Well Construction Log

Sheet: 1 of 10

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
1–20		Topock - Fill	NR		(0.0 - 27.0') 10" SHUR-GRIP SDR17 PVC Casing		
1–3		Topock - Fill	SP		(0.0 - 4.0') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand	(0.0 - 4.0') 9.8 bags	(0.0 - 4.0') 12 bags (122%) Note: Temporary backfill sand to fill annular space prior to vault installation. Used >20% of the calculated volume due to potential voids forming during drilling .
4–7		Topock - Fill	NR				
7–12		Topock - Fill	NR		(4.0 - 15.9') Portland Cement 3% Bentonite Type I, II and V with Hydrogel; (0.0 - 20.3') 18.0" Borehole	(4.0 - 15.9') 108.7 gallons	(4.0 - 15.9') 110 gallons (101%) Note: Grout seal
12–17		Topock - Fill	NR				
16–18					(15.9 - 18.7') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand	(15.9 - 18.7') 6.7 bags	(15.9 - 18.7') 7 bags (104%) Note: Transition sand
17–18		Topock - Fill	NR				
18–20					(18.7 - 58.1') Cemex # 1 C (16x40) Lapis Lustre Sand	(18.7 - 58.1') 96.2 bags	Note: Note: The downhole video camera survey identified a crack in the SHUR-GRIP SDR17 PVC casing at 18.4 to 20.4 ft below top of casing.

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

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 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 - Fill	NR		(19.5 - 20.5') Centralizer; (0.0 - 27.0') 10" SHUR-GRIP SDR17 PVC Casing		
22							
23		Topock - Fill	SP				
24							
25							
26		Topock - Alluvium Deposits	SM				
27					(27.0 - 54.9') 10" 20-Slot 316L SS Wire Wrap Screen		
28		Topock - Alluvium Deposits					
29	IRZ-16-VAS-27.0-32.0 (480 ppb) 2/20/2019 09:46						
30					(18.7 - 58.1') Cemex # 1 C (16x40) Lapis Lustre Sand; (20.3 - 41.2') 18.0" Borehole	(18.7 - 58.1') 96.2 bags	(18.7 - 58.1') 149 bags (155%) Note: Filter pack, swabbed for 60 minutes prior to installation of additional annular materials. Used >20% of the calculated volume due to potential voids forming during drilling.
31		Topock - Alluvium Deposits	SC				
32		Topock - Alluvium Deposits	GW-GM				
33							
34		Topock - Alluvium Deposits	SM				
35							
36							
37							
38		Topock - Alluvium Deposits	ML				
39							
40		Topock - Alluvium Deposits	SM / GW-GM				

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Sheet: 3 of 10

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 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	GW-GM		(27.0 - 54.9') 10" 20-Slot 316L SS Wire Wrap Screen; (20.3 - 41.2') 18.0" Borehole		
42		Topock - Alluvium Deposits	SW-SM				
43							
44							
45							
46							
47							
48							
49		Topock - Alluvium Deposits	SM		(18.7 - 58.1') Cemex # 1 C (16x40) Lapis Lustre Sand	(18.7 - 58.1') 96.2 bags	(18.7 - 58.1') 149 bags (155%) Note: Filter pack, swabbed for 60 minutes prior to installation of additional annular materials. Used >20% of the calculated volume due to potential voids forming during drilling.
50					(41.2 - 60.4') 18.0" Borehole		
51							
52							
53							
54							
55		Topock - Alluvium Deposits	SM		(54.9 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
56							
57							
58	IRZ-16-VAS-57.0-62.0 (<0.33 U ppb) 2/20/2019 14:36	Topock - Alluvium Deposits	SW-SM		(58.1 - 59.0') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand		Note: Filter pack, used >20% of the calculated volume due to potential voids forming during drilling.
59						(59.0 - 146.0') 142.7 buckets	(59.0 - 146.0') 165 buckets (116%) Note: Intermediate seal
60			SM				

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

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 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	IRZ-16-VAS-57.0-62.0 (<0.33 U ppb) 2/20/2019 14:36	Topock - Alluvium Deposits	SM		(54.9 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
62							
63							
64							
65		Topock - Alluvium Deposits	SM				
66							
67							
68		Topock - Alluvium Deposits	SM				
69							
70					(59.0 - 146.0') Bentonite seal pellets Pel-Plug (TR30) 3/8" (69.5 - 70.5') Centralizer	(59.0 - 146.0') 142.7 buckets	(59.0 - 146.0') 165 buckets (116%) Note: Intermediate seal
71					(60.4 - 79.8') 18.0" Borehole		
72		Topock - Alluvium Deposits	ML				
73							
74		Topock - Alluvium Deposits	SM				
75							
76							
77							
78							
79							
80		Topock - Alluvium Deposits	SM				

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 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		Topock - Alluvium Deposits	SW-SM		(54.9 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
82							
83		Topock - Alluvium Deposits	ML				
		Topock - Alluvium Deposits	SW-SM				
84							
85		Topock - Alluvium Deposits	SM				
86							
87							
88		Topock - Alluvium Deposits	ML				
89		Topock - Alluvium Deposits	ML				
90					(59.0 - 146.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(59.0 - 146.0') 142.7 buckets	(59.0 - 146.0') 165 buckets (116%) Note: Intermediate seal
91					(79.8 - 99.5') 18.0" Borehole		
92							
93		Topock - Alluvium Deposits	ML				
94							
95							
96		Topock - Alluvium Deposits	SM				
97							
98		Topock - Alluvium Deposits	ML				
99							
100					(99.5 - 118.1') 16.0" Borehole		

