

**APPENDIX C**

**Geologist's Field Logs From Current Investigation**

Project: SLAC LCLS Geotechnical Investigation  
 Project Location: SLAC Phase II  
 Project Number: 2002-06062

Log of Core Boring LCLS-1

Sheet 1 of 3

Date(s) Drilled	7/22/04	Logged By	R. Harlan	Checked By	
Drilling Method	HQ Wireline Core	Drill Bit Size/Type	HQ diamond-impregnated	Total Drilled Depth/Length	32.0'
Drill Rig Type	CME-55	Drilling Contractor	Taber Consulting	Approximate Surface Elevation	245
Groundwater Level	~12.5' gray rock (see LCLS-2)	Coordinate Location	N _____ E _____	Inclination from Horizontal/Bearing	Vertical
Borehole Completion	Tremie Grout Backfill		Location		

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
0							AS 0'-0.2' Asphalt	1328	Drill w/ 5" finger bit to 1.1'	
0.2							Base 0.2'-1.0' Sandy Gravel Base Rock			
1							<u>LADERA SANDSTONE</u>			
1.0			100		17		1.0'-32.0' SILTY SANDSTONE: lt. yellowish-brown; v. fine grained; slightly weathered; friable; low hardness; mostly uncemented; generally v. little fractured w/ some closely-spaced bedding - parallel jointing; locally weakly to mod. well cemented.		1.1'-2.5' Drive Cal. Sampler; refusal @ 2.5'; retain brass liner, 1.5-2.0' (env.)	
2		liner			18				2.5-2.9' Cal. Sampler; refusal; retain liner 2.5-2.8' (env.)	
3		liner			50/15				4" auger to 5.0'; retain cuttings, 4.5-5.0', in liner (env.)	
4					100		SS Yellowish gray-brown faint orange staining/mottling, below ~4' Weakly cemented ~5' to 8.0'		Set casing to 3.7'	
5		liner					Numerous horizontal breaks, probably mechanical, in Run 1	1413	start coring @ 5.0'	
6	1		75	1+			Set of Fe-stained, 20°-40° healed joints w/in solid core segments, 5.3-6.5'	1418	Casing leaking @ 7.0'; stop, redrive casing.	
7			15	2+			Numerous horizontal mechanical breaks continued to 8.1'	1417		
8			2.0				Uncemented, 8.0-9.2 Weakly cemented 9.2-9.6 Uncemented, 9.6-10.1			
9	2		100	0	0		Very weakly-weakly cemented, possibly some closely spaced subhorizontal bedding, 10.1'-12.5' (some mech. breakage)			
10										
11										
12							Faint Fe-stain on horizontal break (bedding joint) at 12.5'	1452		
12.5	3		100	1+	6		Abrupt color change to dark gray at 12.5'	1456		
13							LT. gray, well-cemented, mod. strong, mod. hard, (RQD), 12.5-12.8'			

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-06062

Log of Core Boring LCLS-1

Sheet 2 of 3

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
13				0				Silty Sandstone, dark gray, v. fine grained, slightly weathered, friable, low hardness, mostly uncemented w/ some weakly-mod. well cemented zones, very little fractured (continued).  v. weakly cemented, 16.9'-17.2'  1/2" clam shell @ 22.3 Weakly cemented, 12.0-12.5  Horizontal breaks along thin, 1/2" cemented layers at 24.9' (bedding)  Lt. gray, well-cemented layer (horizontal bedding), mod. strong (RQD; includes 1 mechanical break), 25.7-26.1  Mod. cemented, 27.0-27.6'  Numerous horizontal mechanical breaks, 27.0-29.1 Well cemented, 27.6-27.9 Weakly cemented, 27.9-28.4 (mech. breakage)		
14	3	1	100	0	6					
15				0						
16				0			SS			
17		2		0					1502	
18				0					1506	
19	4		100	0	0					
20				0						
21				0						
22				0			clam		Not Rec.	1513
23				0						
24	5		100	0	8					
25				0						
26		3		0			cem			
27				0					1518	
28	6		58	?	12				1522	
29			29	?						
			5.0	?						

Project: SLAC LCLS Geotechnical Investigation Phase II

Project Location: SLAC

Project Number: 2002-060G2

Log of Core Boring LCLS-1

Sheet 3 of 3

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D., %	Fracture Drawing Number				
29										
30	6		58	0			Well cemented, mod. strong (RQD) 28.4-29.1 (several horizontal mechanical breaks in cemented zone)			
31		3	29 5.0	?	12		Silty sandstone, dk. gray, v. fine grained, uncemented, friable, low hardness below 29.1'			
32				?			No recovery below 29.9 (presumably v. fine uncemented silty ss, washed out)			
33							BOTTOM OF HOLE @ 32.0'			
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										



Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
13										
14	3	1	3.7 4.5	0 0	0		Silty Sandstone, mod. yellowish brown; v. fine grained, friable, low hardness; v. little fractured (cont.)			Core loss in run 3 assumed at top of run 12.3-13.1'
15			82	0		57H SS				
16							Weakly-mod. cemented, 15.9-18.2 Becomes yellowish gray-brown @ 16.8' Numerous subhorizontal (10°-20°) joints along bedding, closely spaced, 16.9 to 18.2 (some horz. breaks along this section probably mechanical)			Full drill fluid return
17										
18							Mod. yellowish brown, uncemented from 18.2-19.1 Yellowish gray-brown weakly cemented, w/ numerous core breaks along bedding (as above 18.2'), 19.1'-20.0'			
19	4		100	1+	0					
20							Becomes dark gray at 20.0' (ground water? rock is probably saturated below this depth), continued weakly cemented w/ some w horizontal breaks along bedding to 21.0'			
21										
22		2					Uncemented, 21.0'-21.8 Weakly cemented w/ some subhorizontal breaks along bedding, 21.8-22.4' Uncemented, 22.4-23.0' Weakly cemented w/ horizontal breaks along bedding, 23.0-23.7			
23										
24							Mostly uncemented, w/ v. few bedding breaks, 23.7 to hole bottom 1" mod. cemented layer along 10° bedding @ 25.0'			
25	5		100	4	0					
26							Weakly cemented, 26.7-27.1			
27										
28										
29	6		100	0	0					

Project: SLAC LCLS Geotechnical Investigation Phase II

Project Location: SLAC

Project Number: Z002-060GZ

Log of Core Boring LCLS-2

Sheet 3 of 3

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
29										
30	6	2	100	0	0		Silty sandstone, dark gray, v. fine grained, friable, low hardness, uncemented, v. little fractured (continued). SS			
31		3		0						
32				0					1152	
33							HOLE BOTTOM @ 31.8'			
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										

Project: SLAC LCLS Geotechnical Investigation Phase II

Log of Core Boring LCLS-3

Project Location: SLAC

Sheet 1 of 4

Project Number: Z002-060GZ

Date(s) Drilled: 7/21/2004	Logged By: R. Harlan	Checked By:
Drilling Method: HQ wireline core	Drill Bit Size/Type: HQ diamond-impregnated	Total Drilled Depth/Length: 60.0
Drill Rig Type: CME-55	Drilling Contractor: Taber Consulting	Approximate Surface Elevation: 278.9
Groundwater Level: Not measured (probably not present)	Coordinate Location: N _____ E _____	Inclination from Horizontal/Bearing: Vertical
Borehole Completion: Tremie Grout Backfill (after down hole testing)	Location:	

Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %				
0					1		<u>FILL</u>		0'-1.5' Drive* 2 1/2" OD Cal. sampler; retain brass liner sample 0.5-1.0 (env.)
1		110	80		5 10	SC	0'-3' Gravelly clayey sand (SC): mod. yllwsh. brown; damp; med. dense; Fine to coarse gravel to 1"Ø; angular.		Drill to 2.0' w/ 4" flight auger, 2.0-3.5 Cal sampler; retain 2.5-3.0' liner (env.) 2.0-5.0' 4" flight auger *Using HGT hammer, 30" drop.
2					7		<u>RESIDUAL SOIL</u>		
3		112	80		10 11	ML	3'-6' Sandy silt (ML): dk. yllwsh. brown; damp; non-plastic; med. dense; faint orange/gray mottling.		
4									
5					4				5.0-6.5 Cal Sampler; retain 5.5-6.0' liner (env.) 5.0-10.0' 4" flight auger.
6		110	100		3 4	CL	6'-9' Lean Clay (CL): grayish brown; v. moist; mod. plastic; firm.		
7									
8									
9							<u>LADERA SANDSTONE</u>		Harder drilling at 9'
10					50% 16"	silt SS	9'-60.0' SILTY SANDSTONE: mod. yllwsh. brown + yellowish gray; w/ faint orange mottling; x. fine grained; mod. weathered; typically friable, locally weak to mod. strong where cemented; low hardness; generally uncemented, locally weakly to mod. cemented; typically v. little fractured; localized narrow cemented layers, 1/2" to 1" wide, from 9' - w/ 18.5'	0809	10.0-10.5' Cal. sampler; refusal @ 10.5'; retain 10.0-10.5' liner (env.) Set 4" casing to 7'; start coring @ 10.5'; w/ clear water.
11	1		100	1+	0				
12						mod cem.			
13	2		100		6		Mod. well cemented, weak-mod. strong (RQD), 12.2-12.6'	0817 0821	



Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
13										
14		1		?			Core broken up by drilling, 12.6-17.3 (fracturing unclear, but appears to be probably little fractured).			Full drill fluid return
15	2		100	?	6		Silty Sandstone, yellowish-gray-brown, v. fine grained, typically friable, low hardness, v. little fractured, locally cemented, occasionally grades to sandy siltstone (cont.)			
16				?						
17				?						
18	3			0					0829 0832	
19				0						
20			100	0	0					
21				0						
22	2			0			Weakly cemented, 22.3-22.6. Mostly yellowish gray, slightly weathered below 22.6.		0838 0840	
23	4			1		1	70° Fe-stained joint @ 22.5			
24			100	0	0					V. slight fluid loss
25				0						
26				0			Locally mod. weathered along oxidized zones below 26.5'			
27				2			Heavily Fe-stained reddish brown @ 26.5' Weakly cemented, 26.7'-26.9'			
28	5		100	4			Close spaced subhorizontal breaks along bedding N 52-10° E 26.8'-27.1' 40° Fe+clay-filled joint @ 27.1' 40° joint @ 27.3'	0846 0849		
29				0	0		Yellowish gray-brown below ~27' Weakly cemented 27.1'-27.8' 80-90° wavy, Fe-stained joint @ 27.3-27.6'			

Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %				
29							1" heavily Fe-stained, orange brown band e 28.8'		
30	5	2	100	0	0		Faint, discontinuous 60°-80°, Fe-stained seams w/in solid core, ~30'-32'		
31						silty ss			Continued v. slight fluid loss
32				1			30° planar joint (slick clay + faint Fe-stain) at 31.9'		
33	6	3		0			Mod. cemented, 32.3'-32.5'	0857 0900	Note: core is coated w/ 1/16" thick clay film from drilling (scraped off along length of core for logging)
34				0			Silty sandstone, yellowish gray-brown w/ variable orange mottling (Fe-staining), v. fine grained, locally grading to sandy siltstone, friable low hardness, v. little fractured, locally weakly to mod. well cemented, slightly to locally mod. w/ fluid along heavily Fe-oxidized zones (continued)		
35			100	0	0				
36				0			10° faint Fe-stained joint e 36.4'		
37				2			Weakly-mod. cemented, 36.5'-37.7' (RQD 37.3-37.7)		Several horizontal mechanical breaks in run 6.
38	7			3			80° planar, Fe+Mn stain + clay film-coated joint, intersected by 90°+40° joints (closely fractured w/in cemented zone), 36.8'-37.2'	0909 0912	
39			100	3+	8		Subhorizontal concentration of caliche, w/ 1" wide, at 37.9'		
40				0			Very closely fractured (possibly some mechanical breakage), mod. well cemented, 38.0'-38.5'		
41		4		3+			80° wavy, Fe-stained joint, 38.6'-38.9'		
42				2			Orange-brown, heavily Fe-stained, clean silty med. grained sandstone layer, 38.6'-39.7'		
43	8			0			Mod. well cemented, 40.6'-40.9'		
44			100	3	8		90° wavy, Fe-stained joint through cemented zone, 40.6'-40.9'		
45				1			20° clay coated joint e 40.6' (top cemented layer)		
				0			10° planar, lt. brown clay seams/shears (slick), ~1/2" thick e 41.0' and e 41.9' (possibly thin, subhorizontal clay layers)	0920 0924	v. high water loss e ~42'
				3			1/4" lt. gray clay/caliche nodules, 42.7'-43.0'		Regain fluid return (continued mod. loss) at 42.5'
				3			horizontal, orange-brown Fe-stained med. sand layer e 42.5'; heavily Fe-stained 43.1'-43.4'		
				1			Weakly-mod. well cemented, 43.4'-44.2'		
							Irregular near-vertical fracture, Fe-stained, 43.4'-44.2'		
							10-20° boreholes (possibly mechanical) e 43.5', 44.0'		
							Heavily Fe-stained, 44.2'-44.4' (med. sand)		

Report: GEO\_CORE\_4\_SNA\_BOX\_FIELD; File: WCCORP2B.GPJ; 9/6/01

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
45										
46	8		100	0			silty ss	0931 Not Rec.	Fast, easy drilling from 48' to	
47		4	0	0						
48			0	0						
49	9		100	0						
50		5	0	0						
51			0	0						
52			0	0						
53			1	0		/	70° joint, 52.2-52.5 (faint clay film on surface)	Not Rec.	Continued fast drilling to ~ 55'	
54			0	0		/	Faint, 70°, irregular clay-filled joint @ 53.7' (in unbroken core)	Not Rec.		
55	10		100	0						
56			0	0					Somewhat slower drilling below ~ 55'	
57			0	0						
58	11		100	1		)	Increased orange mottling (Fe-staining) from 57.2 to hole bottom. Weakly cemented from 57.2'-58.2'	0954 1000	Slower (typical) drill rate to hole bottom.	
59		6	1	0			80°-90°, wavy + heavily Fe-stained joints, at 58.3'-58.6', and @ 59.8			
60								1006		
61							HOLE BOTTOM @ 60.0'			

