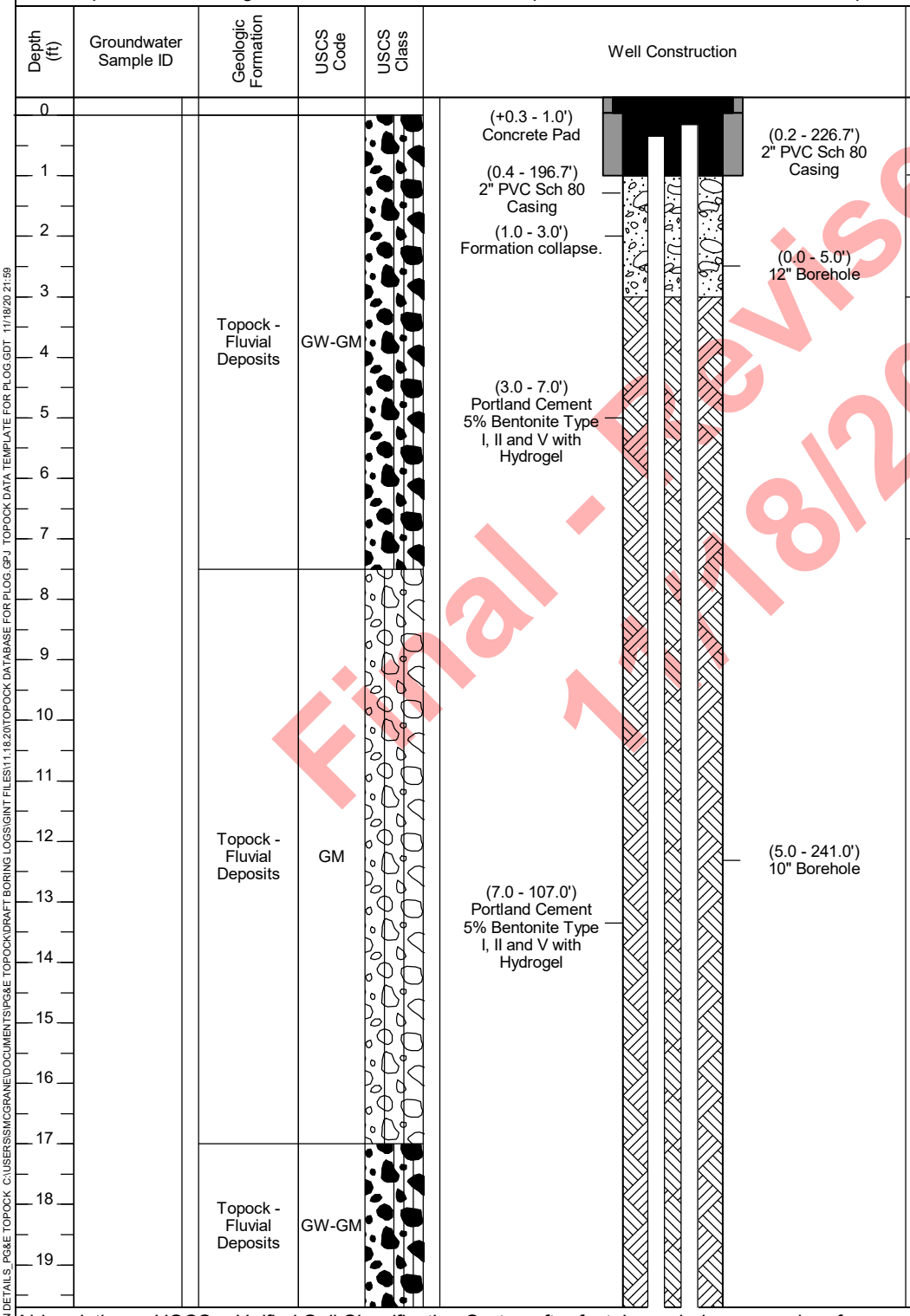
Well Construction Log

Sheet: 1 of 13

Date Started:	03/04/2019	Surface Elevation:	569.66 ft amsl	**Well ID: MW-85-217, MW-85-237**	
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		



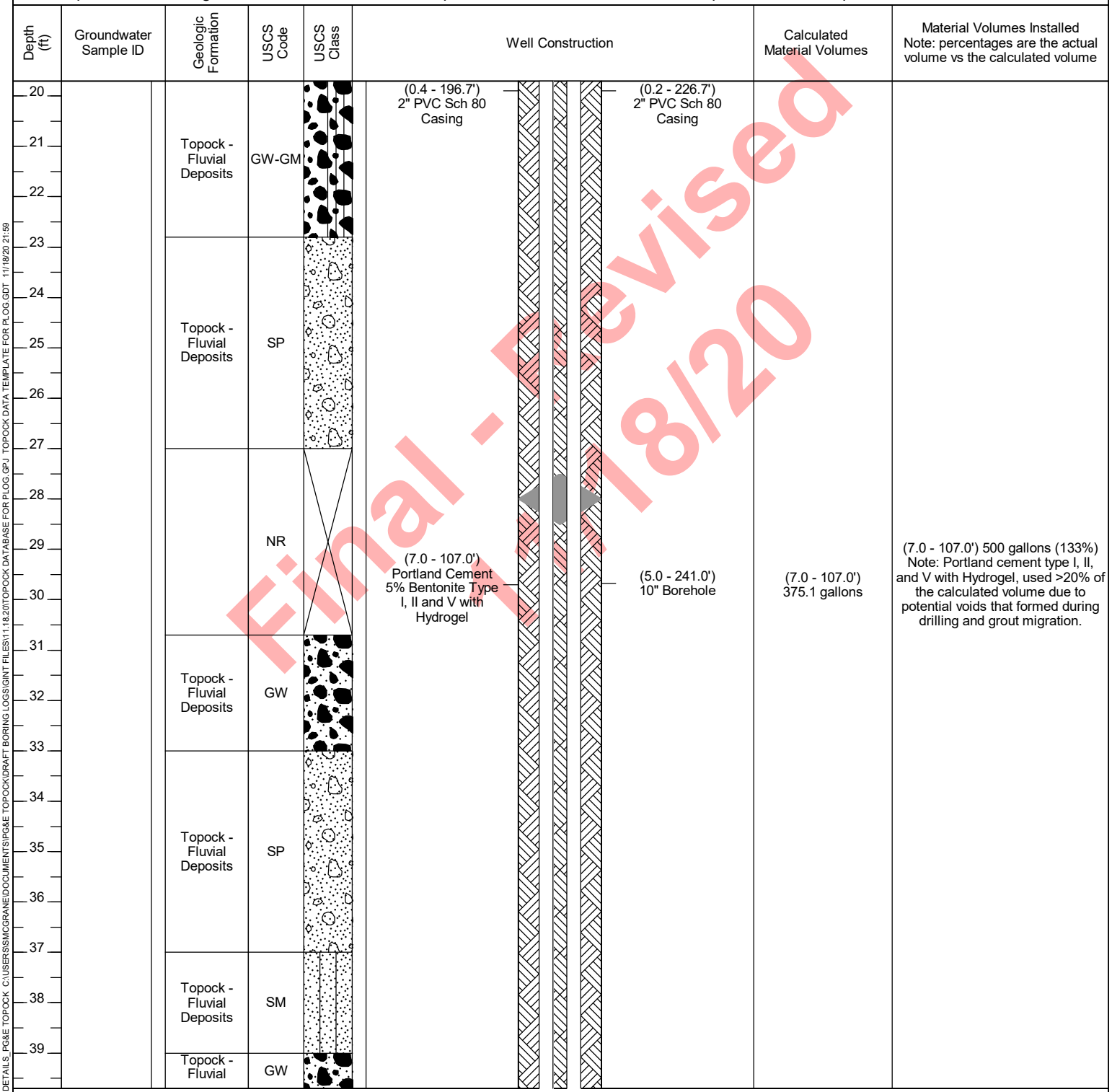
Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
	(+0.3 - 1.0') 9 bags Note: 2.5 x 2.5 ft concrete pad with 18" diameter lockable vault, King Kon-Crete 4000 PSI.
	Note: Surrounding native soil.
(3.0 - 7.0') 18.6 gallons	(3.0 - 7.0') 25 gallons (134%) Note: Grout seal topped off on 4/1/19, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration.
(7.0 - 107.0') 375.1 gallons	(7.0 - 107.0') 500 gallons (133%) Note: Portland cement type I, II, and V with Hydrogel, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration.

