Well Construction Log

Sheet: 1 of 11

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
1–2		Topock - Fill	SP		(0.2 - 22.3') 2" PVC Sch 80 Casing; (+0.2 - 2.5') Surface completion; (0.3 - 191.3') 2" PVC Sch 80 Casing		(+0.2 - 2.5') 21 bags Note: 30" diameter concrete pad with 18" diameter lockable vault Quikrete concrete with Buff dye
3–4		Topock - Fill	SP-SM				
5–8		Topock - Fill	SP-SC				
9–11		Topock - Fill	SP		(3.5 - 15.0') Portland Cement 6% Bentonite Type I, II, and V with Hydrogel; (0.0 - 18.0') 12.0" Borehole	(3.5 - 15.0') 63.8 gallons	(3.5 - 15.0') 90 gallons (141%) Note: Grout seal, used >20% of the calculated volume due to grout migration and potential voids that formed during drilling.
12		Topock - Fill	SM				
13		Topock - Fill	SM				
14		Topock - Fill	SP		(14.0 - 15.0') Centralizer		
15–17		Topock - Fluvial Deposits	SP		(15.0 - 19.5') Cemex #0/30 MESH (30x50) Lapis Lustre Sand	(15.0 - 19.5') 5.9 bags	(15.0 - 19.5') 7 bags (119%) Note: Transition sand
18–19		Topock - Fluvial Deposits	SW-SM		(18.0 - 206.5') 10.0" Borehole		(19.5 - 20.5') 0.3 bags (43%)

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-97

Well Construction Log

Sheet: 2 of 11

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
21		Topock - Alluvium Deposits	SM		(19.5 - 20.5') Bentonite chip seal Puregold Medium Chips; (0.2 - 22.3') 2" PVC Sch 80 Casing; (22.3 - 42.3') 2" 20-Slot Sch 80 PVC Screen; (0.3 - 191.3') 2" PVC Sch 80 Casing	(19.5 - 20.5') 0.7 bags	Note: Seal to prevent transition sand from migrating into filter pack. Used <20% of the calculated volume due to potential formation collapse.
22							
23							
24							
25							
26		Topock - Alluvium Deposits	SM				
27		Topock - Alluvium Deposits	SW-SM				
28							
29	MW-97-VAS-27-32 (270 ppb) 7/9/2020 13:56	Topock - Alluvium Deposits	SW-SM		(20.5 - 45.0') Cemex #3 MESH (8x20) Lapis Lustre Sand; (18.0 - 206.5') 10.0" Borehole	(20.5 - 45.0') 22.8 bags	(20.5 - 45.0') 41 bags (180%) Note: Filter pack, used >20% of the calculated volume due to potential voids that formed during drilling.
30							
31							
32		Topock - Alluvium Deposits	SM				
33							
34							
35		Topock - Alluvium Deposits	SC				
36							
37		Topock - Alluvium Deposits	SM				
38							
39							

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-97

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
41		Topock - Alluvium Deposits	SM		(22.3 - 42.3') 2" 20-Slot Sch 80 PVC Screen; (20.5 - 45.0') Cemex #3 MESH (8x20) Lapis Lustre Sand; (42.3 - 42.8') Sump and SS End Cap; (42.6 - 43.6') Centralizer; (0.3 - 191.3') 2" PVC Sch 80 Casing	(20.5 - 45.0') 22.8 bags	(20.5 - 45.0') 41 bags (180%) Note: Filter pack, used >20% of the calculated volume due to potential voids that formed during drilling.
42							
43							
44		Topock - Alluvium Deposits	SM				
45							
46		Topock - Alluvium Deposits	SW-SM				
47							
48							
49							
50		Topock - Alluvium Deposits	SM		(18.0 - 206.5') 10.0" Borehole		
51		Topock - Alluvium Deposits	SW-SM		(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
52							
53							
54							
55							
56		Topock - Alluvium Deposits	SW-SM				
57							
58		Topock - Alluvium Deposits	GW-GM				
59							

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-97

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
61		Topock - Alluvium Deposits	GW-GM / SC		(0.3 - 191.3') 2" PVC Sch 80 Casing		
62		Topock - Alluvium Deposits	SM				
63		Topock - Alluvium Deposits	SM				
64		Topock - Alluvium Deposits	SM				
65		Topock - Alluvium Deposits	SM				
66		Topock - Alluvium Deposits	SM				
67		Topock - Alluvium Deposits	SM				
68		Topock - Alluvium Deposits	SM		(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
69		Topock - Alluvium Deposits	SM				
70		Topock - Alluvium Deposits	SM		(18.0 - 206.5') 10.0" Borehole		
71		Topock - Alluvium Deposits	SM				
72		Topock - Alluvium Deposits	SM				
73		Topock - Alluvium Deposits	SM				
74		Topock - Alluvium Deposits	SM				
75		Topock - Alluvium Deposits	SM				
76		Topock - Alluvium Deposits	SW-SM				
77		Topock - Alluvium Deposits	SW-SM				
78		Topock - Alluvium Deposits	SW-SM				
79		Topock - Alluvium Deposits	SM				