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-060GZ

Log of Core Boring LCLS-3A  
 Sheet 1 of 3

Date(s) Drilled: 8/13-16/2004	Logged By: R. Harlan	Checked By:
Drilling Method: Auger, rotary wash, NX-core	Drill Bit Size/Type: NX diamond-impregnated	Total Drilled Depth/Length: 41.8'
Drill Rig Type: CME-75	Drilling Contractor: Fugro	Approximate Surface Elevation: ~278
Groundwater Level: Not measured (probably not present)	Coordinate Location: N _____ E _____	Inclination from Horizontal/Bearing: Vertical
Borehole Completion: Tremie Grout Backfill	Location:	

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
0										
0-1							<u>FILL</u> 0'-1.5' silty sand, sandy silt (SM, ML): mod. yellowish-brown; damp; loose-med. dense; some rock fragments (angular gravel up to 1" φ).	0.15	Begin drilling @ 0.15; drill to 3.0' w/ 8" hollow stem auger.	
1-2						SM, ML				
2-3										
3-4			13		7					
4-5			1.5		4					
5-6			86		4					
5-6							<u>RESIDUAL SOIL</u> 1.5'-3.5' Lean Clay (CL): grayish brown; moist; mod. plastic; firm-stiff; some fine sand.		3.0'-4.5' Standard Penetration Test (SPT); 140 <sup>st</sup> automatic hammer; 30" drop.	
6-7						CL				
7-8										
8-9							<u>LADERA SANDSTONE</u> 8.5'-41.8 SILTY SANDSTONE: mod. yellowish-brown + yellowish gray, some orange mottling; very fine grained; moderately weathered; friable; low hardness; non to weakly cemented; typically very little fractured.		8" hollow stem auger to 8.0'	
9-10			100		10					
10-11			1.5		9					
11-12			1.5		12					
12-13						silty ss				
13										

Report: GEO\_CORE\_4\_SNA\_BOX\_FIELD; File: WCCORP2B.GPJ; 9/6/01

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-06062

Log of Core Boring LCLS-3A

Sheet 2 of 3

Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D., %				
13			100	?	24		Silty Sandstone, yellowish gray-brown w/ some orange mottling, v.f. grained, slightly-mod. weathered, friable, low hardness, uncemented to weakly cemented w/ localized mod. to well-cemented zones, generally very little fractured (continued).	13.0-13.8 SPT; refusal @ 13.0'	
14			100	?	50	silty ss			Switch to 3" tricone rock bit, rotary wash drilling - Advance hole to 16.5'
15			100	?					(8" auger used as casing; bottom of auger at 13.0').
16			100	?					Pressuremeter test @ 15.5' (center of test interval).
17	1		100	?					Begin coring @ 16.5', 1227.
18	1		100	?					Auger casing leaking, drill auger to 14'.
19			5.0	?	0			CORE LOSS	Break in drilling, 1233-1423 to replace P.M. membrane (burst after first test).
20			38	?					Pressuremeter test @ 20.5'
21			100	?					* Driller added fluid after first run; improved recovery.
22	2		100	?					Blew membrane during 2nd P.M. test @ 20.5'
23			100	0	0				Hole advanced to 24.5'; crew worked on P.M. for remainder of day.
24			100	1					Resume coring @ 24.5', 0758, 8/16
25	3		100	3	13/25			med. cem.	
26			100	2	52		weat-mod. cem.		
27			100	0?	5				
28	4		100	0?	5	silty ss			
29			100	0?	10				

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, f/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
29	4	2	100	2?	10	1	well-cem. silty ss	0929 1007	P.M. Test #3 @ 25.5' burst membrane again attempting higher pressure step @ 80 bar.	
30				0						mod. cem.
31	5	100	0	1	1	silty ss	1020 1133	Near full fluid return to ~ 34'		
32			0						med. g. ss	33
33	0	100	4	8	1	1	med. g. ss	Increased fluid loss below ~ 34'		
34	0		2						34.5-34.8'	1
35	0	3		35.4-35.6'	2	1	med. g. ss	Med. grained sandstone, weakly-mod. cemented. Light gray, well-cemented, 34.8-35.4' (RQD)		
36	0		3						35.3'	3
37	0	3		35.4'	3	1	well-cem. silty ss	1/4" thick, 10° sandy clay-filled joint @ 35.4'		
38	0		3						36.1'	3
39	0	3		36.4'	4	1	med. g. ss	Orange-brown, med. grained sandstone, weakly cemented 35.6-36.4		
40	0		3						36.6'	4
41	0	3		36.6'-37.0'	4	1	silty ss	Light gray, well-cemented 36.6'-37.0', with irregular, vertical clay-filled + Fe-stained fracture.		
42	0		3						37.0-37.3'	4
43	0	3		37.3-37.5'	4	1	silty ss	Lt. gray, well-cemented 37.3-37.5'		
44	0		3						37.5-38.4'	4
45	0	3		38.1+38.3'	4	1	silty ss	Set of 10° planar, Fe+clay coated joints, 38.1+38.3'		
46	0		3						38.2+38.6'	4
47	0	3		39.2+40.8'	4	1	silty ss	10° joint set (along bedding?) at 39.2+40.8'		
48	0		3						40.1-40.4'	4
49	0	3		40.4-41.1'	4	1	silty ss	Orange-brown, f. to med. grained sandstone layer, 40.4-41.1'		
50	0		3						41.1 to hole bottom	4
51	0	3		41.8'	4	1	silty ss	HOLE BOTTOM @ 41.8'		
52	0		3						41.8'	4
53	0	3		41.8'	4	1	silty ss			
54	0		3						41.8'	4
55	0	3		41.8'	4	1	silty ss			
56	0		3						41.8'	4
57	0	3		41.8'	4	1	silty ss			
58	0		3						41.8'	4
59	0	3		41.8'	4	1	silty ss			
60	0		3						41.8'	4
61	0	3		41.8'	4	1	silty ss			
62	0		3						41.8'	4
63	0	3		41.8'	4	1	silty ss			
64	0		3						41.8'	4
65	0	3		41.8'	4	1	silty ss			
66	0		3						41.8'	4
67	0	3		41.8'	4	1	silty ss			
68	0		3						41.8'	4
69	0	3		41.8'	4	1	silty ss			
70	0		3						41.8'	4
71	0	3		41.8'	4	1	silty ss			
72	0		3						41.8'	4
73	0	3		41.8'	4	1	silty ss			
74	0		3						41.8'	4
75	0	3		41.8'	4	1	silty ss			
76	0		3						41.8'	4
77	0	3		41.8'	4	1	silty ss			
78	0		3						41.8'	4
79	0	3		41.8'	4	1	silty ss			
80	0		3						41.8'	4
81	0	3		41.8'	4	1	silty ss			
82	0		3						41.8'	4
83	0	3		41.8'	4	1	silty ss			
84	0		3						41.8'	4
85	0	3		41.8'	4	1	silty ss			
86	0		3						41.8'	4
87	0	3		41.8'	4	1	silty ss			
88	0		3						41.8'	4
89	0	3		41.8'	4	1	silty ss			
90	0		3						41.8'	4
91	0	3		41.8'	4	1	silty ss			
92	0		3						41.8'	4
93	0	3		41.8'	4	1	silty ss			
94	0		3						41.8'	4
95	0	3		41.8'	4	1	silty ss			
96	0		3						41.8'	4
97	0	3		41.8'	4	1	silty ss			
98	0		3						41.8'	4
99	0	3		41.8'	4	1	silty ss			
100	0		3						41.8'	4