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-85d

Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	03/04/2019	Surface Elevation:	569.66 ft amsl	**Well ID: MW-85-217, MW-85-237**	
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		



Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-85d

ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: MW-85-217, MW-85-237

Date Started:	03/04/2019	Surface Elevation:	569.66 ft amsl		
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 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
40		Deposits Topock - Fluvial Deposits	GW		(0.4 - 196.7') 2" PVC Sch 80 Casing; (0.2 - 226.7') 2" PVC Sch 80 Casing		
41							
42							
43		Topock - Fluvial Deposits	GW				
44							
45							
46							
47							
48		Topock - Fluvial Deposits	GW		(7.0 - 107.0') Portland Cement 5% Bentonite Type I, II and V with Hydrogel; (5.0 - 241.0') 10" Borehole	(7.0 - 107.0') 375.1 gallons	(7.0 - 107.0') 500 gallons (133%) Note: Portland cement type I, II, and V with Hydrogel, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration.
49							
50							
51							
52							
53		Topock - Fluvial Deposits	SW				
54							
55							
56							
57							
58							
59							

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ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: MW-85-217, MW-85-237

Date Started:	03/04/2019	Surface Elevation:	569.66 ft amsl		
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 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
60			SW		(0.4 - 196.7') 2" PVC Sch 80 Casing; (0.2 - 226.7') 2" PVC Sch 80 Casing		
61							
62							
63		Topock - Fluvial Deposits	GW				
64							
65							
66							
67							
68							
69					(7.0 - 107.0') Portland Cement 5% Bentonite Type I, II and V with Hydrogel; (5.0 - 241.0') 10" Borehole	(7.0 - 107.0') 375.1 gallons	(7.0 - 107.0') 500 gallons (133%) Note: Portland cement type I, II, and V with Hydrogel, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration.
70							
71							
72							
73		Topock - Fluvial Deposits	SP				
74							
75							
76							
77							
78							
79							

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ARCADIS Design & Consultancy for natural and built assets

Well Construction Log

Well ID: MW-85-217, MW-85-237

Date Started:	03/04/2019	Surface Elevation:	569.66 ft amsl		
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 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
80			SP		(0.4 - 196.7') 2" PVC Sch 80 Casing; (0.2 - 226.7') 2" PVC Sch 80 Casing		
81							
82							
83							
84							
85							
86		Topock - Fluvial Deposits	GW				
87							
88							
89					(7.0 - 107.0') Portland Cement 5% Bentonite Type I, II and V with Hydrogel; (5.0 - 241.0') 10" Borehole	(7.0 - 107.0') 375.1 gallons	(7.0 - 107.0') 500 gallons (133%) Note: Portland cement type I, II, and V with Hydrogel, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration.
90							
91							
92							
93		Topock - Fluvial Deposits	SW				
94							
95							
96							
97		Topock - Fluvial Deposits	GP				
98		Topock - Fluvial Deposits	GW				
99							