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
101		Topock - Alluvium Deposits	SM		(54.9 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
102							
103		Topock - Alluvium Deposits	SM				
104	IRZ-16-VAS-102-107 (<0.33 U ppb) 2/21/2019 11:51						
105							
106							
107							
108							
109					(99.5 - 118.1') 16.0" Borehole		
110					(59.0 - 146.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(59.0 - 146.0') 142.7 buckets	(59.0 - 146.0') 165 buckets (116%) Note: Intermediate seal
111		Topock - Alluvium Deposits	SM				
112							
113							
114							
115							
116							
117							
118							
119		Topock - Alluvium Deposits	ML		(118.1 - 138.5') 16.0" Borehole		
120							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 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	ML		(54.9 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
122							
123							
124							
125							
126							
127		Topock - Alluvium Deposits	SM				
128							
129					(118.1 - 138.5') 16.0" Borehole		
130					(59.0 - 146.0') Bentonite seal pellets Pel-Plug (TR30) 3/8" (129.5 - 130.5') Centralizer	(59.0 - 146.0') 142.7 buckets	(59.0 - 146.0') 165 buckets (116%) Note: Intermediate seal
131							
132		Topock - Alluvium Deposits	ML				
133		Topock - Alluvium Deposits	GM				
134	IRZ-16-VAS-132-137-EB (<0.17 U ppb) 2/26/2019 13:38						
135							
136							
137		Topock - Alluvium Deposits	SM				
138							
139					(138.5 - 158.2') 16.0" Borehole		
140							

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Well Construction Log

Sheet: 8 of 10

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 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
141–160	IRZ-16-VAS-147.0-152.0 (<0.17 U ppb) 2/27/2019 10:45	Topock - Alluvium Deposits	SM		(54.9 - 155.0') 10" SHUR-GRIP SDR17 PVC Casing		
143		Topock - Alluvium Deposits	ML		(59.0 - 146.0') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(59.0 - 146.0') 142.7 buckets	(59.0 - 146.0') 165 buckets (116%) Note: Intermediate seal
145		Topock - Alluvium Deposits	SM				
146–147		Topock - Alluvium Deposits	ML		(146.0 - 147.6') Cemex #60 Mesh (40x60) Lapis Lustre Sand	(146.0 - 147.6') 2.8 bags	(146.0 - 147.6') 3 bags (107%) Note: Transition sand
148–152		Topock - Alluvium Deposits	SM		(138.5 - 158.2') 16.0" Borehole		
152–154					(147.6 - 194.5') Cemex #1/20 Mesh (20x40) Lapis Lustre Sand	(147.6 - 194.5') 79.3 bags	(147.6 - 194.5') 82.3 bags (104%) Note: Filter pack, swabbed lower screen for approximately 90 minutes prior to the installation of additional annular materials.
155					(155.0 - 186.8') 10" 15-Slot 316L SS Wire Wrap Screen		
156–158		Topock - Alluvium Deposits	ML				
159–160					(158.2 - 177.7') 16.0" Borehole		

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
161		Topock - Alluvium Deposits	ML		(155.0 - 186.8') 10" 15-Slot 316L SS Wire Wrap Screen		
162							
163							
164							
165							
166		Topock - Alluvium Deposits	SM				
167							
168							
169					(158.2 - 177.7') 16.0" Borehole		
170		Topock - Alluvium Deposits	ML		(147.6 - 194.5') Cemex #1/20 Mesh (20x40) Lapis Lustre Sand	(147.6 - 194.5') 79.3 bags	(147.6 - 194.5') 82.3 bags (104%) Note: Filter pack, swabbed lower screen for approximately 90 minutes prior to the installation of additional annular materials.
171							
172							
173							
174	IRZ-16-VAS-172.0-177.0 (110 ppb) 2/27/2019 16:26	Topock - Alluvium Deposits	SW-SM				
175							
176							
177							
178					(177.7 - 179.0') 16.0" Borehole		
179					(179.0 - 194.5') 15.5" Borehole		
180			ML				

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; 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

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	12/05/2019	Surface Elevation:	480.02 ft amsl	**Well ID: IRZ-16**	
Date Completed:	12/11/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Asst:	A. & H. Amezguita	Borehole Diameter:	18-16 inches		
Logger:	Ellen Redner	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	2/10/2020		
Total Depth:	194.45 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		Topock - Alluvium Deposits	ML		(155.0 - 186.8') 10" 15-Slot 316L SS Wire Wrap Screen		
182							
183		Topock - Alluvium Deposits	SM				
184							
185							
186							
187		Topock - Alluvium Deposits	ML		(147.6 - 194.5') Cemex #1/20 Mesh (20x40) Lapis Lustre Sand; (179.0 - 194.5') 15.5" Borehole	(147.6 - 194.5') 79.3 bags	(147.6 - 194.5') 82.3 bags (104%) Note: Filter pack, swabbed lower screen for approximately 90 minutes prior to the installation of additional annular materials.
188							
189							
190					(189.0 - 190.0') Centralizer		
191		Topock - Alluvium Deposits	SM				
192							
193	IRZ-16-VAS-192.0-197.0 (<0.17 U ppb) 2/28/2019 13:41				(186.8 - 192.5') Sump and PVC End Cap		
194							
195					End of Boring at 194.5 ft bgs.		
196							
197							
198							
199							
200							

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Drilling Log

Sheet: 1 of 10

ARCADIS Design & Consultancy for natural and built assets

Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16**
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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
1		NR			(0.0 - 2.0') Topock - Fill; No recovery (NR)	(0.0 - 0.5') Confirmed drill casing was lined up on pilot borehole.	(0.0 - 20.3') 591.4 gallons of water used; 0 gallons of water recovered; 591.4 gallons of water lost
2							
3		SP			(2.0 - 3.2') Topock - Fill; Poorly graded sand (SP); brown (10YR 5/3)		
4					(3.2 - 7.0') Topock - Fill; (NR)		
5		NR					
6							
7					(7.0 - 17.0') Topock - Fill; No recovery (NR)		
8							
9							
10	(0.0 - 20.3) 2.27 mins/ft			(0.0 - 20.3') 18.0" Steel Casing		(10.0') Observed trace amounts of Wildcat Washed Plastering Sand and Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
11							
12		NR					
13							
14							
15							
16							
17					(17.0 - 22.5') Topock - Fill; No recovery (NR)	(17.0 - 19.0') Drill rods chattering	
18		NR					
19							
20							

