposits	SM				
23		Topock - Alluvium Deposits	SW				
24		Topock - Alluvium Deposits	SW-SM				
25		Topock - Alluvium Deposits	SM		(5.0 - 34.5') Portland Cement 5% Bentonite Type I, II and V with Hydrogel	(5.0 - 34.5') 117.9 gallons	(5.0 - 34.5') 150 gallons (127%) Note: Grout seal, used >20% of the calculated volume due to potential voids forming. Installed on 3/30/2020.
26		Topock - Alluvium Deposits	GW				
27		Topock - Alluvium Deposits	SW-SM				
28		Topock - Alluvium Deposits	GW-GM				
29		Topock - Alluvium Deposits					
30		Topock - Alluvium Deposits					
31		Topock - Alluvium Deposits	SM		(9.0 - 188.0') 10.0" Borehole		
32							
33							
34							
35		Topock - Alluvium Deposits	SM		(34.5 - 35.5') Centralizer (34.5 - 85.0') Portland Cement 5% Bentonite Type I, II and V with Hydrogel	(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Grout seal, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
36							
37							

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Driller Name:	Jose Hernandez	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
38		Topock - Alluvium Deposits	SM		(+2.3 - 93.0') 2" PVC Sch 80 Casing		
39		Topock - Alluvium Deposits	SM				
40		Topock - Alluvium Deposits	GW-GM				
41		Topock - Alluvium Deposits	SW				
42		Topock - Alluvium Deposits	ML				
43							
44							
45		Topock - Alluvium Deposits	SW-SM		(34.5 - 85.0') Portland Cement 5% Bentonite Type I, II and V with Hydrogel	(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Grout seal, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
46							
47							
48		Topock - Alluvium Deposits	SM				
49		Topock - Alluvium Deposits	SM				
50							
51		Topock - Alluvium Deposits	SW				
52		Topock - Alluvium Deposits	SM				
53							
54							
55		Topock - Alluvium Deposits	SW				
56		Topock - Alluvium Deposits	SM				
57		Topock - Alluvium Deposits	SW-SM		(9.0 - 188.0') 10.0" Borehole		

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ARCADIS Design & Consultancy for natural and built assets

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Drilling Co.:	Cascade	Deep Well Elevation:	553.60 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	6/10/2020		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
58		Topock - Alluvium Deposits	SW-SM		(+2.3 - 93.0') 2" PVC Sch 80 Casing; (+2.3 - 137.0') 2" PVC Sch 80 Casing		
59							
60							
61							
62							
63							
64							
65							
66							
67		Topock - Alluvium Deposits	SM		(34.5 - 85.0') Portland Cement 5% Bentonite Type I, II and V with Hydrogel; (9.0 - 188.0') 10.0" Borehole	(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Grout seal, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
68							
69		Topock - Alluvium Deposits	SM SW-SM				
70							
71		Topock - Alluvium Deposits	SM				
72							
73							
74		Topock - Alluvium Deposits	SW-SM				
75					(74.5 - 75.5') Centralizer		
76							
77							