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Well Construction Log

ARCADIS Design & Consultancy for natural and built assets

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Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
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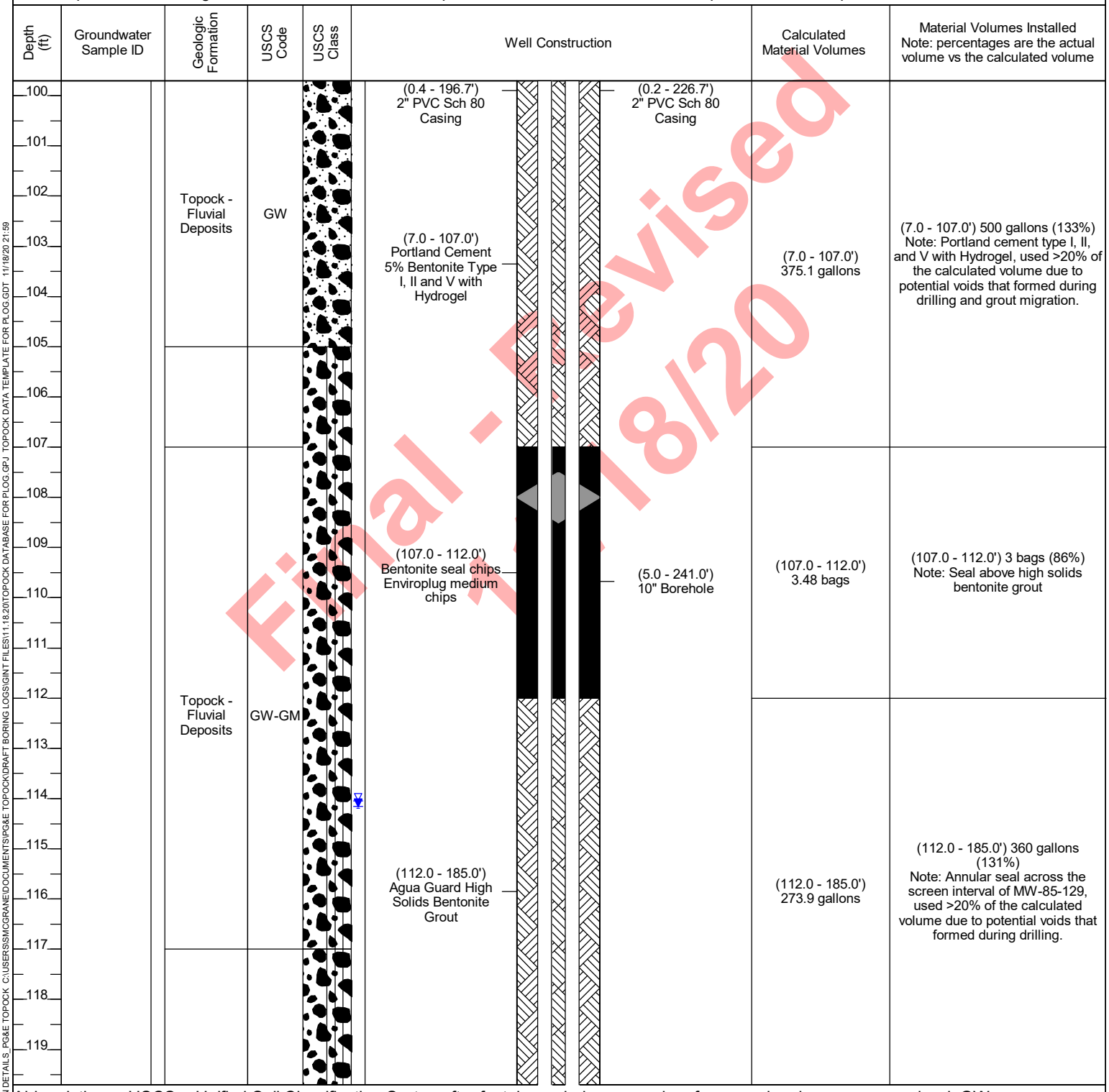

Calculated Material Volumes	Material Volumes Installed Note: percentages are the actual volume vs the calculated volume
(7.0 - 107.0') 375.1 gallons	(7.0 - 107.0') 500 gallons (133%) Note: Portland cement type I, II, and V with Hydrogel, used >20% of the calculated volume due to potential voids that formed during drilling and grout migration.
(107.0 - 112.0') 3.48 bags	(107.0 - 112.0') 3 bags (86%) Note: Seal above high solids bentonite grout
(112.0 - 185.0') 273.9 gallons	(112.0 - 185.0') 360 gallons (131%) Note: Annular seal across the screen interval of MW-85-129, used >20% of the calculated volume due to potential voids that formed during drilling.

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Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
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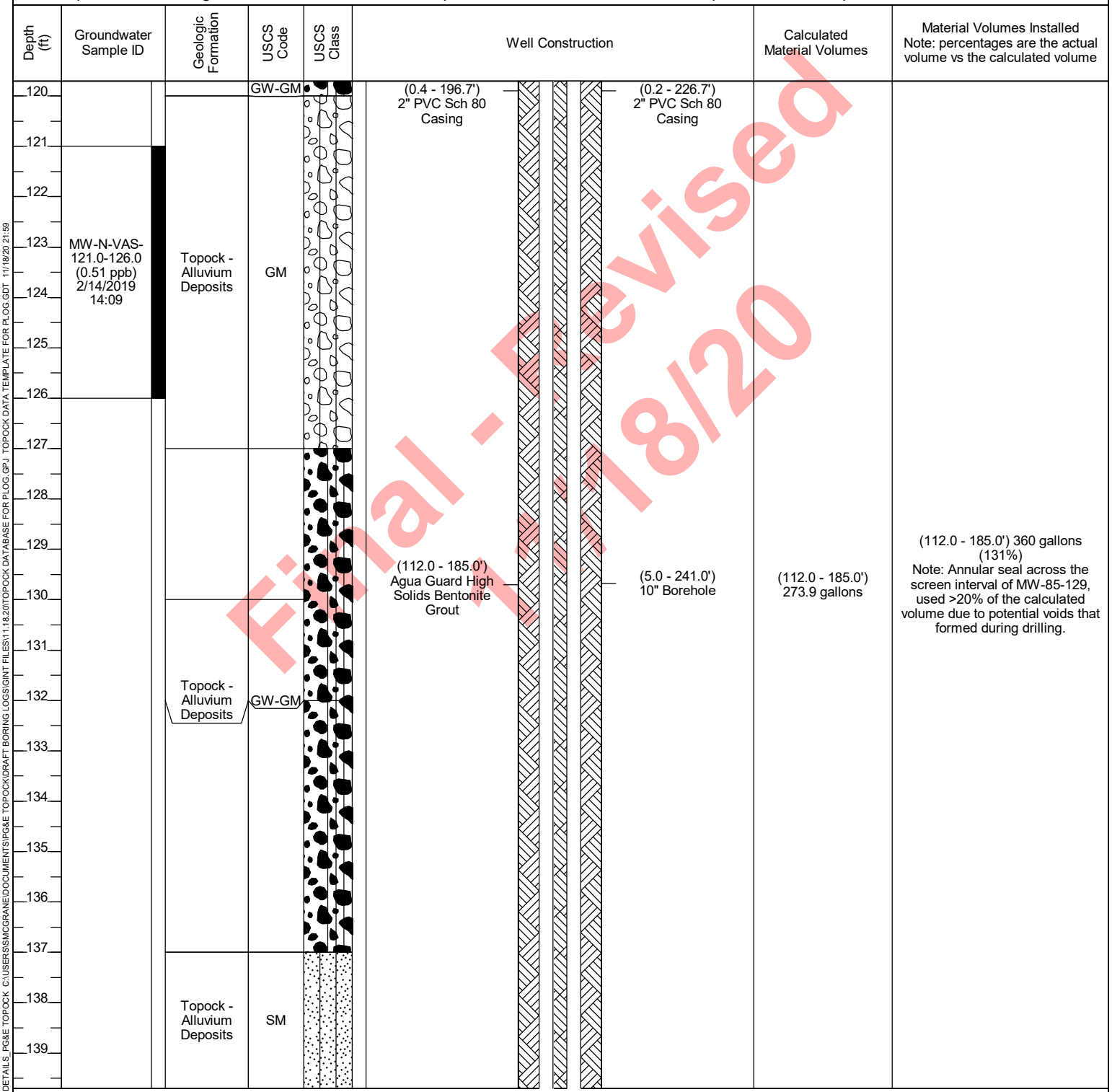

