ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Sheet: 1 of 9

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

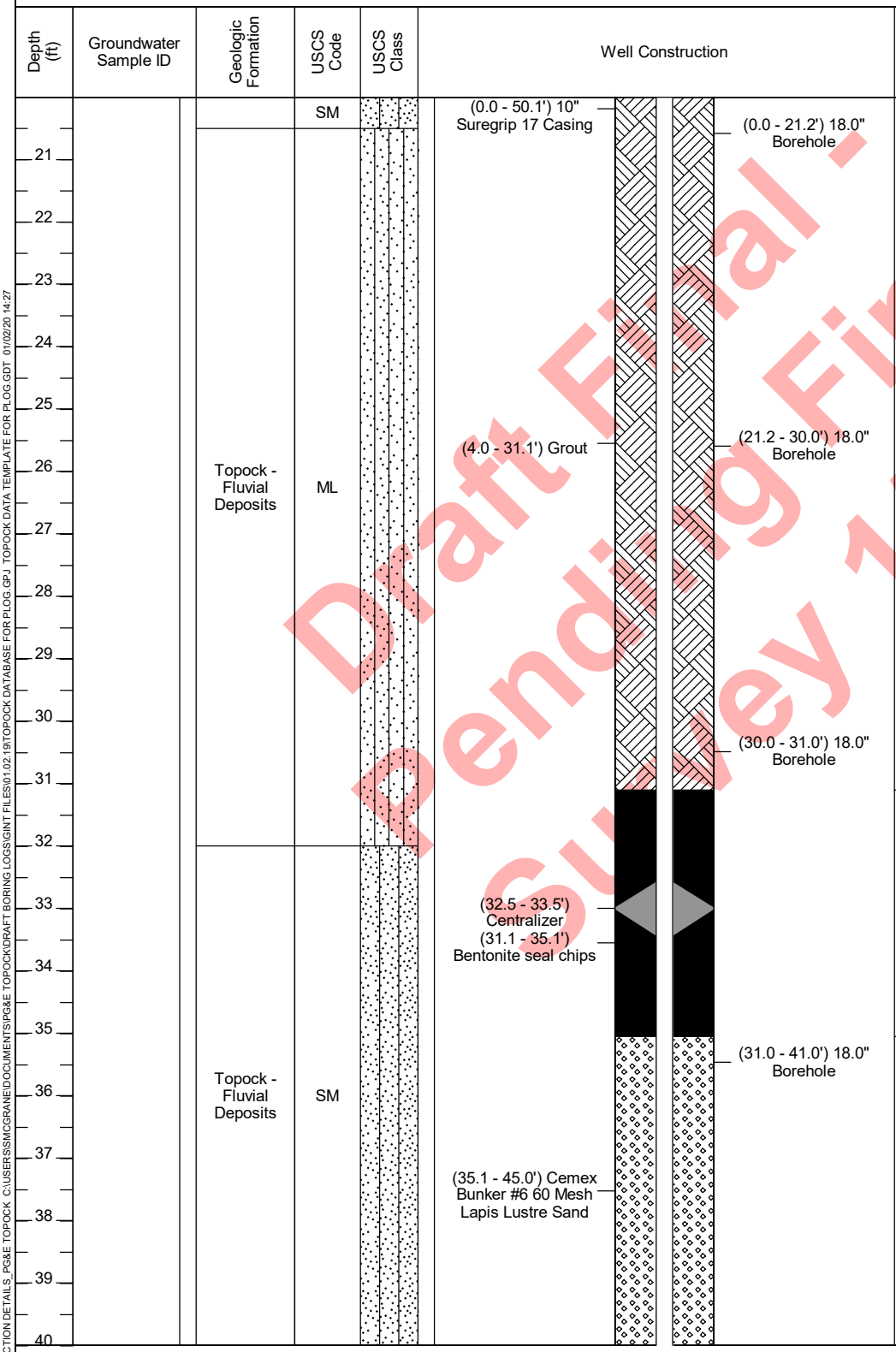
Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
1–4		Topock - Fluvial Deposits	SP-SM		(0.0 - 50.1') 10" Suregrip 17 Casing; (0.0 - 4.0') Cemex #0/30 MESH	(0.0 - 4.0') 9 bags	(0.0 - 4.0') 17 bags (89%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potentialvoids forming during drilling
5–11		Topock - Fluvial Deposits	SP-SM		(0.0 - 21.2') 18.0" Borehole		
12–17		Topock - Fluvial Deposits	SW-SM		(4.0 - 31.1') Grout	(4.0 - 31.1') 211.4 gallons	(4.0 - 31.1') 413 gallons (95%) Note: Type I, II, and V 3% Benseal, grout not tagged will be tagged in morning, used > 20% of the calculated volume due to potentail grout migration and voids forming during drilling
18–20		Topock - Fluvial Deposits	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, groundwater data was collected during drilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		



Calculated Material Volumes	Material Volumes Installed
(4.0 - 31.1') 211.4 gallons	(4.0 - 31.1') 413 gallons (95%) Note: Type I, II, and V 3% Benseal, grout not tagged will be tagged in morning, used > 20% of the calculated volume due to potentail grout migration and voids forming during drilling
(31.1 - 35.1') 6.3 bags	(31.1 - 35.1') 17 bags (170%) Note: Puregold Medium Chips, bentonite installed because of concerns with grout migration due potential large void from 29 to 32 ft. bgs, used >20% of the calculated volume due to potential voids forming during drilling
(35.1 - 45.0') 16.6 bags	(35.1 - 45.0') 51 bags (207%) Note: Lapis Lustre Sand, used >20% of the claulated volume due to potential voids forming during drilling

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, groundwater data was collected during drilling of the pilot borehole