Report: GEO\_CDRE\_4\_SNA\_BOX\_FIELD; File: WCCORP2B.GPJ; 9/6/01

Project: SLAC LCLS Geotechnical Investigation  
 Project Location: SLAC Phase II  
 Project Number: 2002-060GZ

Log of Core Boring LCLS-4

Sheet 1 of 4

Date(s) Drilled: 7/21/04	Logged By: R. Harlan	Checked By:
Drilling Method: HQ wireline core	Drill Bit Size/Type: HQ diamond-impregnated	Total Drilled Depth/Length: 61.0
Drill Rig Type: CME-55	Drilling Contractor: Taber Consulting	Approximate Surface Elevation: 295.5'
Groundwater Level: Not measured (probably not present)	Coordinate Location: N _____ E _____	Inclination from Horizontal/Bearing: Vertical
Borehole Completion: Tremie Grout Backfill	Location:	

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
0										
0.5		lined	0.9		2		CL 0'-2' <u>Residual Soil</u> - Sandy Clay (w) lt gray brown; dry; f. sand, minor gravel. dk. gray brown, damp below ~ 0.8'	1327	0'-1.5' Drive Cal. Sampler, retain brass liner 0.5'-1.0' (envy) Drill w/ 4" flight auger, 0'-2'	
1.0		1.5		7						
1.5		60		8						
2.0		lined	100		22		Silty SS 2'-61.0 <u>SILTY SANDSTONE</u> : lt.-mod yellowish brown, mottled orange; v. fine grained; mod. weathered; friable; low hardness; mostly uncemented w/ occasional weakly to mod. cemented zones; very little fracture.		2.0-3.5' Drive Cal. Sampler, retain 2.5'-3' brass liner (environmental) 4" auger to 5' get 4" casing to 3.4' start coring @ 5.0'	
2.5		1.0		50%						
3.0		1.0		6						
3.5										
4.0										
5.0	1		80	*	0		* Recover mostly broken up core in Run 1; amount of fracturing uncertain but probably v. little fractured.	1354	7.0° Fe-stained joint, 7.0-7.4' 7.0° Fe/Mn-filled vein, 7.3-7.6' (in unbroken core)	
5.5			16	?						
6.0			2.0	?						
7.0							Several faint 50° Fe-filled seams, @ 9.7'	1400	No recovery assumed from 6.6-7.0' (washed out)	
7.5										
8.0	2									
8.5			100		0					
9.0							Faint, waxy Fe-filled seams @ 9.0-5.0; @ 11.0' (in unbroken core)	1410	Full fluid return.	
9.5										
10.0										
10.5							9.0° Fe-stained joint, 11.5-11.7	1412		
11.0										
11.5	3		100	0	0					
12.0										
12.5										
13.0										

Project: SLAC LCLS Geotechnical Investigation  
 Project Location: SLAC Phase II  
 Project Number: 2002-06062

Log of Core Boring LCLS-4  
 Sheet 2 of 4

Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D., %				
13				0			<p>Silty sandstone, bluish brown-yellowish gray, variably mottled orange + gray, v.f. grained, friable, low hardness, mostly unconsolidated, v. little fractured (continued)</p> <p>Several gray clay-filled pockets, 14.0-15.8'</p> <p>Weakly cemented, 15.8-16.3 (core broken mech.)</p> <p>Intersecting 60°+90° joints, Fe-stained, at 16.0-16.3</p> <p>20° joint, Fe-stained, @ 16.8</p> <p>Continued occasional gray clay-filled pockets below 16.3'</p> <p>Set of 70° planar-wavy joints, med spaced, Fe-stained &amp; clay-filled (some healed in unbroken core, but core breaks readily along joints), 17.0-22.0'</p>	<p>1419 1422</p>	<p>Drilling w/ v. slight fluid loss</p>
14	3	1	100	0					
15				1+					
16				3+					
17				1					
18	4	2	100	1					
19				1					
20				1					
21				2					
22				0					
23				0					
24	5	3	100	0					
25				0		<p>Orange-brown, Fe-stained, clean-silty med. sand layer, subhorizontal, 24.6-25.5</p>			
26				0					
27				1		<p>Several planar-wavy, 80°-90° joints, Fe-stained, from 26.4-28.5</p>	<p>1430 1431</p>		
28	6		100	2	0			<p>1439 1442</p>	
29				1					



Project: SLAC LCLS Geotechnical Investigation  
 Project Location: SLAC  
 Project Number: 2002-0606Z

Log of Core Boring LCLS-4

Sheet 3 of 4

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
29										
30	6		100	0	0		Silty Sandstone, yellowish gray-brown w/ some orange + gray mottling, v.f. grain ed, slightly weathered, friable, low hardness, mostly uncemented, very little fractured (continued). Weakly cemented, 31.5-31.8'	1449	Continued slight water loss.	
31		3		0	0			1452		
32	7			0		Silty SS			Covered 31.5-32.7 length of core w/ plastic wrap (for possible lab testing)	
33			100	0	0					
34		4		0			Irregular 90° fracture at 36.5-37.0 (possibly mechanical)			
35				0				1502		
36				0			Clean, horizontal, med-grained sand layer (SP), 39.0-39.7'		Covered 38.0-38.7 w/ plastic wrap (for lab)	
37	8		100	0	0			1505		
38				0			Clean sand layer, as above, 40.3-40.7'			
39				0						
40				0			Heavily Fe-stained, 2" orange-brown layer @ 45.0'			
41				0						
42	9			0				1511		
43		5		0				1514		
44			100	0	0					
45				0						

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-060GZ

Log of Core Boring LCLS-4

Sheet 4 of 4

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
45										
46	9		100	0	0		silty ss	Silty sandstone yllwsh. gray-brown, fine grained, friable low hardness, mostly uncemented, v. little fractured (continued)		
47				1				10° gray clay seam along bedding @ 46.2'	1522	
48	10	5		0			SP-SM	Orange-brown, Fe-stained, clean-silty med. sand layer, 46.2-48.1	1527	
49			100	0	8		cern.	Mod. well cemented, light gray sandstone, mod. strong, mod. hard (RQD), 48.1-48.5		
50				0			silty ss			
51				0						
52		6		0					1535	
53	11			2				1/2" gray clay seam along 10° Fe-stained slick joint surface (bedding?), 52.3'-52.4'	1543	
54			100	0	0			Clean, Fe-stained sand layer, 52.4-52.5'		
55				0				Weakly cemented, 53.0'-53.9'		Covered 53.2-53.9 w/ plastic (lab)
56				0				Several 1/4" thick, white calcite veins, subhorizontal, from 53.9' to hole bottom @ 61.0'		
57				0				Weakly cemented, 56.5-56.8	1552	
58				0					1559	
59	12		100	0	0					
60				0						
61				0				HOLE BOTTOM AT 61.0'	1607	