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Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 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
140–159	MW-N-VAS-142.0-147.0 (<0.033 U) 2/16/2019 10:57	Topock - Alluvium Deposits	SM		(0.4 - 196.7') 2" PVC Sch 80 Casing; (0.2 - 226.7') 2" PVC Sch 80 Casing		
147–159		Topock - Alluvium Deposits	GM		(112.0 - 185.0') Agua Guard High Solids Bentonite Grout; (5.0 - 241.0') 10" Borehole	(112.0 - 185.0') 273.9 gallons	(112.0 - 185.0') 360 gallons (131%) Note: Annular seal across the screen interval of MW-85-129, used >20% of the calculated volume due to potential voids that formed during drilling.

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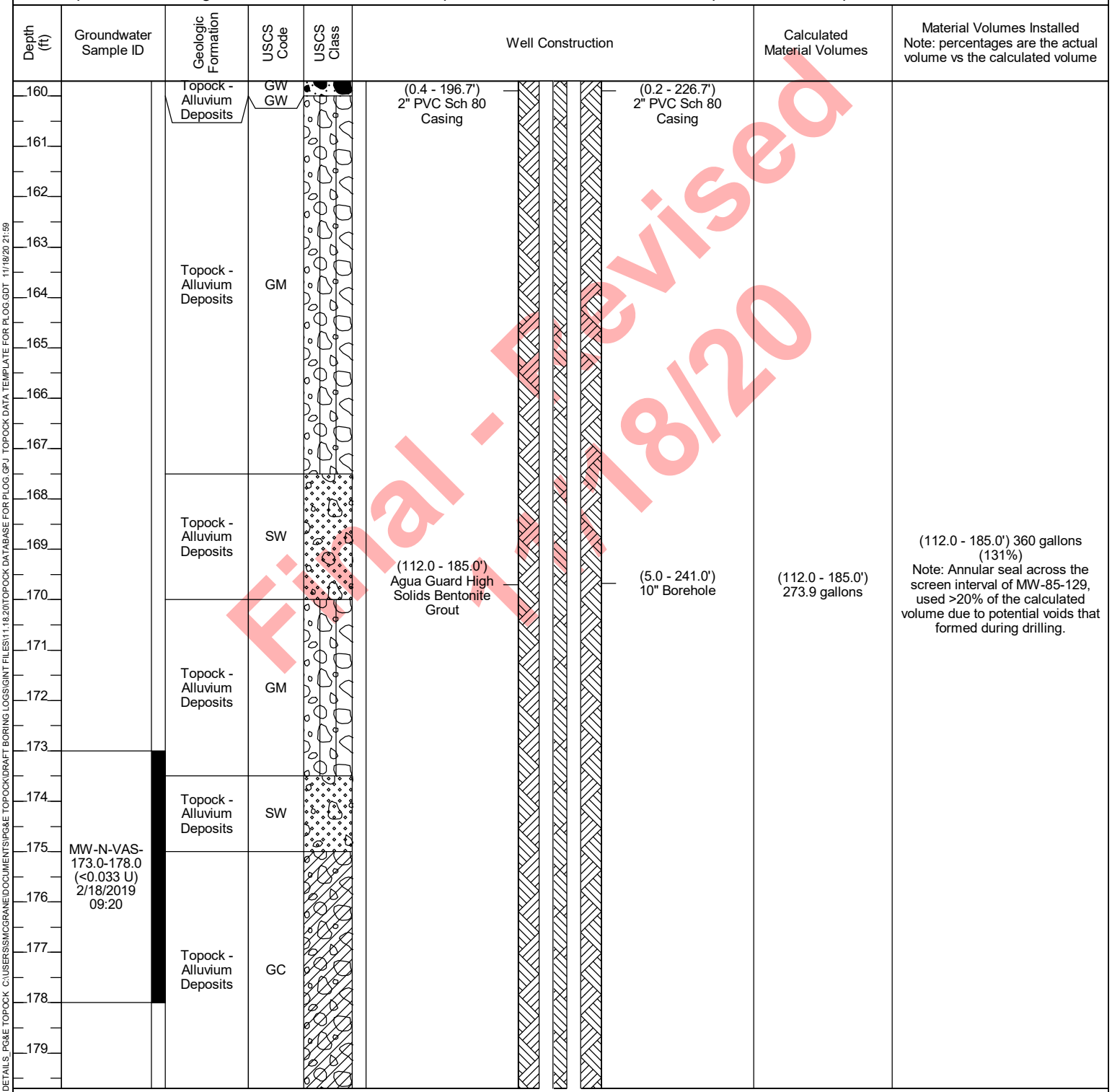
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		



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Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
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Total Depth:	247 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
180–199		Topock - Alluvium Deposits	GC		(0.4 - 196.7') 2" PVC Sch 80 Casing; (0.2 - 226.7') 2" PVC Sch 80 Casing		
180–182		Topock - Alluvium Deposits	GW		(112.0 - 185.0') Agua Guard High Solids Bentonite Grout	(112.0 - 185.0') 273.9 gallons	(112.0 - 185.0') 360 gallons (131%) Note: Annular seal across the screen interval of MW-85-129, used >20% of the calculated volume due to potential voids that formed during drilling.
184–187		Topock - Alluvium Deposits	GC				
188–190		Topock - Alluvium Deposits	SC		(185.0 - 194.5') Bentonite seal pellets Pel-Plug (TR30) 3/8"; (5.0 - 241.0') 10" Borehole	(185.0 - 194.5') 7.3 buckets	(185.0 - 194.5') 7.7 buckets (105%) Note: Seal above filter pack, added more bentonite pellets to avoid open borehole when removing 10 inch casing.
191–193		Topock - Alluvium Deposits	SC				
194–197		Topock - Alluvium Deposits	GW		(194.5 - 221.0') Cemex #3 MESH (8x20) Lapis Lustre Sand	(194.5 - 221.0') 25.7 bags	(194.5 - 221.0') 31 bags (121%) Note: Filter pack, used >20% of the calculated volume due to potential voids that formed during drilling.
198–199		Topock - Alluvium Deposits	GC		(196.7 - 216.7') 2" Sch 80 PVC (20-slot) Screen		