Well Construction Log

Sheet: 3 of 9

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
41		Topock - Fluvial Deposits	GM		(0.0 - 50.1') 10" Suregrip 17 Casing; (31.0 - 41.0') 18.0" Borehole		
42					(41.0 - 43.0') 16.0" Borehole		
43					(35.1 - 45.0') Cemex Bunker #6 60 Mesh Lapis Lustre Sand	(35.1 - 45.0') 16.6 bags	(35.1 - 45.0') 51 bags (207%) Note: Lapis Lustre Sand, used >20% of the claulated volume due to potential voids forming during drilling
44							
45		Topock - Fluvial Deposits	GW-GM				
46							
47							
48							
49							
50		Topock - Alluvium Deposits	SM		(50.1 - 67.1') 10" 10-slot 316 SS Wire Wrap Screen		
51					(43.0 - 61.5') 16.0" Borehole		
52							
53		Topock - Alluvium Deposits	GM		(45.0 - 69.0') Cemex Bunker #11 (30x70) Lapis Lustre Sand	(45.0 - 69.0') 36.5 bags	(45.0 - 69.0') 200 bags (448%) Note: Lapis Lustre Sand, used >20% of calculated volume due to potential voids forming during drilling, swabbed filter pack for approximately 1.5 hours prior to the installation of the bentonite seal
54	IRZ-25-VAS-52-57 (3500 ppb) 12/5/2018 10:40						
55							
56							
57							
58		Topock - Alluvium Deposits	ML				
59							
60			GM				

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, groundwater data was collected during drilling of the pilot borehole

Well Construction Log

Sheet: 4 of 9

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
61					(50.1 - 67.1') 10" 10-slot 316 SS Wire Wrap Screen; (43.0 - 61.5') 16.0" Borehole		
62							
63							
64	IRZ-25-VAS-62-67 (620 ppb) 12/5/2018 14:17	Topock - Alluvium Deposits	GM		(45.0 - 69.0') Cemex Bunker #11 (30x70) Lapis Lustre Sand	(45.0 - 69.0') 36.5 bags	(45.0 - 69.0') 200 bags (448%) Note: Lapis Lustre Sand, used >20% of calculated volume due to potential voids forming during drilling, swabbed filter pack for approximately 1.5 hours prior to the installation of the bentonite seal
65							
66							
67					(67.1 - 77.1') 10" Suregrip 17 Casing		
68					(68.0 - 69.0') Centralizer		
69							
70		Topock - Alluvium Deposits	SM				
71					(70.5 - 71.5') Centralizer; (69.0 - 74.0') Bentonite seal chips; (61.5 - 81.5') 16.0" Borehole	(69.0 - 74.0') 5.3 bags	(69.0 - 74.0') 28 bags (428%) Note: Puregold Medium Chips, used >20% of the calculated volume due to potential voids forming during drilling
72							
73							
74		Topock - Alluvium Deposits	SM				
75							
76							
77					(74.0 - 103.8') Cemex #3 Mesh (8x20); (77.1 - 100.0') 10" 30-slot 316 SS Wire Wrap Screen	(74.0 - 103.8') 45.3 bags	(74.0 - 103.8') 172 bags (280%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling, filter pack was swabbed for approximately 30 minutes prior to installation of the bentonite seal
78		Topock - Alluvium Deposits	GM				
79							
80			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, groundwater data was collected during drilling of the pilot borehole

Well Construction Log

Sheet: 5 of 9

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
81–100	IRZ-25-VAS-92-97 (130 ppb) 12/6/2018 09:07	Topock - Alluvium Deposits	SM		(77.1 - 100.0') 10" 30-slot 316 SS Wire Wrap Screen; (74.0 - 103.8') Cemex #3 Mesh (8x20); (81.5 - 101.5') 16.0" Borehole	(74.0 - 103.8') 45.3 bags	(74.0 - 103.8') 172 bags (280%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling, filter pack was swabbed for approximately 30 minutes prior to installation of the bentonite seal
		Topock - Alluvium Deposits	SM				
		Topock - Alluvium Deposits	ML				
		Topock - Alluvium Deposits	SM				
		Topock - Alluvium Deposits	SW-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, groundwater data was collected during drilling of the pilot borehole

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
101		Topock - Alluvium Deposits	SW-SM		(100.0 - 135.0') 10" Suregrip 17 Casing; (81.5 - 101.5') 16.0" Borehole; (74.0 - 103.8') Cemex #3 Mesh (8x20)	(74.0 - 103.8') 45.3 bags	(74.0 - 103.8') 172 bags (280%) Note: Lapis Lustre Sand, used >20% of the calculated volume due to potential voids forming during drilling, filter pack was swabbed for approximately 30 minutes prior to installation of the bentonite seal
102							
103		Topock - Alluvium Deposits	ML				
104							
105							
106		Topock - Alluvium Deposits	GM				
107							
108							
109							
110							
111					(101.5 - 121.5') 16.0" Borehole		
112					(103.8 - 126.0') Bentonite seal chips	(103.8 - 126.0') 23.4 bags	(103.8 - 126.0') 34 bags (45%) Note: Puregold Medium Chips, used >20% of the calculated volume due to potential voids forming during drilling
113		Topock - Alluvium Deposits	SM				
114	IRZ-25-VAS-112-117 (< 0.17 U ppb) 12/11/2018 10:34						
115					(114.5 - 115.5') Centralizer		
116							
117							
118		Topock - Alluvium Deposits	SM				
119							
120			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, groundwater data was collected during drilling of the pilot borehole

