Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Sheet: 1 of 10

Date Started:	08/05/2020	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18**	
Date Completed:	08/11/2020	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	16-18 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/27/2020		
Total Depth:	193.93 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
0		Topock - Fill	GW		(0.0 - 41.7') 10" SHUR-GRIP SDR17 PVC Casing		
1							
2		Topock - Fluvial Deposits	SW		(0.0 - 4.5') Cemex #60 Mesh (40x70) Lapis Lustre Sand	(0.0 - 4.5') 10.3 bags	(0.0 - 4.5') 11 bags (107%) Note: Temporary Backfill
3							
4							
5		Topock - Fluvial Deposits	SW				
6							
7							
8							
9		Topock - Fluvial Deposits	GW				
10		Topock - Fluvial Deposits	SW		(0.0 - 20.9') 18.0" Borehole		
11							
12		Topock - Fluvial Deposits	SW		(4.5 - 31.0') Portland Cement 3% Bentonite Type I, II, and V with Hydrogel	(4.5 - 31.0') 226.9 gallons	(4.5 - 31.0') 235 gallons (104%) Note: Grout seal
13							
14							
15		Topock - Fluvial Deposits	SW				
16							
17		Topock - Fluvial Deposits	GW				
18		Topock - Fluvial Deposits	SW-SM				
19							
20							

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Drilling Method:	Dual Rotary	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	16-18 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
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Total Depth:	193.93 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
21		Topock - Fluvial Deposits	SW-SM		(0.0 - 41.7') 10" SHUR-GRIP SDR17 PVC Casing (0.0 - 20.9') 18.0" Borehole		
22							
23					(20.9 - 25.0') 18.0" Borehole		
24		Topock - Alluvium Deposits	SW-SM				
25					(24.5 - 25.5') Centralizer (4.5 - 31.0') Portland Cement 3% Bentonite Type I, II, and V with Hydrogel	(4.5 - 31.0') 226.9 gallons	(4.5 - 31.0') 235 gallons (104%) Note: Grout seal
26							
27							
28							
29							
30							
31							
32		Topock - Alluvium Deposits	SW-SM		(31.0 - 34.0') Cemex #60 Mesh (40x70) Lapis Lustre Sand (25.0 - 40.7') 18.0" Borehole	(31.0 - 34.0') 6.8 bags	(31.0 - 34.0') 7 bags (103%) Note: Transition sand
33							
34							
35							
36							
37					(34.0 - 62.6') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand	(34.0 - 62.6') 64.7 bags	(34.0 - 62.6') 77 bags (119%) Note: Filter pack, ran dummy tool and swabbed for approximately 120 minutes.
38		Topock - Alluvium Deposits	SM				
39							
40							

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Drilling Method:	Dual Rotary	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	16-18 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
41		Topock - Alluvium Deposits	SM		(0.0 - 41.7') 10" SHUR-GRIP SDR17 PVC Casing; (25.0 - 40.7') 18.0" Borehole		
42					(41.7 - 59.6') 10" 10-Slot 316L SS Wire Wrap Screen		
43							
44	IRZ-18-VAS-42-47 (580 ppb) 11/19/2019 09:20	Topock - Alluvium Deposits	SM				
45							
46							
47							
48							
49							
50					(34.0 - 62.6') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand; (40.7 - 61.4') 18.0" Borehole	(34.0 - 62.6') 64.7 bags	(34.0 - 62.6') 77 bags (119%) Note: Filter pack, ran dummy tool and swabbed for approximately 120 minutes.
51							
52		Topock - Alluvium Deposits	SM				
53							
54							
55							
56							
57							
58		Topock - Alluvium Deposits	SM				
59							
60							

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Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	16-18 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/27/2020		
Total Depth:	193.93 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					(59.6 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing; (34.0 - 62.6') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand; (40.7 - 61.4') 18.0" Borehole	(34.0 - 62.6') 64.7 bags	(34.0 - 62.6') 77 bags (119%) Note: Filter pack, ran dummy tool and swabbed for approximately 120 minutes.
62							
63		Topock - Alluvium Deposits	SM		(62.6 - 63.9') Cemex #60 Mesh (40x70) Lapis Lustre Sand	(62.6 - 63.9') 2 bags	(62.6 - 63.9') 2 bags (100%) Note: Transition sand
64	IRZ-18-VAS-62-67 (<0.033 U ppb) 11/19/2019 13:05						
65							
66							
67							
68		Topock - Alluvium Deposits	SM				
69	IRZ-18-VAS-67-72 (<0.033 U ppb) 11/19/2019 16:00						
70					(61.4 - 78.6') 16.0" Borehole		
71							
72					(63.9 - 133.8') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(63.9 - 133.8') 86.5	(63.9 - 133.8') 125 (145%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
73		Topock - Alluvium Deposits	SM				
74							
75							
76							
77							
78		Topock - Alluvium Deposits	ML				
79							
80					(78.6 - 98.2') 16.0" Borehole		

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Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	16-18 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	8/27/2020		
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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
81		Topock - Alluvium Deposits	SM		(59.6 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing; (81.0 - 82.0') Centralizer		
82							
83							
84							
85							
86							
87							
88							
89					(78.6 - 98.2') 16.0" Borehole		
90					(63.9 - 133.8') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(63.9 - 133.8') 86.5	(63.9 - 133.8') 125 (145%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
91							
92		Topock - Alluvium Deposits	ML				
93							
94							
95							
96		Topock - Alluvium Deposits	SM				
97							
98							
99							
100					(98.2 - 117.8') 16.0" Borehole		

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Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
101					(59.6 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
102		Topock - Alluvium Deposits	SM				
103							
104	IRZ-18-VAS-102-107 (<0.17 U ppb) 11/20/2019 11:35						
105							
106		Topock - Alluvium Deposits	ML				
107							
108							
109					(98.2 - 117.8') 16.0" Borehole		
110					(63.9 - 133.8') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(63.9 - 133.8') 86.5	(63.9 - 133.8') 125 (145%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
111							
112							
113		Topock - Alluvium Deposits	SM				
114							
115							
116							
117		Topock - Alluvium Deposits	ML				
118							
119		Topock - Alluvium Deposits	SM		(117.8 - 138.6') 16.0" Borehole		
120							