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-97

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
81					(0.3 - 191.3') 2" PVC Sch 80 Casing		
82		Topock - Alluvium Deposits	SM				
83							
84	MW-97-VAS-82-87 (<0.033 U ppb) 7/10/2020 11:18				(84.0 - 85.0') Centralizer		
85							
86		Topock - Alluvium Deposits	GM				
87		Topock - Alluvium Deposits	SM				
88		Topock - Alluvium Deposits	GW-GM				
89							
90					(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
91		Topock - Alluvium Deposits	SW-SM				
92							
93		Topock - Alluvium Deposits	SM				
94							
95		Topock - Alluvium Deposits	SM				
96							
97		Topock - Alluvium Deposits	SM				
98							
99							
		Topock - Alluvium Deposits	SM		(18.0 - 206.5') 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-97

Well Construction Log

Sheet: 6 of 11

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
101		Topock - Alluvium Deposits	SM		(0.3 - 191.3') 2" PVC Sch 80 Casing		
102							
103							
104							
105			NR				
106							
107		Topock - Alluvium Deposits	SW				
108		Topock - Alluvium Deposits	SM		(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
109							
110					(18.0 - 206.5') 10.0" Borehole		
111		Topock - Alluvium Deposits	SW-SM				
112		Topock - Alluvium Deposits	SM				
113							
114		Topock - Alluvium Deposits	SM				
115							
116							
117							
118		Topock - Alluvium Deposits	SM				
119		Topock - Alluvium Deposits	SM				

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-97

Well Construction Log

Sheet: 7 of 11

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
121		Topock - Alluvium Deposits	SM		(0.3 - 191.3') 2" PVC Sch 80 Casing		
122							
123							
124					(124.0 - 125.0') Centralizer		
125							
126		Topock - Alluvium Deposits	SW-SM				
127							
128							
129		Topock - Alluvium Deposits	SM				
130					(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"		
131							
132		Topock - Alluvium Deposits	ML		(18.0 - 206.5') 10.0" Borehole	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
133							
134	MW-97-VAS-132-137 (<0.17 U ppb) 7/12/2020 09:33						
135		Topock - Alluvium Deposits	SM				
136							
137							
138		Topock - Alluvium Deposits	ML				
139							

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-97

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
141		Topock - Alluvium Deposits	SM		(0.3 - 191.3') 2" PVC Sch 80 Casing		
142							
143							
144							
145							
146							
147		Topock - Alluvium Deposits	SM		(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
148							
149							
150					(18.0 - 206.5') 10.0" Borehole		
151							
152							
153							
154					(154.0 - 155.0') Centralizer		
155			NR				
156							
157							
158		Topock - Alluvium Deposits	SM				
159							

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-97

Well Construction Log

Sheet: 9 of 11

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
161		Topock - Alluvium Deposits	SM		(0.3 - 191.3') 2" PVC Sch 80 Casing		
162							
163		Topock - Alluvium Deposits	SM				
164							
165		Topock - Alluvium Deposits	SM				
166							
167							
168		Topock - Alluvium Deposits	ML		(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
169							
170							
171							
172					(18.0 - 206.5') 10.0" Borehole		
173							
174	MW-97-VAS-172-177 (<0.17 U ppb) 7/13/2020 11:58	Topock - Alluvium Deposits	SM				
175		Topock - Alluvium Deposits	SM				
176		Topock - Alluvium Deposits	SM				
177							
178	MW-97-VAS-177-182 (<0.17 U ppb) 7/14/2020 09:58	Topock - Alluvium Deposits	SW-SM				
179							

