ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	N/A	Client:	PG&E
Date Completed:	03/26/2020	Northing (NAD83):	N/A		
Drilling Co.:	Cascade	Easting (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Location:	PG&E Topock, Needles, California
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
1–3	45.6			Topock - Fluvial Deposits	SW		(0.0 - 3.8') Topock - Fluvial Deposits; Well graded sand with gravel (SW); light brown (7.5YR 6/4); very fine grained to very coarse grained, angular to round; little granules to very large pebbles, angular to subangular; trace small to large cobbles, angular to subangular; trace silt; coarser clasts composed of metadiorite; dry to moist	(0.0 - 3.8') Hand augured for utility clearance, had refusal at 3.8 ft bgs, logged from hand augur cuttings.	(0.0 - 32.0') No water used
4–5				Topock - Fluvial Deposits	SM		(3.8 - 5.0') Topock - Fluvial Deposits; Silty sand (SM); light brown (7.5YR 6/4); very fine grained to very coarse grained, angular to round; some silt; little granules to very large pebbles, angular to subangular; trace small to large cobbles, angular to subround; trace boulders, subangular; coarser clasts composed of metadiorite; moist	(3.8 - 9.0') Advanced 12-inch conductor material logged from clean out sample disturbed.	
6–9	62.4			Topock - Alluvium Deposits	SM		(5.0 - 9.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist		
9–10				Topock - Alluvium Deposits	GW		(9.0 - 9.8') Topock - Alluvium Deposits; Well graded gravel (GW); grayish green (GLEY1 5/2); boulders, subangular; dry; iron oxide staining; pulverized into rock flour	(9.0 - 16.0') Normal Drilling.	
10–11				Topock - Alluvium Deposits	SW-SM		(9.8 - 11.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; coarser clasts composed of metadiorite; dry; iron oxide staining	(9.5 - 57.0') Formation tight when advancing 10-inch casing.	
11–13	96			Topock - Alluvium Deposits	SW		(11.0 - 14.3') Topock - Alluvium Deposits; Well graded sand with gravel (SW); gray (2.5Y 5/1); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, subangular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; dry to moist; iron oxide staining		
13–16				Topock - Alluvium Deposits	SW-SM		(14.3 - 16.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/2) and brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; dry to moist; iron oxide staining		
16–17				Topock - Alluvium Deposits	SM		(16.0 - 18.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/2) and brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; dry to moist	(16.0 - 17.0') Hard drilling.	
17–18							(17.5'); trace clay; decrease in sand, increase in granules and pebbles	(17.0 - 22.0') Core came out hot and melted bag 20 to 22 ft. bgs disturbed, potential boulder at 22 ft. bgs.	
18–19	60			Topock - Alluvium Deposits	SW-SM		(18.0 - 19.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; dry to moist		
19–20				Topock - Alluvium	SM		(19.3 - 21.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained,		

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

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

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

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Date Completed:	03/26/2020	Northing (NAD83):	N/A		
Drilling Co.:	Cascade	Easting (NAD83):	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

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

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Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Location:	PG&E Topock, Needles, California
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

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

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Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
81	60			Topock - Alluvium Deposits	SM		(80.0 - 82.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace small cobbles, subangular; moist to dry		
82				Topock - Alluvium Deposits	SW-SM		(82.0 - 86.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist	(82.0 - 92.0') Normal Drilling.	
83									
84									
85									
86							(85.5'); trace small cobbles, angular to subangular		
87	120			Topock - Alluvium Deposits	SW		(86.0 - 92.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); reddish brown (5YR 5/3); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; trace silt; trace clay; coarser clasts composed of metadiorite; moist to dry (87'); and granules to large pebbles, angular to subround		
88							(88'); and granules to very large pebbles, angular to subangular (88.25') grayish brown (2.5Y 5/2); 0.2 foot lens (88.45') reddish brown (5YR 5/3)		
89									
90									
91									
92				Topock - Alluvium Deposits	SM		(92.0 - 94.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; and granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist		
93							(93.5'); little granules to large pebbles, angular to subround; increase in sand		
94	60			Topock - Alluvium Deposits	SW-SM		(94.0 - 94.8') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 5/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; moist		
95				Topock - Alluvium Deposits	GW		(94.8 - 95.0') Topock - Alluvium Deposits; Well graded gravel (GW); (GLEY1 5/3); boulders, subangular; dry; boulders have been pulverized into some rock flour		
96									
97				Topock - Alluvium Deposits	SM		(95.0 - 100.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some silt; little granules to large pebbles, angular to subangular; trace clay; coarser clasts composed of metadiorite; moist; weak cementation; iron oxide staining (97'); little clay; moist to wet; increase in silt, decrease in sand (98'); trace small to large cobbles, subangular (98.25'); increase in sand, decrease in silt, no clay	(96.8') Approximate depth to groundwater. (97.0 - 102.0') Tight drilling, core barrel came out hot, bag melted lost 0.5 ft in hopper. (97.1 - 107.0')	
98	54		MW-95-VAS-97-102.0 (0.79 ppb) 3/10/2020 10:17						
99									
100							(99.75'); trace boulders, subround		