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Driller Name:	Jon Martinez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	16-18 inches		
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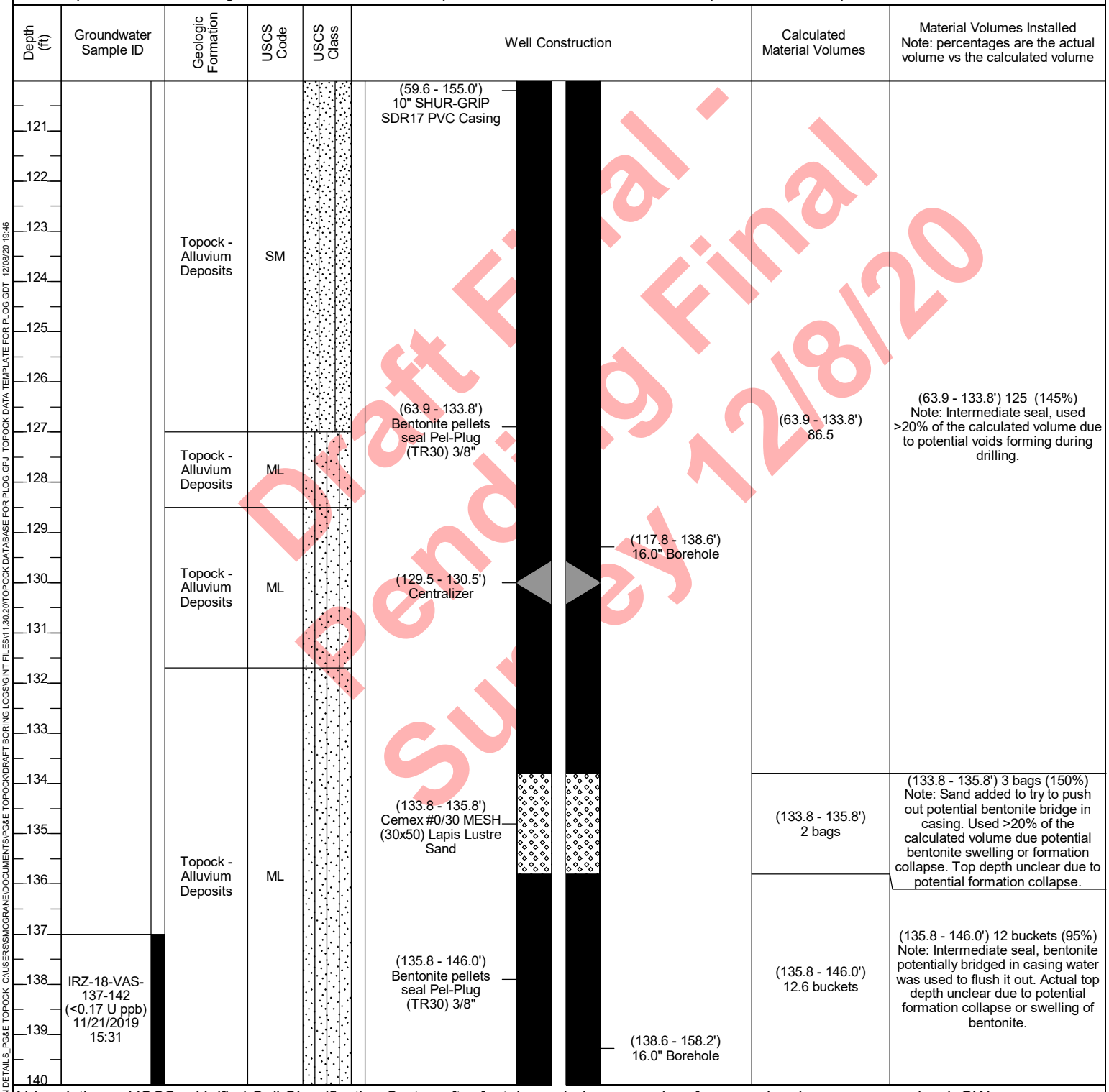

Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
(63.9 - 133.8') 86.5	(63.9 - 133.8') 125 (145%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
(133.8 - 135.8') 2 bags	(133.8 - 135.8') 3 bags (150%) Note: Sand added to try to push out potential bentonite bridge in casing. Used >20% of the calculated volume due potential bentonite swelling or formation collapse. Top depth unclear due to potential formation collapse.
(135.8 - 146.0') 12.6 buckets	(135.8 - 146.0') 12 buckets (95%) Note: Intermediate seal, bentonite potentially bridged in casing water was used to flush it out. Actual top depth unclear due to potential formation collapse or swelling of bentonite.

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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
141	IRZ-18-VAS-137-142 (<0.17 U ppb) 11/21/2019 15:31	Topock - Alluvium Deposits	ML		(59.6 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
142							
143		Topock - Alluvium Deposits	SM		(135.8 - 146.0') Bentonite pellets seal Pel-Plug (TR30) 3/8"	(135.8 - 146.0') 12.6 buckets	(135.8 - 146.0') 12 buckets (95%) Note: Intermediate seal, bentonite potentially bridged in casing water was used to flush it out. Actual top depth unclear due to potential formation collapse or swelling of bentonite.
144							
145							
146		Topock - Alluvium Deposits	ML				
147					(146.0 - 147.3') Cemex #60 MESH (40x70) Lapis Lustre Sand	(146.0 - 147.3') 2 bags	(146.0 - 147.3') 2 bags (100%) Note: Transition sand
148	IRZ-18-VAS-147-152 (<0.17 U ppb) 11/21/2019 13:20	Topock - Alluvium Deposits	SM			(147.3 - 193.9') 80.3 bags	(147.3 - 193.9') 78 bags (97%) Note: Filter pack, confirmed well was plumb with dummy tool and swabbed for approximately 60 minutes. During installation approximately 1 foot of open hole was needed because casing was difficult to remove.
149					(138.6 - 158.2') 16.0" Borehole		
150							
151							
152							
153		Topock - Alluvium Deposits	SM		(147.3 - 193.9') Cemex #1/20 MESH (20x40) Lapis Lustre Sand		
154							
155					(155.0 - 181.8') 10" 18-Slot 316L SS Wire Wrap Screen		
156							
157							
158	IRZ-18-VAS-157-162 (870 ppb) 11/22/2019 12:15	Topock - Alluvium Deposits	SM				
159					(158.2 - 178.2') 16.0" Borehole		
160							