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-16

Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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		NR				(20.0') Observed some Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	(20.3 - 60.4') 1182.7 gallons of water used; 3018 gallons of water recovered; 1835.3 gallons of water gained
22						(20.3 - 20.8') Very hard/rough drilling	
23					(22.5 - 26.0') Topock - Fill; Poorly graded sand (SP); brown (10YR 5/3)		
24		SP					
25							
26		SM			(26.0 - 27.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3)		
27					(27.0 - 30.5') Topock - Alluvium Deposits; Silty sand with gravel brown (7.5YR 4/4)		
28							
29							
30	(20.3 - 41.2) 3.44 mins/ft			(20.3 - 41.2') 18.0" Steel Casing		(30.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
31		SC			(30.5 - 32.0') Topock - Alluvium Deposits; Clayey sand with gravel (SC); brown (7.5YR 4/3)		
32							
33		GW-GM			(32.0 - 33.3') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM)		
34					(33.3 - 37.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3)		
35		SM					
36							
37							
38		ML			(37.0 - 39.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/2)		
39							
40		SM			(39.0 - 39.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/2)		
		GW-GM					

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Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-16

Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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	(20.3 - 41.2) 3.44 mins/ft	GW-GM		(20.3 - 41.2') 18.0" Steel Casing	(39.5 - 41.3') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); brown (10YR 5/3)	(40.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
42		SW-SM			(41.3 - 43.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4)	(41.2 - 60.4') Smooth drilling	
43							
44					(43.3 - 54.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3)		
45							
46							
47							
48							
49		SM					
50							
51	(41.2 - 60.4) 2.98 mins/ft			(41.2 - 60.4') 18.0" Steel Casing		(50.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
52							
53							
54							
55					(54.5 - 57.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4)		
56		SM					
57							
58					(57.0 - 59.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); reddish brown (5YR 4/3)		
59		SW-SM					
60		SM			(59.5 - 64.8') Topock - Alluvium		

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Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-16

Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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		SM			Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4) and reddish brown / moderate brown (5YR 4/4)	(60.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	(60.4 - 99.5') 858.2 gallons of water used; 4347 gallons of water recovered; 3488.8 gallons of water gained
62							
63						(63.0 - 75.0') Smooth but slow drilling	
64							
65		SM			(64.8 - 67.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3)		
66							
67		SM			(67.0 - 72.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4)		
68							
69							
70	(60.4 - 79.8) 3.86 mins/ft			(60.4 - 79.8') 18.0" Steel Casing		(70.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
71							
72		ML			(72.0 - 73.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); strong brown (7.5YR 4/6)		
73		SM			(73.0 - 79.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4) with reddish brown / moderate brown (5YR 4/4)		
74							
75							
76							
77							
78							
79		SM			(79.0 - 80.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4)		
80							

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Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-16

Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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		SM			(80.5 - 82.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4)	(80.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
82		SW-SM				(82.0 - 99.4') Rough drilling	
83		ML			(82.3 - 82.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/3)red (2.5YR 4/6)		
84		SW-SM			(82.8 - 83.8') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4)		
85		SM			(83.8 - 87.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4)		
86							
87							
88		ML			(87.0 - 88.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4)		
89		ML			(88.8 - 89.8') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4)		
90	(79.8 - 99.5) 3.41 mins/ft			(79.8 - 99.5') 18.0" Steel Casing	(89.8 - 96.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4)	(90.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
91							
92							
93		ML					
94							
95							
96		SM			(96.0 - 96.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/3)		
97		ML			(96.5 - 100.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4)		
98							
99							
100	(99.5 - 118.1) 2.94 mins/ft					(99.5') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	(99.5 - 158.2') 6570 gallons of water used;

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: 6 of 10

Boring No.: IRZ-16

Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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		SM			(100.0 - 101.3') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4)	(100.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	12498 gallons of water recovered; 5928 gallons of water gained
102					(101.3 - 104.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4)		
103		SM					
104							
105					(104.5 - 118.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4)	(105.0 - 111.0') Rough drilling	
106							
107							
108							
109	(99.5 - 118.1) 2.94 mins/ft			(99.5 - 118.1') 16.0" Steel Casing			
110						(110.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
111		SM					
112							
113							
114							
115							
116							
117							
118							
119	(118.1 - 138.5) 1.75 mins/ft	ML		(118.1 - 138.5') 16.0" Steel Casing	(118.0 - 121.5') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown (2.5YR 4/4)		
120							

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Drilling Log

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Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16**
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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		ML				(120.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
122					(121.5 - 132.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
123							
124							
125							
126							
127		SM					
128							
129	(118.1 - 138.5) 1.75 mins/ft			(118.1 - 138.5') 16.0" Steel Casing			
130						(130.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
131							
132							
133		ML			(132.0 - 133.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/3)		
134		GM			(133.0 - 134.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (2.5YR 4/4)		
135					(134.0 - 143.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
136							
137		SM					
138							
139	(138.5 - 158.2) 1.89 mins/ft			(138.5 - 158.2') 16.0" Steel Casing		(139.0 - 142.0') Rough drilling	
140							