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/08/2020	Surface Elevation:	N/A	**Boring No.:**	**MW-95**
Date Completed:	03/26/2020	Northing (NAD83):	N/A		
Drilling Co.:	Cascade	Easting (NAD83):	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

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

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	N/A	Client:	PG&E
Date Completed:	03/26/2020	Northing (NAD83):	N/A		
Drilling Co.:	Cascade	Easting (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Location:	PG&E Topock, Needles, California
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

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

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	N/A		
Date Completed:	03/26/2020	Northing (NAD83):	N/A		
Drilling Co.:	Cascade	Easting (NAD83):	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

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

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	N/A	Client:	PG&E
Date Completed:	03/26/2020	Northing (NAD83):	N/A		
Drilling Co.:	Cascade	Easting (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Location:	PG&E Topock, Needles, California
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

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

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-95

Date Started:	03/08/2020	Surface Elevation:	N/A		
Date Completed:	03/26/2020	Northing (NAD83):	N/A		
Drilling Co.:	Cascade	Easting (NAD83):	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	197 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Boart Longyear Track	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	96.7 ft bgs		
Drilling Asst:	J. Colon / F. Sandoval	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

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

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Sheet: 1 of 11

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
0					(+2.3 - 93.0') 2" PVC Sch 80 Casing; (+3.1 - 5.0') Monument painted desert sand; (+2.2 - 137.0') 2" PVC Sch 80 Casing		Note: 12x12-inch Lockable Steel Monument.
1		Topock - Fluvial Deposits	SW		(+0.8 - 5.2') Concrete		(-0.8 - 5.2') 42 bags Note: 30" diameter concrete pad, King Kon-Crete 4000 PSI with Buff concrete dye.
4		Topock - Fluvial Deposits	SM		(0.0 - 9.0') 12.0" Borehole		
5		Topock - Alluvium Deposits	SM				
9		Topock - Alluvium Deposits	GW				
10		Topock - Alluvium Deposits	SW-SM		(5.0 - 34.5') Portland Cement 6% Bentonite	(5.0 - 34.5') 117.9 gallons	(5.0 - 34.5') 150 gallons (127%) Note: Type I, II and V and Hydrogel, used >20% of the calculated volume due to potential voids forming. Installed on 3/30/2020.
11		Topock - Alluvium Deposits	SW				
13					(9.0 - 188.0') 10.0" Borehole		
14		Topock - Alluvium Deposits	SW-SM				
15		Topock - Alluvium Deposits	SM				
16							

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, blue water table symbol represents depth to water measurement during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
18		Topock - Alluvium Deposits	SM		(+2.3 - 93.0') 2" PVC Sch 80 Casing		
19		Topock - Alluvium Deposits	SW-SM				
20		Topock - Alluvium Deposits	SM				
21		Topock - Alluvium Deposits	GW				
22		Topock - Alluvium Deposits	SM				
23		Topock - Alluvium Deposits	SW				
24		Topock - Alluvium Deposits	SW-SM		(5.0 - 34.5') Portland Cement 6% Bentonite	(5.0 - 34.5') 117.9 gallons	(5.0 - 34.5') 150 gallons (127%) Note: Type I, II and V and Hydrogel, used >20% of the calculated volume due to potential voids forming. Installed on 3/30/2020.
25		Topock - Alluvium Deposits	SM				
26		Topock - Alluvium Deposits	GW				
27		Topock - Alluvium Deposits	SW-SM				
28		Topock - Alluvium Deposits	GW-GM				
29		Topock - Alluvium Deposits					
30							
31		Topock - Alluvium Deposits	SM		(9.0 - 188.0') 10.0" Borehole		
32							
33							
34							
35		Topock - Alluvium Deposits	SM		(34.5 - 35.5') Centralizer (34.5 - 85.0') Portland Cement 6% Bentonite	(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Type I, II and V and Hydrogel, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
36					(+2.2 - 137.0') 2" PVC Sch 80 Casing		