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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
161	IRZ-18-VAS-157-162 (870 ppb) 11/22/2019 12:15	Topock - Alluvium Deposits	SM		(155.0 - 181.8') 10" 18-Slot 316L SS Wire Wrap Screen		
162							
163							
164	IRZ-18-VAS-162-167 (3300 ppb) 11/22/2019 15:00						
165		Topock - Alluvium Deposits	SM				
166							
167							
168	IRZ-18-VAS-167-172 (4700 ppb) 11/23/2019 10:00						
169		Topock - Alluvium Deposits	SM		(147.3 - 193.9') Cemex #1/20 MESH (20x40) Lapis Lustre Sand	(147.3 - 193.9') 80.3 bags	(147.3 - 193.9') 78 bags (97%) Note: Filter pack, confirmed well was plumb with dummy tool and swabbed for approximately 60 minutes. During installation approximately 1 foot of open hole was needed because casing was difficult to remove.
170							
171							
172		Topock - Alluvium Deposits	ML				
173							
174	IRZ-18-VAS-172-177 (660 ppb) 12/3/2019 10:30						
175		Topock - Alluvium Deposits	SM				
176							
177							
178	IRZ-18-VAS-177-182 (390 ppb) 12/3/2019 14:40						
179		Topock - Alluvium Deposits	ML		(158.2 - 178.2') 16.0" Borehole; (178.2 - 193.9') 16.0" Borehole		
180							

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Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
181	IRZ-18-VAS-177-182 (390 ppb) 12/3/2019 14:40	Topock - Alluvium Deposits	ML		(155.0 - 181.8') 10" 18-Slot 316L SS Wire Wrap Screen		
182							
183					(147.3 - 193.9') Cemex #1/20 MESH (20x40) Lapis Lustre Sand		
184	IRZ-18-VAS-182-187 (<0.17 U ppb) 12/4/2019 11:00						
185					(184.0 - 185.0') Centralizer		
186		Topock - Alluvium Deposits	SM				
187					(181.8 - 187.4') Sump and SS End Cap	(147.3 - 193.9') 80.3 bags	(147.3 - 193.9') 78 bags (97%) Note: Filter pack, confirmed well was plumb with dummy tool and swabbed for approximately 60 minutes. During installation approximately 1 foot of open hole was needed because casing was difficult to remove.
188							
189	IRZ-18-VAS-187-192 (<0.17 U ppb) 12/4/2019 15:35						
190							
191			NR				
192		Topock - Alluvium Deposits	SM				
193		Topock - Weathered Bedrock - conglomerate	ML				
194					End of Boring at 193.9 ft bgs.		
195							
196							
197							
198							
199							
200							

(178.2 - 193.9') 16.0" Borehole

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

Drilling Log

Sheet: 1 of 10

Boring No.: IRZ-18

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl		
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
0		GW			(0.0 - 0.4') Topock - Fill; Well graded gravel (GW)		(0.0 - 20.9') 165 gallons of water used; 40 gallons of water recovered; 125 gallons of water lost
1					(0.4 - 4.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); very dark gray (7.5YR 3/1)		
2		SW					
3						(3.0 - 7.0') Drill rods chattering	
4					(4.0 - 9.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3)	(4.0') Observed trace amounts of Plastering Sand in drill cuttings.	
5							
6							
7							
8							
9		GW			(9.0 - 9.5') Topock - Fluvial Deposits; Well graded gravel with sand (GW); dark brown (7.5YR 3/2)		
10	(0.0 - 20.9) 3.79 mins/ft	SW		(0.0 - 20.9') 18.0" Steel Casing	(9.5 - 11.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3)	(10.0 - 20.0') Hard drilling (10.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
11							
12		SW			(11.0 - 14.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3)		
13							
14							
15		SW			(14.0 - 16.5') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 5/3)		
16							
17		GW			(16.5 - 17.0') Topock - Fluvial Deposits; Well graded gravel (GW)		
18		SW-SM			(17.0 - 23.0') Topock - Fluvial Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/3)		
19							
20							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18**
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
21	(0.0 - 20.9) 3.79 mins/ft	SW-SM		(0.0 - 20.9') 18.0" Steel Casing		(20.0 - 25.0') Hard/rough drilling (20.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	(20.9 - 25.0') 55 gallons of water used; 8 gallons of water recovered; 47 gallons of water lost
22							
23	(20.9 - 25.0) 4.36 mins/ft			(20.9 - 25.0') 18.0" Steel Casing	(23.0 - 32.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/2)		
24							
25						(25.0 - 27.0') Rough/hard drilling (25.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	(25.0 - 40.7') 220 gallons of water used; 50 gallons of water recovered; 170 gallons of water lost
26							
27		SW-SM					
28							
29							
30						(30.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
31							
32	(25.0 - 40.7) 2.04 mins/ft			(25.0 - 40.7') 18.0" Steel Casing	(32.0 - 37.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/2) with reddish brown / moderate brown (5YR 4/4)		
33							
34		SW-SM					
35							
36							
37					(37.0 - 41.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4)		
38							
39		SM					
40							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Sheet: 3 of 10

Boring No.: IRZ-18

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl		
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
41	(25.0 - 40.7) 2.04 mins/ft	SM			(41.0 - 47.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4)	(40.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	(40.7 - 61.4') 358 gallons of air used; 80 gallons of air recovered; 278 gallons of air lost
42							
43							
44		SM					
45							
46							
47					(47.0 - 57.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3)		
48							
49							
50	(40.7 - 61.4) 1.50 mins/ft			(40.7 - 61.4') 18.0" Steel Casing		(50.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
51							
52		SM					
53							
54							
55							
56							
57							
58					(57.5 - 67.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3)		
59		SM					
60							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

Drilling Log

Sheet: 4 of 10

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18**
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
61	(40.7 - 61.4) 1.50 mins/ft			(40.7 - 61.4') 18.0" Steel Casing		(60.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
62							(61.4 - 78.6') 248 gallons of water used; 80 gallons of water recovered; 168 gallons of water lost
63		SM					
64							
65							
66							
67					(67.0 - 70.0') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/3)		
68		SM					
69							
70	(61.4 - 78.6) 1.22 mins/ft			(61.4 - 78.6') 16.0" Steel Casing	(70.0 - 76.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3)	(70.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
71							
72							
73		SM					
74							
75							
76					(76.0 - 80.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/3)		
77							
78		ML					
79	(78.6 - 98.2) 0.92 mins/ft			(78.6 - 98.2') 16.0" Steel Casing			(78.6 - 98.2') 55 gallons of water used; 10 gallons of water recovered; 45 gallons of water lost
80							