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-97

Well Construction Log

Sheet: 10 of 11

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl	**Well ID: MW-97-42, MW-97-202**	
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
181	MW-97-VAS-177-182 (<0.17 U ppb) 7/14/2020 09:58	Topock - Alluvium Deposits	SM		(0.3 - 191.3') 2" PVC Sch 80 Casing		
182		Topock - Alluvium Deposits	SM		(45.0 - 185.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(45.0 - 185.0') 117.2 buckets	(45.0 - 185.0') 143 buckets (122%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
183		Topock - Alluvium Deposits	SM				
184	MW-97-VAS-182-187 (<0.17 U ppb) 7/14/2020 14:38	Topock - Alluvium Deposits	SM				
185		Topock - Alluvium Deposits	ML				
186							
187		Topock - Alluvium Deposits	SW-SM		(185.0 - 190.0') Cemex #0/30 MESH (30x50) Lapis Lustre Sand	(185.0 - 190.0') 5.2 bags	(185.0 - 190.0') 6 bags (115%) Note: Transition sand
188					(188.0 - 189.0') Centralizer		
189		Topock - Alluvium Deposits	SM				
190					(18.0 - 206.5') 10.0" Borehole		
191	MW-97-VAS-189-194 (<0.17 U ppb) 7/15/2020 11:04	Topock - Alluvium Deposits	ML		(191.3 - 201.3') 2" 20-Slot Sch 80 PVC Screen		
192		Topock - Alluvium Deposits	SM				
193		Topock - Alluvium Deposits	SM				
194		Topock - Alluvium Deposits	SW-SM		(190.0 - 204.2') Cemex #3 MESH (8x20) Lapis Lustre Sand	(190.0 - 204.2') 14.9 bags	(190.0 - 204.2') 19 bags (128%) Note: Filter pack, used <20% of the calculated volume due to potential voids forming during drilling.
195							
196			NR				
197							
198	MW-97-VAS-197-202 (1.1 ppb) 7/16/2020 08:47	Topock - Alluvium Deposits	SM				
199							

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-97

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Well ID: MW-97-42, MW-97-202

Date Started:	07/26/2020	Surface Elevation:	481.98 ft amsl		
Date Completed:	10/07/2020	Shallow Well Elevation:	481.81 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	481.65 ft amsl	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Asst:	F. Sandoval / J. Saldana	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:	10/22/2020		
Total Depth:	217 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
201	MW-97-VAS-197-202 (1.1 ppb) 7/16/2020 08:47	Topock - Alluvium Deposits	SM		(191.3 - 201.3') 2" 20-Slot Sch 80 PVC Screen		
202		Topock - Alluvium Deposits	ML		(190.0 - 204.2') Cemex #3 MESH (8x20) Lapis Lustre Sand; (201.3 - 201.8') Sump and SS End Cap	(190.0 - 204.2') 14.9 bags	(190.0 - 204.2') 19 bags (128%) Note: Filter pack, used <20% of the calculated volume due to potential voids forming during drilling.
203					(18.0 - 206.5') 10.0" Borehole		
204							
205			NR		(204.2 - 206.2') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(204.2 - 206.2') 1.74 buckets	(204.2 - 206.2') 2 buckets (115%) Note: Decommissioned rathole
206					(206.2 - 206.5') Slough		Note: Fines that settled out after fresh water flush of casing.
207		Topock - Alluvium Deposits	SM				
208		Topock - Alluvium Deposits	MH				
		Topock - Alluvium Deposits	SM				
209	MW-97-VAS-207-212 (<0.17 U ppb) 7/21/2020 11:58	Topock - Alluvium Deposits					
210		Topock - Alluvium Deposits	MH				
211							
212		Topock - Alluvium Deposits	SM		(206.5 - 217.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"; (206.5 - 217.0') 6.0" Borehole	(206.5 - 217.0') 3.67 buckets	(206.5 - 217.0') 4 buckets (109%) Note: Decommissioned rathole, bentonite from 205.3 to 206.5 removed during overdrill with 10-inch casing.
213							
214							
215		Topock - Alluvium Deposits	SM				
216		Topock - Alluvium Deposits	SM				
217					End of Boring at 217.0 ft bgs.		
218							
219							