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
121–140		Topock - Alluvium Deposits	ML		(100.0 - 135.0') 10" Suregrip 17 Casing; (101.5 - 121.5') 16.0" Borehole; (103.8 - 126.0') Bentonite seal chips	(103.8 - 126.0') 23.4 bags	(103.8 - 126.0') 34 bags (45%) Note: Puregold Medium Chips, used >20% of the calculated volume due to potential voids forming during drilling
		Topock - Alluvium Deposits	SM				
		Topock - Alluvium Deposits	GM		(121.5 - 141.5') 16.0" Borehole		
		Topock - Alluvium Deposits	ML		(126.0 - 174.0') Cemex Bunker #8 0/30 Mesh; (135.0 - 166.0') 10" 10-slot 316 SS Wire Wrap Screen	(126.0 - 174.0') 67.8 bags	(126.0 - 174.0') 136.7 bags (102%) Note: Lapis Lustre Sand, used >20% of calculated volume due to potential voids forming during redrill of borehole, filter pack entered well through upper screens and removed, swabbed filter pack for approximately 30 minutes prior to installing bentonite seal
		Topock - Alluvium Deposits	ML				
			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, groundwater data was collected during drilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
141–160		Topock - Alluvium Deposits	ML		(135.0 - 166.0') 10" 10-slot 316 SS Wire Wrap Screen		
147–152	IRZ-25-VAS-147-152 (3600 ppb) 12/11/2018 13:54	Topock - Alluvium Deposits	SM		(126.0 - 174.0') Cemex Bunker #8 0/30 Mesh; (141.5 - 161.5') 16" Borehole	(126.0 - 174.0') 67.8 bags	(126.0 - 174.0') 136.7 bags (102%) Note: Lapis Lustre Sand, used >20% of calculated volume due to potential voids forming during redrill of borehole, filter pack entered well through upper screens and removed, swabbed filter pack for approximately 30 minutes prior to installing bentonite seal
157–160		Topock - Weathered Bedrock - conglomerate	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, groundwater data was collected during drilling of the pilot borehole

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	05/12/2019	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25**	
Date Completed:	05/29/2019	Shallow Well Elevation:	N/A		
Drilling Co.:	Cascade	Deep Well Elevation:	N/A	Client:	PG&E
Drilling Method:	Dual Rotary	Northing (NAD83):	2102414.6	Project:	Final GW Remedy Phase 1
Driller Name:	Jon Martinez	Easting (NAD83):	7615824.5	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Martinez / W. Saylors	Borehole Diameter:	15.5-18 inches		
Logger:	D Cornell / K. Keon	Water Level Start:	44.95 ft bgs	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	10/1/2019		
Total Depth:	174 ft bgs	Well Completion:	☒ Flush ☐ Stick-up		

Depth (ft)	Groundwater Sample ID	Geologic Formation	USCS Code	USCS Class	Well Construction	Calculated Material Volumes	Material Volumes Installed
161		Topock - Weathered Bedrock - conglomerate	ML		(135.0 - 166.0') 10" 10-slot 316 SS Wire Wrap Screen	(126.0 - 174.0') 67.8 bags	(126.0 - 174.0') 136.7 bags (102%) Note: Lapis Lustre Sand, used >20% of calculated volume due to potential voids forming during redrill of borehole, filter pack entered well through upper screens and removed, swabbed filter pack for approximately 30 minutes prior to installing bentonite seal
162							
163		Topock - Weathered Bedrock - conglomerate	ML				
164	IRZ-25-VAS-162-167 (3000 ppb) 12/13/2018 10:37						
165							
166							
167					(126.0 - 174.0') Cemex Bunker #8 0/30 Mesh; (161.5 - 173.0') 15.5" Borehole		
168							
169		Topock - Competent Bedrock - conglomerate			(168.0 - 169.0') Centralizer		
170							
171					(166.0 - 171.6') Sump and End Cap		
172							
173							
174					(173.0 - 174.0') 15.5" Borehole		
175					End of Boring at 174.0 'bgs.		
176							
177							
178							
179							
180							

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, groundwater data was collected during drilling of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-25

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl		
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
1–20	(0.0 - 21.2) 8.02 mins/ft	SP-SM		(0.0 - 21.2') 18.0" Steel Casing	(0.0 - 4.5') Topock - Fluvial Deposits; Poorly graded sand with silt and gravel (SP-SM)	(0.0 - 17.0') Drilled with water.	(0.0 - 21.2') 845.46 gallons of water used; 615.18 gallons of water recovered; 230.28 gallons of water lost
		SP-SM			(4.5 - 12.0') Topock - Fluvial Deposits; Poorly graded sand with silt (SP-SM); pale brown (10YR 6/3)		
		SW-SM			(12.0 - 17.0') Topock - Fluvial Deposits; Well graded sand with silt and gravel (SW-SM); pale brown (10YR 6/3)		
		SM			(17.0 - 20.5') Topock - Fluvial Deposits; Silty sand with gravel (SM); brown (10YR 5/3)	(17.0 - 21.2') Rough drilling.	

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

Drilling Log

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl	**Boring No.:**	**IRZ-25**
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
21	(0.0 - 21.2) 8.02 mins/ft	SM		(0.0 - 21.2') 18.0" Steel Casing	(20.5 - 32.0') Topock - Fluvial Deposits; Sandy silt with gravel (ML); light yellowish brown (10YR 6/4)		
22						(21.2 - 30.0') Advanced 9 ft during 1st 2 hrs, no advancement during 3rd hour. Volume of waste water declined from beginning to end of drilling run. Possible loss could be from backflow to cuttings and shaker tanks.	(21.2 - 31.0') 1065.06 gallons of water used; -121.6 gallons of water recovered; 1186.66 gallons of water lost
23							
24							
25	(21.2 - 30.0) 23.89 mins/ft			(21.2 - 30.0') 18.0" Steel Casing			
26		ML					
27							
28							
29							
30	(30.0 - 31.0) 197.18 mins/ft			(30.0 - 31.0') 18.0" Steel Casing		(30.0 - 31.0') Borehole only advanced 1 foot in 4 hrs, likely drilling on a boulder.	
31						(31.0 - 41.0') Drilled with water.	(31.0 - 41.0') 1087.02 gallons of water used; 2478 gallons of water recovered; 1390.98 gallons of water gained
32					(32.0 - 40.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); pale brown (10YR 6/3)		
33							
34							
35	(31.0 - 41.0) 12.09 mins/ft			(31.0 - 41.0') 18.0" Steel Casing			
36		SM					
37							
38							
39							
40							