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Drilling Method:	Sonic Drilling	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
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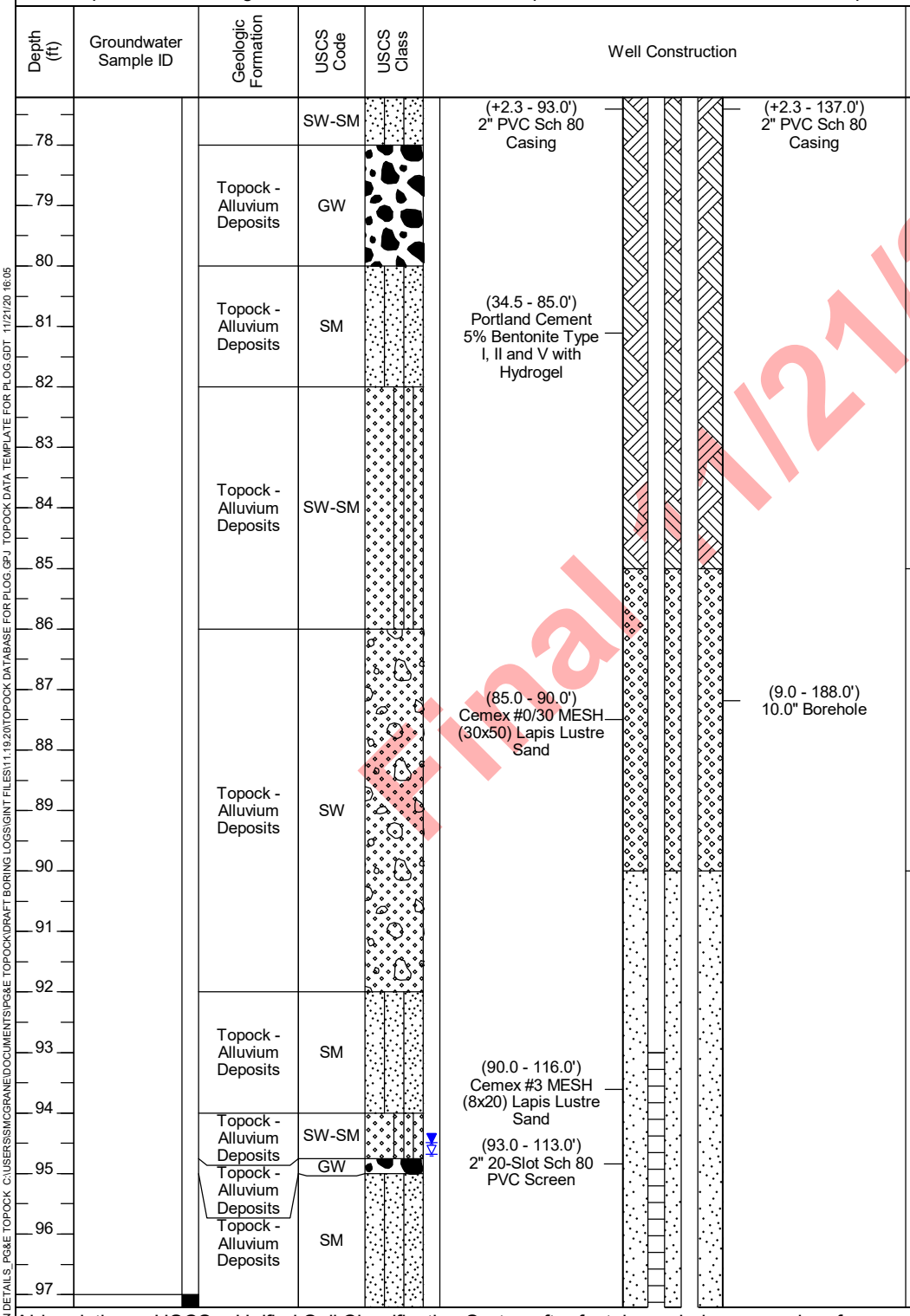

Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Grout seal, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
(85.0 - 90.0') 5 bags	(85.0 - 90.0') 7 bags (140%) Note: Transition sand, used >20% of the calculated volume due to potential voids forming during drilling.
(90.0 - 116.0') 26.4 bags	(90.0 - 116.0') 43 bags (163%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.

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Date Completed:	04/01/2020	Shallow Well Elevation:	553.64 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	553.60 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	6/10/2020		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up ☐ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
98		Topock - Alluvium Deposits	SM		(93.0 - 113.0') 2" 20-Slot Sch 80 PVC Screen; (+2.3 - 137.0') 2" PVC Sch 80 Casing		
99	MW-95-VAS-97-102.0 (0.79 ppb) 3/10/2020 10:17						
100							
101		Topock - Alluvium Deposits	SM				
102			NR				
103		Topock - Alluvium Deposits	SM				
104							
105		Topock - Alluvium Deposits	SM				
106					(90.0 - 116.0') Cemex #3 MESH (8x20) Lapis Lustre Sand	(90.0 - 116.0') 26.4 bags	(90.0 - 116.0') 43 bags (163%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
107		Topock - Alluvium Deposits	ML		(9.0 - 188.0') 10.0" Borehole		
108							
109		Topock - Alluvium Deposits	ML				
110							
111		Topock - Alluvium Deposits	SM				
112							
113		Topock - Alluvium Deposits	ML				
114					(113.5 - 114.2') Centralizer		
115		Topock - Alluvium Deposits	SM		(113.0 - 115.3') Sump and SS End Cap		
116							
117		Topock - Alluvium Deposits	SM		(116.0 - 130.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(116.0 - 130.0') 11.7	