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-97

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 1 of 11

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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
1–3	48	No Sieve Samples Collected		Topock - Fill	SP		(0.0 - 3.5') Topock - Fill; Poorly graded sand (SP); strong brown (7.5YR 5/6); very fine grained to medium grained, subangular to subround; trace silt; trace clay; moist (2'); decrease in clay	(0.0 - 7.0') Lost bottom 3 ft downhole.	(0.0 - 7.0') No water used
4–5				Topock - Fill	SP-SM		(3.5 - 5.0') Topock - Fill; Poorly graded sand with silt (SP-SM); light brown (7.5YR 6/4); very fine grained to fine grained, subangular to round; little silt; trace clay; moist		
6–7				Topock - Fill	SP-SC		(5.0 - 8.5') Topock - Fill; Poorly graded sand with clay (SP-SC); brown (7.5YR 5/4); very fine grained to fine grained, subangular to round; little medium to coarse grained sand, angular to subround; little clay; trace silt; moist (7.25'); dry		
8–10	84			Topock - Fill	SP		(8.3') grayish brown (10YR 5/2); lense of potential broken up concrete according to archaeologists (8.5 - 11.5') Topock - Fill; (SP); pale brown (10YR 6/3); very fine grained to medium grained, subangular to subround; trace coarse grained sand, subangular to subround; trace silt; trace clay; dry	(7.0 - 17.0') Retrieved lost 3 ft. from run one. Driller thinks 4 ft fell out of core barrel.	(7.0 - 17.0') No water used
12				Topock - Fill	SM		(11.5 - 12.0') Topock - Fill; Silty sand (SM); brown (7.5YR 5/3); very fine grained to fine grained, angular to subround; little silt; little clay; trace granules, subangular; dry		
13				Topock - Fill	SM		(12.0 - 13.5') Topock - Fill; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to fine grained, subangular to subround; some granules to very large pebbles, angular to subangular; little medium to very coarse grained sand, subangular to subround; little silt; trace clay; dry		
14				Topock - Fill	SP		(13.5 - 14.5') Topock - Fill; Poorly graded sand (SP); brown (7.5YR 5/3) trace black (7.5YR 2.5/1); very fine grained to medium grained, subangular to round; trace silt; trace clay; moist; trace piece of weathered plastic, some black staining (14'); dry		
15–17				Topock - Fluvial Deposits	SP		(14.5 - 19.0') Topock - Fluvial Deposits; Poorly graded sand (SP); brown (7.5YR 5/3) and brown (7.5YR 5/4); very fine grained to fine grained, subangular to round; trace silt; trace clay; dry; black laminations 0.2 to 0.5 mm thick at top of unit	(17.0 - 27.0') Recovered core lost down hole from run 2, 0 to 17 ft full recovery with compaction of sediments in bag.	(17.0 - 57.0') No water used
18–19	144								
20				Topock - Fluvial Deposits	SW-SM / SM		(19.0 - 19.8') Topock - Fluvial Deposits; Well graded sand with silt and gravel (SW-SM); light olive brown (2.5Y 5/3); very fine grained to very coarse grained, subangular to round; some granules to		

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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							very large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; dry; granules and pebbles increase at base		
22				Topock - Alluvium Deposits	SM		(19.8 - 25.0') 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 subround; little silt; trace small cobbles, angular; coarser clasts composed of metadiorite; dry to moist (21'); no cobbles, increase in silt		
23	144						(23'); some granules to large pebbles, angular to subround		
24									
25									
26				Topock - Alluvium Deposits	SM		(25.0 - 27.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subangular; some silt; coarser clasts composed of metadiorite; dry to moist; 30,35,30,5 (25.5'); wet (26'); increase in silt, decrease in clay	(25.5') Approximate depth to water.	
27									
28				Topock - Alluvium Deposits	SW-SM		(27.0 - 27.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/4); very fine grained to very coarse grained, angular to subround; little granules to large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet	(27.0 - 32.0') Normal drilling	
29									
30	66	No Sieve Samples Collected	MW-97-VAS-27-32 (270 ppb) 7/9/2020 13:56	Topock - Alluvium Deposits	SW-SM		(27.5 - 31.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/4); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to round; little silt; trace clay; coarser clasts composed of metadiorite; wet		
31									
32				Topock - Alluvium Deposits	SM		(31.5 - 34.8') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to boulders, angular to round; some granules to very large pebbles, angular to round; some silt; trace clay; coarser clasts composed of metadiorite; wet (32') small cobbles; little silt; trace clay; increase in sand, decrease in granules and pebbles, no very large pebbles (33'); some granules to very large pebbles, angular to round; some silt; decrease in sand (34'); little silt; increase in sand		
33									
34									
35				Topock - Alluvium Deposits	SC		(34.8 - 36.5') Topock - Alluvium Deposits; Clayey sand with gravel (SC); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subround; little clay; trace silt; coarser clasts composed of metadiorite; moist to wet		
36	168								
37				Topock - Alluvium Deposits	SM		(36.5 - 44.0') 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; little clay; coarser clasts composed of metadiorite; dry to moist (38'); moist to wet; decrease in clay, increase in silt	(38.0') Drilling got harder.	
38									
39									
40									

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-97

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	Client:	PG&E
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs		
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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
41–43				Topock - Alluvium Deposits	SM		(40'); wet; increase in silt, decrease in granules and pebbles, no very large pebbles (42'); moist to wet; increase in granules and pebbles, decrease in silt, very large pebbles		
43–44	168							(43.0') Drilling got harder.	
44–46				Topock - Alluvium Deposits	SM		(44.0 - 46.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to very coarse grained, angular to subangular; some granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; moist to wet		
46–47				Topock - Alluvium Deposits	SW-SM		(46.0 - 50.0') 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 subround; little silt; coarser clasts composed of metadiorite; wet	(46.0 - 47.0') Lost core downhole.	
47–48								(47.0 - 57.0') Recovered 46 to 47 lost down hole.	
48–50		No Sieve Samples Collected							
50–51				Topock - Alluvium Deposits	SM		(50.0 - 51.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet		
51–52				Topock - Alluvium Deposits	SW-SM		(51.0 - 55.5') 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; and granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet		
52–53	132								
53–54								(53.0 - 56.0') Hard drilling	
54–56									
56–57				Topock - Alluvium Deposits	SW-SM		(55.5 - 57.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-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 small to large cobbles, angular; trace clay; coarser clasts composed of metadiorite; wet		
57–58				Topock - Alluvium Deposits	GW-GM		(57.0 - 60.3') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); brown (7.5YR 4/4); 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	(57.0 - 58.0') Hard drilling	(57.0 - 126.0') No water used
58–59	132							(57.1 - 67.0') Extra recovery due to stretching of sediments.	
59–60							(59.5'); moist to wet		

