Well Construction Log

Sheet: 1 of 8

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl	**Well ID: MW-99-60, MW-99-140**	
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 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	No Groundwater Samples Collected	Topock - Fill	SM		(0.0 - 3.0') Surface completion (0.6 - 40.0') 2" PVC Sch 80 Casing (0.6 - 120.0') 2" PVC Sch 80 Casing		(0.0 - 3.0') 11 bags Note: 32" diameter concrete pad with 18" diameter lockable vault, Quickrete concrete
2							
3		Topock - Fill	SP				
4					(3.0 - 6.0') Portland Cement 5% Bentonite Type I, II, and V with Hydrogel	(3.0 - 6.0') 16.6 bags	(3.0 - 6.0') 15 bags (90%) Note: Grout seal
5							
6		Topock - Fill	SW				
7							
8							
9							
10		Topock - Fluvial Deposits	SW		(0.0 - 48.0') 12.0" Borehole		
11							
12							
13					(6.0 - 32.5') Portland Cement 5% Bentonite Type I, II, and V with Hydrogel	(6.0 - 32.5') 147 gallons	(6.0 - 32.5') 200 gallons (136%) Note: Grout seal, used >20% of calculated volume due to potential voids forming during drilling
14			NR				
15							
16		Topock - Fluvial Deposits	SM				
17		Topock - Fluvial Deposits	SW				
18		Topock - Fluvial Deposits	SW				
19							
20			SW				

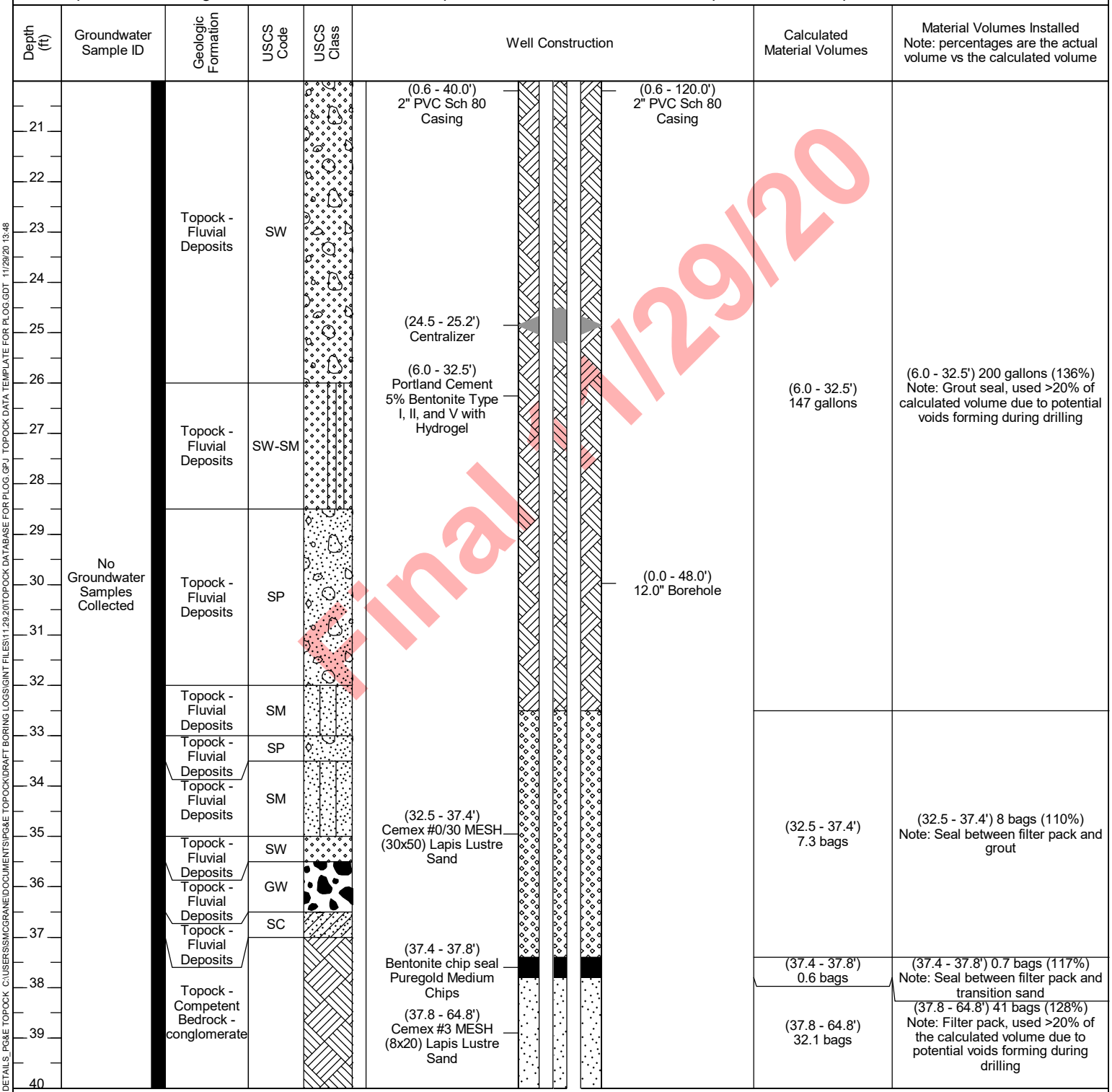
Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-99

