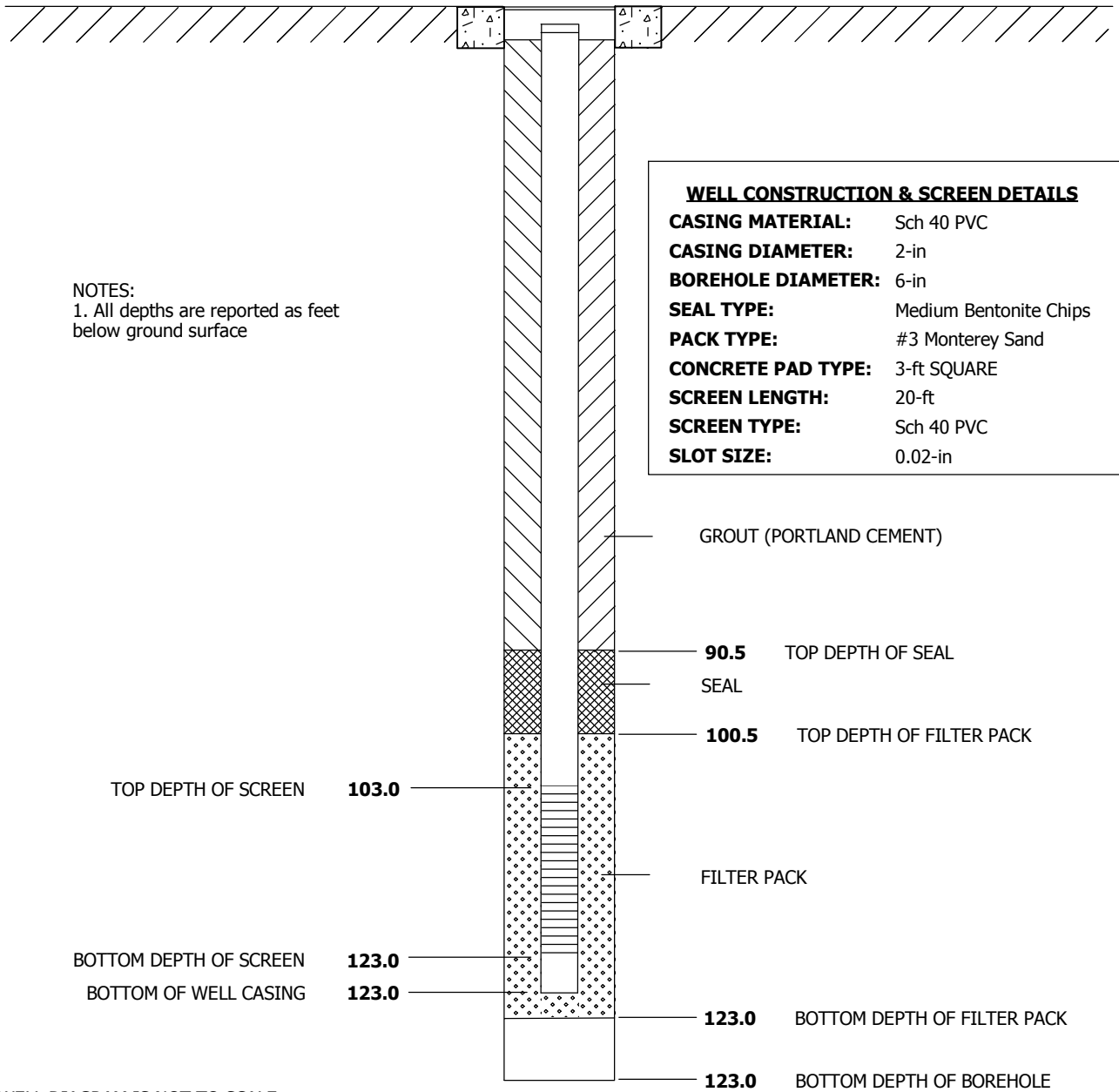
WELL COMPLETION DIAGRAM

PROJECT NO: 382653.FP.04.FW	**PROJECT:** PG&E Topock - ERGI	**WELL NO:** ***MW-60-125***
LOCATION: Site F		

DRILLING CONTRACTOR: Boart Longyear (D. Roberts)	**DRILLING START:** 2/27/2009
DRILLING METHOD: Rotary Core (HQ) - Rotosonic overdrill	**DRILLING END:** 3/3/2009
LOGGER: A. Brewster (Northstar)	**WELL COMPLETION DATE:** 3/3/2009
GROUND SURFACE ELEVATION (NAVD 88): 555.78 ft AMSL	**GENERAL REMARKS:** Alias during field work: MW-60
NORTHING (CCS NAD 83 Z 5): 2100491.63 / **EASTING (CCS NAD 83 Z 5):** 7616434.82	