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Well Construction Log

Sheet: 11 of 13

Date Started:	03/04/2019	Surface Elevation:	569.66 ft amsl	**Well ID: MW-85-217, MW-85-237**	
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 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
200–219	MW-N-VAS-210.0-215.0 (290) 2/21/2019 09:21	Topock - Alluvium Deposits	GC		(196.7 - 216.7') 2" Sch 80 PVC (20-slot) Screen; (0.2 - 226.7') 2" PVC Sch 80 Casing; (194.5 - 221.0') Cemex #3 MESH (8x20) Lapis Lustre Sand; (5.0 - 241.0') 10" Borehole; (216.7 - 219.0') Sump and PVC End Cap	(194.5 - 221.0') 25.7 bags	(194.5 - 221.0') 31 bags (121%) Note: Filter pack, used >20% of the calculated volume due to potential voids that formed during drilling.

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-85d

Well Construction Log

Sheet: 12 of 13

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Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
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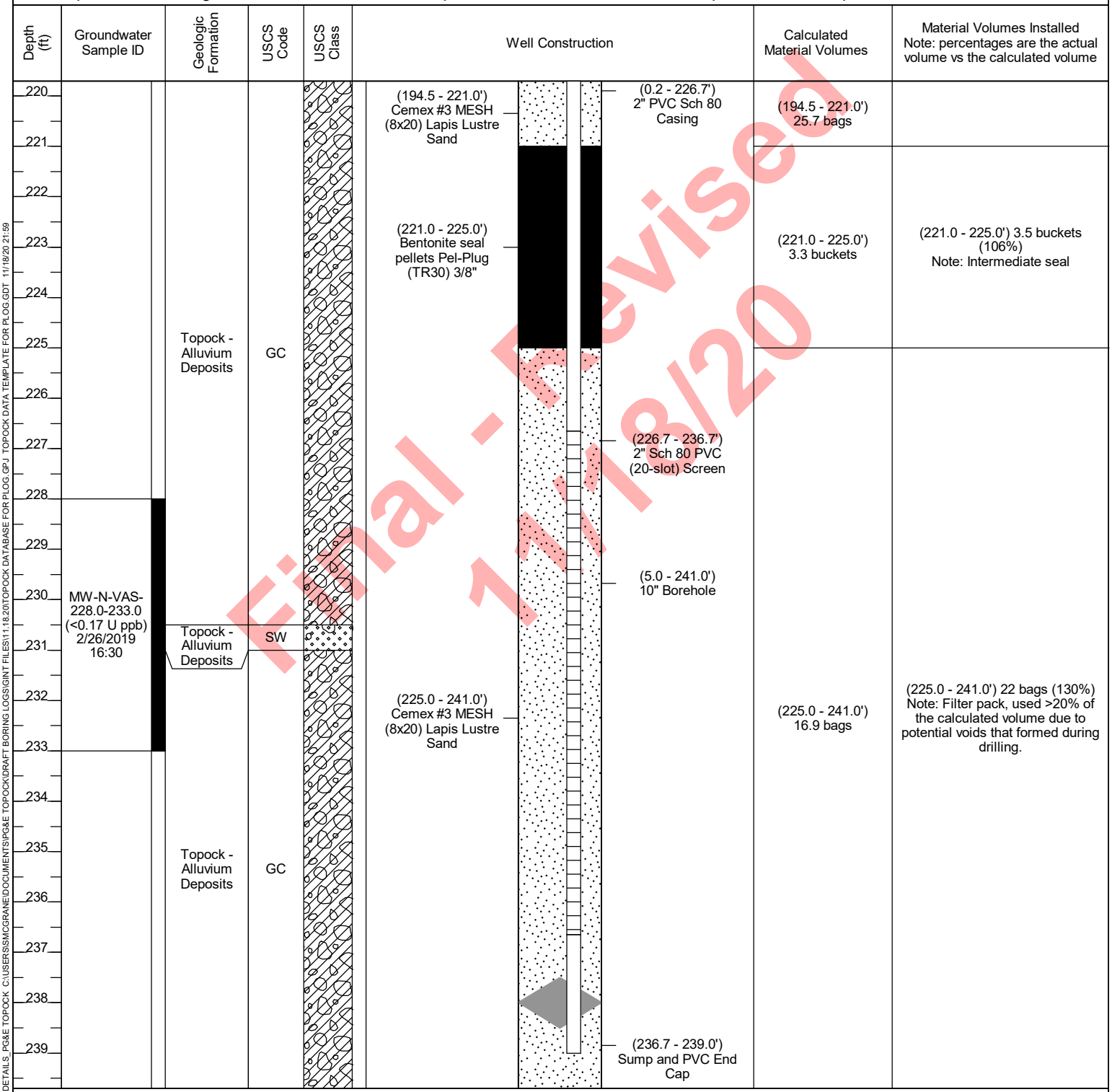
Total Depth:	247 ft bgs	Well Completion:	☒ Flush ☐ Stick-up ☐ To Be Completed in Well Vault		



Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-85d

Well Construction Log

Sheet: 13 of 13

Well ID: MW-85-217, MW-85-237

Date Started:	03/04/2019	Surface Elevation:	569.66 ft amsl		
Date Completed:	04/12/2019	Shallow Well Elevation:	569.36 ft amsl		
Drilling Co.:	Cascade	Deep Well Elevation:	569.50 ft amsl	Client:	PG&E
Drilling Method:	Sonic Drilling	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Driller Name:	Dan O'Mara	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Asst:	E. Huellmantel / T. Wolfe	Borehole Diameter:	4-12 inches		
Logger:	P. Knightly / D. Maurer	Static Water Level:	See Log for Depths	Project Number:	RC000753.0051
Editor:	Sean McGrane	Development End Date:	4/2/2019		
Total Depth:	247 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
240			GC		(225.0 - 241.0') Cemex #3 MESH (8x20) Lapis Lustre Sand; (5.0 - 241.0') 10" Borehole	(225.0 - 241.0') 16.9 bags	
241		Topock - Weathered Bedrock - conglomerate	SC				
242							
243							
244		Topock - Competent Bedrock - conglomerate			(241.0 - 247.0') Bentonite seal chips Enviroplug medium chips; (241.0 - 247.0') 4" Borehole	(241.0 - 247.0') 1.2 bags	(241.0 - 247.0') 1 bags (83%) Note: Decommissioned rathole, installed to 240 ft. bgs 1 foot removed during overdrilling with 10-inch casing.
245							
246							
247					End of Boring at 247.0 ft bgs.		
248							
249							
250							
251							
252							
253							
254							
255							
256							
257							
258							
259							