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: MW-99-60, MW-99-140

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl		
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		



Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, 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-99

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl	**Well ID: MW-99-60, MW-99-140**	
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 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
41–60	No Groundwater Samples Collected	Topock - Competent Bedrock - conglomerate			(40.0 - 60.0') 2" 0.02-Slot Sch 80 PVC Screen; (0.6 - 120.0') 2" PVC Sch 80 Casing; (0.0 - 48.0') 12.0" Borehole; (37.8 - 64.8') Cemex #3 MESH (8x20) Lapis Lustre Sand; (48.0 - 68.0') 10.0" Borehole	(37.8 - 64.8') 32.1 bags	(37.8 - 64.8') 41 bags (128%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, 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-99

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl	**Well ID: MW-99-60, MW-99-140**	
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 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					(0.6 - 120.0') 2" PVC Sch 80 Casing; (60.5 - 61.5') Centralizer		
62					(60.0 - 62.3') Sump and SS End Cap		
63			NR		(37.8 - 64.8') Cemex #3 MESH (8x20) Lapis Lustre Sand	(37.8 - 64.8') 32.1 bags	(37.8 - 64.8') 41 bags (128%) Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling
64					(48.0 - 68.0') 10.0" Borehole		
65							
66		Topock - Competent Bedrock - conglomerate					
67							
68							
69							
70	No Groundwater Samples Collected						
71							
72					(64.8 - 114.8') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(64.8 - 114.8') 27.2 buckets	(64.8 - 114.8') 35 buckets (129%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
73							
74					(68.0 - 116.0') 8.0" Borehole		
75			NR				
76							
77							
78							
79							
80							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl	**Well ID: MW-99-60, MW-99-140**	
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 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					(0.6 - 120.0') 2" PVC Sch 80 Casing		
82							
83			NR				
84							
85							
86							
87							
88		Topock - Competent Bedrock - conglomerate					
89							
90	No Groundwater Samples Collected				(64.8 - 114.8') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(64.8 - 114.8') 27.2 buckets	(64.8 - 114.8') 35 buckets (129%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
91					(68.0 - 116.0') 8.0" Borehole		
92							
93			NR				
94							
95					(94.5 - 95.5') Centralizer		
96							
97							
98		Topock - Competent Bedrock - conglomerate					
99							
100							

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Well Construction Log

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ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl	**Well ID: MW-99-60, MW-99-140**	
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 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
101–120	No Groundwater Samples Collected	Topock - Competent Bedrock - conglomerate			(0.6 - 120.0') 2" PVC Sch 80 Casing (64.8 - 114.8') Bentonite pellets seal Pel-Plug (TR30) 3/8" (68.0 - 116.0') 8.0" Borehole (114.8 - 117.2') Cemex #0/30 MESH (30x50) Lapis Lustre Sand (116.0 - 155.0') 8.0" Borehole (117.2 - 154.0') Cemex #3 MESH (8x20) Lapis Lustre Sand	(64.8 - 114.8') 27.2 buckets	(64.8 - 114.8') 35 buckets (129%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids that formed during drilling.
						(114.8 - 117.2') 1.6 bags	(114.8 - 117.2') 2 bags (125%) Note: Transition sand, used >20% of the calculated volume due to sand potentially entering the shallow screen interval.
						(117.2 - 154.0') 24.6 bags	(117.2 - 154.0') 25 bags (102%) Note: Filter pack, surged filter pack for approximately 60 minutes prior to installing additional annular materials.