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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	132	No Sieve Samples Collected		Topock - Alluvium Deposits	SC		(60.3 - 61.5') Topock - Alluvium Deposits; Clayey sand with gravel (SC); brown (10YR 4/3); very fine grained to very coarse grained, angular to subround; some silt; some clay; little granules to very large pebbles, angular to subround; coarser clasts composed of metadiorite; moist to wet		
62				Topock - Alluvium Deposits	SM		(61'); moist to dry (61.5 - 63.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, angular to subangular; and granules to large pebbles, angular to subangular; some silt; trace clay; coarser clasts composed of metadiorite; moist to dry		
63							(62'); moist		
64				Topock - Alluvium Deposits	SM		(63.0 - 65.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to medium grained, angular to subround; some granules to very large pebbles, angular to subround; some coarse to very coarse grained sand, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist	(64.0') Hard drilling	
65							(64'); dry		
66				Topock - Alluvium Deposits	SM		(65.0 - 66.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist		
67									
68				Topock - Alluvium Deposits	SM		(66.0 - 67.0') 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; coarser clast composed of conglomerate; dry		
69							(67.0 - 70.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 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		
70							(68'); some granules to large pebbles, angular to subround; increase in sand	(70.0') Hard drilling	
71				Topock - Alluvium Deposits	SM		(70.0 - 74.0') 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; little silt; trace small cobbles, angular; trace clay; coarser clasts composed of metadiorite; moist	(71.0') Hard drilling	
72	126						(72'); some granules to large pebbles, angular to subround; some silt; decrease in sand, no cobbles		
73									
74									
75				Topock - Alluvium Deposits	SM		(74.0 - 75.5') 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; little silt; trace clay; coarser clasts composed of metadiorite; wet	(74.0') Hard drilling (74.1 - 77.0') Lost core downhole retrieved with casing clean out run.	
76				Topock - Alluvium Deposits	SW-SM		(75.5 - 79.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); dark yellowish brown (10YR 4/4); 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; wet		
77									
78	138								
79									
80				Topock - Alluvium Deposits	SM		(79.0 - 85.5') Topock - Alluvium Deposits; (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		

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

Boring Log

Sheet: 5 of 11

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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				Topock - Alluvium Deposits	SM		silt; trace clay; coarser clasts composed of metadiorite; wet (81'); trace small cobbles, angular; decrease in sand, increase in silt	(81.0') Hard drilling	
82									
83							(82.5'); trace breccia pebble; increase in sand, decrease in granules and pebbles, decrease in silt	(83.0') Hard drilling	
84	138		MW-97-VAS-82-87 (<0.033 U ppb) 7/10/2020 11:18				(83.75'); increase in granules and pebbles, increase in silt, decrease in sand		
85							(85'); increase in sand, decrease in silt	(85.0') Hard drilling	
86				Topock - Alluvium Deposits	GM		(85.5 - 86.3') Topock - Alluvium Deposits; Silty gravel with sand (GM); brown (10YR 5/3); granules to very large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist to wet		
87				Topock - Alluvium Deposits	SM				
88		No Sieve Samples Collected		Topock - Alluvium Deposits	GW-GM		(86.3 - 87.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to very coarse grained, angular to subround; and granules to large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet (87.0 - 90.5') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); brown (10YR 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	(87.0 - 97.0') Normal drilling	
89									
90									
91				Topock - Alluvium Deposits	SW-SM		(90.5 - 92.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (10YR 5/3); very fine grained to fine grained, angular to round; and granules to very large pebbles, angular to subround; some medium to very coarse grained sand, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist to wet		
92									
93				Topock - Alluvium Deposits	SM		(92.0 - 94.3') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to fine grained, angular to round; some granules to very large pebbles, angular to subround; some medium to very coarse grained sand, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist to wet (93.5'); wet		
94	210								
95				Topock - Alluvium Deposits	SM		(94.3 - 95.3') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish brown / moderate yellowish brown (10YR 5/4); 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		
96				Topock - Alluvium Deposits	SM		(95.3 - 99.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, subangular to subround; some granules to very large pebbles, angular to subround; some silt; coarser clasts composed of metadiorite; wet		
97								(97.0 - 98.0') Hard drilling	
98									
99									
100				Topock - Alluvium Deposits	SM		(99.0 - 104.5') Topock - Alluvium Deposits; (SM); reddish brown / moderate brown (5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large		

