Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	04/12/2019	Surface Elevation:	497.71 ft amsl	**Well ID: IRZ-20**	
Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 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 - Fluvial Deposits	GW-GM		(0.0 - 49.0') 10" SHUR-GRIP SDR17 PVC Casing; (0.0 - 5.0') Cemex #0/30 sand	(0.0 - 5.0') 25 bags	(0.0 - 5.0') 30 bags (120%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling.
5		Topock - Fluvial Deposits	SP-SM				
6		Topock - Fluvial Deposits	SM				
7–13		Topock - Fluvial Deposits	SM		(0.0 - 23.3') 24.0" Borehole; (5.0 - 34.5') Portland Cement 3% Bentonite Type I, II and V with Hydrogel	(5.0 - 34.5') 439.1 gallons	(5.0 - 34.5') 485.3 gallons (111%) Note: Grout seal
14		Topock - Fluvial Deposits	SM				
16		Topock - Fluvial Deposits	SM				
18–20		Topock - Fluvial Deposits	GM				

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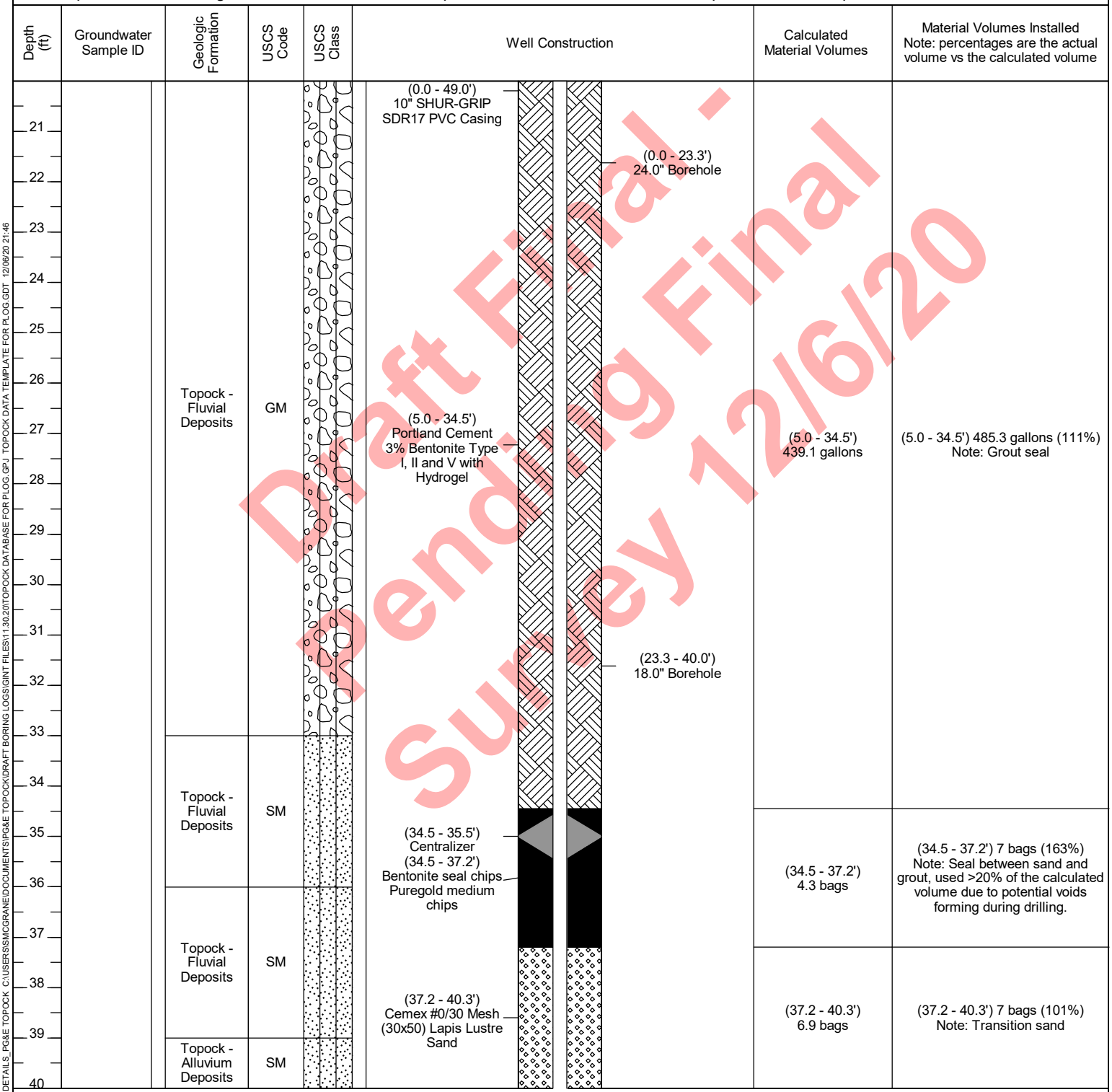
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		



Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
(5.0 - 34.5') 439.1 gallons	(5.0 - 34.5') 485.3 gallons (111%) Note: Grout seal
(34.5 - 37.2') 4.3 bags	(34.5 - 37.2') 7 bags (163%) Note: Seal between sand and grout, used >20% of the calculated volume due to potential voids forming during drilling.
(37.2 - 40.3') 6.9 bags	(37.2 - 40.3') 7 bags (101%) Note: Transition sand