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Well Construction Log

Sheet: 7 of 8

ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl	**Well ID: MW-99-60, MW-99-140**	
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 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					(120.0 - 140.0') 2" 0.02-Slot Sch 80 PVC Screen		
122							
123							
124							
125							
126							
127							
128							
129							
130	No Groundwater Samples Collected	Topock - Competent Bedrock - conglomerate			(117.2 - 154.0') Cemex #3 MESH (8x20) Lapis Lustre Sand; (116.0 - 155.0') 8.0" Borehole	(117.2 - 154.0') 24.6 bags	(117.2 - 154.0') 25 bags (102%) Note: Filter pack, surged filter pack for approximately 60 minutes prior to installing additional annular materials.
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							

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Well Construction Log

Sheet: 8 of 8

ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/23/2020	Surface Elevation:	501.17 ft amsl	**Well ID: MW-99-60, MW-99-140**	
Date Completed:	09/26/2020	Shallow Well Elevation:	500.61 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	500.55 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Asst:	FS / JC / JM	Borehole Diameter:	7-12 inches		
Logger:	Sean McGrane	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/21/2020		
Total Depth:	157 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
141–157	No Groundwater Samples Collected	Topock - Competent Bedrock - conglomerate			(140.5 - 141.5') Centralizer; (140.0 - 142.3') Sump and SS End Cap		
146–147			NR		(117.2 - 154.0') Cemex #3 MESH (8x20) Lapis Lustre Sand; (116.0 - 155.0') 8.0" Borehole	(117.2 - 154.0') 24.6 bags	(117.2 - 154.0') 25 bags (102%) Note: Filter pack, surged filter pack for approximately 60 minutes prior to installing additional annular materials.
147–157		Topock - Competent Bedrock - conglomerate					
154–157					(154.0 - 157.0') Slough; (155.0 - 157.0') 7.0" Borehole		Note: Slough from material falling into open borehole.
157					End of Boring at 157.0 ft bgs.		

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-99

Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	Client:	PG&E
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs		
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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		No Sieve Samples Collected	No Groundwater Samples Collected	Topock - Fill	SM		(0.0 - 1.0') Topock - Fill; Silty sand with gravel (SM); brown (7.5YR 5/4); very fine grained to very coarse grained, subangular to subround; little granules to very large pebbles, subangular to subround; little silt; coarser clasts composed of metadiorite; moist to wet	(0.0 - 16.0') Soft drilling, 12.5 ft recovery, soil fell out of core barrel.	
2				Topock - Fill	SP		(1.0 - 5.5') Topock - Fill; Poorly graded sand (SP); dark yellowish brown (10YR 4/4); very fine grained to fine grained, subangular to subround; trace silt; moist		
3									
4									
5									
6				Topock - Fill	SW		(5.5 - 8.0') Topock - Fill; Well graded sand with gravel (SW); dark yellowish brown (10YR 4/6); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subround; coarser clasts composed of metadiorite; trace mica; moist		
7									
8	150			Topock - Fluvial Deposits	SW		(8.0 - 12.5') Topock - Fluvial Deposits; Well graded sand with gravel (SW); yellowish brown (10YR 5/6); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, subangular to subround; trace clay; some coarser clasts composed of mixed lithology; dry to moist		
9							(9'); moist		
10									
11	48						(11'); dry to moist		
12							(12') dark yellowish brown (10YR 4/4); moist		
13					NR		(12.5 - 16.0') No recovery (NR); see drilling notes		
14									
15									
16				Topock - Fluvial Deposits	SM		(16.0 - 17.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, subangular to subround; some granules to very large pebbles, subangular to subround; little silt; coarser clasts composed of mixed lithology; moist to wet	(16.0 - 22.0') Soft drilling	
17				Topock - Fluvial Deposits	SW		(17.0 - 18.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, subround to round; and granules to very large pebbles, subangular to round; trace small cobbles, subangular; coarser clasts composed of mixed lithology; dry		
18	120								
19				Topock - Fluvial Deposits	SW		(18.0 - 19.5') Topock - Fluvial Deposits; Well graded sand (SW); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, subround to round; little granules to medium pebbles,		
20					SW				