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ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: MW-95-113, MW-95-157

Date Started:	03/27/2020	Surface Elevation:	N/A		
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
38		Topock - Alluvium Deposits	SM		(+2.3 - 93.0') 2" PVC Sch 80 Casing		
39		Topock - Alluvium Deposits	SM				
40		Topock - Alluvium Deposits	GW-GM				
41		Topock - Alluvium Deposits	SW				
42		Topock - Alluvium Deposits	ML				
43							
44							
45		Topock - Alluvium Deposits	SW-SM				
46							
47					(34.5 - 85.0') Portland Cement 6% Bentonite	(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Type I, II and V and Hydrogel, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
48		Topock - Alluvium Deposits	SM				
49							
50		Topock - Alluvium Deposits	SM				
51		Topock - Alluvium Deposits	SW				
52							
53		Topock - Alluvium Deposits	SM				
54							
55		Topock - Alluvium Deposits	SW				
56		Topock - Alluvium Deposits	SM				
		Topock - Alluvium Deposits	SW-SM		(9.0 - 188.0') 10.0" Borehole		

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery, blue water table symbol represents depth to water measurement during the first VAS interval

Well Construction Log

Sheet: 4 of 11

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
58–76		Topock - Alluvium Deposits	SW-SM		(+2.3 - 93.0') 2" PVC Sch 80 Casing; (+2.2 - 137.0') 2" PVC Sch 80 Casing		
67		Topock - Alluvium Deposits	SM		(34.5 - 85.0') Portland Cement 6% Bentonite; (9.0 - 188.0') 10.0" Borehole	(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Type I, II and V and Hydrogel, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
69		Topock - Alluvium Deposits	SM SW-SM				
71		Topock - Alluvium Deposits	SM				
74		Topock - Alluvium Deposits	SW-SM		(74.5 - 75.5') Centralizer		

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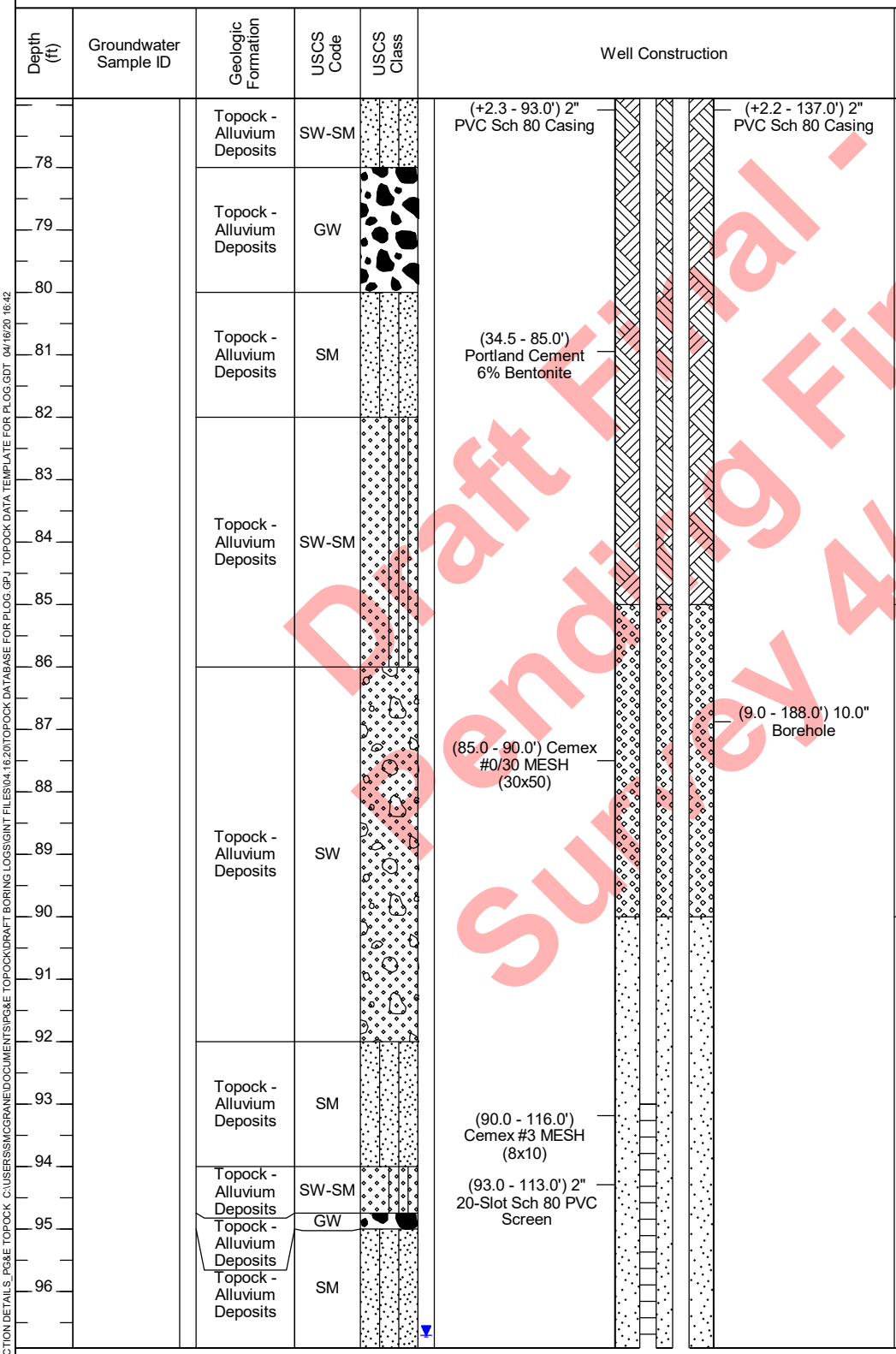
ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Sheet: 5 of 11