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Drilling Log

Sheet: 5 of 10

ARCADIS Design & Consultancy for natural and built assets

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18**
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
81					(80.0 - 92.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4)	(80.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
82							
83							
84							
85							
86		SM					
87							
88							
89	(78.6 - 98.2) 0.92 mins/ft			(78.6 - 98.2') 16.0" Steel Casing			
90						(90.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
91							
92					(92.0 - 96.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4)		
93							
94		ML					
95							
96					(96.0 - 104.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4) with brown (7.5YR 4/4)		
97							
98		SM				(98.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
99	(98.2 - 117.8) 0.82 mins/ft			(98.2 - 117.8') 16.0" Steel Casing			(98.2 - 117.8') 110 gallons of water used; 40 gallons of water recovered; 70 gallons of water lost
100							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-18

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl		
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
101						(100.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
102		SM					
103							
104					(104.0 - 109.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4)		
105		ML					
106							
107							
108							
109	(98.2 - 117.8) 0.82 mins/ft			(98.2 - 117.8') 16.0" Steel Casing	(109.0 - 117.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 4/3)		
110						(110.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
111							
112							
113		SM					
114							
115							
116							
117							
		ML			(117.0 - 117.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 4/3)	(117.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
118					(117.5 - 127.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 4/3)		(117.8 - 138.6') 55 gallons of water used; 300 gallons of water recovered; 245 gallons of water gained
119	(117.8 - 138.6) 0.96 mins/ft	SM		(117.8 - 138.6') 16.0" Steel Casing			
120							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-18

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl	Client:	PG&E
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs		
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches		
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
121						(120.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
122							
123		SM					
124							
125							
126							
127							
128		ML			(127.0 - 128.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown (5YR 4/4)		
129	(117.8 - 138.6) 0.96 mins/ft			(117.8 - 138.6') 16.0" Steel Casing	(128.5 - 131.7') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4) (129') reddish brown (5YR 5/4)		
130		ML				(130.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
131							
132					(131.7 - 142.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown (5YR 4/4)		
133							
134							
135							
136		ML					
137							
138							
139	(138.6 - 158.2) 1.02 mins/ft			(138.6 - 158.2') 16.0" Steel Casing			(138.6 - 158.2') 55 gallons of water used; 1760 gallons of water recovered; 1705 gallons of water gained
140							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-18

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl	Client:	PG&E
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs		
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches		
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	[X] Yes [ ] No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
141		ML				(140.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
142							
143		SM			(142.0 - 145.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
144							
145							
146		ML			(145.0 - 147.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4)		
147							
148		SM			(147.0 - 152.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
149	(138.6 - 158.2) 1.02 mins/ft			(138.6 - 158.2') 16.0" Steel Casing			
150						(150.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
151						(150.1 - 158.0') Soft drilling	
152		SM			(152.0 - 157.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
153							
154							
155							
156							
157							
158		SM			(157.0 - 164.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
159	(158.2 - 178.2) 1.20 mins/ft			(158.2 - 178.2') 16.0" Steel Casing			(158.2 - 178.2') 110 gallons of water used; 920 gallons of water recovered; 810 gallons of water gained
160							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

Drilling Log

Sheet: 9 of 10

Boring No.: IRZ-18

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl		
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
161						(160.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
162		SM					
163							
164					(164.0 - 168.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
165		SM					
166							
167						(167.0 - 180.0') Soft drilling	
168					(168.0 - 172.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
169	(158.2 - 178.2) 1.20 mins/ft	SM		(158.2 - 178.2') 16.0" Steel Casing			
170						(170.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
171							
172					(172.0 - 173.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 4/3)		
173		ML					
174					(173.5 - 177.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
175		SM					
176							
177							
178					(177.5 - 182.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4) to red (2.5YR 4/6)		
179	(178.2 - 193.9) 0.76 mins/ft	ML		(178.2 - 193.9') 16.0" Steel Casing			(178.2 - 193.9') 82.5 gallons of water used; 400 gallons of water recovered; 317.5 gallons of water gained
180							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-18

Date Started:	07/27/2020	Surface Elevation:	494.67 ft amsl	Client:	PG&E
Date Completed:	08/04/2020	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	193.9 ft bgs		
Drill Rig Type:	Foremost DR-24HD	Conductor Casing Diameter:	18 inches		
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	A. & H. Amezguita	Drill Bit:	15.5 & 17.5 inch Tricone	Project Number:	RC000753.0051
Tool-Pusher:	A. Lamon	Depth to First Water:	41.1 ft bgs		
Rig Geologist:	Ellen Redner	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
181		ML				(180.0') Observed trace amounts of Cemex #3 Mesh (8x20) Lapis Luster Sand in drill cuttings.	
182					(182.0 - 190.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); red (2.5YR 4/6)		
183							
184							
185							
186		SM					
187	(178.2 - 193.9) 0.76 mins/ft			(178.2 - 193.9') 16.0" Steel Casing			
188							
189							
190					(190.0 - 192.0') No recovery (NR)	(190.0') Observed trace amounts of Cemex #2/12 Mesh (12x20) Lapis Luster Sand in drill cuttings.	
191		NR					
192					(192.0 - 193.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
193		SM					
194		ML			(193.0 - 193.9') Topock - Weathered Bedrock - conglomerate; Sandy silt with gravel (ML); reddish brown (5YR 4/3)		
195					End of Boring at 193.9 ft bgs.		
196							
197							
198							
199							
200							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol collected during the first VAS interval of the pilot borehole, groundwater data collected during drilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 1 of 11