Abbreviations: USCS = Unified Soil Classification System, ft = feet, bgs = below ground surface, amsl = above mean sea level, GW = groundwater, ppb = parts per billion, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: solid blue and hollow blue water table marks represent depth to water (ft. bgs.) measured post development for the shallow well and deep well respectively; installed in MW-85d

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 1 of 13

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	**Boring No.:**	**MW-85d**
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86		
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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
1–7	72			Topock - Fluvial Deposits	GW-GM		(0.0 - 7.5') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); yellowish brown / moderate yellowish brown (10YR 5/4) some light brown (7.5YR 6/4); granules to very large pebbles, subangular to subround; some fine to very coarse grained sand, angular to subangular; little silt; trace subangular to subround; some coarser clasts composed of metadiorite; dry	(0.0') Paul Knightly geologist on-site 0 to 107 ft bgs.	
8–17	54			Topock - Fluvial Deposits	GM		(7.5 - 17.0') Topock - Fluvial Deposits; Silty gravel with sand (GM); dark grayish brown (2.5Y 4/2); granules to very large pebbles, angular to subround; some silt; little fine to very coarse grained sand; trace angular to subround; some coarser clasts composed of metadiorite; dry		
18–20	90			Topock - Fluvial Deposits	GW-GM		(17.0 - 22.8') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); dark grayish brown / dark yellowish brown (10YR 4/2); granules to very coarse grained, subangular to subround; some fine to very coarse grained sand, subangular to subround; little silt; trace subangular to subround; some coarser clasts composed of metadiorite; 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, NR = no recovery; Notes: depth to water measured during first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-85-217, MW-85-237 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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				Topock - Fluvial Deposits	GW-GM				
23–27	90			Topock - Fluvial Deposits	SP		(22.8 - 27.0') Topock - Fluvial Deposits; Poorly graded sand with gravel (SP); reddish yellow (7.5YR 6/6); fine grained to medium grained; little granules to very large pebbles, angular to subangular; little coarser clasts composed of metadiorite; dry (25.6'); and granules to large pebbles, angular to subround; little coarser clasts composed of metadiorite; dry; decrease in sand (26.2'); little granules to very large pebbles, angular to subangular; increase in sand		
27–30					NR		(27.0 - 30.7') No recovery (NR)		
30–32	87.6			Topock - Fluvial Deposits	GW		(30.7 - 33.0') Topock - Fluvial Deposits; Well graded gravel with sand (GW); dark grayish brown / dark yellowish brown (10YR 4/2); granules to very large pebbles; little fine to very coarse grained sand, angular to subangular; trace; trace silt; little coarser clasts composed of metadiorite; dry		
33–37				Topock - Fluvial Deposits	SP		(33.0 - 37.0') Topock - Fluvial Deposits; Poorly graded sand with gravel (SP); reddish yellow (7.5YR 6/6); fine grained to medium grained; little granules to very large pebbles, angular to subangular; little coarser clasts composed of metadiorite; dry (36') brown (7.5YR 4/2); trace silt; trace clay; decrease in sand		
37–38	96			Topock - Fluvial Deposits	SM		(37.0 - 39.0') Topock - Fluvial Deposits; Well graded gravel (SM); light brownish gray / pale yellowish brown (10YR 6/2); fine grained to very coarse grained, angular to subangular; little granules to large pebbles, subangular to subround; little silt; trace clay; some coarser clasts composed of metadiorite; moist; weak cementation; moisture from drilling fluid	(37.0 - 47.0') Rough drilling, formation collapse.	(37.0') gallons of water used; gallons of water recovered; gallons of water lost
39–40				Topock - Fluvial Deposits	GW		(39.0 - 41.0') Topock - Fluvial Deposits; Well graded gravel with sand (GW); grayish brown (2.5Y 5/2); granules to very large pebbles, angular to subround; little fine to very coarse grained		