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-25

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl		
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
41	(31.0 - 41.0) 12.09 mins/ft	GM		(31.0 - 41.0') 18.0" Steel Casing	(40.0 - 41.5') Topock - Fluvial Deposits; Silty gravel with sand (GM); pale brown (10YR 6/3)		
42	(41.0 - 43.0) 8.50 mins/ft			(41.0 - 43.0') 16.0" Steel Casing	(41.5 - 49.5') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); light brown (7.5YR 6/4)	(41.0 - 43.0') Drilled with water.	(41.0 - 43.0') 230.58 gallons of water used; 0 gallons of water recovered; 230.58 gallons of water lost
43						(43.0 - 61.5') Drilled with water.	(43.0 - 61.5') 684.42 gallons of water used; 526.16 gallons of water recovered; 158.26 gallons of water lost
44							
45		GW-GM					
46							
47							
48							
49							
50		SM			(49.5 - 52.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3)		
51	(43.0 - 61.5) 7.04 mins/ft			(43.0 - 61.5') 16.0" Steel Casing			
52		GM			(52.0 - 57.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (5YR 5/4)		
53							
54							
55							
56							
57		ML			(57.0 - 59.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 5/4)		
58							
59							
60		GM			(59.5 - 68.0') Topock - Alluvium		

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-25

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl		
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
61	(43.0 - 61.5) 7.04 mins/ft	GM		(43.0 - 61.5') 16.0" Steel Casing	Deposits; Silty gravel with sand (GM); reddish brown (5YR 5/4)	(61.5 - 81.5') Drilled with water.	(61.5 - 81.5') 527.04 gallons of water used; 848.24 gallons of water recovered; 321.2 gallons of water gained
62							
63							
64							
65							
66							
67							
68							
69		SM			(68.0 - 72.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 5/4)		
70							
71	(61.5 - 81.5) 3.67 mins/ft			(61.5 - 81.5') 16.0" Steel Casing			
72							
73		SM			(72.0 - 77.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish brown / moderate yellowish brown (10YR 5/4)		
74							
75							
76							
77							
78		GM			(77.0 - 79.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (5YR 5/4)		
79							
80		SM			(79.5 - 87.0') Topock - Alluvium		

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

Drilling Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl	**Boring No.:**	**IRZ-25**
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
81	(61.5 - 81.5) 3.67 mins/ft	SM		(61.5 - 81.5') 16.0" Steel Casing	Deposits; Silty sand with gravel (SM); reddish brown (5YR 5/4)		
82						(81.5 - 101.5') Drilled with water.	(81.5 - 101.5') 475.8 gallons of water used; 1816.12 gallons of water recovered; 1340.32 gallons of water gained
83							
84							
85							
86							
87					(87.0 - 94.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 5/4)		
88							
89							
90							
91	(81.5 - 101.5) 4.60 mins/ft	SM		(81.5 - 101.5') 16.0" Steel Casing			
92							
93							
94							
95		ML			(94.5 - 95.5') Topock - Alluvium Deposits; Gravelly silt (ML); reddish brown (5YR 5/4)		
96		SM			(95.5 - 97.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4)		
97							
98		SW-SM			(97.0 - 102.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); light reddish brown / light brown (5YR 6/4)		
99							
100							

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-25

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl		
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
101	(81.5 - 101.5) 4.60 mins/ft	SW-SM		(81.5 - 101.5') 16.0" Steel Casing			
102					(102.0 - 103.5') Topock - Alluvium Deposits; Sandy silt with gravel (ML); light reddish brown / light brown (5YR 6/4)	(101.5 - 121.5') Drilled with water.	(101.5 - 121.5') 325.74 gallons of water used; 4086.84 gallons of water recovered; 3761.1 gallons of water gained
103		ML					
104					(103.5 - 109.5') Topock - Alluvium Deposits; Silty gravel (GM); reddish brown (5YR 5/4)		
105							
106		GM					
107							
108							
109							
110	(101.5 - 121.5) 6.21 mins/ft				(109.5 - 117.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); (5YR 4/)		
111				(101.5 - 121.5') 16.0" Steel Casing			
112							
113		SM					
114							
115							
116							
117					(117.0 - 119.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown (5YR 4/4)		
118		SM					
119							
120		ML			(119.5 - 124.5') Topock - Alluvium		

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-25

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl		
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
121	(101.5 - 121.5) 6.21 mins/ft	ML		(101.5 - 121.5') 16.0" Steel Casing	Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4)		
122						(121.5 - 141.5') Drilled with water.	(121.5 - 141.5') 118.34 gallons of water used; 1244.4 gallons of water recovered; 1126.06 gallons of water gained
123							
124							
125		SM			(124.5 - 127.0') Topock - Alluvium Deposits; Silty sand (SM); reddish brown / moderate brown (5YR 4/4)		
126							
127		GM			(127.0 - 132.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (5YR 5/4)	(127.0') During the first attempt of installing the well the lower screen twisted during removal of the drill casing. The well was removed from the borehole and the borehole was redrilled. Cascasde recommended not advacning 16 inch casing and install the well in an open hole after redrilling.	(127.0 - 174.0') 280 gallons of water used; 12440 gallons of water recovered; 12160 gallons of water gained
128							
129							
130							
131	(121.5 - 141.5) 1.75 mins/ft			(121.5 - 141.5') 16.0" Steel Casing			
132		ML			(132.0 - 137.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4)		
133							
134							
135							
136							
137							
138		ML			(137.0 - 139.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown (5YR 4/4)		
139							
140		ML			(139.5 - 147.0') Topock - Alluvium		

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Drilling Log

Boring No.: IRZ-25

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl		
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
141	(121.5 - 141.5) 1.75 mins/ft	ML		(121.5 - 141.5') 16.0" Steel Casing	Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown (5YR 4/4)	(141.5 - 161.5') Drilled with water.	(141.5 - 161.5') 161.04 gallons of water used; 1726.08 gallons of water recovered; 1565.04 gallons of water gained
142							
143							
144							
145							
146							
147					(147.0 - 157.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 4/3)		
148							
149							
150							
151	(141.5 - 161.5) 2.10 mins/ft	SM		(141.5 - 161.5') 16" Steel Casing			
152							
153							
154							
155						(155.0') During redrill the loss returns due to a plug in the drill pipe tripped out drill rods and installed normal bottom hole assembly.	
156							
157					(157.0 - 162.0') Topock - Weathered Bedrock - conglomerate; Gravelly silt (ML); reddish brown (5YR 5/4)		
158		ML					
159							
160							