Boring No.: IRZ-18 Pilot

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	Client:	PG&E
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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	36			Topock - Fill	GW		(0.0 - 0.4') Topock - Fill; Well graded gravel (GW); medium pebbles to very large pebbles, round; little small to large cobbles, subround to round; trace very fine to very coarse grained sand, subangular to subround; trace silt; trace clay; dry; gravel road base		
				Topock - Fluvial Deposits	SW		(0.4 - 4.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); very dark gray (7.5YR 3/1); very fine grained to very coarse grained, subangular to subround; some granules to very large pebbles, subround to round; little small to large cobbles, subround to round; trace silt; trace clay; dry; logged from hand auger cuttings	(3.0') Hand auger refusal	(3.0') 2 gallons of water used; 0 gallons of water recovered; 2 gallons of water lost
4–7	48			Topock - Fluvial Deposits	SW		(4.0 - 9.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3); very fine grained to medium grained, subangular to round; little granules to very large pebbles, subround to round; little small cobbles, round; little medium to very coarse grained sand, subangular to round; trace silt; dry		(4.0 - 12.0') No water used
8–12	60			Topock - Fluvial Deposits	GW		(9.0 - 9.5') Topock - Fluvial Deposits; Well graded gravel with sand (GW); dark brown (7.5YR 3/2); granules to large pebbles, subangular to round; and very fine to very coarse grained sand, subangular to round; trace small cobbles, round; trace silt; dry		
				Topock - Fluvial Deposits	SW		(9.5 - 11.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3); very fine grained to very coarse grained, subangular to round; little granules to very large pebbles, subround to round; little small cobbles, round; trace silt; dry; grading coarser with depth	(10.0 - 17.0') Formation collapse	
				Topock - Fluvial Deposits	SW		(11.0 - 14.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3); very fine grained to medium grained, subangular to round; little granules to very large pebbles, subround to round; little small cobbles, round; little medium to very coarse grained sand, subangular to round; trace silt; dry	(12.0 - 14.0') Drilled with water	(12.0 - 14.0') 10 gallons of water used; 0 gallons of water recovered; 10 gallons of water lost
13–16	48			Topock - Fluvial Deposits	SW		(14.0 - 16.5') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 5/3); very fine grained to very coarse grained, subangular to round; some granules to very large pebbles, subround to round; little small to large cobbles, round; trace silt; dry	(14.0 - 34.0') Rough drilling	(14.0 - 207.0') No water used
17	12			Topock - Fluvial Deposits	GW		(16.5 - 17.0') Topock - Fluvial Deposits; Well graded gravel (GW); boulder		
18–20	48			Topock - Fluvial Deposits	SW-SM		(17.0 - 23.0') Topock - Fluvial Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/3); very fine grained to very coarse grained, subangular to round; and small to very large pebbles, subround to round; some small to large cobbles, round; little silt; dry; many pulverized cobbles resulted in higher concentration of silt		

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, J = estimated value, NR = no recovery; Notes: blue water table symbol represents depth to water measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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	48			Topock - Fluvial Deposits	SW-SM				
22									
23							(23.0 - 32.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/2); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; dry		
24	60								
25									
26									
27				Topock - Alluvium Deposits	SW-SM				
28							(28'); increase in gravel, decrease in sand		
29									
30	96						(30'); decrease in gravel, increase in sand		
31									
32									
33							(32.0 - 37.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/2) with 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 small to large cobbles, subangular to subround; trace clay; dry		
34				Topock - Alluvium Deposits	SW-SM			(34.0 - 47.0') Rough drilling	
35									
36									
37	72	IRZ-18-SS-35-40 12/6/2019 11:05							
38				Topock - Alluvium Deposits	SM		(37.0 - 41.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; dry		
39							(39'); moist		
40									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-18 Pilot