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Drilling Log

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Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16**
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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
141		SM				(140.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
142							
143							
144		ML			(143.0 - 144.3') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4)		
145		SM			(144.3 - 145.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); olive brown (2.5Y 4/4)		
146		ML			(145.5 - 147.8') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4)		
147							
148		SM			(147.8 - 155.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
149	(138.5 - 158.2) 1.89 mins/ft			(138.5 - 158.2') 16.0" Steel Casing			
150						(150.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
151							
152							
153							
154							
155							
156		ML			(155.5 - 162.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown (2.5YR 4/4)		
157							
158						(158.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
159	(158.2 - 177.7) 1.81 mins/ft			(158.2 - 177.7') 16.0" Steel Casing			(158.2 - 194.5') 2760 gallons of water used; 12440 gallons of water recovered; 9680 gallons of water gained
160							

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Drilling Log

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Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16**
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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		ML				(160.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
162							
163					(162.8 - 169.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
164							
165						(165.0 - 173.0') Rough drilling	
166		SM					
167							
168							
169	(158.2 - 177.7) 1.81 mins/ft			(158.2 - 177.7') 16.0" Steel Casing			
170		ML			(169.5 - 170.5') Topock - Alluvium Deposits; Sandy silt (ML); olive brown (2.5Y 4/4)	(170.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
171					(170.5 - 179.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); dark reddish brown (2.5YR 3/4)		
172							
173							
174							
175		SW-SM					
176							
177							
178	(177.7 - 179.0) 8.54 mins/ft			(177.7 - 179.0') 16.0" Steel Casing			
179							
180	(179.0 - 194.5) 0.72 mins/ft	ML		(179.0 - 194.5') 15.5" Open Hole	(179.5 - 182.0') Topock -		

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

Sheet: 10 of 10

Date Started:	11/21/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16**
Date Completed:	12/04/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	194.5 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:	17 5/8" & 15 5/8" Tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	26.3 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			Alluvium Deposits; Sandy silt with gravel (ML); reddish brown (2.5YR 4/4)	(180.0') Observed trace amounts of Cal-Silica 1/4"-3/8" Pea Gravel in drill cuttings.	
182							
183		SM			(182.0 - 187.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
184							
185							
186							
187	(179.0 - 194.5) 0.72 mins/ft	ML		(179.0 - 194.5') 15.5" Open Hole	(187.0 - 187.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown (2.5YR 4/4)		
188		SM			(187.8 - 194.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4)		
189							
190						(190.0') Observed trace amounts of Monterey #3 in drill cuttings.	
191							
192							
193							
194						(194.0') Observed trace amounts of Monterey #3 in drill cuttings.	
195					End of Boring at 194.5 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

Boring No.: IRZ-16 Pilot

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches		
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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
1–2				Topock - Fill	NR		(0.0 - 2.0') Topock - Fill; No recovery (NR); No recovery dredge sands sloughed in during advancement of 12 inch conductor casing	(0.0 - 7.0') Loose dredge sands falling out of core barrel causing poor recovery.	(0.0 - 217.0') No water used
2–3				Topock - Fill	SP		(2.0 - 3.2') Topock - Fill; Poorly graded sand (SP); brown (10YR 5/3); very fine grained to medium grained, subround to round; trace silt; trace clay; dry		
3–7	14.4			Topock - Fill	NR		(3.2 - 7.0') Topock - Fill; (NR); No recovery loose dredge sands falling out of core barrel could not provide core will accurate depths		
7–17	0			Topock - Fill	NR		(7.0 - 17.0') Topock - Fill; No recovery (NR); No recovery loose dredge sands falling out of core barrel and sloughing into hole, could not provide core with accurate depths	(7.0 - 17.0') Loose dredge sands continuously fell out of core barrel.	
17–20	54			Topock - Fill	NR		(17.0 - 22.5') Topock - Fill; No recovery (NR); No recovery unclear at what depth core sample was lost. Based on drilling native material at bottom of core started at approximately 26 ft bgs and is representative	(17.0 - 27.0') Poor recovery maybe due to compaction of loose dredge sands, drilling change at approximately 25 ft. bgs.	

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16 Pilot**
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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				Topock - Fill	NR				
22									
23	54	IRZ-16-SS-22.0-27.0 3/7/2019 14:15		Topock - Fill	SP		(22.5 - 26.0') Topock - Fill; Poorly graded sand (SP); brown (10YR 5/3); very fine grained to medium grained, subround to round; trace silt; trace clay; moist; contact depths unclear due to poor recovery, moisture due to water added during drilling (23.5'); dry		
24									
25									
26				Topock - Alluvium Deposits	SM		(26.0 - 27.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to round; little granules to large pebbles, angular to subround; little silt; trace organics; moist to wet; organics in sit lens at top		
27								(27.0') Approximate depth to water table.	
28	60	IRZ-16-SS-22.0-27.0 3/7/2019 14:20	IRZ-16-VAS-27.0-32.0 (480 ppb) 2/20/2019 09:46	Topock - Alluvium Deposits			(27.0 - 30.5') Topock - Alluvium Deposits; Silty sand with gravel brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet		
29							(29.5'); increase in silt content		
30									
31				Topock - Alluvium Deposits	SC		(30.5 - 32.0') Topock - Alluvium Deposits; Clayey sand with gravel (SC); brown (7.5YR 4/3); very fine grained to very coarse grained, angular to subround; little granules to large pebbles, angular to subangular; little clay; trace silt; coarser clasts composed of metadiorite; wet		
32				Topock - Alluvium Deposits	GW-GM		(32.0 - 33.3') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); granules to large pebbles, angular to subround; some very fine to very coarse grained sand, angular to subround; little silt; trace clay; coarser clasts composed of metadiorite; wet		
33									
34	300	IRZ-16-SS-32.0-37.0 3/7/2019 14:25		Topock - Alluvium Deposits	SM		(33.3 - 37.0') 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 subround; trace clay; coarser clasts composed of metadiorite; wet		
35									
36									
37									
38		IRZ-16-SS-37.0-42.0 3/7/2019 14:30		Topock - Alluvium Deposits	ML		(37.0 - 39.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/2); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to large pebbles, angular to subround; little clay; moist to wet		
39									
40				Topock - Alluvium Deposits	SM / GW-GM		(39.0 - 39.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/2); very fine grained to very coarse grained, angular to subround; little granules to large pebbles, angular to subround;		