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

Drilling Log

Sheet: 9 of 9

Boring No.: IRZ-25

Date Started:	04/26/2019	Surface Elevation:	500.4 ft amsl		
Date Completed:	05/12/2019	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Dual Rotary	Total Depth:	174 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Foremost DR-24 HD	Conductor Casing Diameter:	18 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Jon Martinez	Drill Casing Diameter:	16 inches		
Drilling Asst:	E. Martinez / W. Saylors	Drill Bit:	15.5 & 17.5 inch Tri-cone	Project Number:	RC000753.0051
Tool-Pusher:	Arnold Lamon	Depth to First Water:	48.4 ft bgs		
Rig Geologist:	A. Mack / D Cornell	Converted to Well:	☒ Yes ☐ No		

Depth (ft)	Drilling Run and Average Penetration Rate	USCS Code	USCS Class	Casing Diameter	Description (See Pilot boring log for full geologic descriptions)	Drilling Notes	Drilling Fluid
161	(141.5 - 161.5) 2.10 mins/ft	ML		(141.5 - 161.5') 16" Steel Casing			
162					(162.0 - 166.0') Topock - Weathered Bedrock - conglomerate; Gravelly silt (ML); reddish brown / moderate brown (5YR 4/4)	(161.5 - 173.0') Drilled with water, casing became stuck in bedrock attempted to dislodge while advancing borehole. Circulated water to clean out borehole.	
163							
164		ML					
165							
166					(166.0 - 174.0') Topock - Competent Bedrock - conglomerate; reddish brown (5YR 5/4)		
167	(161.5 - 173.0) 6.22 mins/ft			(161.5 - 173.0') 15.5" Open Hole			
168							
169							
170							
171							
172							
173							
174	(173.0 - 174.0) mins/ft			(173.0 - 174.0') 15.5" Open Hole			
					End of Boring at 174.0 'bgs.		
175							
176							
177							
178							
179							
180							

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

Remarks: blue water table symbol represents depth to water measured during the first VAS interval of the pilot borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 1 of 9

Boring No.: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs		PG&E Topock, Needles, California
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Project Number:	RC000753.0051
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel		
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	84			Topock - Fluvial Deposits	SP-SM		(0.0 - 4.5') Topock - Fluvial Deposits; Poorly graded sand with silt and gravel (SP-SM); very fine grained to fine grained, subangular to subround; little granules to very large pebbles, angular to subangular; little silt; dry (4.0 - 4.5'); lens of granules to medium pebbles	(7.0') Rough drilling	(0.0 - 172.0') No water used
5–12	120			Topock - Fluvial Deposits	SP-SM		(4.5 - 12.0') Topock - Fluvial Deposits; Poorly graded sand with silt (SP-SM); pale brown (10YR 6/3); very fine grained to fine grained, angular to subround; little silt; trace granules to very large pebbles, angular to round; trace cobbles, subround to round; dry		
13–17				Topock - Fluvial Deposits	SW-SM		(12.0 - 17.0') Topock - Fluvial Deposits; Well graded sand with silt and gravel (SW-SM); pale brown (10YR 6/3); very fine grained to coarse grained, angular to subround; some granules to very large pebbles, angular to subangular; little silt; trace cobbles, angular to subangular; trace boulders, angular to subangular; dry (14') very dark grayish brown (10YR 3/2); solid rock cores from boulders of basalt with frothy texture		
18–20	120			Topock - Fluvial Deposits	SM		(17.0 - 20.5') Topock - Fluvial Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to coarse grained, angular to subangular; some silt; little granules to very large pebbles, angular to subround; trace cobbles, angular to subangular; trace boulders, angular to subangular; dry (19.0 - 20.5') gray (7.5YR 6/1) and white (10YR 8/1); rock core from boulder composed of metadiorite, very hard		

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

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs		PG&E Topock, Needles, California
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Project Number:	RC000753.0051
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel		
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
					SM				(0.0 - 172.0') No water used
21							(20.5 - 32.0') Topock - Fluvial Deposits; Sandy silt with gravel (ML); light yellowish brown (10YR 6/4); no plasticity; little granules to large pebbles, angular to subround; little very fine to fine grained sand, angular to subround; trace cobbles, angular to subround; trace boulders, angular to subangular; dry		
22									
23									
24	120								
25									
26				Topock - Fluvial Deposits	ML				
27									
28									
29									
30							(29.5'); to 32' powerdized rock and solid cores from boulders composed of metadiorite.		
31									
32	120								
33							(32.0 - 40.0') Topock - Fluvial Deposits; Silty sand with gravel (SM); pale brown (10YR 6/3); very fine grained to medium grained, angular to subround; and granules to very large pebbles, subangular to subround; little silt; trace cobbles, angular to subround; dry		
34									
35									
36				Topock - Fluvial Deposits	SM				
37									
38									
39	108								
40									

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, blue water table symbol represents depth to water measured during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs		PG&E Topock, Needles, California
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Project Number:	RC000753.0051
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel		
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				Topock - Fluvial Deposits	GM		(40.0 - 41.5') Topock - Fluvial Deposits; Silty gravel with sand (GM); pale brown (10YR 6/3); granules to very large pebbles, angular to subround; some very fine to medium grained sand, angular to subangular; little silt; trace cobbles, angular to subround; dry		(0.0 - 172.0') No water used
42									
43	108			Topock - Fluvial Deposits	GW-GM		(41.5 - 49.5') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); light brown (7.5YR 6/4); granules to very large pebbles, subangular to subround; some cobbles, angular to subround; little very fine to medium grained sand, angular to round; little silt; dry		
44									
45									
46									
47							(47'); moist; to 49.5 ft bgs		
48									
49		IRZ-25-SS-47-52 12/14/2018 10:35							
50				Topock - Alluvium Deposits	SM		(49.5 - 52.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); brown (10YR 5/3); very fine grained to very coarse grained, subangular to subround; some granules to medium pebbles, angular to subangular; some silt; wet	(49.5') Approximate depth to water table	
51									
52	114								
53				Topock - Alluvium Deposits	GM		(52.0 - 57.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (5YR 5/4); angular to subangular; some very fine to coarse grained sand, angular to subangular; some silt; little clay; dry to moist		
54		IRZ-25-SS-52-57 12/14/2018 10:40	IRZ-25-VAS-52-57 (3500 ppb) 12/5/2018 10:40						
55									
56									
57									
58	120	IRZ-25-SS-57-62 12/14/2018 10:45		Topock - Alluvium Deposits	ML		(57.0 - 59.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown (5YR 5/4); no plasticity; and very fine to very coarse grained sand, angular to subangular; little granules to small pebble, angular to subangular; wet to dry; stiff; strong cementation		
59									
60					GM		(59.5 - 68.0') Topock - Alluvium Deposits; Silty gravel with sand		