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Well Construction Log

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Date Started:	04/12/2019	Surface Elevation:	497.71 ft amsl	**Well ID: IRZ-20**	
Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
41		Topock - Alluvium Deposits	SM		(0.0 - 49.0') 10" SHUR-GRIP SDR17 PVC Casing		
42							
43							
44							
45							
46							
47							(40.3 - 73.3') 129 bags (173%) Note: Filter pack, used >20% of the calculated volume due to potential voids froming during drilling. Swabbed filter pack for approximately 48 minutes prior to installation of additional annular materials.
48		Topock - Alluvium Deposits	GM		(40.3 - 73.3') Cemex # 1 C (16x40) Lapis Lustre Sand		
49							
50					(49.0 - 71.0') 10" 316LStainless Steel Wire Wrap (20-slot) Screen	(40.3 - 73.3') 74.6 bags	
51							
52							
53	IRZ-20-VAS-51-56 (150 ppb) 10/20/2018 11:40						
54							
55							
56		Topock - Alluvium Deposits	SM				
57							
58		Topock - Alluvium Deposits	SM				
59							
60					(40.0 - 59.8') 18" Borehole		

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Date Started:	04/12/2019	Surface Elevation:	497.71 ft amsl	**Well ID: IRZ-20**	
Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 ft bgs	Well Completion:	☐ Flush ☐ Stick-up ☒ To Be Completed in Well Vault		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
61		Topock - Alluvium Deposits	SM		(49.0 - 71.0') 10" 316LStainless Steel Wire Wrap (20-slot) Screen		
62							
63							
64							
65							
66		Topock - Alluvium Deposits	ML			(40.3 - 73.3') 74.6 bags	
67							
68							
69		Topock - Alluvium Deposits	ML		(59.8 - 78.9') 18" Borehole		
70							
71					(71.0 - 136.0') 10" SHUR-GRIP SDR17 PVC Casing		
72		Topock - Alluvium Deposits	ML				
73							
74					(73.3 - 75.4') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand	(73.3 - 75.4') 4.7 bags	(73.3 - 75.4') 6 bags (128%) Note: Transition sand, used >20% of the calculated volume due to potential voids forming during drilling.
75							
76							
77		Topock - Alluvium Deposits	ML		(75.4 - 125.6') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(75.4 - 125.6') 90.9 buckets	(75.4 - 125.6') 148 buckets (163%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
78							
79							
80					(78.9 - 99.9') 18" Borehole		

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Date Started:	04/12/2019	Surface Elevation:	497.71 ft amsl	**Well ID: IRZ-20**	
Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 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	ML		(79.5 - 80.5') Centralizer; (71.0 - 136.0') 10" SHUR-GRIP SDR17 PVC Casing		
82							
83							
84	IRZ-20-VAS-82-87 (<0.033 U ppb) 10/21/2018 14:45						
85							
86							
87							
88							
89							
90		Topock - Alluvium Deposits	SM		(75.4 - 125.6') Bentonite seal pellets Pel-Plug (TR30) 3/8"; (78.9 - 99.9') 18" Borehole	(75.4 - 125.6') 90.9 buckets	(75.4 - 125.6') 148 buckets (163%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
91							
92							
93							
94							
95							
96							
97							
98							
99							
100							

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Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 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
101–107		Topock - Alluvium Deposits	SM		(71.0 - 136.0') 10" SHUR-GRIP SDR17 PVC Casing		
107–109		Topock - Alluvium Deposits	SM				
109–112		Topock - Alluvium Deposits	ML		(75.4 - 125.6') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(75.4 - 125.6') 90.9 buckets	(75.4 - 125.6') 148 buckets (163%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
112–117	IRZ-20-VAS-112-117 (<0.17 U ppb) 10/22/2018 14:02	Topock - Alluvium Deposits	ML		(99.9 - 119.9') 18" Borehole		
117–120		Topock - Alluvium Deposits	ML				

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Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 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		(119.5 - 120.5') Centralizer; (71.0 - 136.0') 10" SHUR-GRIP SDR17 PVC Casing	(75.4 - 125.6') 90.9 buckets	(75.4 - 125.6') 148 buckets (163%) Note: Intermediate seal, used >20% of the calculated volume due to potential voids forming during drilling.
122							
123		Topock - Alluvium Deposits	GM		(75.4 - 125.6') Bentonite seal pellets Pel-Plug (TR30) 3/8"		
124							
125		Topock - Alluvium Deposits	ML				
126					(125.6 - 127.2') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand	(125.6 - 127.2') 3.5 bags	(125.6 - 127.2') 4 bags (114%) Note: Transition sand
127		Topock - Alluvium Deposits	ML				
128							
129							
130					(119.9 - 139.9') 18" Borehole		
131							
132	IRZ-20-SS-131-136 (<0.17 U ppb) 10/23/2018 13:25	Topock - Alluvium Deposits	SM		(127.2 - 163.3') Cemex # 1 C (16x40) Lapis Lustre Sand	(127.2 - 163.3') 86 bags	(127.2 - 163.3') 123 bags (143%) Note: Filter pack, used >20% of the calculated volume due to potential voids froming during drilling. Swabbed filter pack for approximately 75 minutes prior to installation of additional annular materials.
133							
134							
135							
136					(136.0 - 155.0') 10" 316LStainless Steel Wire Wrap (20-slot) Screen		
137		Topock - Weathered Bedrock - conglomerate	SM				
138							
139							
140							