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-060GZ

Log of Core Boring LCLS-5

Sheet 1 of 9

Date(s) Drilled	7/19-20, 2004	Logged By	R. Harlan	Checked By	
Drilling Method	HQ wireline core	Drill Bit Size/Type	HQ diamond-impregnated	Total Drilled Depth/Length	136.5
Drill Rig Type	CME-55	Drilling Contractor	Taber Consulting	Approximate Surface Elevation	354.1
Groundwater Level	Measured at 78.0' 1/2 hrs after drilling + washing holes, no groundwater present.	Coordinate Location	N _____ E _____	Inclination from Horizontal/Bearing	Vertical
Borehole Completion	Tremie grout backfill	Location			

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
0			75		6		Res. Soil	0'-11' Residual Soil: mod. brown, dry; fine sandy silt (ML) w/ minor csc. sand-gravel		0-1.5' Drive 2 1/2" o.d., 2" I.D. Cal. Sampler
1			50		8			<u>LADERA SANDSTONE</u>		Retain 6" brass sample, 0'-0.5' (Environmental)
2			?		10		silty	~1'-136.5' SILTY SANDSTONE: light brown w/ some orange mottling; v. fine-grained, mod. weathered; friable; low hardness; uncemented.		Advance hole w/ 4" flight auger 0'-2.0'.
3		liner	100	?	13		SS	Minor coarse sand, gravel (+ cobbles (chert) to 1/2") (possible thin Santa Clara Fm. at surface?); generally v. little fractured to massive w/ traces of subhorizontal bedding; occasional gray clay-filled pockets (bioturbation). * occasional clayey films on white core breaks.		2.0'-3.0' Cal. Sampler; retain 2.5'-3.0' sample (Environmental).
4			?		29					Advance w/ 4" flight auger to 5.5'; set 4" casing to 4.0'.
5			?							Start coring at 5.5'; drilling w/ clear water; yellowish brown return fluid.
6	1		1+					Chert cobble at ~5.5' (? depth; in top of core barrel). 70°-80°, wavy, Fe-stained fracture at 6.1	1245	Full fluid return.
7			96	1+	0					
8			0?							
9	2		65 4.0	0?					1256 1304	
10			38	1+				80° planar, Fe-Mn stained fracture w/ some carbonaceous material / rootlets, e.g. 7'		
11			No	?	0					Washed out core, 9.7' to 12.2'; driller probably blocked core + drilled out soft rock.
12			Rec	?						
13	3		100	0	0			Mostly yellowish gray w/ some orange + gray mottling below ~12'.	1311 1316	

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-06062

Log of Core Boring LCLS-S

Sheet 2 of 9

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D., %	Fracture Drawing Number				
13										
14	3	1		0			silty SS	Silty sandstone, mostly v. fine grained, mod. to slightly weathered, friable, low hardness, very little fractured, generally yellowish gray w/ variable orange & gray mottling (continued).		Continued full fluid return.
15			100	0	0					
16				0						
17				1			30° planar joint at 16.5'			
18				0					Not Rec 1347	Advance casing to 12' (water leaking around casing)
19	4	2		0			i			Continued full fluid return.
20			100	0	0					
21				0						
22				0						
23				1			70° planar joint @ 22.5'		1354	
24				1			80° fracture(s?), 23.8-24.7		1358	
25	5			2			Mottled dk. brown-black, heavily Fe-stained, clayey, and some carbonaceous material, 23.8-24.7'			
26			100	0	0					
27				0						
28	6			0			Yellowish gray-brown w/ more distinct gray-orange mottling below 24.7'			
29			100	0	0					
							10° Fe-stained joint (along bedding) @ 27.1		1404	
							Moderately - weakly cemented (still friable), 27.2-27.7'		1408	

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-06062

Log of Core Boring LCLS-S

Sheet 3 of 9

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D., %	Fracture Drawing Number				
29										
30	6	3	100	0	0		silty SS Silty Sandstone, mostly v. fine grained, slightly weathered, friable, low hardness, v. little fractured, typically uncemented, locally weakly - mod. cemented, yellowish gray to yellowish brown w/ faint orange gray mottling (continued). Gray-brown, weakly-mod. cemented, weak-friable, 31.6-33.4'			
31				0						
32				0			Set of low-angle joints, 5°-20°, closely spaced, 32.5'-33.4'	1415		Continued Full fluid return
33				3				1419		
34	7		100	0	0					
35				0						
36		4		0						
37				0						
38				1			70° Fe-stained joint @ 38.0'	1427		
39				1			clean, med. grained sandstone (soil type: SP), uncemented, from 38.6-39.0 (appears sub-horizontal)	1432		
40	8		100	0	0		30° Fe-stained joint @ 39.1'			
41				1			Locally cemented pockets, w/ hard, gray clay fragments, 39.1-40.2			
42				1			80°-90° Fe/Mn-stained joint, 40.8-41.3'			
43				?			Weakly cemented, friable-weak, 42.3-42.6	1441		
44	9		100	?	8		Core broken up (drill action) from 42.8-45.0	1446		
45		5		?			1/2" thick med.-grained, clean sand layer @ 43.5'			

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
45							SP	1" med. sand layer at ~30°, at 45.1'		
46	9		100	1+				1/2" clayey sand layer along 10° joint surface, c 46.4		
47				2+				*Mod. cemented, mod. strong, low hardness (positive RQD - unable to break core by hand), 46.4-47.6	1455 1498	
48		5		1+?						
49				0			silty SS	Silty Sandstone, mostly v. fine grained, slightly weathered, friable, low hardness, very little fractured, typically uncemented, locally weakly to mod. cemented, generally yellowish gray - yellowish brown. (continued)		
50	10		100	0						
51				0						
52				0						1508 1513
53				0						
54		6		0						
55	11		100	0				20° Festained joint w/ med. sand seam (bedding) c 55.1'		
56				2				30° silty seam/joint c 55.7'		
57				0				Mod. cemented, weak-mod. strong, low hardness (pos. RQD), 55.1-57.1'		
58				1?				60° joint (possibly mechanical) c 57.5	1524 1528	
59	12		100	0						
60				0						
61				0						

Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D. %				
61									
62	12	6	100	0	0		Silty sandstone, mostly v.f. grained, slightly weathered, friable, low hardness, v. little fractured, mostly uncemented, locally weakly-mod. cemented, typically yellowish-gray-yellowish-brown w/ minor orange + gray mottling (continued)	1537	
63				0		silty ss		1540	
64		7	100	0					
65	13			0			60° joint? (possibly mechanical) at 65.2'		
66				1?	6	SP	Clean, f. to med. sand (SP) layer from 65.5-66.1		Continued fluid return.
67				0		SP	Well-cemented, mod. strong, (mod. hard, positive RQD) from 66.1-66.4'	1548	
68				1			Clean sand (SP), as above, 66.4-66.6	1552	
69				1		SP	60° joint @ 67.7		
70	14		100	0		SP	Clean-silty sand layer, heavily Fe-stained orange-brown, 67.7-68.2' (SP-SM)		
71				0			Clean sand layer (SP), f. to med., 68.2'-68.8'		
72				0			Closely spaced, planar, cemented (calcite/calcitic) joints @ 60°, @ 69.0'		
73	8			1?			1" cemented layer/concretion @ 71.1'		
74			100	0			Grayish-brown claystone layer, soft, plastic (v. stiff soil-like consistency), 72.0-72.2	1602	7/19
75				0			60° joint (possibly mechanical break) @ 73.3	8726	7/20
76				0			clean, med. grained sand layer, 74.4-74.5		
77				0			Clean, med. grained sand layer, 75.8-76.5' (lower contact at 10° (bedding) at 76.5').		
				0			Weakly-mod. cemented, friable-weak, 76.5-77.2		