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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	GW		sand, angular to subangular; trace angular to subround; trace silt; and coarser clasts composed of metadiorite; dry		
42									
43									
44	96			Topock - Fluvial Deposits	GW		(41.0 - 47.0') Topock - Fluvial Deposits; Well graded gravel with sand (GW); dark gray (2.5Y 4/1); granules to very large pebbles, angular to subround; little fine to very coarse grained sand, angular to subround; trace angular to subround; trace silt; trace clay		
45									
46									
47									
48				Topock - Fluvial Deposits	GW		(47.0 - 52.0') Topock - Fluvial Deposits; Well graded gravel with sand (GW); dark grayish brown / dark yellowish brown (10YR 4/2); granules to very large pebbles, subangular to round; little very fine to coarse grained sand, subangular to subround; trace subangular to round; trace silt; moist; moisture from drilling fluid	(47.0 - 67.0') Drilling water was used could not determine quantity.	
49									
50									
51									
52	120								
53									
54									
55									
56				Topock - Fluvial Deposits	SW		(52.0 - 60.0') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (7.5YR 5/3); fine grained to coarse grained, subangular to subround; little granules to large pebbles, subangular to round; little silt; little coarser clast composed of conglomerate; trace coarser clast composed of basalt; dry		
57									
58	120								
59									
60									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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							(60.0 - 67.0') Topock - Fluvial Deposits; Well graded gravel with sand (GW); brown (7.5YR 5/3); granules to very large pebbles, angular to round; some fine to medium grained sand; trace angular to round; trace silt; and coarser clast composed of conglomerate; dry		
62									
63									
64	120			Topock - Fluvial Deposits	GW				
65									
66									
67									
68							(67.0 - 80.3') Topock - Fluvial Deposits; Poorly graded sand (SP); brown (10YR 5/3); very fine grained to medium grained; little granules to very large pebbles, subangular to round; trace subangular to subround; trace silt; trace clay; trace coarser clast composed of conglomerate; dry to moist; moisture due to drilling fluid, conglomerate cobbles weakly cemented	(67.0 - 77.0') Slow drilling, core samples came out hot.	
69									
70									
71									
72	120			Topock - Fluvial Deposits	SP				
73									
74									
75									
76									
77									
78									
79	120								
80									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	**Boring No.:**	**MW-85d**
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86		
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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					SP		(80.3 - 92.2') Topock - Fluvial Deposits; Well graded gravel with sand (GW); brown (7.5YR 5/3); granules to very large pebbles, subangular to round; little fine to medium grained sand; trace subangular to round; trace silt; dry		
82									
83									
84	120								
85									
86				Topock - Fluvial Deposits	GW				
87									
88									
89									
90									
91									
92	120						(92.2 - 96.5') Topock - Fluvial Deposits; Well graded sand with gravel (SW); brown (10YR 5/3); fine grained to coarse grained, angular to subround; some granules to very large pebbles, subangular to round; trace coarser clast composed of conglomerate; dry		
93									
94				Topock - Fluvial Deposits	SW				
95									
96									
97				Topock - Fluvial Deposits	GP		(96.5 - 97.0') Topock - Fluvial Deposits; Poorly graded gravel with sand (GP); reddish brown (2.5YR 4/4) little brown (10YR 5/3); small cobbles, subangular to round; little fine to coarse grained sand, angular to subround; dry; cobbles of conglomerate sandstone		
98									
99	120			Topock - Fluvial Deposits	GW		(97.0 - 105.0') Topock - Fluvial Deposits; Well graded gravel with sand (GW); brown (10YR 5/3); granules to very large pebbles, subround to round; little fine to coarse grained sand, subangular to subround; trace angular to round; trace silt; dry		
100									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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				Topock - Fluvial Deposits	GW				
102									
103									
104	120								
105									
106							(105.0 - 120.0') Topock - Fluvial Deposits; Well graded gravel with silt and sand (GW-GM); dark grayish brown (2.5Y 4/2); small pebbles to very large pebbles, angular to round; little fine to medium grained sand; little silt; dry		
107									
108							(107.0 - 117.0') reddish brown (2.5YR 5/3); granules to very large pebbles, subround to round; moist	(107.0') Derrick Maurer geologist on-site 107 to 247 ft bgs.	
109									
110									
111							(110.0 - 117.0'); trace; increase in gravel, decrease in sand		
112	120			Topock - Fluvial Deposits	GW-GM			(112.0 - 117.0') Rough drilling, drill rod broke and was retrieved.	
113									
114									
115									
116									
117									
118							(117.0 - 120.0') reddish brown (2.5YR 4/4); wet	(117.0') Approximate depth to water table.	(117.0') 150 gallons of water used; 0 gallons of water recovered; 150 gallons of water lost
119	120								
120									

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ARCADIS Design & Consultancy for natural and built assets

Boring Log

Sheet: 7 of 13

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	**Boring No.:**	**MW-85d**
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86		
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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		MW-N-VAS-121.0-126.0 (0.51 ppb) 2/14/2019 14:09	Topock - Alluvium Deposits	GM		(120.0 - 127.0') Topock - Alluvium Deposits; Silty gravel with sand (GM); reddish brown (2.5YR 4/4); granules to very large pebbles, subangular to subround; little very fine to medium grained sand; little silt; wet		
122									
123									
124									
125									
126									
127									
128	36			Topock - Alluvium Deposits	GW-GM		(127.0 - 137.0') Topock - Alluvium Deposits; Well graded gravel with silt and sand (GW-GM); reddish brown (2.5YR 4/4); granules to medium pebbles, subangular to subround; some fine to medium grained sand; little silt; wet		
129									
130							(130.0 - 132.0') reddish brown (2.5YR 4/3)		
131	84								
132							(132.0 - 137.0') granules to very large pebbles		
133									
134									
135									
136									
137									
138	120			Topock - Alluvium Deposits	SM		(137.0 - 147.0') Topock - Alluvium Deposits; Silty sand (SM); brown (7.5YR 4/3); fine grained to medium grained; little silt; trace granules to very large pebbles, subangular to subround; trace clay; wet		
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, U = not detected above the laboratory reporting limit, NR = no recovery; Notes: depth to water measured during first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-85-217, MW-85-237 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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									
143									
144	120		MW-N-VAS-142.0-147.0 (<0.033 U) 2/16/2019 10:57	Topock - Alluvium Deposits	SM				
145									
146									
147									
148							(147.0 - 159.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); brown (7.5YR 4/3); granules to very large pebbles, subangular to subround; some fine to medium grained sand; little silt; little clay; wet	(147.0') 6-inch casing broke downhole and was retrieved.	
149									
150									
151									
152									
153				Topock - Alluvium Deposits	GM				
154	240								
155									
156									
157									
158									
159									
160				Topock -	GW		(159.5 - 160.0') Topock - Alluvium Deposits; Well graded 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, NR = no recovery; Notes: depth to water measured during first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-85-217, MW-85-237 installed in borehole

Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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				Alluvium Deposits			with sand (GW); brown (7.5YR 4/3); granules to very large pebbles, subangular to subround; and fine to medium grained sand; trace silt; wet		
162							(160.0 - 167.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); brown (7.5YR 4/3); granules to very large pebbles, subangular to subround; some fine to medium grained sand; little silt; wet		
163									
164	240			Topock - Alluvium Deposits	GM				
165									
166									
167								(167.0 - 175.0') Rough drilling.	
168				Topock - Alluvium Deposits	SW		(167.5 - 170.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/3); fine grained to coarse grained, subangular to subround; some granules to very large pebbles, subangular to subround; trace silt; wet		
169									
170									
171	96			Topock - Alluvium Deposits	GM		(170.0 - 173.5') Topock - Alluvium Deposits; Silty gravel with sand (GM); brown (7.5YR 4/3); granules to very large pebbles, subangular to subround; some fine to medium grained sand; little silt; wet		
172									
173								(173.0 - 178.0') Sample collected with bailer.	
174				Topock - Alluvium Deposits	SW		(173.5 - 175.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); brown (7.5YR 4/4); fine grained to coarse grained, subangular to subround; some granules to very large pebbles, subangular to subround; trace silt; wet		
175			MW-N-VAS-173.0-178.0 (<0.033 U) 2/18/2019 09:20						
176							(175.0 - 181.5') Topock - Alluvium Deposits; Clayey gravel with sand (GC); brown (10YR 5/3); granules to very large pebbles, subangular to subround; little fine to medium grained sand; little clay; trace silt; moist to wet		
177									
178	144			Topock - Alluvium Deposits	GC				(177.0') 250 gallons of water used; 0 gallons of water recovered; 250 gallons of water lost
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, NR = no recovery; Notes: depth to water measured during first VAS interval; apparent partial recoveries can be the result of potential compaction of sediments in the core bag; wells MW-85-217, MW-85-237 installed in borehole