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Well Construction Log

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ARCADIS Design & Consultancy for natural and built assets

Date Started:	04/12/2019	Surface Elevation:	497.71 ft amsl	**Well ID: IRZ-20**	
Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 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					(136.0 - 155.0') 10" 316LStainless Steel Wire Wrap (20-slot) Screen		
142							
143							
144							
145							
146							
147							
148		Topock - Weathered Bedrock - conglomerate	SM				
149							(127.2 - 163.3') 123 bags (143%) Note: Filter pack, used >20% of the calculated volume due to potential voids froming during drilling. Swabbed filter pack for approximately 75 minutes prior to installation of additional annular materials.
150					(127.2 - 163.3') Cemex # 1 C (16x40) Lapis Lustre Sand; (139.9 - 159.9') 18" Borehole	(127.2 - 163.3') 86 bags	
151							
152							
153							
154							
155							
156							
157							
158		Topock - Weathered Bedrock - conglomerate	ML		(157.0 - 158.0') Centralizer		
159							
160					(155.0 - 160.0')		

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ARCADIS Design & Consultancy for natural and built assets

Well ID: IRZ-20

Date Started:	04/12/2019	Surface Elevation:	497.71 ft amsl		
Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 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
161–180	IRZ-20-VAS-173-178 (<0.83 U ppb) 10/24/2018 14:12	Topock - Weathered Bedrock - conglomerate	CL		Sump and PVC End Cap; (127.2 - 163.3') Cemex # 1 C (16x40) Lapis Lustre Sand; (159.9 - 179.9') 18" Borehole; (163.3 - 188.1') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(127.2 - 163.3') 86 bags	(127.2 - 163.3') 123 bags (143%) Note: Filter pack, used >20% of the calculated volume due to potential voids froming during drilling. Swabbed filter pack for approximately 75 minutes prior to installation of additional annular materials.
		Topock - Weathered Bedrock - conglomerate	ML			(163.3 - 188.1') 68.6 buckets	(163.3 - 188.1') 71 buckets (103%) Note: Decommissioned rathole

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Well Construction Log

Sheet: 10 of 10

Well ID: IRZ-20

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Date Completed:	04/23/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	18-24 inches		
Logger:	David Cornell	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	5/30/2019		
Total Depth:	188.1 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 - Competent Bedrock - conglomerate			(179.9 - 180.0') 18" Borehole		
182							
183							
184		Topock - Competent Bedrock - conglomerate			(163.3 - 188.1') Bentonite seal pellets Pel-Plug (TR30) 3/8"	(163.3 - 188.1') 68.6 buckets	(163.3 - 188.1') 71 buckets (103%) Note: Decommissioned rathole
185					(180.0 - 188.1') 17.5" Borehole		
186							
187							
188			NR		End of Boring at 188.1 ft bgs.		
189							
190							
191							
192							
193							
194							
195							
196							
197							
198							
199							
200							

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Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-20

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs		
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches		
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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
1–4	(0.0 - 23.3) 10.37 mins/ft	GW-GM		(0.0 - 23.3') 24.0" Steel Casing Note: Removed after during well installtion	(0.0 - 4.0') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); very pale brown (10YR 8/3)	(0.0 - 8.0') Losing air to the formation, not getting any cuttings back.	(0.0 - 23.3') 400 gallons of water used; 200 gallons of water recovered; 200 gallons of water lost
5		SP-SM			(4.0 - 5.5') Topock - Fluvial Deposits; Poorly graded sand with silt (SP-SM); very pale brown (10YR 8/3)		
6		SM			(5.5 - 7.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3)		
7–10		SM			(7.0 - 13.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3)	(8.0 - 8.5') Started getting fines and water back at 8 ft bgs.	
11–14		SM			(13.0 - 15.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3)	(13.0 - 13.5') Rough drilling	
15–16		SM			(15.0 - 17.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3)		
17–20		GM			(17.0 - 33.0') Topock - Fluvial Deposits; Silty gravel with sand (GM); grayish brown (10YR 5/2)	(17.0 - 17.5') Rough drilling	

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Drilling Log

Sheet: 2 of 10

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20**
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run (ft) and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling notes and observations confirming presence of temporary backfill material in drill cuttings	Drilling Fluid
21				(0.0 - 23.3') 24.0" Steel Casing Note: Removed after during well installtion			
22	(0.0 - 23.3) 10.37 mins/ft					(22.0 - 23.3') Conductor casing down to 23.3 ft bgs.	
23							
24							(23.3 - 40.0') 200 gallons of water used; 100 gallons of water recovered; 100 gallons of water lost
25						(25.0 - 33.0') Rough drilling	
26		GM					
27							
28							
29							
30							
31				(23.3 - 40.0') 18.0" Steel Casing Note: Removed after during well installtion			
32	(23.3 - 40.0) 8.91 mins/ft						
33					(33.0 - 36.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); brown (10YR 5/3)		
34		SM					
35							
36					(36.0 - 39.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); brown (10YR 4/3)		
37		SM					
38						(38.0 - 39.0') Rough drilling	
39					(39.0 - 47.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); grayish brown (10YR 5/2)		
40		SM					