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
77	15			4						
78		8					silty ss- CS	Several closely-spaced, Fe-stained joints at 20°-30°, 77.0-77.3'	0737 0742	
79	16		100	1	24			1/8" med. sand layer along 10° bedding @ 77.5'		
80				2				Weak-mod. strong, continued low hardness, appears clayey (clayey siltstone-sandstone) 77.5'-79.0 (positive RQD)		
81				1?			silty ss, some clayey	Occasional clayey siltstone-silty claystone (v. stiff-hard consistency) 79.0 - ~83'		
82	9			1?				20° joint (possibly mechanical) @ 78.5'		
83				1				Closely-spaced, 10° joints @ 79.1' (faint Fe-stains)		
84			100	0	0			Note: several subhorizontal breaks, some or most mechanical, 80'-82'	0751 0755	
85	17			0			silty ss	10° Fe-stained joint @ 82.1'		
86				0				Continued predominately silty sandstone, v. fine grained, occasionally grades to sandy siltstone, yellowish gray-brown w/ variable orange + gray mottling, slightly weathered, friable, low hardness		
87				0				typically v. little fractured and uncemented, locally weakly to mod. cemented (localized zones merit positive RQD), below 83'		
88				1					0803 0813	Dropped bottom w/ 1' in hole; recover in run 18 (86'-87')
89	18		100	0	0			10°, planar, clay+caliche-coated joint (polished) @ 87.6'		
90				0				Clean-silty, med. sand layer, 89.3-89.6'		
91		10		0					Not Rec. 0822	
92	19		100	1	0					
93								50° Fe-stained joint @ 92.7'		



Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
93							SS	50° Fe-stained joint @ 93.4'		
94	19	10	100	0	0		SP-SS SM	Clean to silty, med. grained sand layer (SP-SM) 93.5'-95.5'		
95				0			SS			
96				1		1	SP-SS SM	Clean to silty, med. grained sand layer (SP-SM) 96.3'-98.2'	0835 0840	Continued FM fluid return.
97				0			SS	70° Fe (Mn?) stained joint @ 96.5'		
98				0			SS	1" cemented band @ 97.5'		
99	20		100	0	8		silty SS	Contact of med. sand / Fine silty sandstone at 10°, @ 98.2' (bedding)		
100		11		1		1	SP-SS SM	88°-90°, wavy, Fe+clay coated fracture @ 99.8		
101				1			SS	Mod. cemented, weak-mod. strong, mod. hard med. sandstone layer, 99.3-99.9 (pos. RQB)		
102				2+			SS	80° irregular Fe-stained joint, 100.8 to 101.5	0849 0901	Driller thinned out drill fluid (becoming too muddy) at 101'; noted some water loss below this depth.
103			100	2	10		SP-SS SM	10° irregular Fe-stained fracture @ 101.8		
104	21			1			SS	80°-90° wavy, Fe+clay coated joint, 101.7-102.8		
105				1			SS	30° planar, Fe-stained joint @ 102.8		
106				0			SS	Well-cemented, mod. strong, mod. hard, lt. gray, med. grained sandstone, 101.2-102.9		
107				0			SS	30°, planar-wavy Fe-stained joint @ 103.1		
108	22		100	0	0		SS	Clean to silty, med. sand layer, uncemented, 102.9-105.0		
109		12		0			SS	60° planar, Fe+clay coated joint @ 104.6		
				0			SS	Continued v. fine silty sandstone, uncemented below 105.0'		
				0			SS	Fine-med. silty sandstone, 106.5-107.1	Not Rec. Not Rec.	

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-06062

Log of Core Boring LCLS-5

Sheet 8 of 9

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D., %	Fracture Drawing Number				
109							CS 2" claystone layer, orange/grey, at $\approx 45^\circ$ at 109.4			
110	22	12	100	0	0		Indistinct 1" clay layer @ 110.0 (at 50')		Continued slight water loss	
111				0	0		Fine-med, clean-silty sand layer 110.2-111.3			
112	23			1			100 joint, faint Fe-staining+clay, @ 111.7	Not Rec. 0941		
113				0			Continued v. fine silty sandstone, yellowish gray-brown, slightly weathered, friable, low hardness, mostly uncemented.			
114				0			silty SS			
115			100	0	0					
116				1			70°, faint Fe-stained joint @ 116.0			
117	24			0				0951 0957		
118				0						
119		13	100	0	0					
120				0						
121				0						
122	25			0			Numerous small fossils/shells, up to $\approx 1/4"$ wide, 122.1-122.6	1006 1011		
123			100	0	0					
124				0			Fe-stained band, $\approx 1/2"$ wide, @ 124.5			
125							Several small shells, 124.8-125.0			

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
125										
126	25	13	100	0	0			Continued v. fine grained silty sandstone, friable, low hardness, very little fractured, mostly uncemented, yellowish-gray-yellowish brown (continued).	1021	Break to refill water truck.
127	26			0			silty SS		1044	
128				2				2 v. closely spaced, calcite/calcite-filled joints at 10°; @ 127.8'		
129		14		1+	20			Irregular, 80-90° joint runs along length of core from 128.4' to 132.5'; fracture infilled w/ clay/calcite, w/ some Fe-staining (aperture up to 1/8")		
130			100	1+			med. SS, cemented	Mod. well cemented, med. grained, lt. gray sandstone layer, weak-mod. strong, low hardness to mod. hard, 128.8-130.6 (10° top + bottom contacts are bedding).		Continued mod. fluid loss to hole bottom.
131				1+			weakly cemented	Note: some horizontal breaks through cemented zone probably mechanical.	1055	
132	27			1+			med. SS, cemented	Weakly cemented, friable from 130.6-131.3	1101	
133				1+				Mod. well cemented, lt. gray sandstone, 131.3-134.5 (weakly cemented, 130.0-130.2)		
134			100	1	12			70°-90° joint, irregular, runs along length of core from 132.9-134.5 (through cemented zone); joint filled w/ clay, calcite, some Fe-staining.		
135				1				Continued v. f. grained silty sandstone, friable, low hardness, v. little fractured, uncemented, 134.5' to hole bottom @ 136.5'.		
136				0			silty SS			
137				?					1110	
138								Bottom of hole @ 136.5'		Wash hole prior to downhole geophysical testing (PTS wave via OYO downhole suspension logger)
139								Grout hole via Tremie on completion of downhole testing.		
140										
141										

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-060GZ

Log of Core Boring LCLS-6  
 Sheet 1 of 8

Date(s) Drilled: <u>8/16-18/04</u>	Logged By: <u>R. Harlan</u>	Checked By:
Drilling Method: <u>Auger, rotary wash, NX-core</u>	Drill Bit Size/Type: <u>NX diamond-impregnated</u>	Total Drilled Depth/Length: <u>110.9'</u>
Drill Rig Type: <u>CME-75</u>	Drilling Contractor: <u>Fugro</u>	Approximate Surface Elevation: <u>~354</u>
Groundwater Level: <u>Not measured (probably not present)</u>	Coordinate Location: <u>N _____ E _____</u>	Inclination from Horizontal/Bearing: <u>Vertical</u>
Borehole Completion: <u>Tremie Grout Backfill</u>	Location:	