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-97

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	Client:	PG&E
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs		
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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				Topock - Alluvium Deposits	SM		pebbles, angular to subround; some silt; coarser clasts composed of metadiorite; moist to wet		
102							(101.5'); dry		
103							(102.25'); wet		
104	210								
105					NR		(104.5 - 107.0') No recovery (NR); see drilling notes	(104.5 - 107.0') Core fell out of barrel into hopper.	
106								(105.0 - 106.0') Hard drilling	
107									
108		No Sieve Samples Collected		Topock - Alluvium Deposits	SW		(107.0 - 108.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; wet	(107.0 - 117.0') Normal drilling, extra recovery due to stretching of sediments.	
109				Topock - Alluvium Deposits	SM		(108.0 - 110.5') 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 subround; some silt; trace clay; coarser clasts composed of metadiorite; wet		
110									
111				Topock - Alluvium Deposits	SW-SM		(110.5 - 112.0') 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 large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; wet; trace very large pebbles, angular		
112	132			Topock - Alluvium Deposits	SM		(112.0 - 113.0') 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; wet		
113									
114				Topock - Alluvium Deposits	SM		(113.0 - 117.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to medium grained, angular to subround; some granules to very large pebbles, subangular to subround; some silt; little coarse to very coarse grained sand, angular to subround; trace small cobbles, angular; trace clay; coarser clasts composed of metadiorite; moist to wet; decrease in sand (114'); little silt; increase in granules and pebbles, decrease in sand, no cobbles (116'); wet		
115									
116									
117									
118	120			Topock - Alluvium Deposits	SM		(117.0 - 118.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to medium grained, angular to subround; some coarse to very coarse grained sand, angular to subround; some silt; little granules to large pebbles, angular to subangular; trace clay; moist	(117.0 - 126.0') Stopped at 126 ft core barrel was full from clean out run. Extra recovery slough.	
119				Topock - Alluvium Deposits	SM		(118.5 - 126.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); 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		
120									

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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									
122									
123	120			Topock - Alluvium Deposits	SM		(121'); moist to dry		
124									
125									
126									
127				Topock - Alluvium Deposits	SW-SM		(126.0 - 128.3') 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; and granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; wet	(126.0 - 134.0') Normal drilling. Extra recovery stretching of sediments.	(126.0 - 177.0') No water used
128									
129				Topock - Alluvium Deposits	SM		(128.3 - 131.0') 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 subround; some silt; coarser clasts composed of metadiorite; moist (130'); trace clay; decrease in silt		
130	102	No Sieve Samples Collected							
131									
132				Topock - Alluvium Deposits	ML		(131.0 - 134.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4); no plasticity; some granules to very large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; trace clay; coarser clasts composed of metadiorite; moist to dry; hard		
133									
134			MW-97-VAS-132-137 (<0.17 U ppb) 7/12/2020 09:33						
135	48			Topock - Alluvium Deposits	SM		(134.0 - 137.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/4); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subround; some silt; coarser clasts composed of metadiorite; moist to wet (135'); some very large pebbles, angular to subround; wet; no clay, increase in granules and pebbles (136'); little silt; increase in sand	(134.0 - 137.0') Normal drilling, top foot slough.	
136									
137									
138	204			Topock - Alluvium Deposits	ML		(137.0 - 140.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4); medium 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; moist; very soft	(138.0') Hard drilling	
139									
140									

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-97

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	Client:	PG&E
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs		
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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							(140.0 - 146.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 5/4); 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 dry		
142								(142.0 - 147.0') Hard drilling	
143				Topock - Alluvium Deposits	SM				
144							(144'); moist to wet		
145									
146									
147	204						(146.0 - 154.0') 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 subround; some silt; trace clay; coarser clasts composed of metadiorite; moist to wet		
148									
149									
150		No Sieve Samples Collected		Topock - Alluvium Deposits	SM			(150.0 - 152.0') Core fell out of bag and is disturbed.	
151									
152								(151.0 - 154.0') Hard drilling	
153									
154									
155					NR		(154.0 - 157.0') No recovery (NR); see drilling notes	(154.0 - 157.0') Sample was accidently vibed into the hopper.	
156									
157	72								
158				Topock - Alluvium Deposits	SM		(157.0 - 163.0') 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; and silt; some granules to very large pebbles, angular to subangular; trace clay; moist to wet		
159									
160									