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Drilling Log

Sheet: 3 of 10

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20**
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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						(41.0 - 56.0') smooth driling	(40.0 - 59.8') 260 gallons of water used; 100 gallons of water recovered; 160 gallons of water lost
42							
43		SM					
44							
45							
46							
47					(47.0 - 56.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); brown (10YR 4/3)		
48							
49							
50	(40.0 - 59.8) 2.68 mins/ft			(40.0 - 59.8') 18" Steel Casing Note: Removed after during well installtion			
51		GM					
52							
53							
54							
55							
56							
57		SM			(56.0 - 57.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark grayish brown / dark yellowish brown (10YR 4/2)		
58		SM			(57.0 - 65.0') Topock - Alluvium Deposits; Silty sand (SM); yellowish brown / moderate yellowish brown (10YR 5/4)		
59							
60							

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20**
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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					(59.8 - 79.9') 500 gallons of water used; 350 gallons of water recovered; 150 gallons of water lost
62							
63							
64							
65					(65.0 - 69.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (10YR 5/3)		
66		ML					
67							
68							
69	(59.8 - 78.9) 4.99 mins/ft			(59.8 - 78.9') 18" Steel Casing Note: Removed after during well installtion			
70		ML			(69.0 - 71.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4)		
71					(71.0 - 77.0') Topock - Alluvium Deposits; Silt with sand (ML); brown (7.5YR 4/4)		
72							
73							
74		ML				(74.0 - 75.0') Rough drilling	
75							
76							
77							
78					(77.0 - 83.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4)		
79		ML					
80	(78.9 - 99.9) 3.81 mins/ft						

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-20

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl		
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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		ML					(79.9 - 99.9') 220 gallons of water used; 2600 gallons of water recovered; 2380 gallons of water gained
82							
83					(83.0 - 107.0') Topock - Alluvium Deposits; Silty sand (SM); brown (10YR 4/3)		
84							
85							
86							
87							
88							
89				(78.9 - 99.9') 18" Steel Casing Note: Removed after during well installtion			
90	(78.9 - 99.9) 3.81 mins/ft						
91							
92		SM					
93							
94							
95							
96							
97							
98							
99							
100							

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Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-20

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs		
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches		
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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							(99.9 - 119.9') 200 gallons of water used; 5000 gallons of water recovered; 4800 gallons of water gained
102							
103		SM					
104							
105							
106							
107							
108		SM			(107.0 - 109.0') Topock - Alluvium Deposits; Sandy silt with gravel (SM); brown (7.5YR 4/3)		
109							
110	(99.9 - 119.9) 5.70 mins/ft			(99.9 - 119.9') 18" Steel Casing Note: Removed after during well installtion	(109.0 - 117.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (10YR 4/3)		
111							
112							
113		ML					
114							
115							
116							
117							
118		ML			(117.0 - 123.0') Topock - Alluvium Deposits; Sandy silt (ML); strong brown (7.5YR 4/6)		
119							
120							

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Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: IRZ-20

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl		
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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					(119.9 - 139.9') 200 gallons of water used; 4700 gallons of water recovered; 4500 gallons of water gained
122							
123							
124		GM			(123.0 - 124.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); yellowish brown / moderate yellowish brown (10YR 5/4)		
125		ML			(124.5 - 127.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/3)		
126							
127							
128		ML			(127.0 - 131.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown (5YR 4/4)		
129				(119.9 - 139.9') 18" Steel Casing Note: Removed after during well installtion			
130	(119.9 - 139.9) 4.75 mins/ft						
131							
132		SM			(131.0 - 136.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 5/3)		
133							
134							
135							
136							
137		SM			(136.5 - 157.0') Topock - Weathered Bedrock - conglomerate; Silty sand (SM); reddish brown (5YR 5/4)		
138							
139							
140							

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-20

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl		
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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							(139.9 - 159.9') 220 gallons of water used; 4900 gallons of water recovered; 4680 gallons of water gained
142							
143							
144							
145							
146							
147							
148							
149		SM					
150	(139.9 - 159.9) 4.95 mins/ft			(139.9 - 159.9') 18" Steel Casing Note: Removed after during well installtion			
151							
152							
153							
154							
155							
156							
157					(157.0 - 160.0') Topock - Weathered Bedrock - conglomerate; Sandy silt (ML); brown (7.5YR 5/4)		
158		ML					
159							
160							

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-20

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl		
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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		CL			(160.0 - 166.0') Topock - Weathered Bedrock - conglomerate; Lean clay with sand (CL); brown (10YR 4/3)		(159.9 - 179.9') 200 gallons of water used; 2150 gallons of water recovered; 1950 gallons of water gained
162							
163							
164							
165							
166		ML			(166.0 - 179.5') Topock - Weathered Bedrock - conglomerate; Sandy silt with gravel (ML); dark yellowish brown (10YR 3/6)		
167							
168							
169							
170	(159.9 - 179.9) 3.70 mins/ft			(159.9 - 179.9') 18" Steel Casing Note: Removed after during well installtion			
171							
172							
173							
174							
175							
176							
177							
178							
179							
180					(179.5 - 182.0') Topock -		