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	Client:	PG&E
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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	SM		(40'); wet; increase in coarse sand		
42		IRZ-18-SS-40-45 12/6/2019 11:10		Topock - Alluvium Deposits	SM		(41.0 - 47.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4); very fine grained to very coarse grained, angular to subround; some silt; little granules to very large pebbles, angular to subangular; trace clay; moist; core was very hot upon extraction, moisture content may be biased		
43	84								
44			IRZ-18-VAS-42-47 (580 ppb) 11/19/2019 09:20				(44'); wet		
45									
46									
47		IRZ-18-SS-45-50 12/6/2019 11:15					(47.0 - 57.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3); very fine grained to very coarse grained, subangular to subround; some silt; little granules to large pebbles, angular to subround; trace clay; moist	(47.0 - 67.0') Rough drilling	
48									
49									
50									
51									
52	120	IRZ-18-SS-50-55 12/6/2019 11:20		Topock - Alluvium Deposits	SM		(52') brown (7.5YR 4/3) to brown (10YR 4/3); little silt; wet		
53									
54									
55									
56									
57		IRZ-18-SS-55-60 12/6/2019 11:25							
58	120			Topock - Alluvium Deposits	SM		(57.5 - 67.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3); very fine grained to very coarse grained, angular to subround; some silt; little granules to very large pebbles, angular to subangular; trace clay; wet		
59									
60									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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		IRZ-18-SS-60-65 12/6/2019 11:30					(62'); some granules to large pebbles, subangular to subround; little silt		
63	120		IRZ-18-VAS-62-67 (<0.033 U ppb) 11/19/2019 13:05	Topock - Alluvium Deposits	SM				
64									
65									
66									
67		IRZ-18-SS-65-70 12/6/2019 11:35					(67.0 - 70.0') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/3); very fine grained to very coarse grained, angular to subround; and silt; little granules to very large pebbles, angular to subangular; trace clay; wet		
68				Topock - Alluvium Deposits	SM				
69	60		IRZ-18-VAS-67-72 (<0.033 U ppb) 11/19/2019 16:00						
70									
71							(70.0 - 76.0') 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; little silt; trace clay; wet		
72								(72.0 - 86.0') Rough drilling	
73		IRZ-18-SS-70-76 12/6/2019 11:40		Topock - Alluvium Deposits	SM		(74'); some silt; little granules to very large pebbles, angular to subangular; wet to moist		
74									
75									
76	180						(76.0 - 80.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/3); low plasticity; some very fine to very coarse grained sand, subangular to subround; little granules to large pebbles, subangular to subround; little clay; moist; very stiff		
77									
78		IRZ-18-SS-76-80 12/6/2019 11:45		Topock - Alluvium Deposits	ML				
79							(79') reddish brown / moderate brown (5YR 4/4)		
80									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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							(80.0 - 92.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; trace clay; wet		
82		IRZ-18-SS-80-85 12/6/2019 11:50							
83									
84	180								
85									
86				Topock - Alluvium Deposits	SM				
87							(87') brown (7.5YR 5/3); little granules to large pebbles, angular to subround; wet		
88		IRZ-18-SS-85-92 12/6/2019 11:55							
89									
90								(90.0 - 102.0') Rough drilling	
91									
92	120								
93							(92.0 - 96.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4); low plasticity; some very fine to very coarse grained sand, subangular to subround; little granules to large pebbles, subangular to subround; little clay; moist; very stiff		
94		IRZ-18-SS-92-96 12/6/2019 12:00		Topock - Alluvium Deposits	ML				
95							(95'); wet		
96							(96.0 - 104.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4) with brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some silt; little granules to very large pebbles, angular to subround; trace clay; wet; coarseness increases with depth		
97									
98	60	IRZ-18-SS-96-100 12/6/2019 12:05		Topock - Alluvium Deposits	SM				
99									
100									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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	60	IRZ-18-SS-100-104 12/6/2019 12:10		Topock - Alluvium Deposits	SM		(102') reddish brown / moderate brown (5YR 4/4); some granules to very large pebbles, angular to subround		
102									
103			IRZ-18-VAS-102-107 (<0.17 U ppb) 11/20/2019 11:35						
104	60						(104.0 - 109.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4); low plasticity; some granules to very large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; trace clay; wet; stiff		
105		IRZ-18-SS-104-109 12/6/2019 12:15		Topock - Alluvium Deposits	ML				
106									
107									
108									
109									
110	120	IRZ-18-SS-109-115 12/6/2019 12:20		Topock - Alluvium Deposits	SM		(109.0 - 117.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 4/3); medium grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subangular; little silt; trace clay; wet	(109.0 - 122.0') Drill rods chattering	
111									
112			IRZ-18-VAS-112-117 (<0.17 U ppb) 11/20/2019 14:25				(112'); some granules to very large pebbles, angular to subangular; decrease in sand, increase in silt, increase in granules and pebbles		
113									
114									
115									
116									
117		IRZ-18-SS-115-120 12/6/2019 12:25		Topock - Alluvium Deposits	ML		(117.0 - 117.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 4/3); low plasticity; little granules to very large pebbles, angular to subround; little very fine to very coarse grained sand, angular to subround; trace clay; dry; hard; strong cementation (117.3'); strongly cemented silt layer		
118	120			Topock - Alluvium Deposits	SM		(117.5 - 127.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 4/3); medium grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace clay; wet		
119									
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, J = estimated value, NR = no recovery; Notes: blue water table symbol represents depth to water measured during the first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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							(120'); some granules to very large pebbles, angular to subangular; some silt; decrease in sand, decrease in granules and pebbles, increase in silt		
122									
123									
124	120	IRZ-18-SS-120-127 12/6/2019 12:30		Topock - Alluvium Deposits	SM		(123'); little granules to very large pebbles, angular to subangular; increase in sand, decrease in silt, decrease in granules and pebbles		
125									
126								(126.0 - 130.0') Rough drilling	
127									
128				Topock - Alluvium Deposits	ML		(127.0 - 128.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown (5YR 4/4); low plasticity; little very fine to very coarse grained sand, angular to subround; trace granules to very large pebbles, angular to subround; trace clay; moist; stiff		
129		IRZ-18-SS-127-131.5 12/6/2019 12:35		Topock - Alluvium Deposits	ML		(128.5 - 131.7') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4); low plasticity; little granules to large pebbles, angular to subangular; little very fine to very coarse grained grained sand, angular to subround; trace clay; dry; hard; moderate cementation (129') reddish brown (5YR 5/4); dry; very stiff (129.5'); moist; hard		
130	84								
131							(131.5'); dry		
132							(131.7 - 142.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown (5YR 4/4); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subround; little clay; moist; very stiff		
133		IRZ-18-SS-131.5-135 12/6/2019 12:40							
134								(134.0 - 142.0') Very hard drilling	
135									
136				Topock - Alluvium Deposits	ML				
137	96	IRZ-18-SS-135-140 12/6/2019 12:45					(137'); wet; medium stiff		
138			IRZ-18-VAS-137-142 (<0.17 U ppb) 11/21/2019 15:31						
139									
140									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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	96		IRZ-18-VAS-137-142 (<0.17 U ppb) 11/21/2019 15:31	Topock - Alluvium Deposits	ML		(140'); dry; hard		
142		IRZ-18-SS-140-145 12/6/2019 12:50		Topock - Alluvium Deposits	SM		(142.0 - 145.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to subangular; some silt; little granules to very large pebbles, subangular to subround; little clay; wet		
143									
144									
145				Topock - Alluvium Deposits	ML		(145.0 - 147.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subround; little clay; wet; medium stiff		
146									
147	120	IRZ-18-SS-145-150 12/6/2019 12:55	IRZ-18-VAS-147-152 (<0.17 U ppb) 11/21/2019 13:20	Topock - Alluvium Deposits	SM		(147.0 - 152.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to subangular; some silt; little granules to very large pebbles, subangular to subround; little clay; wet		
148									
149									
150									
151									
152		IRZ-18-SS-150-155 12/6/2019 13:00	IRZ-18-VAS-152-157 (<0.17 U ppb) 11/22/2019 09:30	Topock - Alluvium Deposits	SM		(152.0 - 157.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); medium grained to very coarse grained, angular to subangular; little granules to very large pebbles, subangular to subround; little silt; little clay; wet		
153									
154	60								
155									
156									
157		IRZ-18-SS-155-160 12/6/2019 13:05	IRZ-18-VAS-157-162 (870 ppb) 11/22/2019 12:15	Topock - Alluvium Deposits	SM		(157.0 - 164.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); medium grained to very coarse grained, angular to subround; some very fine to fine grained grained sand, angular to subround; little granules to very large pebbles, angular to subangular; little silt; trace clay; wet	(157.0') Multiple clean out runs to set sampler due to slough in casing.	
158	60								
159									
160									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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	60	IRZ-18-SS-160-165 12/6/2019 13:10	IRZ-18-VAS-157-162 (870 ppb) 11/22/2019 12:15	Topock - Alluvium Deposits	SM				
162									
163									
164	60		IRZ-18-VAS-162-167 (3300 ppb) 11/22/2019 15:00	Topock - Alluvium Deposits	SM		(164.0 - 168.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to medium grained, angular to subround; some coarse to very coarse grained grained sand, angular to subround; little granules to large pebbles, angular to subangular; little silt; trace clay; wet		
165									
166		IRZ-18-SS-165-170 12/6/2019 13:15							
167								(167.0 - 172.0') Slough fell in around the sampler had to retract and clean out casing.	
168	60		IRZ-18-VAS-167-172 (4700 ppb) 11/23/2019 10:00	Topock - Alluvium Deposits	SM		(168.0 - 172.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); medium grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; some very fine to fine grained grained sand, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet (170'); little granules to very large pebbles, angular to subangular; wet; increase in sand, decrease in granules and pebbles		
169									
170									
171									
172				Topock - Alluvium Deposits	ML		(172.0 - 173.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 4/3); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to large pebbles, angular to subangular; little clay; wet; medium stiff		
173		IRZ-18-SS-170-177.5 12/6/2019 13:20							
174	60		IRZ-18-VAS-172-177 (660 ppb) 12/3/2019 10:30	Topock - Alluvium Deposits	SM		(173.5 - 177.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); medium grained to very coarse grained, angular to subround; some very fine to fine grained grained sand, angular to subround; little granules to very large pebbles, angular to subangular; little silt; trace clay; wet		
175									
176									
177								(177.0 - 187.0') Hard drilling	
178	60	IRZ-18-SS-177.5-182 12/6/2019 13:25	IRZ-18-VAS-177-182 (390 ppb) 12/3/2019 14:40	Topock - Alluvium Deposits	ML		(177.5 - 182.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4) to red (2.5YR 4/6); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to large pebbles, angular to subangular; little clay; wet; medium stiff		
179									
180									