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Drilling Co.:	Cascade	Deep Well Elevation:	553.60 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	6/10/2020		
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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
118		Topock - Alluvium Deposits	GM		(+2.3 - 137.0') 2" PVC Sch 80 Casing		
119		Topock - Alluvium Deposits	GM				
120							
121							
122		Topock - Alluvium Deposits	SM				
123					(116.0 - 130.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(116.0 - 130.0') 11.7	(116.0 - 130.0') 24 (205%) Note: Pel-Plug (TR30) 3/8", used >20% of the calculated volume due to potential voids forming during drilling.
124	MW-95-VAS-122-127 (0.87 ppb) 3/10/2020 15:24						
125		Topock - Alluvium Deposits	SM		(124.5 - 125.2') Centralizer		
126							
127							
128		Topock - Alluvium Deposits	GW-GM		(9.0 - 188.0') 10.0" Borehole		
129							
130		Topock - Alluvium Deposits	GM			(130.0 - 135.0') 5.2 bags	(130.0 - 135.0') 7 bags (135%) Note: Transition sand, used >20% of the calculated volume due to potential voids forming during drilling.
131							
132					(130.0 - 135.0') Cemex #0/30 MESH (30x50) Lapis Lustre Sand		
133		Topock - Alluvium Deposits	ML				
134		Topock - Alluvium Deposits	SM				
135							
136					(135.0 - 161.5') Cemex #3 MESH (8x20) Lapis Lustre Sand	(135.0 - 161.5') 27.3 bags	(135.0 - 161.5') 35 bags (128%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
137							

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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
138		Topock - Alluvium Deposits	ML		(137.0 - 157.0') 2" 20-Slot Sch 80 PVC Screen		
139							
140		Topock - Alluvium Deposits	SW-SM				
141							
142		Topock - Alluvium Deposits	ML				
143							
144		Topock - Alluvium Deposits	SW-SM				
145							
146							
147		Topock - Alluvium Deposits	ML		(135.0 - 161.5') Cemex #3 MESH (8x20) Lapis Lustre Sand; (9.0 - 188.0') 10.0" Borehole	(135.0 - 161.5') 27.3 bags	(135.0 - 161.5') 35 bags (128%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
148							
149		Topock - Alluvium Deposits	SM				
150							
151							
152							
153		Topock - Alluvium Deposits	SW-SM				
154	MW-95-VAS152-157 (<0.033 U ppb) 3/12/2020 09:57						
155							
156							
157							

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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
158		Topock - Alluvium Deposits	SM		(157.5 - 158.5') Centralizer (135.0 - 161.5') Cemex #3 MESH (8x20) Lapis Lustre Sand (157.0 - 159.3') Sump and SS End Cap	(135.0 - 161.5') 27.3 bags	(135.0 - 161.5') 35 bags (128%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
159							
160							
161							
162							
163		Topock - Alluvium Deposits	ML				
164							
165							
166		Topock - Alluvium Deposits	SM		(9.0 - 188.0') 10.0" Borehole		
167							
168							
169					(161.5 - 193.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(161.5 - 193.0') 25.9 buckets	(161.5 - 193.0') 32 buckets (124%) Note: Decommissioned rathole, used >20% of the calculated volume due to potential voids forming during drilling.
170		Topock - Alluvium Deposits	ML				
171							
172		Topock - Alluvium Deposits	SM				
173							
174							
175							
176		Topock - Alluvium Deposits	SM				
177			ML				

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Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
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178		Topock - Alluvium Deposits	ML				
179							
180		Topock - Alluvium Deposits	SM				
181							
182		Topock - Alluvium Deposits	SM		(9.0 - 188.0') 10.0" Borehole		
183							
184	MW-95-VAS-182-187 (<0.17 U ppb) 3/20/2020 16:18	Topock - Alluvium Deposits	ML		(161.5 - 193.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(161.5 - 193.0') 25.9 buckets	(161.5 - 193.0') 32 buckets (124%) Note: Decommissioned rathole, used >20% of the calculated volume due to potential voids forming during drilling.
185							
186							
187							
188		Topock - Alluvium Deposits	ML				
189							
190		Topock - Weathered Bedrock - conglomerate	SM		(188.0 - 193.0') 8.0" Borehole		
191							
192		Topock - Competent Bedrock - conglomerate					
193							
194					(193.0 - 196.0') 6.0" Borehole	(193.0 - 197.0') 1.08 buckets	(193.0 - 197.0') 1 buckets (93%) Note: Decommissioned rathole, overshot draft design by 1 foot.
195					(193.0 - 197.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"		
196							
197					(196.0 - 197.0') 4.0" Borehole End of Boring at 197.0 ft bgs.		