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-16 Pilot

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches		
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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	300	IRZ-16-SS-37.0-42.0 3/7/2019 14:30		Topock - Alluvium Deposits	GW-GM		little silt; trace clay; wet (39.5 - 41.3') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); brown (10YR 5/3); granules to large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; little silt; trace very large pebbles, angular; trace clay; coarser clasts composed of metadiorite; wet; dense		
42				Topock - Alluvium Deposits	SW-SM		(41.3 - 43.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subangular; little silt; wet		
43									
44		IRZ-16-SS-42.0-47.0 3/7/2019 14:35					(43.3 - 54.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet		
45									
46									
47									
48									
49		IRZ-16-SS-47.0-52.0 3/7/2019 14:40		Topock - Alluvium Deposits	SM				
50									
51									
52									
53		IRZ-16-SS-52.0-57.0 3/7/2019 14:45							
54									
55									
56				Topock - Alluvium Deposits	SM		(54.5 - 57.0') 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 angular; trace clay; coarser clasts composed of metadiorite; wet (55.5'); little silt; increase in sand		
57									
58	120	IRZ-16-SS-57.0-62.0 3/7/2019 14:50	IRZ-16-VAS-57.0-62.0 (<0.33 U ppb) 2/20/2019 14:36	Topock - Alluvium Deposits	SW-SM		(57.0 - 59.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); reddish brown (5YR 4/3); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; coarser clast composed of conglomerate; wet	(57.0 - 62.0') Adjusted sample interval based on geology, sandier zone with less fines.	
59									
60					SM		(59.5 - 64.8') Topock - Alluvium Deposits; Silty sand with gravel		

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-16 Pilot

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches		
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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	120	IRZ-16-SS-57.0-62.0 3/7/2019 14:50	IRZ-16-VAS-57.0-62.0 (<0.33 U ppb) 2/20/2019 14:36	Topock - Alluvium Deposits	SM		(SM); brown (7.5YR 4/4) and reddish brown / moderate brown (5YR 4/4); very fine grained to very coarse grained; rapid dilatency; some granules to very large pebbles, angular to subround; little silt; trace subangular; coarser clasts composed of metadiorite; coarser clast composed of conglomerate; wet		
62									
63									
64		IRZ-16-SS-62.0-67.0 3/7/2019 14:55							
65				Topock - Alluvium Deposits	SM		(64.8 - 67.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to very coarse grained, angular to subround; some granules to large pebbles, angular to subangular; some silt; coarser clasts composed of metadiorite; wet		
66									
67									
68	240	IRZ-16-SS-67.0-72.0 3/7/2019 15:00		Topock - Alluvium Deposits	SM		(67.0 - 72.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet		
69									
70									
71									
72				Topock - Alluvium Deposits	ML		(72.0 - 73.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); strong brown (7.5YR 4/6); low plasticity; and very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subangular; trace angular; coarser clasts composed of metadiorite; moist to wet		
73		IRZ-16-SS-72.0-77.0 3/7/2019 15:05		Topock - Alluvium Deposits	SM		(73.0 - 79.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4) 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 angular; coarser clasts composed of metadiorite; wet (75.5'); increase in silt, decrease in sand		
74									
75									
76									
77									
78		IRZ-16-SS-77.0-82.0 3/7/2019 15:10							
79									
80				Topock - Alluvium Deposits	SM		(79.0 - 80.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); some silt; little granules to very large pebbles, angular to subround; wet		