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
0							Res. soil	0'-~1' Residual Soil	1557	Start drilling w/ 8" hollow stem auger at 1557 on 8/16.  Drill w/out sampling to 5'; auger used as casing.  Drill w/ 3" tricone rock bit, w/out sampling, 5.0' to 19.3' (using clear water for circulation).
1			?					<u>LADGERA SANDSTONE</u>		
2			?	?				~1'-110.9' SILTY SANDSTONE: H. brown, yellowish gray-brown; very fine grained; mod. weathered; friable; low hardness; mostly uncemented, w/ localized weakly to well-cemented zones (initial description based on log of LCLS-5, located ~60' east of LCLS-6).		
3			?				silty ss			
4			?							
5			?						1626	
6			?							
7			?							
8			?							
9			?							
10			?							
11			?							
12			?							
13			?							

Project: SLAC LCLS Geotechnical Investigation Phase III  
 Project Location: SLAC  
 Project Number: 2002-060G2

Log of Core Boring LCLS-6

Sheet 2 of 8

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	RQD, %	Fracture Drawing Number				
13										
14			0 (not sampled)	?				Silty Sandstone, yellowish gray-brown, mod. to slightly weathered, friable, low hardness, typically uncemented w/ localized cemented zones, generally v. little fractured (continued).		Continued drilling w/ 3" tri-core bit to 19.3' (without sampling).
15			?	?						
16			?			silty ss				
17			?							
18			?							
19			?							
20	1		19/5.0	1+	0?		Light gray, well-cemented, 19.3'-19.5' Irregular vertical fracture, Fe-stained through cemented zone (19.3-19.5)	1647		Start NX coring @ 19.3', @ 1647 @ 16.5, using clear water.
21			38	?	0					No recovery, 21.2'-24.3'
22				?						
23				?						Add Revert to drill fluid, Run #2.
24				?			CORE LOSS			
25	2		10	?	3				1653 1715	
26				3	18			20° Fe-stained joint @ 25.5' 80° planar Fe-stained joint @ 25.6' Irregular 5° fracture, some Fe-staining, @ 25.7'	Nit Rec. 1750	Plugged bit/ blocked off @ 26'.
27	3		88	0	0					Thin out drill fluid.
28			5/2	1	0					Near full drill fluid return.
29				1						

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
29										
30	1		88	2		1	60° wavy, Fe-stained joint, 29.3'-29.7' 10° Fe-stained joint, 29.8'			
31	3		52/59	3+	0		Several near-vertical, wavy, discontinuous Fe-stained microfractures, 30.0'-30.9'			Overdrilled Run #3; washed out core, 31.2'-31.9'
32				?			Silty Sandstone, yellowish-gray-brown, v.f. grained, slightly weathered, friable, low hardness, mostly uncemented and very little fractured (continued)	1808 1813		8/16 8/17
33	2			2		1	70° planar, Fe-stained joint @ 32.2' 1/16" thick gray clay seam along 10° bedding @ 32.7'			
34	4		100	1	0	1	1/8" thick gray clay seam along 10° bedding, above 1" thick clean, med. sand layer (SP), @ 33.7'			
35				0		1				
36				1		1	80°, planar-wavy Fe-stained joint, 35.5-36.1			
37				3			70°-80°, wavy, 1/4-1/2" thick calcite-filled joint, 36.4-37.4'	0924 0900		
38	5			2	0		Set of 60°-70°, planar-wavy, Fe-stained joints, 36.5', 37.4', 38.5', 38.8'			Moderate dmi fluid loss below ~36.
39			100	2						
40				0		1				
41				0		1	Light gray, mod. well cemented (mod. strong, mod. hard), 40.5-41.2'			P.M. #1 Pressuremeter Test @ 39.0' (center of test interval)
42				5+			Very closely fractured, w/ clay + calcite?, 41.0-41.2'	0921 1019		
43	6		100	0	0	1	10°, wavy Fe + clay coated joint @ 41.9'			
44				0		1				
45				0		1				P.M. #2 P.M. Test #2 @ 44.0'

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
45	6	3	100	0	0		silty ss	Silty Sandstone, yllwsh. gray-brown, very fine grained, slightly weathered friable, low hardness, typically uncemented to very weakly cemented w/ localized, mod. to well cemented zones, generally v. little fractured (continued)	Not Rec 1121	
46				0			mod. cem.			
47	7			0	1.6		silty ss	Gray-brown, mod. cemented, weak-mod. strong (possibly clayey), 46.0-46.5 (RQD)		
48			100	0	5.0		well cem.	1/8" thick gray clay seam along bedding, w/ Fe-staining (10°), @ 48.1'		
49				3	32		silty ss	Lt. gray, coarse-grained well cemented sandstone layer, strong, mod. hard, 48.2-48.5' (RQD)	P.M. #3	P.M. #3 @ 49.0'
50				1				1/8" reddish brown clay seam at 10° (bedding?) @ 49.1'		
51				0			mod. cem.	Gray-brown, mod. cemented, weak-mod. strong (RQD), 50.1-51.5 (gradually becomes weaker at ~51.5')	1135 1232	
52	8			0	0.6					
53		4	100	0	5.0		silty ss	3/4" gray clay-filled pocket @ 52.7'		
54				0	12			Irregular clay-filled pocket @ 53.9'	P.M. #4	P.M. #4 @ 54.0'
55				0						
56				0				60° planar joint w/ Fe-staining, @ 55.5'	1244	
57	9			0	0				Not Rec.	
58			90	0						
59			4.5	0						
60			5.0	1				80-90° Fe-stained joint, 58.8'-59.5'	P.M. #5	P.M. #5 @ 59.0; burst membrane. Blocked & washed out 60.4-60.9
61				2				60° planar Fe-stained joint, 59.8'-60.2'	1349	Rig pump down, 1520
				1+				Lt. gray cemented zone (fractured/broken up by drill), 60.4-60.5'		1520

Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D. %				
61	10	4		2+		well cem. SP	Lt. gray well cemented sandstone, strong, hard (RQD), ~61'-61.7'		Note: poor recovery in Run 10 probably due to long breaks in drilling (softer zones may have swelled, blocked off & washed out) Breaks in drilling to prepare pressuremeter for Test #6.
62		5				SP	5° Fe-stained joints in well cemented zone, closely spaced, at ~61'		
63			3.5	3+	4	Alt. silty ss + SP	Notes: location(s) of core loss in Run 10 uncertain; assumed total loss at 63.7-65.2'		P.M. #6 1528 1724
64			5.0	?	5.0	silty ss	Orange-brown, med. to coarse clean sand layer, weakly cemented, ~61.7-62.0 (SP)		
65			70	?	8	CORE LOSS	10° Fe-stained + clay-coated joints @ ~62.1'		P.M. #6 @ 64.0' 8/17 8/18
66				?		silty ss	60° planar, Fe-stained joint @ 62.3'		
67	11			?		silty ss	Alternating fine silty sandstone + med. clean sand layers, bedding at ~10°, from 62.1-63.1	1730 1822 1825 0742	Slight drill fluid loss.
68							Numerous mechanical breaks in silty sandstone bottom of Run 10		
69			100	0	0	mod. cem.	Uniform, v.f. silty sandstone, yellowish gray-brown w/ variable orange mottling + few, localized med. gray clay pockets (typically less than 1/4") friable, low hardness, uncemented to v. weakly cemented, v. little fractured, below 63.1'	Not Rec. 0832	Break in drilling to prepare pressuremeter.
70				0	0	silty ss	Lt. gray, mod. cemented, 69.0'-69.2'	P.M. #7	
71				0	0			0837	P.M. #7 @ 69.0'
72	12			0	0		Fine to med. silty sandstone, 71.6'-72.0'	Not Rec.	
73				0	0		10°, wavy Fe-stained joint @ 72.0'		Mod. drill fluid loss.
74			6	1	0	use & stain color	1/2" thick coarse sand + gray clay seam, at ~10° @ 73.3'		
75				0	0	silty ss	10° planar-irregular, Fe-stained joint @ 74.1'	P.M. #8	P.M. Test #8 @ 74.0'
76				0	0	dk. gray	Abrupt color change to dark gray, along 10° planar-wavy contact @ 74.7'		
77	13		4.4 / 5.0	0?	0	silty ss	Becomes grayish brown @ 75.8', gradually becoming yellowish gray brown.	0953 1056	Core loss 76.8'-77.4'
						CORE LOSS			



Depth, feet	ROCK CORE					Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R.Q.D., %					
77						col 26 to 55	CS?	Core loss from 76.8 to 77.4; recover some plastic brown clay (possibly just ground/redrilled core) from zone of core loss e ~ 77'; possible plastic claystone layer as at 90.1'	1106 1154	Plugged bit e ~ 77.5'; trip rods, clean bit resume coring
78	13	6	4.4	?	0		silty ss	Silty sandstone, yellowish-gray-brown w/ variable orange mottling, v.f. grained, friable, low hardness, typically uncemented - v. weakly cemented, v. little fractured (continued).		
79			5.0		0				1159 1233	Break to prepare pressuremeter.
80			88	1				Irregular, near vertical Fe-stained fracture e 79.3'	P.M. #9	P.M. #9 e 79.0'
81	14								1240 1323	Almost full fluid return.
82		7								
83			100							
84										
85				1			SP-5M	5° planar, slick, Fe-stained clayey joint e 84.7'	P.M. #10	P.M. #10 e 84.0'
86				1			silty ss	1/2" orange brown, med. sand layer e 85.0'		
87	15							60° planar joint w/ faint Fe-staining (possibly mechanical) e 85.6'	1333 1416	
88			100							
89										
90								Several med. grained sand seams, up to 1/8" thick, 89.8-90.1'		
91	16	8		2+			CS	1" thick med. sand layer, bedded at ~ 10° e 90.1'	1427 1521	Constriction in hole at ~ 94' (unable to lower P.M. to target depth); run P.M. #12 at 93.0'
92			100				SP-5M	Olive gray, med.-highly plastic claystone layer, 90.1-90.5'		
93							well cemented	60° striated fracture surface/shear, in CS, e 90.4'		
							65, Frayed	10° bedding (slick) in CS e 90.4'	P.M. #12	
								Med. sand layer (SP) 90.5-~91'		
								Fine to med. grained sandstone-silty ss w/ shell fragments (calcareous), ~91-91.5'		

Report: GEO\_CORE\_4\_SNA\_BOX\_FIELD; File: WCCORP2B.GPJ; 9/6/01

Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
93							calc. fine med. gr. ss-silty ss	Lt. gray, well-cemented, f.g. sandstone 91.5'-92.1'		Continued near full fluid return.
94	16	8	100	0	4/5.0		20° Fe-stained joints at 91.5', 91.9' (bedding joint @ 91.5') Fine-med. grained sandstone-silty sandstone, yellowish gray-brown, speckled w/white calcite shell fragments, friable 92.1'-94.5' V. fine grained silty sandstone, uncemented, friable, low hardness 94.5'-95.5'			
95				2	8		silty ss	Well-cemented, calcareous, white-yellowish brown sandstone, 95.5'-96.1' (some RQD) Irregular, Fe-stained fracture, w/90° @ 95.5'		
96							well cem.	Wavy 60° Fe-stained fracture @ 95.8'	1536	
97	17			1			calc. ss	Continued fine med. sandstone-silty sandstone speckled w/white shell fragments + calcite seams, friable, low hardness, v. weakly cemented, below 96.1'	1633	
98			100	1	1.2/5.0		well cem.	Irregular near vertical fracture coated w/calcite + some Fe-stains, 96.4'-97.8' 20° planar joint w/calcite, 98.1'		
99				2	24		well cem. calc. ss	White-lt. gray, well-cemented sandstone, 98.1-98.5' (RQD) Irregular calcite-coated fracture @ 98.5' Irregular Fe-stained joint @ 99.1'	P.M. #13 #13	P.M. #13 @ 98.0' (1-foot above target depth-cemented zones seem to be causing slight deflection of drill, as evident in core; this impedes placement of P.M.-driller had to push P.M. to 98.0')
100				1			well cem. silty ss	White-lt. gray, well-cemented sandstone 99.6-100.0 (RQD); 5° bedding contact w/silty ss.		
101	18	9		0			calc. ss	V.f. silty sandstone, friable, 100.0-100.2 (uncemented) Continued f. to med. calcareous sandstone, 100.2-101.9	1649 1805	drill, as evident in core; this impedes placement of P.M.-driller had to push P.M. to 98.0')
102			100	0	0		silty ss	Returns to very fine silty sandstone, yellowish gray brown, slightly weathered, friable, low hardness, uncemented, v. little fractured, at 101.9'		
103				1			med. sand	Near vertical calcite seam, 1/8" to 3/4" thick, 103.1' to 105.3'	P.M. #14	P.M. to 98.0')
104				2			silty ss	1" thick med. sand layer w/brick red, angular clay fragments (up to 1/4"), @ 103.3'		P.M. #14 @ 103.0
105				1				5° Fe-stained joint @ 104.9 Brick red clay fragments in calcite vein, @ 105.2'		
106	19			2				Near vertical calcite (from 105.3') re-enters hole, from 105.9-106.8.	1815 1912	
107			100	1	0			70°, 1/8" thick calcite vein, 106.9'-107.5'		
108				0					P.M. #15	P.M. #15 @ 108.0
109										

Project: SLAC LCLS Geotechnical Investigation Phase II  
 Project Location: SLAC  
 Project Number: 2002-06062

Log of Core Boring LCLS-6

Sheet 8 of 8

Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Rate, ft/hr]	FIELD NOTES
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %				
109									
110	19	10	100	0	0	silty ss	Silty Sandstone, yellowish-gray-brown, v. fine grained, slightly weathered, friable, low hardness, uncemented, v. little fractured (continued). Fme to med. grained sandstone (SP-SM) 109.7' to hole bottom. Hole Bottom @ 110.9'.		
111						SP-SM			
112									
113									
114									
115									
116									
117									
118									
119									
120									
121									
122									
123									
124									
125									