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-95

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 1 of 10

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	**Boring No.:**	**MW-95**
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56		
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
1–4	45.6			Topock - Fluvial Deposits	SW		(0.0 - 3.8') Topock - Fluvial Deposits; Well graded sand with gravel (SW); light brown (7.5YR 6/4); very fine grained to very coarse grained, angular to round; little granules to very large pebbles, angular to subangular; trace small to large cobbles, angular to subangular; trace silt; coarser clasts composed of metadiorite; dry to moist	(0.0 - 3.8') Hand augered for utility clearance, had refusal at 3.8 ft bgs, logged from hand auger cuttings.	(0.0 - 32.0') No water used
4–9	62.4			Topock - Fluvial Deposits	SM		(3.8 - 5.0') Topock - Fluvial Deposits; Silty sand (SM); light brown (7.5YR 6/4); very fine grained to very coarse grained, angular to round; some silt; little granules to very large pebbles, angular to subangular; trace small to large cobbles, angular to subround; trace boulders, subangular; coarser clasts composed of metadiorite; moist	(3.8 - 9.0') Advanced 12-inch conductor material logged from clean out sample disturbed.	
				Topock - Alluvium Deposits	SM		(5.0 - 9.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist		
9–14	96			Topock - Alluvium Deposits	GW		(9.0 - 9.8') Topock - Alluvium Deposits; Well graded gravel (GW); grayish green (GLEY1 5/2); boulders, subangular; dry; iron oxide staining; pulverized into rock flour	(9.0 - 16.0') Normal Drilling (9.5 - 57.0') Formation tight when advancing 10-inch casing.	
				Topock - Alluvium Deposits	SW-SM		(9.8 - 11.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; dry; iron oxide staining		
				Topock - Alluvium Deposits	SW		(11.0 - 14.3') Topock - Alluvium Deposits; Well graded sand with gravel (SW); gray (2.5Y 5/1); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, subangular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; dry to moist; iron oxide staining		
				Topock - Alluvium Deposits	SW-SM		(14.3 - 16.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/2) and brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist; iron oxide staining		
14–17				Topock - Alluvium Deposits	SM		(16.0 - 18.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/2) and brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; dry to moist (17.5'); trace clay; decrease in sand, increase in granules and pebbles	(16.0 - 17.0') Hard drilling (17.0 - 22.0') Core came out hot and melted bag 20 to 22 ft. bgs disturbed, potential boulder at 22 ft. bgs.	
17–20	60			Topock - Alluvium Deposits	SW-SM		(18.0 - 19.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; dry to moist		
				Topock - Alluvium	SM		(19.3 - 21.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained,		

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	Client:	PG&E
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs		
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
21	60			Topock - Alluvium Deposits	SM		angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist		
22				Topock - Alluvium Deposits	GW		(21.0 - 22.0') Topock - Alluvium Deposits; Well graded gravel (GW); greenish gray (GLEY1 5/1); small cobbles to boulders; dry; cobbles and boulders pulverized into pieces and rock flour		
23	66			Topock - Alluvium Deposits	SM		(22.0 - 23.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/4) with brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist; organic odor	(22.0 - 27.0') Hard drilling, top 0.5 feet of core slough.	
24				Topock - Alluvium Deposits	SW		(23.5 - 25.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); brown (7.5YR 5/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; trace small cobbles, subangular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; dry to moist		
25				Topock - Alluvium Deposits	SW-SM		(25.0 - 26.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist	(25.0') Slow drilling with 10-inch casing due to potential boulder.	
26				Topock - Alluvium Deposits	SM		(26.0 - 27.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace small cobbles, subround; trace clay; coarser clasts composed of metadiorite; dry to moist		
27				Topock - Alluvium Deposits	GW		(27.0 - 27.5') Topock - Alluvium Deposits; Well graded gravel with sand (GW); dark greenish gray (GLEY1 4/1); small cobbles, subangular to round; and small to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; trace silt; coarser clasts composed of metadiorite; moist; iron oxide staining; cobbles pulverized into rock flour difficult to determine silt content	(27.0 - 32.0') Hard drilling	
28				Topock - Alluvium Deposits	SW-SM		(27.5 - 28.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/2); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist to dry		
29				Topock - Alluvium Deposits	GW-GM		(28.3 - 30.5') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); gray (2.5Y 5/1); small cobbles, angular to subangular; and granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to round; little silt; dry; iron oxide staining; cobbles pulverized to rock flour difficult to determine silt content		
30							(30.5 - 34.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3) and brown (7.5YR 5/4); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist		
31									
32	120			Topock - Alluvium Deposits	SM			(32.0 - 37.0') Drilling got softer	(32.0 - 67.0') No water used
33									
34									
35									
36							(34.5 - 37.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subangular; some silt; dry to moist (35'); little silt; trace small cobbles, subround; trace clay; increase in sand, increase in granules and pebbles		
37									
38	24			Topock - Alluvium Deposits	SM		(37.0 - 38.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish brown / moderate yellowish brown (10YR 5/4); very fine grained to medium grained, angular to subround; some granules to very large pebbles, angular to subangular; some silt; little coarse to very coarse grained sand, angular to subround; trace small cobbles, subangular; trace clay; coarser clasts composed of metadiorite; trace; dry; weak cementation; iron oxide staining	(37.0 - 39.0') Formation tight 2 foot drill run.	
39				Topock - Alluvium Deposits	SM				
40	108			Topock - Alluvium Deposits	GW-GM		(38.0 - 39.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); grayish brown (10YR 5/2); very fine grained to very coarse	(39.0 - 47.0') Soft drilling, top one foot of	