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, NR = no recovery; RQD = Rock Quality Designation; Notes: blue water table symbol represents depth to water was measured during drilling after drilling water was removed by bailing and allowed to stabilize over night; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-99-60, MW-99-140 installed in borehole

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	**Boring No.:**	**MW-99**
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46		
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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							subangular to round; coarser clasts composed of mixed lithology; moist		
22							(19.5 - 26.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, subround to round; and small to very large pebbles, subangular to subround; trace small to large cobbles, angular to subangular; trace silt; coarser clasts composed of mixed lithology; moist	(22.0 - 26.0') Rough drilling	
23	120			Topock - Fluvial Deposits	SW		(21'); dry to moist (22'); moist		
24									
25									
26									
27				Topock - Fluvial Deposits	SW-SM		(26.0 - 28.5') Topock - Fluvial Deposits; Well graded sand with silt and gravel (SW-SM); dark yellowish brown (10YR 4/4); very fine grained to very coarse grained, subangular to round; and granules to very large pebbles, subangular to round; little silt; coarser clasts composed of mixed lithology; moist	(26.0 - 30.0') Normal Drilling	
28									
29							(28.5 - 32.0') Topock - Fluvial Deposits; Poorly graded sand with gravel (SP); very dark grayish brown (10YR 3/2); coarse grained to very coarse grained, angular to subround; and granules to very large pebbles, subangular to subround; coarser clasts composed of mixed lithology; dry to moist		
30		No Sieve Samples Collected	No Groundwater Samples Collected	Topock - Fluvial Deposits	SP			(30.0 - 46.0') Very rough drilling, very tight, used water to dislodge drill rod. Core from 36 to 46 ft bgs hot from rough drilling.	
31	120								
32									
33				Topock - Fluvial Deposits	SM		(32.0 - 33.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); light olive brown (2.5Y 5/4); very fine grained to very coarse grained, subround; some silt; little granules to large pebbles, subangular to subround; coarser clasts composed of mixed lithology; dry		
				Topock - Fluvial Deposits	SP				
34				Topock - Fluvial Deposits	SM		(33.0 - 33.5') Topock - Fluvial Deposits; Poorly graded sand with gravel (SP); very dark grayish brown (10YR 3/2); coarse grained to very coarse grained, angular to subround; and granules to very large pebbles, subangular to subround; coarser clasts composed of mixed lithology; dry to moist		
35				Topock - Fluvial Deposits	SW		(33.5 - 35.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); light olive brown (2.5Y 5/4); very fine grained to very coarse grained, subangular to subround; some granules to very large pebbles, subangular to round; little silt; trace small cobbles, subround; trace clay; coarser clasts composed of mixed lithology; dry		
36				Topock - Fluvial Deposits	GW				(36.0 - 46.0') 200 gallons of water used; 20 gallons of water recovered; 180 gallons of water lost
				Topock - Fluvial Deposits	SC				
37				Topock - Fluvial Deposits			(35.0 - 35.5') Topock - Fluvial Deposits; Well graded sand (SW); dark yellowish brown (10YR 4/4); fine grained to very coarse grained, subangular to subround; trace granules to very large pebbles, subangular to round; coarser clasts composed of mixed lithology; moist		
38	120			Topock - Competent Bedrock - conglomerate			(35.5 - 36.5') Topock - Fluvial Deposits; Well graded gravel (GW); very dark grayish green (GLEY1 3/2); boulder composed of basalt		
39							(36.5 - 37.0') Topock - Fluvial Deposits; Clayey sand with gravel (SC); yellowish brown (10YR 5/6); very fine grained to very coarse grained, angular to round; no plasticity; some granules to very		
40									