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

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	**Boring No.:**	**IRZ-25-Pilot**
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/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	120	IRZ-25-SS-57-62 12/14/2018 10:45	IRZ-25-VAS-62-67 (620 ppb) 12/5/2018 14:17	Topock - Alluvium Deposits	GM		(GM); reddish brown (5YR 5/4); granules to very large pebbles, angular to subangular; some very fine to coarse grained sand, angular to subangular; some silt; little clay; dry to moist		(0.0 - 172.0') No water used
62									
63									
64		IRZ-25-SS-62-67 12/14/2018 10:55							
65									
66									
67									
68	120	IRZ-25-SS-67-72 12/14/2018 10:55		Topock - Alluvium Deposits	SM		(68.0 - 72.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 5/4); very fine grained to very coarse grained, subangular to subround; some silt; little granules to medium pebble, angular to subangular; wet		
69									
70									
71									
72		IRZ-25-SS-72-77 12/14/2018 11:05		Topock - Alluvium Deposits	SM		(72.0 - 77.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); yellowish brown / moderate yellowish brown(10YR 5/4); fine grained to very coarse grained, subangular to subround; some silt; little granules to medium pebble, angular to subround; wet		
73									
74									
75									
76									
77	60	IRZ-25-SS-77-82 12/14/2018 11:05		Topock - Alluvium Deposits	GM		(77.0 - 79.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (5YR 5/4); granules to large pebbles, angular to subangular; some very fine to very coarse grained sand, angular to subround; little silt; wet		
78									
79									
80					SM		(79.5 - 87.0') Topock - Alluvium Deposits; Silty sand with gravel		

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

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	**Boring No.:**	**IRZ-25-Pilot**
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/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	60	IRZ-25-SS-77-82 12/14/2018 11:05		Topock - Alluvium Deposits	SM		(SM); reddish brown (5YR 5/4); very fine grained to very coarse grained, subangular to round; little granules to medium pebbles, angular to subangular; little silt; trace cobbles, angular to subangular; wet; cobbles composed of metadiorite		(0.0 - 172.0') No water used
82									
83									
84		IRZ-25-SS-82-87 12/14/2018 11:10							
85									
86									
87									
88	108	IRZ-25-SS-87-92 12/14/2018 11:15		Topock - Alluvium Deposits	SM		(87.0 - 94.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 5/4); fine grained to very coarse grained, subangular to round; some silt; little granules to medium pebble, angular to subangular; wet; trace large pebbles		
89									
90									
91									
92									
93		IRZ-25-SS-92-97 12/14/2018 11:20	IRZ-25-VAS-92-97 (130 ppb) 12/6/2018 09:07						
94									
95				Topock - Alluvium Deposits	ML		(94.5 - 95.5') Topock - Alluvium Deposits; Gravelly silt (ML); reddish brown (5YR 5/4); no plasticity; little granules to medium pebble, angular to subangular; little very fine to very coarse grained sand, angular to subangular; dry to moist; hard; pebbles composed of metadiorite		
96				Topock - Alluvium Deposits	SM		(95.5 - 97.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown(5YR 4/4); very fine grained to very coarse grained, angular to subround; some granules to large pebble, angular to subangular; some silt; trace cobbles; wet; cobbles composed of metadiorite		
97									
98	114	IRZ-25-SS-97-102 12/14/2018 11:25		Topock - Alluvium Deposits	SW-SM		(97.0 - 102.0') Topock - Alluvium Deposits; Well graded sand with silt and gravel (SW-SM); light reddish brown / light brown(5YR 6/4); fine grained to very coarse grained, angular to round; some small to large pebbles, angular to subangular; some silt; wet; trace very large pebbles composed of metadiorite		
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, blue water table symbol represents depth to water measured during the first VAS interval

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5		
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/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		IRZ-25-SS-97-102 12/14/2018 11:25		Topock - Alluvium Deposits	SW-SM				(0.0 - 172.0') No water used
102				Topock - Alluvium Deposits	ML		(102.0 - 103.5') Topock - Alluvium Deposits; Sandy silt with gravel (ML); light reddish brown / light brown(5YR 6/4); little granules to large pebbles, angular to subangular; little very fine to very coarse grained sand, subangular to subround; little clay; trace cobbles; wet; 100 mm cobble composed of metadiorite		
103	114								
104		IRZ-25-SS-102-107 12/14/2018 11:30		Topock - Alluvium Deposits	GM		(103.5 - 109.5') Topock - Alluvium Deposits; Silty gravel (GM); reddish brown (5YR 5/4); granules to large pebbles, angular to subround; some silt; little very fine to very coarse grained sand, angular to subround; trace; wet; trace very large pebble		
105									
106									
107									
108									
109		IRZ-25-SS-107-112 12/14/2018 11:35							
110				Topock - Alluvium Deposits	SM		(109.5 - 117.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); (5YR 4/); fine grained to very coarse grained, subangular to subround; some granules to very large pebbles, angular to subround; some silt; trace cobbles; wet; very large pebbles to cobbles composed of trace amounts of metadiorite		
111									
112	120								
113									
114		IRZ-25-SS-112-117 12/14/2018 11:40	IRZ-25-VAS-112-117 (< 0.17 U ppb) 12/11/2018 10:34						
115									
116									
117									
118		IRZ-25-SS-117-122 12/14/2018 11:45		Topock - Alluvium Deposits	SM		(117.0 - 119.5') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown / moderate brown(5YR 4/4); very fine grained to very coarse grained, subangular to subround; little granules to medium pebbles, angular to subround; little silt; little clay; wet		
119	120								
120					ML		(119.5 - 124.5') Topock - Alluvium Deposits; Sandy silt with gravel		