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16 Pilot**
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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	240	IRZ-16-SS-77.0-82.0 3/7/2019 15:10			SM				
				Topock - Alluvium Deposits	SW-SM		(80.5 - 82.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet		
82				Topock - Alluvium Deposits	ML		(82.3 - 82.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/3)red (2.5YR 4/6); low plasticity; some very fine to very coarse grained sand, angular to subangular; little granules to very large pebbles, angular to subround; coarser clasts composed of metadiorite; hard; iron oxide staining		
83				Topock - Alluvium Deposits	SW-SM				
84		IRZ-16-SS-82.0-87.0 3/7/2019 15:15		Topock - Alluvium Deposits	SM		(82.8 - 83.8') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet		
85							(83.8 - 87.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subangular; some silt; coarser clasts composed of metadiorite; wet		
86									
87									
88	240	IRZ-16-SS-87.0-92.0 3/7/2019 15:20		Topock - Alluvium Deposits	ML		(87.0 - 88.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4); low plasticity; some granules to large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to round; trace clay; moist; hard	(87.0 - 107.0') Drilling was hard, formation tight, core came out hot and steaming moist to wet.	
89				Topock - Alluvium Deposits	ML		(88.8 - 89.8') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to medium pebbles, angular to subangular; trace clay; moist; hard		
90				Topock - Alluvium Deposits	ML		(89.8 - 96.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4); low plasticity; some granules to large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to round; trace clay; moist; hard		
91									
92									
93									
94		IRZ-16-SS-92.0-97.0 3/7/2019 15:25							
95									
96				Topock - Alluvium Deposits	SM		(96.0 - 96.5') 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 large pebbles, angular to subangular; coarser clasts composed of metadiorite; dry	(96.0 - 96.5') Dry.	
97									
98		IRZ-16-SS-97.0-102.0 3/7/2019 15:30		Topock - Alluvium Deposits	ML		(96.5 - 100.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 4/4); low plasticity; some granules to large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to round; trace; trace clay; moist; hard		
99									
100									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: blue water table symbol represents depth to water 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:	02/19/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16 Pilot**
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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	240	IRZ-16-SS-97.0-102.0 3/7/2019 15:30	IRZ-16-VAS-102-107 (<0.33 U ppb) 2/21/2019 11:51	Topock - Alluvium Deposits	SM		(100.0 - 101.3') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subround; some silt; little clay; coarser clasts composed of metadiorite; moist to dry		
102							(101.3 - 104.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (7.5YR 4/4); very fine grained to very coarse grained, angular to subround; little granules to large pebbles, angular to subangular; little silt; trace clay; moist to dry		
103				Topock - Alluvium Deposits	SM				
104		IRZ-16-SS-102.0-107.0 3/7/2019 15:35							
105							(104.5 - 118.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4); very fine grained to very coarse grained, angular to round; some granules to medium pebbles, angular to subangular; some silt; coarser clasts composed of metadiorite; moist to wet		
106									
107							(107'); some granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite, no clay; wet		
108									
109		IRZ-16-SS-107.0-112.0 3/7/2019 15:37					(109'); trace cobble		
110							(109.5'); no cobbles		
111				Topock - Alluvium Deposits	SM				
112									
113	240								
114		IRZ-16-SS-112.0-117.0 3/7/2019 15:40							
115									
116									
117									
118		IRZ-16-SS-117.0-122.0 3/7/2019 15:45							
119				Topock - Alluvium Deposits	ML		(118.0 - 121.5') Topock - Alluvium Deposits; Sandy silt with gravel (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 subangular; trace; trace boulders, subangular; trace clay; coarser clasts composed of metadiorite; moist; very stiff		
120									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16 Pilot**
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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		IRZ-16-SS-117.0-122.0 3/7/2019 15:45		Topock - Alluvium Deposits	ML				
122							(121.5 - 132.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to round; some granules to very large pebbles, angular to subangular; some silt; coarser clasts composed of metadiorite; wet		
123	240								
124		IRZ-16-SS-122.0-127.0 3/7/2019 15:50							
125									
126									
127				Topock - Alluvium Deposits	SM		(127'); little silt; increase in sand		
128							(127.5'); some silt; wet		
129		IRZ-16-SS-127.0-132.0 3/7/2019 15:55					(129'); some silt; wet; increase in silt, decrease in sand		
130									
131									
132	120			Topock - Alluvium Deposits	ML		(132.0 - 133.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); brown (7.5YR 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; coarser clasts composed of metadiorite; wet; very stiff		
133				Topock - Alluvium Deposits	GM		(133.0 - 134.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (2.5YR 4/4); granules to very large pebbles, angular; some very fine to very coarse grained sand, angular to subround; trace angular; coarser clasts composed of metadiorite; wet		
134		IRZ-16-SS-132.0-137.0 3/7/2019 13:00	IRZ-16-VAS-132-137 (<0.17 U ppb) 2/26/2019 13:38						
135							(134.0 - 143.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subround; little silt; wet		
136									
137				Topock - Alluvium Deposits	SM			(137.0 - 147.0') Soils were soft to drill through, core barrel was full, 144.5 to 147 ft. bgs sediments very wet , poor recovery may	
138									
139	210	IRZ-16-SS-137.0-142.0 3/7/2019 13:05							
140									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16 Pilot**
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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		IRZ-16-SS-137.0-142.0 3/7/2019 13:05		Topock - Alluvium Deposits	SM			be due to soft wet soils expanding in bags.	
142									
143				Topock - Alluvium Deposits	ML		(143.0 - 144.3') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4); low plasticity; some fine to very coarse grained sand, angular to subround; trace granules to large pebbles, angular to subangular; moist to wet		
144		IRZ-16-SS-142.0-147.0 3/7/2019 13:10					(144'); trace angular to subangular		
145				Topock - Alluvium Deposits	SM		(144.3 - 145.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); olive brown (2.5Y 4/4); very fine grained to very coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; wet		
146				Topock - Alluvium Deposits	ML		(145.5 - 147.8') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (2.5YR 4/4); medium plasticity; some very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subangular; wet; very soft		
147									
148	210	IRZ-16-SS-147.01-152.0 3/7/2019 13:15	IRZ-16-VAS-147.0-152.0 (<0.17 U ppb) 2/27/2019 10:45	Topock - Alluvium Deposits	SM		(147.8 - 155.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to subround; some silt; little granules to very large pebbles, angular to subangular; wet		
149							(149.5'); little silt; increase in sand		
150									
151							(151'); trace clay; decrease in sand		
152									
153							(152.5'); some granules to very large pebbles, angular to subangular; decrease in sand		
154		IRZ-16-SS-152.0-157.0 3/7/2019 13:20							
155									
156				Topock - Alluvium Deposits	ML		(155.5 - 162.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown (2.5YR 4/4); low plasticity; some very fine to very coarse grained sand, angular to round; little granules to very large pebbles, angular to subangular; coarser clasts composed of metadiorite; moist to wet; very stiff		
157									
158	240	IRZ-16-SS-157.0-162.0 3/7/2019 13:25					(158'); trace boulder		
159							(158.5'); no boulders		
160									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16 Pilot**
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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	240	IRZ-16-SS-157.0-162.0 3/7/2019 13:25		Topock - Alluvium Deposits	ML				
162									
163		IRZ-16-SS-162.0-167.0 3/7/2019 13:30		Topock - Alluvium Deposits	SM		(162.8 - 169.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained, angular to subround; little granules to very large pebbles, angular to subangular; little silt; coarser clasts composed of metadiorite; wet		
164									
165									
166									
167							(167'); increase in silt, decrease in sand		
168									
169		IRZ-16-SS-167.0-172.0 3/7/2019 13:35							
170				Topock - Alluvium Deposits	ML		(169.5 - 170.5') Topock - Alluvium Deposits; Sandy silt (ML); olive brown (2.5Y 4/4); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to medium pebbles, angular to subangular; wet; very stiff		
171				Topock - Alluvium Deposits	SW-SM		(170.5 - 179.5') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); dark reddish brown (2.5YR 3/4); very fine grained to very coarse grained, angular to subangular; some granules to large pebbles, angular to subround; little silt; coarser clasts composed of metadiorite; wet		
172									
173									
174		IRZ-16-SS-172.01-177.0 3/7/2019 13:45	IRZ-16-VAS-172.0-177.0 (110 ppb) 2/27/2019 16:26						
175									
176									
177								(177.0 - 187.0') Drilling through soils was soft, softer sediments compacted in core bag causing poor	
178	210	IRZ-16-SS-177.0-182.0 3/7/2019 13:50							
179									
180					ML		(179.5 - 182.0') Topock - Alluvium Deposits; Sandy silt with gravel		