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Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	**Boring No.:**	**IRZ-18 Pilot**
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71		
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	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	60	IRZ-18-SS-177.5-182 12/6/2019 13:25	IRZ-18-VAS-177-182 (390 ppb) 12/3/2019 14:40	Topock - Alluvium Deposits	ML		(181'); dry; hard; moderate cementation (181.3'); wet; medium stiff; decrease in sand, increase in silt		
182							(182.0 - 190.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); red (2.5YR 4/6); very fine grained to very coarse grained, angular to subround; low plasticity; some silt; little granules to large pebbles, angular to subangular; little clay; wet		
183		IRZ-18-SS-182-185 12/6/2019 13:30							
184	60		IRZ-18-VAS-182-187 (<0.17 U ppb) 12/4/2019 11:00						
185							(185'); dry (185.2'); moist		
186				Topock - Alluvium Deposits	SM		(186'); dry (186.1'); moist		
187		IRZ-18-SS-185-190 12/6/2019 13:35						(187.0 - 192.0') Hard drilling, lost last 2 feet downhole upon extraction.	
188									
189	36		IRZ-18-VAS-187-192 (<0.17 U ppb) 12/4/2019 15:35						
190									
191					NR		(190.0 - 192.0') No recovery (NR); see drilling notes		
192									
193				Topock - Alluvium Deposits	SM		(192.0 - 193.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to subround; low plasticity; some silt; little granules to large pebbles, angular to subangular; little clay; wet	(192.0 - 203.0') Rough drilling	
194				Topock - Weathered Bedrock - conglomerate	ML		(193.0 - 198.0') Topock - Weathered Bedrock - conglomerate; Sandy silt with gravel (ML); reddish brown (5YR 4/3); low plasticity; some very fine to very coarse grained sand, angular to subangular; little granules to very large pebbles, angular to subangular; little clay; coarser clasts composed of metadiorite; moist to wet; stiff		
195	60						(195'); moist to dry; hard		
196									
197									
198									
199	120			Topock - Weathered Bedrock - conglomerate	ML		(198.0 - 204.0') Topock - Weathered Bedrock - conglomerate; Sandy silt (ML); reddish brown (5YR 4/3); medium plasticity; some very fine to very coarse grained sand, angular to subround; little granules to large pebbles, angular to subangular; little clay; moist to dry; hard		
200									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-18 Pilot

Date Started:	11/17/2019	Surface Elevation:	494.67 ft amsl	Client:	PG&E
Date Completed:	12/05/2019	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	217 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-10 inches		
Driller Name:	Jose Hernandez	Depth to First Water:	41.1 ft bgs		
Drilling Asst:	L. Amaya / P. Almanza	Sampling Method:	4 inch x 10 ft Core Barrel	Project Number:	RC000753.0051
Logger:	Chris Bonessi	Sampling Interval:	Continuous		
Editor:	Kendra Keon	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
201				Topock - Weathered Bedrock - conglomerate	ML				
202									
203								(203.0 - 207.0') Soft drilling	
204	120		IRZ-18-VAS-202-207 (<0.17 U ppb) 12/5/2019 13:10				(204.0 - 211.0') Topock - Weathered Bedrock - conglomerate; Sandy silt with gravel (ML); reddish brown (5YR 4/3); low plasticity; some very fine to very coarse grained sand, angular to subangular; little granules to very large pebbles, angular to subangular; little clay; coarser clasts composed of metadiorite; moist; very stiff		
205									
206									
207				Topock - Weathered Bedrock - conglomerate	ML			(207.0 - 214.0') Hard drilling	(207.0 - 217.0') 500 gallons of water used; 50 gallons of water recovered; 450 gallons of water lost
208									
209									
210									
211									
212	120			Topock - Weathered Bedrock - conglomerate	ML		(211.0 - 214.0') Topock - Weathered Bedrock - conglomerate; Sandy silt (ML); reddish brown (5YR 4/3); some very fine to very coarse grained sand, angular to subangular; little granules to large pebbles, angular to subangular; little clay; moist		
213							(213.5'); dry; hard		
214									
215				Topock - Weathered Bedrock - conglomerate	SM		(214.0 - 217.0') Topock - Weathered Bedrock - conglomerate; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to subround; low plasticity; some silt; little granules to large pebbles, angular to subangular; little clay; coarser clasts composed of metadiorite; moist	(214.0 - 217.0') Soft drilling, stopped drilling due to the collection of three ND samples below last detection.	
216									
217									
218							End of Boring at 217.0 ft bgs.		
219									
220									

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Well Construction Log

Sheet: 1 of 11

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
0		Topock - Fill	GW		(0.0 - 0.5') Steel Plate		Note: Steel plates with BMPs in place
1		Topock - Fluvial Deposits	SW				
2							
3					(0.5 - 5.0') Wildcat Washed Plastering Sand	(0.5 - 5.0') 5.5 bags	(0.5 - 5.0') 10 bags (182%) Note: Wildcat Washed, used >20% of the calculated volume due to potential voids forming during drilling
4					(0.0 - 7.0') 10.0" Borehole		
5							
6		Topock - Fluvial Deposits	SW				
7							
8							
9		Topock - Fluvial Deposits	GW				
10		Topock - Fluvial Deposits	SW				
11							
12		Topock - Fluvial Deposits	SW		(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
13					(7.0 - 207.0') 6.0" Borehole		
14							
15		Topock - Fluvial Deposits	SW				
16							
17		Topock - Fluvial Deposits	GW				
18		Topock - Fluvial Deposits	SW-SM				
19							
20							

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ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
21		Topock - Fluvial Deposits	SW-SM				
22							
23							
24		Topock - Alluvium Deposits	SW-SM				
25							
26							
27							
28							
29							
30					(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis; (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
31							
32		Topock - Alluvium Deposits	SW-SM				
33							
34							
35							
36							
37		Topock - Alluvium Deposits	SM				
38							
39							
40							

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

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
41		Topock - Alluvium Deposits	SM				
42							
43							
44	IRZ-18-VAS-42-47 (580 ppb) 11/19/2019 09:20	Topock - Alluvium Deposits	SM				
45							
46							
47							
48							
49							
50					(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis; (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
51							
52		Topock - Alluvium Deposits	SM				
53							
54							
55							
56							
57							
58		Topock - Alluvium Deposits	SM				
59							
60							