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Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	**Boring No.:**	**MW-99**
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46		
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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							large pebbles, angular to round; coarser clasts composed of mixed lithology; dry; 25,55,0,20		
42							(37.0 - 60.0') Topock - Competent Bedrock - conglomerate (37.0 - 46.0'); RQD 4.6%; 2.5YR 5/6; moderately weathered; very fine grained to very coarse grained; medium; iron oxide staining; dry, friable, pulverized by drilling		
43	120						(43.0 - 46.0'); highly weathered; iron oxide staining		
44									
45									
46							(46.0 - 48.0'); RQD 0%; 2.5YR 5/6; highly weathered; very fine grained to very coarse grained; iron oxide staining; friable, pulverized by drilling	(46.0 - 52.0') Very rough drilling, core barrel became stuck at approximately 52 ft bgs, used water to dislodge.	(46.0 - 52.0') 200 gallons of water used; 0 gallons of water recovered; 200 gallons of water lost
47	24								
48							(48.0 - 50.0'); RQD 0%; 2.5YR 5/6; highly weathered; very fine grained to very coarse grained; iron oxide staining; friable, pulverized by drilling		
49	24	No Sieve Samples Collected	No Groundwater Samples Collected	Topock - Competent Bedrock - conglomerate					
50							(50.0 - 52.0'); RQD 0%; 2.5YR 5/6; highly weathered; very fine grained to very coarse grained; iron oxide staining; friable, pulverized by drilling		
51	24								
52							(52.0 - 56.0'); RQD 0%; 2.5YR 5/6; highly weathered; very fine grained to very coarse grained; iron oxide staining; friable, pulverized by drilling	(52.0 - 56.0') Very rough drilling	(52.0 - 58.0') 670 gallons of water used; 95 gallons of water recovered; 575 gallons of water lost
53									
54	48								
55									
56							(56.0 - 60.0'); RQD 52%; 2.5YR 5/6; highly weathered; very fine grained to very coarse grained; iron oxide staining; friable, pulverized by drilling, 5 to 10 inch sections of solid rock core	(56.0 - 66.0') Very rough drilling, recovered 5 ft and bottom foot of the core sample was washed out slough.	(56.0 - 66.0') 670 gallons of water used; 95 gallons of water recovered; 575 gallons of water lost
57									
58	48							(58.0 - 68.0') Advancing 10 inch casing difficult crew	(58.0 - 66.0') 820 gallons of water used; 0 gallons of water
59									
60									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-99

Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	Client:	PG&E
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs		
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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
61–66	48	No Sieve Samples Collected	No Groundwater Samples Collected		NR		(60.0 - 66.0') No recovery (NR); see drilling notes	had to troubleshoot issues with rig.	recovered; 820 gallons of water lost
66–70	48			Topock - Competent Bedrock - conglomerate			(66.0 - 70.0') Topock - Competent Bedrock - conglomerate; RQD 39%; 2.5YR 5/6; highly weathered; very fine grained to very coarse grained; iron oxide staining; friable, pulverized by drilling, 4 to 10 inch sections of solid rock core	(66.0 - 76.0') Very rough drilling, recovered 4 ft, rest of the core sample was pulverized and washed out.	(66.0 - 86.0') 700 gallons of water used; 600 gallons of water recovered; 100 gallons of water lost
70–76	48				NR		(70.0 - 86.0') No recovery (NR); see drilling notes		
76–80	0							(76.0 - 86.0') Very rough drilling, no recovery, core sample fell out.	