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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				
162	72								
163									
164				Topock - Alluvium Deposits	SM		(163.0 - 164.5') 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 small to large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet	(163.0 - 177.0') Extra recovery due to stretching of sediments.	
165				Topock - Alluvium Deposits	SM		(164.5 - 168.0') 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 subround; some silt; trace clay; coarser clasts composed of metadiorite; moist to wet		
166									
167									
168									
169				Topock - Alluvium Deposits	ML		(168.0 - 173.5') Topock - Alluvium Deposits; Sandy silt with gravel (ML); yellowish red (5YR 4/6); medium plasticity; and very fine to very coarse grained sand, angular to subround; some granules to very large pebbles, angular to subround; coarser clast composed of conglomerate; moist to wet; soft		
170	180	No Sieve Samples Collected							
171									
172							(172'); some very fine to very coarse grained sand, angular to subround; little clay	(172.0 - 176.0') Harder drilling	
173									
174			MW-97-VAS-172-177 (<0.17 U ppb) 7/13/2020 11:58	Topock - Alluvium Deposits	SM		(173.5 - 175.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish red (5YR 4/6); 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		
175				Topock - Alluvium Deposits	SM		(175.0 - 175.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish red (5YR 4/6); very fine grained to medium grained, angular to subround; some granules to very large pebbles, angular to subround; some coarse to very coarse grained sand, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist to wet		
176				Topock - Alluvium Deposits	SM			(176.0 - 177.0') Drilling became harder.	
177									
178			MW-97-VAS-177-182 (<0.17 U ppb) 7/14/2020 09:58	Topock - Alluvium Deposits	SW-SM		(175.5 - 177.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4); very fine grained to medium grained, angular to subround; some granules to very large pebbles, angular to subround; some coarse to very coarse grained sand, angular to subround; little silt; coarser clasts composed of metadiorite; wet	(178.0') Hard drilling	(177.0 - 187.0') No water used
179	120						(177.0 - 180.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/4); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subangular; little silt; coarser clasts		
180									

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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	120	No Sieve Samples Collected	MW-97-VAS-177-182 (<0.17 U ppb) 7/14/2020 09:58	Topock - Alluvium Deposits	SM		composed of metadiorite; wet	(180.0') Formation caving in when drilling with 10-inch casing.	
				Topock - Alluvium Deposits	SM		(180.0 - 180.8') Topock - Alluvium Deposits; Silty sand with gravel (SM); strong brown (7.5YR 4/6); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subangular; some silt; coarser clasts composed of metadiorite; wet		
182				Topock - Alluvium Deposits	SM		(180.8 - 181.8') Topock - Alluvium Deposits; Silty sand with gravel (SM); moderate red (5R 4/6); very fine grained to medium grained, angular to round; and silt; some granules to large pebbles, angular to subround; some coarse to very coarse grained sand, angular to subround; coarser clasts composed of metadiorite; moist to dry	(182.0 - 186.0') Hard drilling on and off.	
183			MW-97-VAS-182-187 (<0.17 U ppb) 7/14/2020 14:38	Topock - Alluvium Deposits	SM				
184							(181.8 - 183.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3); very fine grained to medium grained, angular to subround; some granules to medium pebbles, angular to subround; some coarse to very coarse grained sand, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist (182.5'); dry		
185				Topock - Alluvium Deposits	ML				
186							(183.0 - 184.0') 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 small pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist	(186.0 - 187.0') Hard drilling	
187									
188	96			Topock - Alluvium Deposits	SW-SM		(184.0 - 187.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); yellowish red (5YR 4/6) with dark red (2.5YR 3/6); low plasticity; and very fine to very coarse grained sand, angular to subround; some granules to small pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; dry; hard (185'); some granules to medium pebbles, angular to subround; sight increase in clay (186'); some very fine to very coarse grained sand, angular to subround; little clay	(187.0 - 197.0') Lost 2 ft of core downhole, attempt to retrieve it was unsuccessful, top foot slough.	(187.0 - 206.6') No water used
189				Topock - Alluvium Deposits	SM				
190			MW-97-VAS-189-194 (<0.17 U ppb) 7/15/2020 11:04					(190.0') Formation tight and caving in when drilling with 10-inch casing.	
191				Topock - Alluvium Deposits	ML		(187.0 - 188.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); yellowish red (5YR 4/6); very fine grained to very coarse grained, angular to subangular; and granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; moist		
192				Topock - Alluvium Deposits	SM		(188.5 - 190.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish red (5YR 4/6); very fine grained to very coarse grained, angular to subround; and silt; some granules to very large pebbles, angular to subround; trace clay; coarser clasts composed of metadiorite; moist to wet	(190.1 - 200.0') Formation tight when drilling with 10-inch casing.	
193									
194				Topock - Alluvium Deposits	SM		(190.5 - 191.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); yellowish red (5YR 4/6); low plasticity; some granules to very large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; trace clay; coarser clasts composed of metadiorite; moist		
195				Topock - Alluvium Deposits	SW-SM		(191.8 - 193.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish red (5YR 4/6); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; little clay; coarser clasts composed of metadiorite; moist	(193.0 - 197.0') Hard drilling	
196					NR				
197							(193.0 - 194.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish red (5YR 4/6); 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; dry		
198	84		MW-97-VAS-197-202 (1.1 ppb) 7/16/2020 08:47	Topock - Alluvium Deposits	SM		(194.0 - 195.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); yellowish red (5YR 4/6); 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 wet		
199							(195.0 - 197.0') No recovery (NR); see drilling notes		
200							(197.0 - 201.0') Topock - Alluvium Deposits; Silty sand with gravel		