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	**Boring No.:**	**MW-95**
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56		
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
41				Topock - Alluvium Deposits	SW		grained, angular to round; some granules to large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry; weak cementation; iron oxide staining	core slough.	
42				Topock - Alluvium Deposits	ML		(39.0 - 40.0') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); brown (7.5YR 5/3); granules to very large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist to dry		
43							(40.0 - 41.5') Topock - Alluvium Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3); very fine grained to very coarse grained, angular to round; some granules to large pebbles, angular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; moist to dry		
44	108								
45				Topock - Alluvium Deposits	SW-SM		(41.5 - 44.5') Topock - Alluvium Deposits; Silt with sand (ML); brown (10YR 5/3); no plasticity; some granules to large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; trace clay; coarser clasts composed of metadiorite; dry; weak cementation		
46							(44.5 - 48.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist to dry; iron oxide staining		
47							(46.5') boulders; dry; trace boulder subround pulverized into rock flour		
48				Topock - Alluvium Deposits	SM		(48.0 - 49.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); grayish brown (10YR 5/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry; boulder pulverized into rock flour	(47.0 - 56.0') Got tight at 56 ft. tripped out core barrel. top 0.5 ft slough.	
49									
50				Topock - Alluvium Deposits	SM		(49.0 - 51.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist; weak cementation; iron oxide staining	(50.0') Hard drilling	
51									
52	114			Topock - Alluvium Deposits	SW		(51.0 - 52.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; dry		
53				Topock - Alluvium Deposits	SM		(52.0 - 54.3') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist; weak cementation		
54							(53'); some granules to very large pebbles, angular to subround; little silt; increase in sand, no clay	(54.0') Hard Drilling	
55				Topock - Alluvium Deposits	SW		(54.3 - 55.3') Topock - Alluvium Deposits; Well graded sand with gravel (SW); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; trace silt; coarser clasts composed of metadiorite; strong cementation		
56				Topock - Alluvium Deposits	SM				
57				Topock - Alluvium Deposits	SW-SM		(55.3 - 56.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to very coarse grained, angular to subround; some silt; little granules to large pebbles, angular to subround; trace clay; coarser clasts composed of metadiorite; dry; weak cementation; iron oxide staining	(56.0 - 67.0') Normal drilling, interbedded moist and dry layers.	
58	132						(56.0 - 67.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; dry to moist		
59							(59') brown (7.5YR 5/2); weak cementation; iron oxide staining		
60									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	**Boring No.:**	**MW-95**
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56		
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
61									
62									
63									
64	132			Topock - Alluvium Deposits	SW-SM		(61.5'); and granules to large pebbles, angular to subround (64'); and granules to very large pebbles, angular to subround; trace small cobbles, subround		
65									
66									
67									
68				Topock - Alluvium Deposits	SM		(67.0 - 69.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist	(67.0 - 77.0') Normal Drilling	(67.0 - 107.0') No water used
69									
70				Topock - Alluvium Deposits	SM SW-SM		(69.0 - 70.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist		
71				Topock - Alluvium Deposits	SM		(69.5') Silty sand with gravel (SM); gray / light brownish gray (5YR 6/1); dry; weak cementation; 0.4 foot lens (70.5 - 71.3') Topock - Alluvium Deposits; Silty sand with gravel (SM); pinkish gray (7.5YR 6/2); very fine grained to very coarse grained, angular to subround; little granules to large pebbles, angular to subround; little silt; trace clay; dry to moist; weak cementation		
72	120								
73							(71.3 - 78.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist		
74							(73.5'); some granules to large pebbles, angular to subangular		
75				Topock - Alluvium Deposits	SW-SM		(75'); some granules to very large pebbles, angular to subangular		
76							(75.5'); some granules to large pebbles, angular to subangular; weak cementation		
77									
78							(77'); some granules to very large pebbles, angular to subround; moist; weak cementation	(77.0 - 82.0') Normal Drilling, stopped at 82 ft core barrel full with slough.	
79	60			Topock - Alluvium Deposits	GW		(78.0 - 80.0') Topock - Alluvium Deposits; Well graded gravel with sand (GW); grayish brown (2.5Y 5/2); granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; little small cobbles, subangular; coarser clasts composed of metadiorite; dry; iron oxide staining; pebbles and cobbles pulverized into rock flour cannot determine silt content		
80									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	**Boring No.:**	**MW-95**
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56		
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
81	60			Topock - Alluvium Deposits	SM		(80.0 - 82.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace small cobbles, subangular; moist to dry		
82									
83	120			Topock - Alluvium Deposits	SW-SM		(82.0 - 86.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist	(82.0 - 92.0') Normal Drilling	
84									
85									
86							(85.5'); trace small cobbles, angular to subangular		
87				Topock - Alluvium Deposits	SW		(86.0 - 92.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); reddish brown (5YR 5/3); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; moist to dry (87'); and granules to large pebbles, angular to subround		
88							(88'); and granules to very large pebbles, angular to subangular (88.25') grayish brown (2.5Y 5/2); 0.2 foot lens (88.45') reddish brown (5YR 5/3)		
89									
90									
91									
92									
93	60			Topock - Alluvium Deposits	SM		(92.0 - 94.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist (93.5'); little granules to large pebbles, angular to subround; increase in sand		
94				Topock - Alluvium Deposits	SW-SM		(94.0 - 94.8') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist		
95				Topock - Alluvium Deposits	GW		(94.8 - 95.0') Topock - Alluvium Deposits; Well graded gravel (GW); (GLEY1 5/3); boulders, subangular; dry; boulders have been pulverized into some rock flour		
96									
97				Topock - Alluvium Deposits	SM		(95.0 - 100.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some silt; little granules to large pebbles, angular to subangular; trace clay; coarser clasts composed of metadiorite; moist; weak cementation; iron oxide staining (97'); little clay; moist to wet; increase in silt, decrease in sand (98'); trace small to large cobbles, subangular (98.25'); increase in sand, decrease in silt, no clay	(96.8') Approximate depth to groundwater. (97.0 - 102.0') Tight drilling, core barrel came out hot, bag melted lost 0.5 ft in hopper.	
98	54		MW-95-VAS-97-102.0 (0.79 ppb) 3/10/2020 10:17						
99									
100									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol represents depth to water measurement during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-95-113, MW-95-157 installed in borehole