ARCADIS Design & Consultancy for natural and built assets

Boring Log

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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				Topock - Alluvium Deposits	GC				
182				Topock - Alluvium Deposits	GW		(181.5 - 183.5') Topock - Alluvium Deposits; Well graded gravel with sand (GW); light gray (10YR 7/2); granules to very large pebbles, angular to subround; little fine to medium grained sand; trace silt; dry to moist		
183	144								
184				Topock - Alluvium Deposits	GC		(183.5 - 187.0') Topock - Alluvium Deposits; Clayey gravel with sand (GC); brown (10YR 5/3); granules to very large pebbles, subangular to subround; little fine to medium grained sand; little clay; trace silt; moist		
185									
186									
187									
188				Topock - Alluvium Deposits	SC		(187.0 - 190.0') Topock - Alluvium Deposits; Clayey sand with gravel (SC); reddish brown / moderate brown (5YR 4/4); fine grained to medium grained; little granules to large pebbles, angular to subangular; little clay; trace silt; moist		
189									
190									
191				Topock - Alluvium Deposits	SC		(190.0 - 193.5') Topock - Alluvium Deposits; Clayey sand (SC); brown (7.5YR 4/3); fine grained to medium grained; dry; weak cementation; increase in sand, decrease in gravel		
192	120								
193									
194				Topock - Alluvium Deposits	GW		(193.5 - 197.0') Topock - Alluvium Deposits; Well graded gravel (GW); (7.5R 5/3); granules to very large pebbles, angular to subround; trace fine to medium grained sand; trace silt; dry		
195									
196									
197									
198				Topock - Alluvium Deposits	GC		(197.0 - 217.0') Topock - Alluvium Deposits; Clayey gravel with sand (GC); brown (7.5YR 4/3); granules to very large pebbles, subangular to subround; little fine to medium grained sand; little clay; trace silt; moist to wet		
199	228								
200									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	**Boring No.:**	**MW-85d**
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86		
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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
201									
202									
203									
204									
205									
206									
207									
208	228			Topock - Alluvium Deposits	GC				(207.0') 70 gallons of water used; 40 gallons of water recovered; 30 gallons of water lost
209									
210									
211									
212			MW-N-VAS-210.0-215.0 (290) 2/21/2019 09:21						
213									
214									
215									
216								(216.0 - 217.0') Lost soil core down hole, tripped back in to retrieve.	
217									
218	240			Topock - Alluvium Deposits	GC		(217.0 - 230.5') Topock - Alluvium Deposits; Clayey gravel with sand (GC); reddish brown / moderate brown (5YR 4/4); granules to very large pebbles, subangular to subround; some clay; little fine to medium grained sand; trace silt; moist to wet		(217.0 - 217.0') 120 gallons of water used; 50 gallons of water recovered; 70 gallons of water lost
219									
220									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	**Boring No.:**	**MW-85d**
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86		
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Client:	PG&E
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs	Project:	Final GW Remedy Phase 1
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches	Location:	PG&E Topock, Needles, California
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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
221									
222									
223									
224									
225				Topock - Alluvium Deposits	GC				
226									
227									
228									
229	240								
230			MW-N-VAS-228.0-233.0 (<0.17 U ppb) 2/26/2019 16:30						
231				Topock - Alluvium Deposits	SW		(230.5 - 231.0') Topock - Alluvium Deposits; Well graded sand with gravel (SW); reddish brown (5YR 4/3); medium grained to very coarse grained, subangular to subround; some granules to medium pebbles, subangular to subround; trace silt; trace coarser clasts composed of metadiorite; wet		
232							(231.0 - 240.0') Topock - Alluvium Deposits; Clayey gravel with sand (GC); reddish brown / moderate brown (5YR 4/4); granules to very large pebbles, subangular to subround; some clay; little fine to medium grained sand; trace silt; moist to wet		
233									
234									
235				Topock - Alluvium Deposits	GC				
236									
237									
238									
239	120								
240									

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Boring Log

ARCADIS Design & Consultancy for natural and built assets

Boring No.: MW-85d

Date Started:	01/07/2019	Surface Elevation:	569.66 ft amsl	Client:	PG&E
Date Completed:	03/03/2019	Northing (NAD83):	2102325.86	Project:	Final GW Remedy Phase 1
Drilling Co.:	Cascade	Easting (NAD83):	7615441.49	Location:	PG&E Topock, Needles, California
Drilling Method:	Sonic Drilling	Total Depth:	247 ft bgs		
Drill Rig Type:	Terrasonic Track Mount	Borehole Diameter:	4-12 inches		
Driller Name:	Dan O'Mara	Depth to First Water:	120.4 ft bgs		
Drilling Asst:	E. Huellmantel / T. Wolfe	Sampling Method:	4 inch x 10 ft. Core Barrel	Project Number:	RC000753.0051
Logger:	P. Knightly / D. Maurer	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
241				Topock - Weathered Bedrock - conglomerate	SC		(240.0 - 242.5') Topock - Weathered Bedrock - conglomerate; Clayey sand with gravel (SC); reddish brown (5YR 4/3); fine grained to medium grained; some clay; little granules to medium pebbles, subangular to subround; trace silt; moist to wet		
242									(241.0') gallons of water used; gallons of water recovered; gallons of water lost; flushed out casing prior to well installation
243	120						(242.5 - 247.0') Topock - Competent Bedrock - conglomerate; reddish brown (5YR 4/3); little fine to medium grained sand; little silt; trace clay; dry; friable pulverized by drilling		
244				Topock - Competent Bedrock - conglomerate					
245									
246									
247							(246.5') (10YR 2.5/1); metadiorite boulder End of Boring at 247.0 ft bgs.	(246.5 - 247.0') Drill bit broke/melted and had a 0.5 of bedrock in the core.	
248									
249									
250									
251									
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260									

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