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

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6	Project:	Final Groundwater Remedy Phase
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Location:	1
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs		PG&E Topock, Needles, California
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Project Number:	RC000753.0051
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		
Drilling Asst:	N. Dominguez/C. Alverez	Sampling Method:	4 inch x 10 ft Core Barrel		
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	120	IRZ-25-SS-117-122 12/14/2018 11:45		Topock - Alluvium Deposits	ML		(ML); reddish brown / moderate brown(5YR 4/4); some very fine to very coarse grained sand, angular to subround; little granules to medium pebbles, angular to subangular; wet		(0.0 - 172.0') No water used
122									
123		IRZ-25-SS-122-127 12/14/2018 10:50							
124									
125				Topock - Alluvium Deposits	SM		(124.5 - 127.0') Topock - Alluvium Deposits; Silty sand (SM); reddish brown / moderate brown(5YR 4/4); very fine grained to coarse grained, subangular to subround; some silt; little granules to medium pebbles, angular to subangular; wet		
126									
127									
128	120	IRZ-25-SS-127-132 12/14/2018 11:55		Topock - Alluvium Deposits	GM		(127.0 - 132.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (5YR 5/4); granules to large pebbles, angular to subangular; and silt; little very fine to coarse grained sand, angular to subangular; dry to moist; moderate cementation		
129									
130									
131									
132									
133		IRZ-25-SS-132-137 12/14/2018 12:00		Topock - Alluvium Deposits	ML		(132.0 - 137.0') Topock - Alluvium Deposits; Sandy silt with gravel (ML); reddish brown / moderate brown(5YR 4/4); no plasticity; little granules to medium pebbles, angular to subangular; little very fine to very coarse grained sand, angular to subround; dry to moist		
134									
135									
136									
137									
138	120	IRZ-25-SS-137-142 12/14/2018 12:05		Topock - Alluvium Deposits	ML		(137.0 - 139.5') Topock - Alluvium Deposits; Sandy silt (ML); reddish brown / moderate brown(5YR 4/4); no plasticity; some very fine to coarse grained sand, angular to subround; little granules to medium pebbles, angular to subangular; little clay; wet; dessicated		
139									
140					ML		(139.5 - 147.0') Topock - Alluvium Deposits; Sandy silt with gravel		

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

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Project:	Final Groundwater Remedy Phase
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs	Location:	1
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches		PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		
Drilling Asst:	N. Dominguez/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	120	IRZ-25-SS-137-142 12/14/2018 12:05		Topock - Alluvium Deposits	ML		(ML); reddish brown / moderate brown(5YR 4/4); no plasticity; little granules to medium pebbles, angular to subangular; little very fine to coarse grained sand, angular to subangular; little clay; hard		(0.0 - 172.0') No water used
142									
143									
144		IRZ-25-SS-142-147 12/14/2018 00:10							
145									
146									
147									
148	108	IRZ-25-SS-147-152 12/14/2018 12:15	IRZ-25-VAS-147-152 (3600 ppb) 12/11/2018 13:54	Topock - Alluvium Deposits	SM		(147.0 - 157.0') Topock - Alluvium Deposits; Silty sand with gravel (SM); reddish brown (5YR 4/3); fine grained to very coarse grained, subangular to round; some granules to large pebbles, angular to subround; little silt; trace cobbles, angular to subangular; wet; cobbles composed of metadiorite	(147.0 - 157.0') Very saturated material with potential to poduce water	
149									
150									
151									
152									
153									
154		IRZ-25-SS-152-157 12/14/2018 00:20							
155									
156									
157									
158	108			Topock - Weathered Bedrock - conglomerate	ML		(157.0 - 162.0') Topock - Weathered Bedrock - conglomerate; Gravelly silt (ML); reddish brown (5YR 5/4); no plasticity; little granules to large pebbles, angular to subangular; little very fine to medium grained sand, angular to subangular; dry		
159									
160									

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

Boring Log

Sheet: 9 of 9

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	**Boring No.:**	**IRZ-25-Pilot**
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs	Project:	Final Groundwater Remedy Phase
Drill Rig Type:	Prosonic Truck Mount	Borehole Diameter:	6-12 inches	Location:	1
Driller Name:	Steve Vasquez	Depth to First Water:	48.4 ft bgs		PG&E Topock, Needles, California
Drilling Asst:	N. Dominguez/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				Topock - Weathered Bedrock - conglomerate	ML				(0.0 - 172.0') No water used
162									
163	108	IRZ-25-SS-162-166 12/14/2018 12:25	IRZ-25-VAS-162-167 (3000 ppb) 12/13/2018 10:37	Topock - Weathered Bedrock - conglomerate	ML		(162.0 - 166.0') Topock - Weathered Bedrock - conglomerate; Gravelly silt (ML); reddish brown / moderate brown(5YR 4/4); low plasticity; some granules to medium pebbles, angular to subround; little very fine to coarse grained sand, angular to subround; wet; stiff	(162.0 - 172.0') Drill rods chattering, rough drilling	
164									
165									
166									
167							(166.0 - 172.0') Topock - Competent Bedrock - conglomerate; reddish brown (5YR 5/4); dry; moderate cementation; friable		
168				Topock - Competent Bedrock - conglomerate					
169	60								
170									
171									
172							End of Boring at 172.0 'bgs.		
173									
174									
175									
176									
177									
178									
179									
180									