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	**Boring No.:**	**MW-95**
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56		
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
101	54		MW-95-VAS-97-102.0 (0.79 ppb) 3/10/2020 10:17		SM		(99.75'); trace boulders, subround	(97.1 - 107.0') Drilling easy with 8-inch core barrel.	
				Topock - Alluvium Deposits	SM		(99.9'); some granules to large pebbles, angular to subangular; trace clay; decrease in sand, increase in silt		
102					NR		(100.5 - 101.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; well sorted; moist to wet		
103				Topock - Alluvium Deposits	SM		(101.5 - 102.0') No recovery (NR); fell out of core barrel into hopper	(102.0 - 107.0') Hard drilling	
104	60						(102.0 - 104.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some silt; little granules to large pebbles, angular to subangular; trace clay; coarser clasts composed of metadiorite; wet		
105				Topock - Alluvium Deposits	SM		(103.5'); some granules to very large pebbles, angular to subangular; increase in sand, decrease in silt		
106							(104.0 - 107.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist to wet; weak cementation		
107									
108	120			Topock - Alluvium Deposits	ML		(107.0 - 108.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4); no plasticity; some very fine to very coarse grained sand, angular to subangular; little granules to very large pebbles, angular to subangular; trace clay; moist to wet; very stiff	(107.0') Hard Drilling	(107.0 - 147.0') No water used
109				Topock - Alluvium Deposits	ML		(108.0 - 110.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 5/3); no plasticity; some granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; trace clay; coarser clasts composed of metadiorite; dry to moist; hard		
110							(109.5'); trace small cobbles, subangular; cobbles pulverized into rock flour	(110.0') Hard Drilling	
111				Topock - Alluvium Deposits	SM		(110.0 - 112.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; some silt; trace small cobbles, subangular; moist to wet		
112									
113				Topock - Alluvium Deposits	ML		(112.5 - 114.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (10YR 5/3); low plasticity; some granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; coarser clasts composed of metadiorite; moist to wet; very stiff		
114									
115				Topock - Alluvium Deposits	SM		(114.0 - 115.8') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist to wet (114.75'); moist to dry	(114.0') Hard Drilling	
116				Topock - Alluvium Deposits	SM		(115.8 - 117.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; moist to dry		
117									
118	114			Topock - Alluvium Deposits	GM		(117.0 - 118.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); grayish brown (10YR 5/2); granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; little silt; coarser clasts composed of metadiorite; moist to wet; pebbles pulverized, some silt maybe rock flour	(117.0 - 127.0') Normal drilling, 9.5 ft of recovery due to compaction.	
119				Topock - Alluvium Deposits	GM		(118.0 - 121.5') Topock - Alluvium Deposits; (GM); brown (10YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some		
120									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	Client:	PG&E
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs		
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
121				Topock - Alluvium Deposits	GM		silt; coarser clasts composed of metadiorite; moist to wet; weak cementation		
122				Topock - Alluvium Deposits	SM		(121.5 - 124.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); grayish brown (10YR 5/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace small cobbles, subangular to subround; trace clay; coarser clasts composed of metadiorite; dry		
123	114		MW-95-VAS-122-127 (0.87 ppb) 3/10/2020 15:24				(123'); and granules to very large pebbles, angular to subangular; little silt; trace boulders, subangular; increase in sand		
124				Topock - Alluvium Deposits	SM		(124.0 - 127.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet		
125									
126									
127									
128				Topock - Alluvium Deposits	GW-GM		(127.0 - 129.5') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); brown (7.5YR 5/3); granules to very large pebbles, angular to subround; and very fine to very coarse grained sand, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet	(127.0 - 137.0') Normal drilling	
129									
130				Topock - Alluvium Deposits	GM		(129.5 - 132.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); brown (7.5YR 5/3); granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subangular; some silt; coarser clasts composed of metadiorite; wet (130.5'); increase in granules and pebbles, increase in sand, decrease in silt	(130.0 - 140.0') Borehole caving in during drilling with 8-inch, potential voids forming. Advancing 10-inch casing hard.	
131									
132	120								
133				Topock - Alluvium Deposits	ML		(132.5 - 133.5') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 5/3); low plasticity; some granules to very large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; trace clay; moist; very stiff		
134				Topock - Alluvium Deposits	SM		(133.5 - 137.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subangular; some granules to very large pebbles, angular to subangular; some silt; trace clay; coarser clasts composed of metadiorite; moist to moist		
135									
136									
137									
138				Topock - Alluvium Deposits	ML		(137.0 - 140.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); dark yellowish brown (10YR 4/4) with reddish brown (5YR 5/4); medium plasticity; and very fine to very coarse grained sand, angular to round; little granules to very large pebbles, angular to subround; coarser clasts composed of metadiorite; moist to wet; soft; mottled	(137.0 - 147.0') Normal Drilling, 9.5 ft of recovery due to compaction.	
139	114								
140								(138.0') Encountered potential	