12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



NOTES:
1. All depths are reported as feet below ground surface

WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
BOREHOLE DIAMETER:	6-in
SEAL TYPE:	Medium Bentonite Chips
PACK TYPE:	#3 Monterey Sand
CONCRETE PAD TYPE:	3-ft SQUARE
SCREEN LENGTH:	20-ft
SCREEN TYPE:	Sch 40 PVC
SLOT SIZE:	0.02-in

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
382653.FP.04.FW	MW-60 SHEET 1 OF 7

SOIL BORING LOG

PROJECT : PG&E Topock - ERGI
LOCATION : Site F (2100491.6 N, 7616434.8 E)
ELEVATION : 555.8 ft
DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools
ORIENTATION : Vertical
WATER LEVELS : Approx. 98 ft BGS
START : 2/27/2009
END : 3/3/2009
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE		SM	**Silty Sand (SM)** 0.0-9.0' - dark yellowish brown, (10YR 4/4), dry, loose, 15% gravel, 60% sand, 25% fines, angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 60 mm.		Boring initially drilled to 86.5' bgs using Rotosonic tools up to 6-in in diameter. 6-in conductor casing then used as a temporary conductor casing to facilitate rotary core drilling. Boring drilled from 86.5' bgs to a total depth of 123.0' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter), and then overdrilled to total depth using 6-in Rotosonic tools.
5							
10				pTbr	**Metadiorite (pTbr)** 9.0-86.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are described, as appropriate.		
15					16.0-26.0'- greyish green (5G 5/2), fine grained, some calcite infill (1 mm max) and reddish staining observed on fracture surfaces		
20							

PROJECT NUMBER: 382653.FP.04.FW	BORING NUMBER: MW-60	SHEET 2 OF 7

SOIL BORING LOG

PROJECT : PG&E Topock - ERGI
LOCATION : Site F (2100491.6 N, 7616434.8 E)
ELEVATION : 555.8 ft
DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools
ORIENTATION : Vertical
WATER LEVELS : Approx. 98 ft BGS
START : 2/27/2009
END : 3/3/2009
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE			**Metadiorite (pTbr)** 16.0-26.0'- greyish green (5G 5/2), fine grained, some calcite infill (1 mm max) and reddish staining observed on fracture surfaces		
25					26.0-35.0'- dusky yellowish green (10GY 3/2), fine grained, some calcite infill (1 mm max) and reddish staining observed on fracture surfaces		
30				pTbr			
35					36.0-73.0'- dusky green (5G 3/2), fine grained, no infill, very little reddish staining on fracture surfaces		
40							

PROJECT NUMBER: 382653.FP.04.FW	BORING NUMBER: MW-60	SHEET 3 OF 7

SOIL BORING LOG

PROJECT : PG&E Topock - ERGI
LOCATION : Site F (2100491.6 N, 7616434.8 E)
ELEVATION : 555.8 ft
DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools
ORIENTATION : Vertical
WATER LEVELS : Approx. 98 ft BGS
START : 2/27/2009
END : 3/3/2009
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE			**Metadiorite (pTbr)** 36.0-73.0'- dusky green (5G 3/2), fine grained, no infill, very little reddish staining on fracture surfaces		
45							
50				pTbr			
55							
60							

PROJECT NUMBER: 382653.FP.04.FW	BORING NUMBER: MW-60	SHEET 4 OF 7

SOIL BORING LOG

PROJECT : PG&E Topock - ERGI
LOCATION : Site F (2100491.6 N, 7616434.8 E)
ELEVATION : 555.8 ft
DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools
ORIENTATION : Vertical
WATER LEVELS : Approx. 98 ft BGS
START : 2/27/2009
END : 3/3/2009
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE			**Metadiorite (pTbr)** 36.0-73.0'- dusky green (5G 3/2), fine grained, no infill, very little reddish staining on fracture surfaces		
65							
70				pTbr			
					73.0-86.5'- dusky green (5G 3/2) rock mass with very light grey (N8) mottling, medium grained, calcite infill and reddish staining on fracture surfaces		73.0-86.5'- Nearly 100% of core recovered is intact.
75							
80							