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	**Boring No.:**	**MW-99**
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46		
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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									
82									
83	0				NR				
84									
85									
86									
87	12			Topock - Competent Bedrock - conglomerate			(86.0 - 91.0') Topock - Competent Bedrock - conglomerate; RQD 39%; 2.5YR 5/6; highly weathered; very fine grained to very coarse grained; iron oxide staining; friable, pulverized by drilling, 4 to 10 inch sections of solid rock core (87.0 - 91.0'); 2.5YR 4/6 with GLEY1 8/1; freshly to slightly weathered; very fine grained to very coarse grained; medium; massive; wet; iron oxide staining (87.1 - 87.6'); freshly weathered; 0 degree mechanical fractures (88.0 - 91.0'); slightly weathered; iron oxide staining; 70 degree fracture, clay on surface	(86.0 - 87.0') Very rough, core barrel got stuck. Switch from 10 inch drill casing to 8 inch drill casing. (87.0 - 96.0') Very rough drilling, recovered 4 ft, rest of the core sample was washed out	(86.0 - 96.0') 950 gallons of water used; 600 gallons of water recovered; 350 gallons of water lost
88									
89									
90		No Sieve Samples Collected	No Groundwater Samples Collected						
91									
92	48						(91.0 - 96.0') No recovery (NR); see drilling notes		
93									
94					NR				
95									
96									
97				Topock - Competent Bedrock - conglomerate			(96.0 - 146.0') Topock - Competent Bedrock - conglomerate (96.0 - 106.0'); RQD 90%; 2.5YR 4/6 with GLEY1 8/1; freshly to slightly weathered; extremely hard; very fine grained to very coarse grained; medium; massive; wet (96.2'); freshly weathered; 70 degree fracture, clay on surface (96.7'); freshly weathered; 0 degree fracture, clay on surface (97.1'); freshly weathered; 0 degree fracture, clay on surface (97.2 - 97.9'); slightly weathered; iron oxide staining; 60 degree fracture, clay on surface (98.7 - 99.1'); freshly weathered; Two parallel 0 degree fractures cross cut with 50 degree fracture, clay on surfaces (99.5 - 100.8'); slightly weathered; iron oxide staining; 70 degree	(96.0 - 116.0') Drill rods chattering	(96.0 - 116.0') 1060 gallons of water used; 940 gallons of water recovered; 120 gallons of water lost
98	120								
99									
100									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	**Boring No.:**	**MW-99**
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46		
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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							fracture, clay on surface (100'); slightly weathered; 0 degree fracture, clay on surface		
102							(102'); slightly weathered; 55 degree fracture, clay on surface (102.1 - 103.5'); highly weathered; highly fractured, broken up by drilling process		
103	120								
104									
105							(105.1'); freshly weathered; 0 degree mechanical fracture		
106							(105.9 - 106.0'); slightly weathered; 25 degree fracture (106.0 - 116.0'); RQD 98%; 2.5YR 4/6 with GLEY1 8/1; freshly to slightly weathered; extremely hard; very fine grained to very coarse grained; medium; massive; wet; 25 degree slightly weathered fracture at 106 ft bgs		
107									
108							(108.0 - 108.2'); freshly weathered; 25 degree mechanical fracture, no secondary mineralization		
109									
110		No Sieve Samples Collected	No Groundwater Samples Collected	Topock - Competent Bedrock - conglomerate			(109.7 - 110.1'); freshly weathered; 60 degree mechanical fracture, no secondary mineralization		
111	120						(110.1'); freshly weathered; 0 degree fracture, no secondary mineralization		
112									
113							(112.3 - 112.6'); slightly weathered; 30 degree fracture, no secondary mineralization		
114							(113.4'); slightly weathered; 0 degree fracture, no secondary mineralization (113.7'); slightly weathered; 0 degree fracture, no secondary mineralization		
115									
116									
117							(116.0 - 119.5'); RQD 100%; 2.5YR 4/6 with GLEY1 8/1; freshly weathered; extremely hard; very fine grained to very coarse grained; medium; massive; wet	(116.0 - 126.0') Rough drilling, poor recovery. Tagged borehole at approximately 122 ft. Will attempt to retrieve with next run. Two feet of no recovery potentially	(116.0 - 159.0') 3087.6 gallons of water used; 2808.72 gallons of water recovered; 278.88 gallons of water lost
118	42						(117.4 - 119.5'); slightly weathered; iron oxide staining; 80 degree fracture		
119									
120							(119.5 - 130.7'); RQD 94%; 2.5YR 4/6 with GLEY1 8/1; freshly to		