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Boring Log

Sheet: 8 of 10

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	**Boring No.:**	**MW-95**
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56		
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
141				Topock - Alluvium Deposits	SW-SM		(140.0 - 141.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/2); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist to wet	boulder advancing 10-inch casing. (140.0 - 150.0') Normal drilling advancing 10-inch casing.	
142				Topock - Alluvium Deposits	ML		(141.0 - 144.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4); low plasticity; and very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subround; trace clay; coarser clasts composed of metadiorite; moist to wet; soft		
143									
144	114						(143.8'); trace small cobbles, subangular		
145				Topock - Alluvium Deposits	SW-SM		(144.0 - 147.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/3); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subround; little silt; some coarser clasts composed of metadiorite; moist to wet		
146									
147							(146.5'); trace small cobbles, subangular		
148				Topock - Alluvium Deposits	ML		(147.0 - 149.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subangular; trace clay; coarser clasts composed of metadiorite; moist; very stiff	(147.0 - 153.0') Hard Drilling, 5.2 ft of recovery due to compaction in sample bag.	(147.0 - 157.0') No water used
149									
150	62.4			Topock - Alluvium Deposits	SM		(149.0 - 153.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; some silt; trace clay; coarser clasts composed of metadiorite; moist		
151							(151.5'); increase in sand, no clay		
152									
153			MW-95-VAS152-157 (<0.033 U ppb) 3/12/2020 09:57						
154				Topock - Alluvium Deposits	SW-SM		(153.0 - 157.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet	(153.0 - 157.0') Normal drilling, 3.5 ft recovery due to compaction of sediments in bag.	
155	42						(154.5'); trace small cobbles, subangular		
156							(155'); trace clay; decrease in sand		
157									
158				Topock - Alluvium Deposits	SM		(157.0 - 163.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 4/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet	(157.0 - 175.0') Normal drilling	(157.0 - 175.0') No water used
159	216						(159'); some silt; decrease in sand		
160									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	Client:	PG&E
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs		
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
161				Topock - Alluvium Deposits	SM		(161.5'); little silt; increase in sand		
162									
163									
164				Topock - Alluvium Deposits	ML		(163.0 - 166.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (10YR 4/3); medium plasticity; and very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subangular; coarser clasts composed of metadiorite; soft		
165								(165.0') Hard drilling	
166				Topock - Alluvium Deposits	SM		(166.0 - 170.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet		
167	216						(167.5'); increase in silt, decrease in sand		
168									
169							(169') brown (10YR 4/3); some silt; trace clay; moist; decrease in sand		
170				Topock - Alluvium Deposits	ML		(170.0 - 171.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); very dark grayish brown (10YR 3/2); medium plasticity; some very fine to very coarse grained sand, angular to round; little granules to very large pebbles, angular to subround; trace small cobbles, subangular; trace silt; wet; soft		
171				Topock - Alluvium Deposits	SM		(171.0 - 175.8') Topock - Alluvium Deposits; Silty sand with gravel (SM); very dark grayish brown (10YR 3/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; some silt; coarser clasts composed of metadiorite; wet		
172							(172'); and silt; trace clay; decrease in sand		
173							(173'); no clay, increase in sand		
174									
175								(175.0 - 182.0') Normal drilling, driller said lost 1 foot of core out of bottom of core barrel.	(175.0 - 187.0') No water used
176							(175.5'); trace clay; decrease in sand		
177				Topock - Alluvium Deposits	SM		(175.8 - 176.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark grayish brown / dark yellowish brown (10YR 4/2); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; wet		
178	74.4			Topock - Alluvium Deposits	ML		(176.5 - 179.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); dark grayish brown / dark yellowish brown (10YR 4/2); medium plasticity; some very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subangular; trace clay; coarser clasts composed of metadiorite; moist; very stiff; some metadiorite is weathered		
179									
180				Topock - Alluvium Deposits	SM		(179.0 - 182.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); very dark grayish brown (10YR 3/2); very fine grained to very		