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl	**Boring No.:**	**IRZ-16 Pilot**
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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		IRZ-16-SS-177.0-182.0 3/7/2019 13:50		Topock - Alluvium Deposits	ML		(ML); reddish brown (2.5YR 4/4); low plasticity; and very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subround; coarser clasts composed of metadiorote; moist to wet	recovery, core barrel was full.	
182									
183		IRZ-16-SS-182.0-187.0 3/7/2019 16:26		Topock - Alluvium Deposits	SM		(182.0 - 187.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained; little granules to large pebbles, angular to subangular; little silt; wet		
184									
185									
186									
187				Topock - Alluvium Deposits	ML		(187.0 - 187.8') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown (2.5YR 4/4); low plasticity; and very fine to very coarse grained sand, angular to subround; little granules to very large pebbles, angular to subround; trace angular; coarser clasts composed of metadiorote; moist to wet; some metadiorite pebbles highly weathered	(187.0 - 197.0') Tight formation.	
188	210								
189		IRZ-16-SS-187.0-192.0 3/7/2019 13:55					(187.8 - 197.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (2.5YR 4/4); very fine grained to very coarse grained; little granules to very large pebbles, angular to subangular; little silt; wet		
190							(189.5'); some silt; trace subangular; decrease in sand		
191									
192				Topock - Alluvium Deposits	SM		(192'); little silt; increase in sand		
193									
194			IRZ-16-VAS-192.0-197.0 (<0.17 U ppb) 2/28/2019 13:41						
195									
196									
197							(196.75') black (10YR 2/1); possible organics		
198	120			Topock - Alluvium Deposits	SW-SM		(197.0 - 198.3') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); very fine grained to very coarse grained, angular to subround; little granules to large pebbles, angular to subround; little silt; coarser clasts composed of metadiorote; wet		
199				Topock - Weathered Bedrock - conglomerate	ML		(198.3 - 204.5') Topock - Weathered Bedrock - conglomerate; Sandy silt with gravel (ML); reddish brown (2.5YR 4/4); low plasticity; some very fine to very coarse grained sand, angular to subround; little granules to large pebbles, angular to subround;		
200									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-16 Pilot

Date Started:	02/19/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	02/28/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	26.3 ft bgs		
Drilling Asst:	L. Amaya / O. Flores	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Sean McGrane	Sampling Interval:	Continuous		
Editor:	Michael Andrews	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	120			Topock - Weathered Bedrock - conglomerate	ML		trace clay; coarser clast composed of conglomerate; moist to wet; very stiff	(202.0 - 203.0') Rough drilling. (203.0 - 207.0') Hard drilling.	
202									
203									
204									
205				Topock - Competent Bedrock - conglomerate			(204.5 - 207.0') Topock - Competent Bedrock - conglomerate; reddish brown (2.5YR 4/4); moist to dry; moderate cementation; friable		
206									
207							End of Boring at 207.0 ft bgs.		
208									
209									
210									
211									
212									
213									
214									
215									
216									
217									
218									
219									
220									

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Temporary Backfill Log

ARCADIS Design & Consultancy for natural and built assets

Sheet: 1 of 11

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
1		Topock - Fill	NR		(0.0 - 0.5') Steel Plate		Note: Steel plate BMPs in place
2							
3		Topock - Fill	SP		(0.5 - 5.0') Wildcat Washed Plastering Sand	(0.5 - 5.0') 7.9 bags	(0.5 - 5.0') 7 bags (89%) Note: Surface seal sand
4							
5		Topock - Fill	NR		(0.0 - 9.0') 12" Borehole		
6							
7							
8							
9							
10							
11							
12		Topock - Fill	NR		(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
13							
14							
15					(9.0 - 207.0') 6" Borehole		
16							
17							
18		Topock - Fill	NR				
19							
20							

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Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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 - Fill	NR				
22							
23		Topock - Fill	SP				
24							
25							
26		Topock - Alluvium Deposits	SM				
27							
28		Topock - Alluvium Deposits					
29	IRZ-16-VAS-27.0-32.0 (480 ppb) 2/20/2019 09:46						
30					(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel; (9.0 - 207.0') 6" Borehole	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
31		Topock - Alluvium Deposits	SC				
32							
33		Topock - Alluvium Deposits	GW-GM				
34							
35		Topock - Alluvium Deposits	SM				
36							
37							
38		Topock - Alluvium Deposits	ML				
39							
40		Topock - Alluvium Deposits	SM / GW-GM				

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, BMP = Best Management Practices for stormwater, U = not detected above the laboratory reporting limit, NR = no recovery;

Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 3 of 11

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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	GW-GM				
42		Topock - Alluvium Deposits	SW-SM				
43							
44							
45							
46							
47							
48							
49		Topock - Alluvium Deposits	SM				
50					(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel; (9.0 - 207.0') 6" Borehole	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
51							
52							
53							
54							
55		Topock - Alluvium Deposits	SM				
56							
57							
58	IRZ-16-VAS-57.0-62.0 (<0.33 U ppb) 2/20/2019 14:36	Topock - Alluvium Deposits	SW-SM				
59							
60			SM				