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		



Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
(34.5 - 85.0') 189.4 gallons	(34.5 - 85.0') 400 gallons (211%) Note: Type I, II and V and Hydrogel, used >20% of the calculated volume due to potential voids forming. Installed on 3/29/30.
(85.0 - 90.0') 5 bags	(85.0 - 90.0') 7 bags (140%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling.
(90.0 - 116.0') 26.4 bags	(90.0 - 116.0') 43 bags (163%) Note: Lapis Lustre Sand, 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, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery, blue water table symbol represents depth to water measurement during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
98	MW-95-VAS-97-102.0 (0.79 ppb) 3/10/2020 10:17	Topock - Alluvium Deposits	SM		(93.0 - 113.0') 2" 20-Slot Sch 80 PVC Screen; (+2.2 - 137.0') 2" PVC Sch 80 Casing		
99							
100							
101		Topock - Alluvium Deposits	SM				
102			NR				
103		Topock - Alluvium Deposits	SM				
104							
105		Topock - Alluvium Deposits	SM				
106					(90.0 - 116.0') Cemex #3 MESH (8x10); (9.0 - 188.0') 10.0" Borehole	(90.0 - 116.0') 26.4 bags	(90.0 - 116.0') 43 bags (163%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling.
107		Topock - Alluvium Deposits	ML				
108							
109		Topock - Alluvium Deposits	ML				
110							
111		Topock - Alluvium Deposits	SM				
112							
113		Topock - Alluvium Deposits	ML				
114					(113.5 - 114.2') Centralizer		
115		Topock - Alluvium Deposits	SM		(113.0 - 115.3') Sump and End Cap		
116							
		Topock - Alluvium Deposits	SM		(116.0 - 130.0') Bentonite seal pellets	(116.0 - 130.0') 11.7	

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Well Construction Log

Sheet: 7 of 11

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
118		Topock - Alluvium Deposits	GM		(+2.2 - 137.0') 2" PVC Sch 80 Casing		
119		Topock - Alluvium Deposits	GM				
120							
121							
122		Topock - Alluvium Deposits	SM				
123					(116.0 - 130.0') Bentonite seal pellets	(116.0 - 130.0') 11.7	(116.0 - 130.0') 24 (205%) Note: Pel-Plug (TR30) 3/8", used >20% of the calculated volume due to potential voids forming during drilling.
124	MW-95-VAS-122-127 (0.87 ppb) 3/10/2020 15:24						
125		Topock - Alluvium Deposits	SM		(124.5 - 125.2') Centralizer		
126							
127					(9.0 - 188.0') 10.0" Borehole		
128		Topock - Alluvium Deposits	GW-GM				
129							
130		Topock - Alluvium Deposits	GM				
131							
132					(130.0 - 135.0') Cemex #0/30 MESH (30x50)	(130.0 - 135.0') 5.2 bags	(130.0 - 135.0') 7 bags (135%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling
133		Topock - Alluvium Deposits	ML				
134							
135		Topock - Alluvium Deposits	SM				
136					(135.0 - 161.5') Cemex #3 MESH (8x10)	(135.0 - 161.5') 27.3 bags	(135.0 - 161.5') 35 bags (128%) Note: Lapis Lustre Sand, 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, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery, blue water table symbol represents depth to water measurement during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
138		Topock - Alluvium Deposits	ML		(137.0 - 157.0') 2" 20-Slot Sch 80 PVC Screen		
139							
140		Topock - Alluvium Deposits	SW-SM				
141							
142		Topock - Alluvium Deposits	ML				
143							
144		Topock - Alluvium Deposits	SW-SM				
145							
146							
147		Topock - Alluvium Deposits	ML		(135.0 - 161.5') Cemex #3 MESH (8x10)	(135.0 - 161.5') 27.3 bags	(135.0 - 161.5') 35 bags (128%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling
148							
149		Topock - Alluvium Deposits	SM		(9.0 - 188.0') 10.0" Borehole		
150							
151							
152							
153		Topock - Alluvium Deposits	SW-SM				
154	MW-95-VAS152-157 (<0.033 U ppb) 3/12/2020 09:57						
155							
156							