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, J = estimated value, NR = no recovery; Notes: blue water table symbol represents depth to water measured during the first VAS interval

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
61							
62							
63		Topock - Alluvium Deposits	SM				
64	IRZ-18-VAS-62-67 (<0.033 U ppb) 11/19/2019 13:05						
65							
66							
67							
68		Topock - Alluvium Deposits	SM				
69	IRZ-18-VAS-67-72 (<0.033 U ppb) 11/19/2019 16:00						
70					(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis; (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
71							
72							
73		Topock - Alluvium Deposits	SM				
74							
75							
76							
77							
78		Topock - Alluvium Deposits	ML				
79							
80							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
81							
82							
83							
84							
85							
86		Topock - Alluvium Deposits	SM				
87							
88							
89							
90					(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis; (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
91							
92							
93		Topock - Alluvium Deposits	ML				
94							
95							
96							
97		Topock - Alluvium Deposits	SM				
98							
99							
100							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
101							
102		Topock - Alluvium Deposits	SM				
103							
104	IRZ-18-VAS-102-107 (<0.17 U ppb) 11/20/2019 11:35						
105							
106		Topock - Alluvium Deposits	ML				
107							
108							
109							
110					(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis; (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
111							
112							
113		Topock - Alluvium Deposits	SM				
114	IRZ-18-VAS-112-117 (<0.17 U ppb) 11/20/2019 14:25						
115							
116							
117							
118		Topock - Alluvium Deposits	ML				
119		Topock - Alluvium Deposits	SM				
120							

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Well Construction Log

Sheet: 7 of 11

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
121		Topock - Alluvium Deposits	SM		(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
122							
123							
124							
125							
126							
127		Topock - Alluvium Deposits	ML				
128							
129		Topock - Alluvium Deposits	ML				
130							
131							
132		Topock - Alluvium Deposits	ML				
133							
134							
135							
136							
137							
138	IRZ-18-VAS-137-142 (<0.17 U ppb) 11/21/2019 15:31						
139							
140							

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ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
141	IRZ-18-VAS-137-142 (<0.17 U ppb) 11/21/2019 15:31	Topock - Alluvium Deposits	ML				
142							
143		Topock - Alluvium Deposits	SM				
144							
145							
146		Topock - Alluvium Deposits	ML				
147							
148							
149	IRZ-18-VAS-147-152 (<0.17 U ppb) 11/21/2019 13:20	Topock - Alluvium Deposits	SM		(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis; (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
150							
151							
152							
153							
154	IRZ-18-VAS-152-157 (<0.17 U ppb) 11/22/2019 09:30	Topock - Alluvium Deposits	SM				
155							
156							
157							
158	IRZ-18-VAS-157-162 (870 ppb) 11/22/2019 12:15	Topock - Alluvium Deposits	SM				
159							
160							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
161	IRZ-18-VAS-157-162 (870 ppb) 11/22/2019 12:15	Topock - Alluvium Deposits	SM				
162							
163							
164	IRZ-18-VAS-162-167 (3300 ppb) 11/22/2019 15:00						
165		Topock - Alluvium Deposits	SM				
166							
167							
168	IRZ-18-VAS-167-172 (4700 ppb) 11/23/2019 10:00						
169							
170		Topock - Alluvium Deposits	SM		(5.0 - 180.0') Cemex #3 MESH (8x20) Lapis Lustre Sand Lapis; (7.0 - 207.0') 6.0" Borehole	(5.0 - 180.0') 70.1 bags	(5.0 - 180.0') 92 bags (131%) Note: Backfill sand, used >20% of the calculated volume due to potential voids forming during drilling
171							
172		Topock - Alluvium Deposits	ML				
173							
174	IRZ-18-VAS-172-177 (660 ppb) 12/3/2019 10:30						
175		Topock - Alluvium Deposits	SM				
176							
177							
178	IRZ-18-VAS-177-182 (390 ppb) 12/3/2019 14:40						
179		Topock - Alluvium Deposits	ML				
180							

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Well Construction Log

Sheet: 10 of 11

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
181	IRZ-18-VAS-177-182 (390 ppb) 12/3/2019 14:40	Topock - Alluvium Deposits	ML				
182							
183	IRZ-18-VAS-182-187 (<0.17 U ppb) 12/4/2019 11:00	Topock - Alluvium Deposits	SM		(180.0 - 190.0') Cemex # 2/12 MESH (12x20) Lapis Lustre Sand	(180.0 - 190.0') 3.9 bags	(180.0 - 190.0') 7 bags (179%) Note: Indicator sand, used >20% of the calculated volume due to potential voids forming during drilling
184							
185							
186							
187							
188	IRZ-18-VAS-187-192 (<0.17 U ppb) 12/4/2019 15:35				(7.0 - 207.0') 6.0" Borehole		
189							
190							
191			NR				
192		Topock - Alluvium Deposits	SM				
193							
194		Topock - Weathered Bedrock - conglomerate	ML		(190.0 - 217.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(190.0 - 217.0') 6.7 buckets	(190.0 - 217.0') 8 buckets (119%) Note: Decommissioned rathole
195							
196							
197							
198		Topock - Weathered Bedrock - conglomerate	ML				
199							
200							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/06/2019	Surface Elevation:	494.67 ft amsl	**Well ID: IRZ-18 Pilot**	
Date Completed:	12/06/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102884.71	Project:	Final GW Remedy Phase 1
Driller Name:	Jose Hernandez	Easting (NAD83):	7615808.83	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / P. Almanza	Borehole Diameter:	4-10 inches		
Logger:	Chris Bonessi	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Kendra Keon	Development End Date:	N/A		
Total Depth:	217 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
201							
202		Topock - Weathered Bedrock - conglomerate	ML		(7.0 - 207.0') 6.0" Borehole		
203							
204	IRZ-18-VAS-202-207 (<0.17 U ppb) 12/5/2019 13:10						
205							
206							
207		Topock - Weathered Bedrock - conglomerate	ML		(190.0 - 217.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(190.0 - 217.0') 6.7 buckets	(190.0 - 217.0') 8 buckets (119%) Note: Decommissioned rathole
208							
209							
210							
211							
212		Topock - Weathered Bedrock - conglomerate	ML		(207.0 - 217.0') 4.0" Borehole		
213							
214							
215		Topock - Weathered Bedrock - conglomerate	SM				
216							
217					End of Boring at 217.0 ft bgs.		
218							
219							
220							

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