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-99

Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	Client:	PG&E
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs		
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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							slightly weathered; extremely hard; very fine grained to very coarse grained; medium; massive; wet (120.1'); slightly weathered; 3 degree fracture (120.7 - 121.5'); slightly weathered; iron oxide staining; 80 degree fracture terminating at 0 degree fracture at 122.4 ft	from 119 to 121 ft. bgs.	
122									
123	42								
124							(123.8'); freshly weathered; 0 degree mechanical fracture		
125							(125.1'); slightly weathered; 0 degree fracture		
126									
127							(127.5'); slightly weathered; iron oxide staining; 0 degree fracture (127.6 - 128.7'); slightly weathered; iron oxide staining; 85 degree fracture	(126.0 - 136.0') Rough drilling, recovered 11 ft, approximately 5 ft from run 116 to 126 ft bgs. Tagged hole at 132 ft bgs approximately 4 ft still down hole. Will attempt to recover during 136 to 146 run.	
128									
129							(128.7 - 130.7'); 2.5YR 4/6; moderately weathered; medium hard; iron oxide staining; zone of increased fractures pulverized by the drilling process		
130		No Sieve Samples Collected	No Groundwater Samples Collected	Topock - Competent Bedrock - conglomerate					
131	127.2						(130.7 - 146.0'); RQD 98%; 2.5YR 4/6 with GLEY1 8/1; freshly to slightly weathered; extremely hard; very fine grained to very coarse grained; medium; massive; wet (130.8 - 131.1'); moderately weathered; iron oxide staining; 45 degree fracture (132'); slightly weathered; 0 degree fracture, clay on surface		
132									
133									
134							(133.6'); slightly weathered; 0 degree fracture, clay on surface (133.9 - 134.5'); slightly weathered; iron oxide staining; 30 degree fracture, clay on surface		
135									
136							(135.3'); freshly weathered; O degree mechanical fracture, no clay on surface		
137							(136.8 - 137.2'); slightly weathered; 45 degree fracture, clay on surface	(136.0 - 146.0') Rough drilling, tagged hole at 146 ft bgs. Extra 5 ft of recovery from run 126 to 136. Total recovery from 116 to 146 30 ft.	
138	192						(137.8'); freshly weathered; 20 degree mechanical fracture, no clay on surface		
139									
140							(139.7 - 140.3'); moderately weathered; fracture zone pulverized		

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ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-99

Date Started:	09/09/2020	Surface Elevation:	501.17 ft amsl	Client:	PG&E
Date Completed:	09/25/2020	Northing (NAD83):	2101948.46	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7618563.48	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	157 ft bgs		
Drill Rig Type:	Boart Longyear Trackmount	Borehole Diameter:	7-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	48.6 ft bgs		
Drilling Asst:	FS / JC / JM	Sampling Method:	7 in x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	J. Latham / S. 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							by drilling, clay on surfaces		
142							(141.4'); freshly weathered; 0 degree fracture, no clay on surface		
143	192			Topock - Competent Bedrock - conglomerate			(143.0 - 143.3'); slightly weathered; iron oxide staining; 45 degree fracture, clay on surface		
144							(143.7'); slightly weathered; 0 degree fracture		
145							(144.5 - 144.9'); slightly weathered; iron oxide staining; 50 degree fracture, clay on surface, potential slicken lines		
146							(144.9 - 146.8'); moderately weathered; iron oxide staining; two parallel 85 degree fracture, clay on surface, pulverized by drilling		
147					NR		(146.0 - 147.0') No recovery (NR); potential wash out of weathered zone	(146.0 - 156.0') Rough drilling, advanced casing to 155 ft bgs. Core not retrieved drilling to 157 to retrieve core. Tagged at borehole at 149 ft potential wash out 146 to 149 ft bgs.	
148		No Sieve Samples Collected	No Groundwater Samples Collected				(147.0 - 157.0') Topock - Competent Bedrock - conglomerate; RQD 76%; 2.5YR 4/6 with GLEY1 8/1; freshly to slightly weathered; extremely hard; very fine grained to very coarse grained; medium; massive; wet; no odor		
149							(147.1'); freshly weathered; 0 degree mechanical fracture (147.3'); freshly weathered; 0 degree mechanical fracture		
150							(149.2'); freshly weathered; 0 degree mechanical fracture		
151	0			Topock - Competent Bedrock - conglomerate			(150.3'); freshly weathered; 0 degree mechanical fracture (150.8 - 151.6'); moderately weathered; iron oxide staining; 0 degree mechanical fracture with 70 degree fracture below, clay on surface, pulverized by drilling process		
152									
153							(153'); freshly weathered; 0 degree mechanical fracture		
154							(153.8 - 155.2'); highly weathered zone, pulverized by drilling		
155									
156									
157	120						(156.5'); moderately weathered; 0 degree fracture, clay on surface	(156.0 - 157.0') Core retrieved.	
							End of Boring at 157.0 ft bgs.		
158									
159									
160									

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