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ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-20

Date Started:	03/31/2019	Surface Elevation:	497.71 ft amsl		
Date Completed:	04/12/2019	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	188.1 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	24 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	18 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	17.5 inch tricone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	44.6 ft bgs		
Rig Geologist:	David Cornell	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	(179.9 - 180.0) mins/ft			(179.9 - 180.0') 18" Steel Casing Note: Removed after during well installtion	Competent Bedrock - conglomerate; dark yellowish brown (10YR 4/4)	(179.9 - 188.1') Rough drilling	220 gallons used; 900 gallons recovered; 680 gallons gained
182					(182.0 - 187.0') Topock - Competent Bedrock - conglomerate; yellowish red (5YR 4/6)		
183							
184	(180.0 - 188.1) 6.30 mins/ft			(180.0 - 188.1') 17.5" Open Hole			
185							
186							
187					(187.0 - 188.1') (NR)		
188		NR					
	End of Boring at 188.1 ft bgs.						
189							
190							
191							
192							
193							
194							
195							
196							
197							
198							
199							
200							

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-20 Pilot

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
1–4	60			Topock - Fluvial Deposits	GW-GM		(0.0 - 4.0') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); very pale brown (10YR 8/3); granules to very large pebbles, angular to subround; and very fine to very coarse grained sand, angular to round; little silt; trace angular to subangular; dry		(0.0 - 187.0') No water used
4–5				Topock - Fluvial Deposits	SP-SM		(4.0 - 5.5') Topock - Fluvial Deposits; Poorly graded sand with silt (SP-SM); very pale brown (10YR 8/3); very fine grained to fine grained, angular to subround; little silt; dry; homogeneous		
6–7				Topock - Fluvial Deposits	SM		(5.5 - 7.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3); very fine grained to very coarse grained, angular to round; and silt; trace granule to small pebbles, angular to subround; dry		
8–12	66			Topock - Fluvial Deposits	SM		(7.0 - 13.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3); fine grained to fine grained, angular to round; little silt; dry		
13–15				Topock - Fluvial Deposits	SM		(13.0 - 15.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3); very fine grained to very coarse grained, angular to subround; little silt; trace granules to very large pebbles, angular to subround; trace angular to subround; dry		
15–17				Topock - Fluvial Deposits	SM		(15.0 - 17.0') Topock - Fluvial Deposits; Silty sand (SM); very pale brown (10YR 8/3); very fine grained to fine grained, angular to subround; little silt; dry		
17–20	120			Topock - Fluvial Deposits	GM		(17.0 - 33.0') Topock - Fluvial Deposits; Silty gravel with sand (GM); grayish brown (10YR 5/2); very fine grained to coarse grained, angular to round; some fine to very coarse grained sand, angular to round; little silt; little clay; trace angular to subangular; dry		

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; 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

Sheet: 2 of 10

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20 Pilot**
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
21									
22								(22.0 - 36.0') Open borehole collapsed overnight between 10/18/18 to 10/19/18.	
23									
24									
25									
26				Topock - Fluvial Deposits	GM				
27									
28	120								
29									
30									
31									
32									
33									
34				Topock - Fluvial Deposits	SM		(33.0 - 36.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to coarse grained, angular to round; some silt; little clay; trace granules to very large, angular to subround; dry		
35									
36									
37				Topock - Fluvial Deposits	SM		(36.0 - 39.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); brown (10YR 4/3); very fine grained to very coarse grained, angular to subangular; little granule to very large pebbles, angular to subround; little silt; dry; strong cementation		
38	96								
39									
40				Topock - Alluvium Deposits	SM		(39.0 - 47.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); grayish brown (10YR 5/2); very fine grained to very coarse grained, angular to subangular; and granule to very large pebbles,		