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, BMP = Best Management Practices for stormwater, U = not detected above the laboratory reporting limit, NR = no recovery;

Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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	IRZ-16-VAS-57.0-62.0 (<0.33 U ppb) 2/20/2019 14:36	Topock - Alluvium Deposits	SM				
62							
63							
64							
65		Topock - Alluvium Deposits	SM				
66							
67		Topock - Alluvium Deposits	SM		(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel; (9.0 - 207.0') 6" Borehole	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
68							
69							
70							
71							
72		Topock - Alluvium Deposits	ML				
73		Topock - Alluvium Deposits	SM				
74							
75							
76							
77							
78							
79							
80		Topock - Alluvium Deposits	SM				

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Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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, SW-SM		(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel; (9.0 - 207.0') 6" Borehole	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
82							
83		Topock - Alluvium Deposits	ML, SW-SM				
84							
85		Topock - Alluvium Deposits	SM				
86							
87							
88		Topock - Alluvium Deposits	ML				
89		Topock - Alluvium Deposits	ML				
90		Topock - Alluvium Deposits	ML				
91							
92							
93							
94							
95							
96		Topock - Alluvium Deposits	SM				
97							
98		Topock - Alluvium Deposits	ML				
99							
100							

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Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
101		Topock - Alluvium Deposits	SM				
102							
103		Topock - Alluvium Deposits	SM				
104	IRZ-16-VAS-102-107 (<0.33 U ppb) 2/21/2019 11:51						
105							
106							
107							
108							
109							
110					(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel; (9.0 - 207.0') 6" Borehole	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
111		Topock - Alluvium Deposits	SM				
112							
113							
114							
115							
116							
117							
118							
119		Topock - Alluvium Deposits	ML				
120							

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Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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	ML				
122							
123							
124							
125							
126		Topock - Alluvium Deposits	SM				
127							
128							
129							
130					(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
131							
132		Topock - Alluvium Deposits	ML		(9.0 - 207.0') 6" Borehole		
133		Topock - Alluvium Deposits	GM				
134	IRZ-16-VAS-132-137 (<0.17 U ppb) 2/26/2019 13:38						
135							
136							
137		Topock - Alluvium Deposits	SM				
138							
139							
140							

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Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl	Client:	PG&E
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08		
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
141		Topock - Alluvium Deposits	SM				
142							
143							
144		Topock - Alluvium Deposits	ML				
145		Topock - Alluvium Deposits	SM				
146		Topock - Alluvium Deposits	ML				
147							
148							
149	IRZ-16-VAS-147.0-152.0 (<0.17 U ppb) 2/27/2019 10:45						
150					(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
151		Topock - Alluvium Deposits	SM				
152							
153							
154							
155							
156							
157							
158		Topock - Alluvium Deposits	ML				
159							
160							

(9.0 - 207.0') 6" Borehole

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Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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
161–162		Topock - Alluvium Deposits	ML				
163–169		Topock - Alluvium Deposits	SM				
170		Topock - Alluvium Deposits	ML		(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel; (9.0 - 207.0') 6" Borehole	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
171–173		Topock - Alluvium Deposits	SW-SM				
174–177	IRZ-16-VAS-172.0-177.0 (110 ppb) 2/27/2019 16:26						
178–179							
180			ML				

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Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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		Topock - Alluvium Deposits	ML		(5.0 - 182.0') Cal-Silica 1/4"x3/8" pea gravel	(5.0 - 182.0') 78.8 bags	(5.0 - 182.0') 83 bags (105%) Note: Backfill gravel
182							
183		Topock - Alluvium Deposits	SM				
184							
185							
186							
187		Topock - Alluvium Deposits	ML		(182.0 - 192.0') Cemex #3 MESH (8x10) Lapis Lustre Sand	(182.0 - 192.0') 4.2 bags	(182.0 - 192.0') 4 bags (95%) Note: Indicator sand
188							
189							
190					(9.0 - 207.0') 6" Borehole		
191							
192		Topock - Alluvium Deposits	SM				
193							
194	IRZ-16-VAS-192.0-197.0 (<0.17 U ppb) 2/28/2019 13:41						
195							
196					(192.0 - 207.0') Bentonite seal chips Puregold medium chips	(192.0 - 207.0') 4.4 bags	(192.0 - 207.0') 4 bags (91%) Note: Decommissioned rathole
197							
198		Topock - Alluvium Deposits	SW-SM				
199		Topock - Weathered Bedrock - conglomerate	ML				
200							

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ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 11 of 11

Well ID: IRZ-16 Pilot

Date Started:	03/01/2019	Surface Elevation:	480.02 ft amsl		
Date Completed:	03/01/2019	Northing (NAD83):	2103041.42		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.08	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	207 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	L. Amaya / O. Flores	Depth to First Water:	26.3 ft bgs		
Logger:	Sean McGrane	Editor:	Michael Andrews	Project Number:	RC000753.0051

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		Topock - Weathered Bedrock - conglomerate	ML		(192.0 - 207.0') Bentonite seal chips Puregold medium chips; (9.0 - 207.0') 6" Borehole	(192.0 - 207.0') 4.4 bags	(192.0 - 207.0') 4 bags (91%) Note: Decommissioned rathole
202							
203							
204							
205		Topock - Competent Bedrock - conglomerate					
206							
207							
208							
209							
210							
211							
212							
213							
214							
215							
216							
217							
218							
219							
220							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, BMP = Best Management Practices for stormwater, U = not detected above the laboratory reporting limit, NR = no recovery;

Notes: blue water table symbol represents depth to water measured during the first VAS interval; granular backfill material was removed during overdrilling of the pilot borehole