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

Temporary Backfill Log

ARCADIS Design & Consultancy for natural and built assets

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
0					(0.0 - 0.5') Temporary Steel Plate with BMP	(0.0 - 0.5') 1	(0.0 - 0.5') 1 (0%)
1–4		Topock - Fluvial Deposits	SP-SM		(0.0 - 4.0') 12" Borehole; (0.5 - 5.0') Plastered Sand	(0.5 - 5.0') 7.9 bags	(0.5 - 5.0') 4 bags (-49%) Note: Wildcat Washed
5–11		Topock - Fluvial Deposits	SP-SM				
12–16		Topock - Fluvial Deposits	SW-SM		(4.0 - 172.0') 6" Borehole; (5.0 - 157.0') Pea Gravel	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
17–20		Topock - Fluvial Deposits	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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 2 of 9

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl		
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 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:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
20			SM				
21							
22							
23							
24							
25							
26		Topock - Fluvial Deposits	ML				
27							
28							
29							
30					(5.0 - 157.0') Pea Gravel; (4.0 - 172.0') 6" Borehole	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
31							
32							
33							
34							
35							
36		Topock - Fluvial Deposits	SM				
37							
38							
39							
40							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl		
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 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:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
41		Topock - Fluvial Deposits	GM				
42							
43							
44							
45		Topock - Fluvial Deposits	GW-GM				
46							
47							
48							
49							
50		Topock - Alluvium Deposits	SM		(5.0 - 157.0') Pea Gravel; (4.0 - 172.0') 6" Borehole	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
51							
52							
53							
54	IRZ-25-VAS-52-57 (3500 ppb) 12/5/2018 10:40	Topock - Alluvium Deposits	GM				
55							
56							
57							
58		Topock - Alluvium Deposits	ML				
59							
60			GM				

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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	**Well ID: IRZ-25-Pilot**	
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 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:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
61							
62							
63							
64	IRZ-25-VAS-62-67 (620 ppb) 12/5/2018 14:17	Topock - Alluvium Deposits	GM				
65							
66							
67							
68							
69		Topock - Alluvium Deposits	SM		(5.0 - 157.0') Pea Gravel	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
70					(4.0 - 172.0') 6" Borehole		
71							
72							
73		Topock - Alluvium Deposits	SM				
74							
75							
76							
77							
78		Topock - Alluvium Deposits	GM				
79							
80			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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl		
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 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:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
81		Topock - Alluvium Deposits	SM				
82							
83							
84							
85							
86							
87							
88		Topock - Alluvium Deposits	SM		(5.0 - 157.0') Pea Gravel; (4.0 - 172.0') 6" Borehole	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
89							
90							
91							
92							
93							
94	IRZ-25-VAS-92-97 (130 ppb) 12/6/2018 09:07						
95		Topock - Alluvium Deposits	ML				
96		Topock - Alluvium Deposits	SM				
97							
98		Topock - Alluvium Deposits	SW-SM				
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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl		
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 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:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
101		Topock - Alluvium Deposits	SW-SM				
102							
103		Topock - Alluvium Deposits	ML				
104							
105							
106		Topock - Alluvium Deposits	GM				
107							
108							
109							
110					(5.0 - 157.0') Pea Gravel; (4.0 - 172.0') 6" Borehole	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
111							
112							
113		Topock - Alluvium Deposits	SM				
114	IRZ-25-VAS-112-117 (< 0.17 U ppb) 12/11/2018 10:34						
115							
116							
117							
118		Topock - Alluvium Deposits	SM				
119							
120			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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Sheet: 7 of 9

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl	Client:	PG&E
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Project:	Final GW Remedy Phase 1
Drilling Method:	Sonic Drilling	Total Depth:	172 ft bgs	Location:	PG&E Topock, Needles, California
Driller Name:	Steve Vasquez	Borehole Diameter:	6-12 inches		
Drilling Asst:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
121		Topock - Alluvium Deposits	ML				
122							
123							
124							
125		Topock - Alluvium Deposits	SM				
126							
127		Topock - Alluvium Deposits	GM		(5.0 - 157.0') Pea Gravel; (4.0 - 172.0') 6" Borehole	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
128							
129							
130							
131							
132		Topock - Alluvium Deposits	ML				
133							
134							
135							
136							
137		Topock - Alluvium Deposits	ML				
138							
139							
140			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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl		
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 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:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
141–160		Topock - Alluvium Deposits	ML				
147–152	IRZ-25-VAS-147-152 (3600 ppb) 12/11/2018 13:54	Topock - Alluvium Deposits	SM		(5.0 - 157.0') Pea Gravel; (4.0 - 172.0') 6" Borehole	(5.0 - 157.0') 65.8 bags	(5.0 - 157.0') 60 bags (-9%) Note: Cal-Silica 3/8"x1/4"
157–160		Topock - Weathered Bedrock - conglomerate	ML		(157.0 - 172.0') Cemex # 2/12 Mesh (16x30)	(157.0 - 172.0') 2.8 bags	(157.0 - 172.0') 4 bags (43%) Note: Lapis Lustre Sand

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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.

ARCADIS Design & Consultancy for natural and built assets

Temporary Backfill Log

Well ID: IRZ-25-Pilot

Date Started:	12/04/2018	Surface Elevation:	500.4 ft amsl		
Date Completed:	12/12/2018	Northing (NAD83):	2102414.6		
Drilling Co.:	Cascade	Easting (NAD83):	7615824.5	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	172 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:	N. Dominguez/C. Alverez	Depth to First Water:	48.4 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
161		Topock - Weathered Bedrock - conglomerate	ML				
162							
163							
164	IRZ-25-VAS-162-167 (3000 ppb) 12/13/2018 10:37	Topock - Weathered Bedrock - conglomerate	ML				
165							
166					(157.0 - 172.0') Cemex # 2/12 Mesh (16x30)	(157.0 - 172.0') 2.8 bags	(157.0 - 172.0') 4 bags (43%) Note: Lapis Lustre Sand
167					(4.0 - 172.0') 6" Borehole		
168		Topock - Competent Bedrock - conglomerate					
169							
170							
171							
172							
173							
174							
175							
176							
177							
178							
179							
180							

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, blue water table symbol represents depth to water measured during the first VAS interval Note: Granule backfill material will be excavated from the pilot borehole during drilling for the construction of the well.