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Boring Log

Sheet: 3 of 10

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20 Pilot**
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
41							angular to subround; little silt; trace clay; dry		
42									
43									
44	96			Topock - Alluvium Deposits	SM				
45									
46									
47		IRZ-20-SS-45-50 10/30/2018 12:00							
48							(47.0 - 56.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); brown (10YR 4/3); granules to large pebbles, angular to subangular; some very fine to coarse grained sand, angular to subround; little silt; moist	(48.0') Soil starts getting moist.	
49									
50									
51				Topock - Alluvium Deposits	GM				
52	114	IRZ-20-SS-50-55 10/30/2018 12:02							
53			IRZ-20-VAS-51-56 (150 ppb) 10/20/2018 11:40						
54									
55									
56				Topock - Alluvium Deposits	SM		(56.0 - 57.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); dark grayish brown / dark yellowish brown (10YR 4/2); very fine grained to coarse grained, angular to subround; some granule to large pebbles, angular to subangular; some silt; wet		
57		IRZ-20-SS-55-60 10/30/2018 12:04							
58	96			Topock - Alluvium Deposits	SM		(57.0 - 65.0') Topock - Alluvium Deposits; Silty sand (SM); yellowish brown / moderate yellowish brown (10YR 5/4); very fine grained to fine grained, angular to subround; and silt; trace granule to medium pebbles, angular to subround; moist		
59									
60									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20 Pilot**
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
61									
62		IRZ-20-SS-60-65 10/30/2018 12:06		Topock - Alluvium Deposits	SM				
63									
64	96								
65									
66		IRZ-20-SS-65-70 10/30/2018 12:08		Topock - Alluvium Deposits	ML		(65.0 - 69.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (10YR 5/3); no plasticity; some very fine to coarse grained sand, angular to subround; little small pebbles, angular to subangular; moist		
67									
68									
69				Topock - Alluvium Deposits	ML		(69.0 - 71.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4); no plasticity; some fine to coarse grained sand, angular to subround; little granule to small pebbles, angular to subangular; moist		
70									
71		IRZ-20-SS-70-75 10/30/2018 12:10		Topock - Alluvium Deposits	ML		(71.0 - 77.0') Topock - Alluvium Deposits; Silt with sand (ML); brown (7.5YR 4/4); no plasticity; little very fine to coarse grained sand, angular to subround; trace granule to medium pebbles, angular to subangular; trace clay; moist		
72									
73									
74									
75									
76									
77		IRZ-20-SS-75-80 10/30/2018 12:12		Topock - Alluvium Deposits	ML		(77.0 - 83.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/4); no plasticity; some very fine to medium grained sand, angular to subround; trace granule, angular to subangular; wet		
78									
79	114								
80									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 5 of 10

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20 Pilot**
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
81				Topock - Alluvium Deposits	ML				
82		IRZ-20-SS-80-85 10/30/2018 12:14							
83							(83.0 - 107.0') Topock - Alluvium Deposits; Silty sand (SM); brown (10YR 4/3); very fine grained to coarse grained, angular to subround; and silt; little granule to small pebbles, angular to subangular; wet		
84	114		IRZ-20-VAS-82-87 (<0.033 U ppb) 10/21/2018 10:37						
85									
86									
87		IRZ-20-SS-85-90 10/30/2018 12:16							
88									
89									
90				Topock - Alluvium Deposits	SM				
91									
92	132	IRZ-20-SS-90-95 10/30/2018 12:18							
93									
94									
95									
96									
97		IRZ-20-SS-95-100 11/30/2018 12:20							
98									
99	120								
100									

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Boring Log

Sheet: 6 of 10

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20 Pilot**
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
101									
102		IRZ-20-SS-100-105 10/30/2018 12:22							
103				Topock - Alluvium Deposits	SM				
104	120								
105									
106									
107		IRZ-20-SS-105-110 10/30/2018 12:24							
108				Topock - Alluvium Deposits	SM		(107.0 - 109.0') Topock - Alluvium Deposits; Sandy silt with gravel (SM); brown (7.5YR 4/3); fine grained to coarse grained, angular to subround; and silt; little granule to small pebbles, angular to subangular; wet		
109									
110							(109.0 - 117.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (10YR 4/3); no plasticity; some fine to coarse grained sand, angular to subround; trace granule, angular to subround; trace clay; wet		
111									
112	103.2	IRZ-20-SS-110-115 10/30/2018 12:26							
113				Topock - Alluvium Deposits	ML				
114			IRZ-20-VAS-112-117 (<0.17 U ppb) 10/22/2018 14:02						
115									
116									
117		IRZ-20-SS-115-120 10/30/2018 12:28							
118				Topock - Alluvium Deposits	ML		(117.0 - 123.0') Topock - Alluvium Deposits; Sandy silt (ML); strong brown (7.5YR 4/6); no plasticity; little granule to medium pebbles, angular to subangular; little fine to coarse grained sand, angular to subround; wet		
119	132								
120									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-20 Pilot