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Sheet: 11 of 11

Date Started:	07/08/2020	Surface Elevation:	481.98 ft amsl	**Boring No.:**	**MW-97**
Date Completed:	07/30/2020	Northing (NAD83):	2103431.68		
Drilling Co.:	Cascade	Easting (NAD83):	7615635.51	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	26.0 ft bgs		
Drilling Asst:	F. Sandoval / J. Saldana	Sampling Method:	4 in 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
201	84	No Sieve Samples Collected	MW-97-VAS-197-202 (1.1 ppb) 7/16/2020 08:47	Topock - Alluvium Deposits	SM		(SM); yellowish red (5YR 4/6); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace clay; wet (199'); moist to wet		
202				Topock - Alluvium Deposits	ML		(201.0 - 204.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); yellowish red (5YR 4/6); low plasticity; some granules to large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; trace clay; coarser clasts composed of metadiorite; moist		
203									
204									
205					NR		(204.0 - 207.0') No recovery (NR); see drilling notes	(204.0 - 207.0') Hard drilling, lost core downhole could not retrieve.	
206								(206.0') 10-inch casing had to be pulled up and readvance to get to TD, potential for void formation.	
207				Topock - Alluvium Deposits	SM		(207.0 - 207.5') 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 subround; little silt; trace clay; coarser clasts composed of metadiorite; wet		(206.5') 1354 gallons of water used; 796.8 gallons of water recovered; 557.2 gallons of water lost; Used to flush casing prior to well install.
208				Topock - Alluvium Deposits	MH				
209			MW-97-VAS-207-212 (<0.17 U ppb) 7/21/2020 11:58	Topock - Alluvium Deposits	SM			(207.0 - 217.0') Extra recovery due to stretching of sediments 211 to 213.75 ft bgs.	
210				Topock - Alluvium Deposits	MH		(207.5 - 208.3') Topock - Alluvium Deposits; Elastic silt with gravel (MH); yellowish red (5YR 4/6); high plasticity; some granules to medium pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; trace clay; coarser clasts composed of metadiorite; wet; soft		(209.0 - 217.0') 759.6 gallons of water used; 258.96 gallons of water recovered; 500.64 gallons of water lost; Used to flush casing prior to abandonment of rathole.
211				Topock - Alluvium Deposits			(208.3 - 208.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); same as 207 to 207.5 ft bgs		
212	132			Topock - Alluvium Deposits	SM		(208.5 - 210.5') Topock - Alluvium Deposits; Elastic silt with gravel (MH); yellowish red (5YR 4/6); same as 207.5 to 208.3, granules to very large pebbles, angular to subround		
213							(210.5 - 214.5') Topock - Alluvium Deposits; (SM); yellowish red (5YR 4/6); 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; wet (211.25'); and silt; some granules to very large pebbles, angular to subround; moist to wet; no clay		
214							(213.75') reddish brown / moderate brown (5YR 4/4); little silt; decrease in sand	(214.0') Hard drilling	
215				Topock - Alluvium Deposits	SM		(214.5 - 215.3') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to medium grained, angular to round; some very fine to very coarse grained sand, angular to round; some silt; little granules to large pebbles, angular to round; trace clay; coarser clasts composed of metadiorite; dry		
216				Topock - Alluvium Deposits	SM			(216.0') Hard drilling	
217							(215.3 - 217.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish red (5YR 4/6); very fine grained to very coarse grained, angular to subround; some granules to medium pebbles, angular to subround; some silt; trace clay; coarser clasts composed of metadiorite; moist to wet (216.5'); little silt; increase in sand		
218							End of Boring at 217.0 ft bgs.		
219									
220									

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 measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-97-42, MW-97-202 installed in borehole