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ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: MW-95-113, MW-95-157

Date Started:	03/27/2020	Surface Elevation:	N/A		
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
158		Topock - Alluvium Deposits	SM		(157.5 - 158.5') Centralizer; (135.0 - 161.5') Cemex #3 MESH (8x10); (157.0 - 159.3') Sump and End Cap	(135.0 - 161.5') 27.3 bags	(135.0 - 161.5') 35 bags (128%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling
159							
160							
161							
162							
163		Topock - Alluvium Deposits	ML				
164							
165							
166		Topock - Alluvium Deposits	SM		(9.0 - 188.0') 10.0" Borehole		
167							
168							
169					(161.5 - 193.0') Bentonite seal pellets	(161.5 - 193.0') 25.9 buckets	(161.5 - 193.0') 32 buckets (124%) Note: Pel-Plug (TR30) 3/8", used >20% of the calculated volume due to potential voids forming during drilling
170		Topock - Alluvium Deposits	ML				
171							
172		Topock - Alluvium Deposits	SM				
173							
174							
175							
176		Topock - Alluvium Deposits	SM				
			ML				

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, blue water table symbol represents depth to water measurement during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: MW-95-113, MW-95-157

Date Started:	03/27/2020	Surface Elevation:	N/A		
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

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
178		Topock - Alluvium Deposits	ML		(9.0 - 188.0') 10.0" Borehole		
179							
180		Topock - Alluvium Deposits	SM				
181							
182							
183		Topock - Alluvium Deposits	SM				
184	MW-95-VAS-182-187 (<0.17 U ppb) 3/20/2020 16:18						
185		Topock - Alluvium Deposits	ML		(161.5 - 193.0') Bentonite seal pellets	(161.5 - 193.0') 25.9 buckets	(161.5 - 193.0') 32 buckets (124%) Note: Pel-Plug (TR30) 3/8", used >20% of the calculated volume due to potential voids forming during drilling
186							
187							
188							
189		Topock - Alluvium Deposits	ML				
190							
191		Topock - Weathered Bedrock - conglomerate	SM		(188.0 - 193.0') 8.0" Borehole		
192							
193		Topock - Competent Bedrock - conglomerate			(193.0 - 196.0') 6.0" Borehole	(193.0 - 197.0') 1.08 buckets	(193.0 - 197.0') 1 buckets (93%) Note: Pel-Plug (TR30) 3/8", overshot draft design by 1 foot
194					(193.0 - 197.0') Bentonite seal pellets		
195							
196					(196.0 - 197.0') 4.0" 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, blue water table symbol represents depth to water measurement during the first VAS interval

Well Construction Log

Sheet: 11 of 11

Date Started:	03/27/2020	Surface Elevation:	N/A	**Well ID: MW-95-113, MW-95-157**	
Date Completed:	04/01/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	N/A	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	N/A	Location:	PG&E Topock, Needles, California
Drilling Asst:	J. Colon / F. Sandoval	Borehole Diameter:	6-12 inches		
Logger:	Sean McGrane	Water Level Start:	96.7 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	N/A		
Total Depth:	197 ft bgs	Well Completion:	☐ Flush ☒ Stick-up		

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
					End of Boring at 197.0 'bgs.		
198							
199							
200							
201							
202							
203							
204							
205							
206							
207							
208							
209							
210							
211							
212							
213							
214							
215							
216							

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, blue water table symbol represents depth to water measurement during the first VAS interval