PROJECT NUMBER: 382653.FP.04.FW	BORING NUMBER: MW-60	SHEET 5 OF 7

SOIL BORING LOG

PROJECT : PG&E Topock - ERGI
LOCATION : Site F (2100491.6 N, 7616434.8 E)
ELEVATION : 555.8 ft
DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools
ORIENTATION : Vertical
WATER LEVELS : Approx. 98 ft BGS
START : 2/27/2009
END : 3/3/2009
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
85	86.5	COMPLETE		pTbr	73.0-86.5'- dusky green (5G 3/2) rock mass with very light grey (N8) mottling, medium grained, calcite infill and reddish staining on fracture surfaces		Total depth of initial Rotosonic boring is 86.5 ft bgs. Begin rotary core drilling.
					Begin rock coring from 86.5 ft bgs See the next page for the rock core log.		
90							
95							
100							

PROJECT NUMBER: 382653.FP.04.FW	BORING NUMBER: MW-60	SHEET 6 OF 7

ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site F (2100491.6 N, 7616434.8 E)

ELEVATION : 555.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 98 ft BGS

START : 2/27/2009

END : 3/3/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES: R Q D (%)	DISCONTINUITIES: FRACTURES PER FOOT	DISCONTINUITIES: DESCRIPTION (DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS)	SYMBOLIC LOG	LITHOLOGY (ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS)	COMMENTS (SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.)
	86.5		>10	86.5-89.5' - Fracture zone, rough, undulating, < 1 mm calcite infilling, reddish staining, no dominant orientation		**Metadiorite (pTbr)** 86.5-123.0' - dusky green, (5G 3/2), intermediate (dioritic) mineralogy, medium grained, unweathered, massive to foliated	General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling.
	R1 3 ft 100%	0	>10				
			>10				
	89.5		>10	89.5-96.5' - Fracture zone, 30 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight			R1 = 23.0 min
90			2				
			2				
	R2 7 ft 100%	53	3			92.0' - fine grained	
			2				
			>10				
95			>10				
	96.5		0				R2 = 36.0 min
			1	97' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight			
			0				
			1				
100			1	100' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
	R3 9.9 ft 100%	48	2	100.5-105.0' - Fracture zone, 30 deg and 60 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, rusty staining at 102.5' and 103.6', tight.			
			1				
			1				
			1				
105						104.5' - medium grained	
			0				
	106.4						R3 = 50.0 min

PROJECT NUMBER: 382653.FP.04.FW	BORING NUMBER: MW-60	SHEET 7 OF 7

ROCK CORE LOG

PROJECT : PG&E Topock - ERGI
LOCATION : Site F (2100491.6 N, 7616434.8 E)
ELEVATION : 555.8 ft
DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)
ORIENTATION : Vertical
WATER LEVELS : Approx. 98 ft BGS
START : 2/27/2009
END : 3/3/2009
LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES: R Q D (%)	DISCONTINUITIES: FRACTURES PER FOOT	DISCONTINUITIES: DESCRIPTION (DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS)	SYMBOLIC LOG	LITHOLOGY (ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS)	COMMENTS (SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.)
			1			**Metadiorite (pTbr)** 86.5-123.0' - dusky green, (5G 3/2), intermediate (dioritic) mineralogy, medium grained, unweathered, massive to foliated	
			1	107.5' - Joint, 70 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight			
	R4 6 ft 100%	90	0				
			0				
110							
			0			110.5' - coarse grained	
			0				
	112.4			112.0-115.0' - Fracture zone or mechanical break, 30 deg and 60 deg, < 1 mm calcite infilling, rusty-reddish staining, tight, likely mechanical breaks along healed joints		112.0' - fine grained	R4 = 33.0 min
			1				
	R5 3.6 ft 100%	0	1			113.5' - yellow-orange staining	
			1				
115							
			>10	115.0-116.0' - Fracture zone, rough, undulating, no staining, no dominant orientation			
	116.0			116.0-123.0' - Fracture zone, 30 deg, rough, undulating, < 0.05 mm calcite infilling, no staining, tight			
			1				R5 = 45.0 min
			1				
			2				
	R6 7 ft 100%	77	1				
120							
			0				
			1			121.0-122.0' - yellow-orange staining	
			1				R6 = 31.0 min
	123.0						
						End Drilling on 3/3/2009 Total Borehole Depth: 123.0 ft bgs	
125							