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
121				Topock - Alluvium Deposits	ML				
122		IRZ-20-SS-120-125 10/30/2018 12:30							
123				Topock - Alluvium Deposits	GM		(123.0 - 124.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); yellowish brown / moderate yellowish brown (10YR 5/4); granules to very large pebbles, angular to subangular; some silt; little very fine to coarse grained sand, angular to subangular; moist		
124	132								
125				Topock - Alluvium Deposits	ML		(124.5 - 127.0') Topock - Alluvium Deposits; Sandy silt (ML); brown (7.5YR 4/3); no plasticity; little granule to medium pebbles, angular to subangular; little fine to coarse grained sand, angular to subround; moist		
126									
127		IRZ-20-SS-125-130 10/30/2018 12:32							
128				Topock - Alluvium Deposits	ML		(127.0 - 131.0') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown (5YR 4/4); no plasticity; some fine grained sand, angular to subround; trace granule to small pebbles, angular to subangular; wet		
129									
130									
131									
132	132	IRZ-20-SS-130-135 10/30/2018 12:34	IRZ-20-VAS-131-136 (<0.17 U ppb) 10/23/2018 12:00	Topock - Alluvium Deposits	SM		(131.0 - 136.5') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 5/3); fine grained to coarse grained, angular to subround; some silt; little granule to medium pebbles, subangular to round; wet		
133									
134									
135									
136									
137		IRZ-20-SS-135-140 10/30/2018 12:36							
138				Topock - Alluvium Deposits	SM		(136.5 - 157.0') Topock - Alluvium Deposits; Silty sand (SM); reddish brown (5YR 5/4); very fine grained to coarse grained, angular to subangular; and silt; little granule to very large pebbles, angular to subangular; wet; granules and pebbles are composed of metadiorite		
139	132								
140									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20 Pilot**
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
141									
142		IRZ-20-SS-140-145 10/30/2018 12:38							
143	132								
144									
145									
146		IRZ-20-SS-145-150 10/30/2018 12:40							
147									
148				Topock - Alluvium Deposits	SM				
149									
150									
151		IRZ-20-SS-150-155 10/30/2018 12:42							
152	132								
153									
154									
155									
156									
157		IRZ-20-SS-155-160 10/30/2018 12:44							
158				Topock - Weathered Bedrock - conglomerate	ML		(157.0 - 160.0') Topock - Weathered Bedrock - conglomerate; Sandy silt (ML); brown (7.5YR 5/4); no plasticity; and fine to coarse grained sand, angular to subround; trace granule, angular to subangular; trace clay; moist	(157.0 - 167.0') Soil core hot and dry, lost approximately 2 ft. of core down hole, tripped back in to retrieve lost core.	
159	132								
160									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	**Boring No.:**	**IRZ-20 Pilot**
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
161							(160.0 - 166.0') Topock - Weathered Bedrock - conglomerate; Lean clay with sand (CL); brown (10YR 4/3); low plasticity; some small to medium pebbles, angular to subangular; some fine to coarse grained sand, angular to subround; little silt; trace angular to subangular; dry		
162		IRZ-20-SS-160-165 10/30/2018 12:46		Topock - Weathered Bedrock - conglomerate	CL				
163	132								
164									
165									
166									
167		IRZ-20-SS-165-170 10/30/2018 12:48					(166.0 - 179.5') Topock - Weathered Bedrock - conglomerate; Sandy silt with gravel (ML); dark yellowish brown (10YR 3/6); medium plasticity; some fine to coarse grained sand, angular to subround; little granule to small pebbles, angular to subangular; wet		
168									
169									
170									
171									
172	87.6	IRZ-20-SS-170-175 10/30/2018 12:50		Topock - Weathered Bedrock - conglomerate	ML				
173									
174									
175			IRZ-20-VAS-173-178 (<0.83 U ppb) 10/24/2018 18:52						
176									
177		IRZ-20-SS-175-180 10/30/2018 12:52						(177.0 - 182.0') Very rough drilling, had refusal at 182', tripped out and make another run for 182-187'.	
178	79.2								
179									
180							(179.5 - 182.0') Topock - Competent Bedrock - conglomerate;		

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-20 Pilot

Date Started:	10/18/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/25/2018	Northing (NAD83):	2102761.41	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs		
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Eddie Ramoes	Depth to First Water:	44.6 ft bgs		
Drilling Asst:	T. Alymer/C. Alverez	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	Connor Mills	Sampling Interval:	Continuous		
Editor:	Sean McGrane	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Recovery (in)	Sieve Sample ID	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Soil Description	Drilling Notes	Drilling Fluid
181	79.2	IRZ-20-SS-180-187 10/30/2018 12:54		Topock - Competent Bedrock - conglomerate			dark yellowish brown (10YR 4/4); dry; moderate cementation; friable		
182									
183	58.8			Topock - Competent Bedrock - conglomerate			(182.0 - 187.0') Topock - Competent Bedrock - conglomerate; yellowish red (5YR 4/6); moist; weak cementation; friable	(182.0 - 187.0') Had to vibe the core barrel and lost the core downhole, retrieved with flapper bit, sediment were very wet due to lost of core in the borehole.	
184									
185									
186									
187							End of Boring at 187.0 ft bgs.		
188									
189									
190									
191									
192									
193									
194									
195									
196									
197									
198									
199									
200									

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ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 1 of 10

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	**Well ID: IRZ-20 Pilot**	
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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 - Fluvial Deposits	GW-GM		(0.0 - 0.5') Steel Plate		Note: Steel plates with BMPs in place
2							
3							
4		Topock - Fluvial Deposits	SP-SM		(0.0 - 9.0') 12" Borehole		
5					(0.5 - 10.0') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand	(0.5 - 10.0') 7.9 bags	(0.5 - 10.0') 8 bags (101%) Note: Surface sand seal
6		Topock - Fluvial Deposits	SM				
7							
8		Topock - Fluvial Deposits	SM				
9							
10							
11							
12							
13		Topock - Fluvial Deposits	SM				
14							
15					(9.0 - 177.0') 6" Borehole		
16		Topock - Fluvial Deposits	SM		(10.0 - 177.0') Wildcat Washed Plastering Sand	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
17							
18		Topock - Fluvial Deposits	GM				
19							
20							

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; 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-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches		
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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							
22							
23							
24							
25							
26		Topock - Fluvial Deposits	GM				
27							
28							
29							
30					(10.0 - 177.0') Wildcat Washed Plastering Sand; (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
31							
32							
33		Topock - Fluvial Deposits	SM				
34							
35							
36		Topock - Fluvial Deposits	SM				
37							
38							
39		Topock - Alluvium Deposits	SM				
40							