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	551.34 ft amsl	Client:	PG&E
Date Completed:	03/27/2020	Northing (NAD83):	2101097.56	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7614460.91	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs		
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
181	74.4			Topock - Alluvium Deposits	SM		coarse grained, angular to round; some silt; little granules to very large pebbles, angular to subround; trace clay; coarser clasts composed of metadiorite; moist to wet (179.5'); dry (180'); weak cementation (181.5') brown (7.5YR 4/3) with dark gray (10YR 4/1); mottled		
182									
183	78		MW-95-VAS-182-187 (<0.17 U ppb) 3/20/2020 16:18	Topock - Alluvium Deposits	SM		(182.0 - 183.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; wet	(182.0 - 186.0') Normal drilling, extra recovery material lost downhole 181 to 182.	
184				Topock - Alluvium Deposits	ML		(183.5 - 188.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); dark gray (10YR 4/1); medium plasticity; some granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand; coarser clasts composed of metadiorite; moist; very stiff (185'); wet (185.5'); moist		
185									
186									
187							(187'); trace small to large cobbles, subangular	(186.0 - 187.0') Started getting hard during drilling.	(187.0 - 188.0') No water used
188				Topock - Alluvium Deposits	ML		(188.0 - 190.2') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown (5YR 4/3) and grayish brown (10YR 5/2); no plasticity; some granules to very large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; trace small to large cobbles, subangular; trace clay; coarser clast composed of conglomerate; coarser clasts composed of metadiorite; moist; hard; mottled; conglomerate clasts weathered (188.5'); dry (189.5'); moist (190'); dry	(187.0 - 193.0') Cobble may have jammed up core barrel, preventing advancing to 197, lost 3 ft. of core down hole going back in to retreive.	(188.0 - 193.0') 1744 gallons of water used; 800 gallons of water recovered; 944 gallons of water lost; Used to flush casing prior to installation of the well.
189									
190	38.4			Topock - Weathered Bedrock - conglomerate	SM		(190.2 - 191.7') Topock - Weathered Bedrock - conglomerate; Sandy silt with gravel (SM); reddish brown (5YR 4/3) with red (2.5YR 4/6); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subangular; trace clay; coarser clasts composed of metadiorite; moist; mottled; iron oxide staining	(188.0') Very hard drilling with 8-inch multiple clean outs, driller did not want to advance 10 inch further.	
191									
192							(191.7 - 197.0') Topock - Competent Bedrock - conglomerate; red (2.5YR 4/6); dry; friable, pulverized by drilling	(192.0') Drilling got hard.	(193.0 - 197.0') 484 gallons of water used; 123 gallons of water recovered; 361 gallons of water lost; Used to flush casing prior to installation of bentonite in rathole.
193									
194				Topock - Competent Bedrock - conglomerate					
195	80.4							(193.0 - 197.0') Hard drilling, extra recovery retrieved core from 187 to 193 ft run.	
196									
197							End of Boring at 197.0 ft bgs.	(196.0') Very hard drilling, 6-inch casing refusal.	
198									
199									
200									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol represents depth to water measurement during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-95-113, MW-95-157 installed in borehole