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; 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-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches		
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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
41–47		Topock - Alluvium Deposits	SM				
47–51		Topock - Alluvium Deposits	GM		(10.0 - 177.0') Wildcat Washed Plastering Sand; (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
51–56	IRZ-20-VAS-51-56 (150 ppb) 10/20/2018 11:40						
56–57		Topock - Alluvium Deposits	SM				
57–60		Topock - Alluvium Deposits	SM				

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Temporary Backfill Log

ARCADIS Design & Consultancy for natural and built assets

Well ID: IRZ-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches		
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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
61–65		Topock - Alluvium Deposits	SM				
65–69		Topock - Alluvium Deposits	ML				
69–71		Topock - Alluvium Deposits	ML		(10.0 - 177.0') Wildcat Washed Plastering Sand; (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
71–77		Topock - Alluvium Deposits	ML				
77–80		Topock - Alluvium Deposits	ML				

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Temporary Backfill Log

ARCADIS Design & Consultancy for natural and built assets

Well ID: IRZ-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches		
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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	ML				
82							
83							
84	IRZ-20-VAS-82-87 (<0.033 U ppb) 10/21/2018 10:37						
85							
86							
87							
88							
89							
90					(10.0 - 177.0') Wildcat Washed Plastering Sand; (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
91		Topock - Alluvium Deposits	SM				
92							
93							
94							
95							
96							
97							
98							
99							
100							

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Temporary Backfill Log

ARCADIS Design & Consultancy for natural and built assets

Well ID: IRZ-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches		
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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		(10.0 - 177.0') Wildcat Washed Plastering Sand; (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
102							
103							
104							
105							
106							
107		Topock - Alluvium Deposits	SM				
108							
109							
110		Topock - Alluvium Deposits	ML				
111							
112							
113	IRZ-20-VAS-112-117 (<0.17 U ppb) 10/22/2018 14:02						
114							
115							
116							
117							
118		Topock - Alluvium Deposits	ML				
119							
120							

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Temporary Backfill Log

Sheet: 7 of 10

Well ID: IRZ-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23		
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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		Topock - Alluvium Deposits	GM				
124							
125		Topock - Alluvium Deposits	ML				
126							
127							
128		Topock - Alluvium Deposits	ML				
129							
130					(10.0 - 177.0') Wildcat Washed Plastering Sand; (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
131							
132							
133	IRZ-20-VAS-131-136 (<0.17 U ppb) 10/23/2018 12:00	Topock - Alluvium Deposits	SM				
134							
135							
136							
137		Topock - Alluvium Deposits	SM				
138							
139							
140							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, BMP = Best Management Practices for stormwater, U = not detected above the laboratory reporting limit; 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-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl		
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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
141–160		Topock - Alluvium Deposits	SM		(10.0 - 177.0') Wildcat Washed Plastering Sand; (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
157–160		Topock - Weathered Bedrock - conglomerate	ML				

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ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl	Client:	PG&E
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches		
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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							
163		Topock - Weathered Bedrock - conglomerate	CL				
164							
165							
166							
167							
168					(10.0 - 177.0') Wildcat Washed Plastering Sand (9.0 - 177.0') 6" Borehole	(10.0 - 177.0') 46.7 bags	(10.0 - 177.0') 68 bags (146%) Note: Backfill sand, used >20% of the calcualated volume due to potential voids forming during drilling.
169							
170							
171							
172		Topock - Weathered Bedrock - conglomerate	ML				
173							
174							
175	IRZ-20-VAS-173-178 (<0.83 U ppb) 10/24/2018 18:52						
176							
177							
178					(177.0 - 187.0') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand (177.0 - 187.0') 4" Borehole	(177.0 - 187.0') 2.8 bags	(177.0 - 187.0') 2 bags (71%) Note: Indicator sand, used <20% of the calcualated volume due to potential formation collapse.
179							
180							

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ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-20 Pilot

Date Started:	10/30/2018	Surface Elevation:	497.71 ft amsl		
Date Completed:	10/31/2018	Northing (NAD83):	2102761.41		
Drilling Co.:	Cascade	Easting (NAD83):	7615814.23	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	187 ft bgs	Project:	Final GW Remedy Phase 1
Driller Name:	Eddie Ramoes	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Drilling Asst:	T. Alymer/C. Alverez	Depth to First Water:	44.6 ft bgs		
Logger:	Connor Mills	Editor:	Sean McGrane	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 - Competent Bedrock - conglomerate			(177.0 - 187.0') Cemex #0/30 Mesh (30x50) Lapis Lustre Sand; (177.0 - 187.0') 4" Borehole	(177.0 - 187.0') 2.8 bags	(177.0 - 187.0') 2 bags (71%) Note: Indicator sand, used <20% of the calcualated volume due to potential formation collapse.
182							
183							
184		Topock - Competent Bedrock - conglomerate					
185							
186							
187							
188							
189							
190							
191							
192							
193							
194							
195							
196							
197							
198							
199							
200							

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; 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