

**Los Alamos**  
NATIONAL LABORATORY  
EST. 1943

Los Alamos National Laboratory  
Environmental Programs  
Corrective Actions Project, MS M992  
Los Alamos, New Mexico 87545  
(505) 667-0819/FAX (505) 665-4747



National Nuclear Security Administration  
Los Alamos Site Office, MS A316  
Environmental Restoration Program  
Los Alamos, New Mexico 87544  
(505) 667-7203/FAX (505) 665-4504

Date: November 28, 2006  
Refer to: EP2006-1004

Mr. James Bearzi  
NMED-Hazardous Waste Bureau  
2905 Rodeo Park Drive East, Building 1  
Santa Fe, NM 87505-6303



**SUBJECT: RESPONSE TO THE APPROVAL WITH MODIFICATIONS INVESTIGATION REPORT FOR THE TA-16-340 COMPLEX [CONSOLIDATED UNITS 13-003(a)-99 AND 16-003(n)-99 AND SOLID WASTE MANAGEMENT UNITS 16-003(o), 16-026(j2), AND 16-029(f)] LOS ALAMOS NATIONAL LABORATORY, NM0890010515 HWB-LANL-06-005**

Dear Mr. Bearzi:

Los Alamos National Laboratory (LANL) and the Department of Energy (DOE) have received the Approval with Modifications for the "Investigation Report for the TA-16-340 Complex [Consolidated Units 13-003(a)-99 and 16-003(n)-99 and Solid Waste Management Units 16-003(o), 16-026(j2), and 16-029(f)]" from the New Mexico Environment Department (NMED) on October 30, 2006. LANL appreciates the rapid approval of this document and acknowledges the modifications outlined therein.

In its approval, NMED requested additional information related to two of the comments in the notice of disapproval (NOD). This additional information is provided below and electronically on the attached CD. LANL provides each NMED comment (requiring response) verbatim below, followed by the LANL response.

*Comments:*

- 6. "The Permittees must propose a due date for the Phase II investigation report subject to approval by NMED."

LANL Response: LANL anticipates that fieldwork will take one year to complete. The current schedule for delivery of the Phase II investigation report is September 30, 2008.



16. *"The Permittees agreed to relog the core that was collected from the intermediate boreholes 16-23691 and 16-23692 but did not provide the information in the Response. The permittees must provide the requested information within the timeframe provided in this letter."*

LANL Response: LANL has relogged the boreholes 16-23691 and 16-23692 with a particular emphasis on identifying surge beds and other geologic subunits that may potentially represent contaminant pathways. Emily Schultz, a LANL geologist with extensive experience mapping and logging the Bandelier Tuff, performed this logging. She identified no surge beds in the two cores. However, the two cores had poor recovery, which makes identifying surge beds that are typically high porosity and poorly welded, difficult. Updated logs are provided as Attachment 1 to this letter.

Please contact John McCann at (505) 665-1091(jmccann@lanl.gov) or Tony Trujillo at (505) 847-5987 (ltrujillo@doeal.gov) if you have any questions.

Sincerely,



Andrew Phelps, Associate Director  
Environmental Programs  
Los Alamos National Laboratory

Sincerely,



David Gregory, Federal Project Director  
Department of Energy  
Los Alamos Site Office

AP/DG/DH/ew

Attachment(s): 1) Log of boreholes 16-23691 and 16-23692  
2) CD of NOD comments requiring response and LANL responses

Cy: (w/enc)

D. Hickmott, EP-CAP, MS M992 (with CD)  
J. McCann, EP-CAP, MS M992 (with CD)  
L.T. Trujillo, DOE LASO, MS A316 (with CD)  
F. Bosiljevac, DOE AL, MS A316 (with CD)  
EP-CAP File, MS M992 (with CD)  
RPF, MS M707 (with two CDs)

Cy:(Letter and CD only)

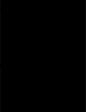
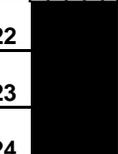
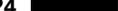
L. King, EPA Region 6  
P. Reneau, EP-ERSS, MS M992

Cy: (w/o enc)

A. Dorries, EP-ERSS, MS M992  
G. Dover, EP-CAP, MS M992  
D. McInroy, EP-CAP, MS M992  
A. Phelps, ADEP, MS J591  
C. Mangeng, ADEP, MS J591  
D. Gregory, DOE-LASO, MS A316  
T. Skibitski, DOE-OB  
IRM-RMMSO, MS A150

**D-1.0 LITHOLOGIC BOREHOLE LOG 16-23691, RELOGGED 11/15-11/16 BY EMILY SCHULTZ**

DATE: 10-25-04		LITHOLOGIC BORING LOG					PAGE: 1 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23691			
PROJECT MANAGER: Angelo Ortelli			PROJECT NO.: 109029			LOGGED BY: Jeff Sanders and Russell Lyon			
START TIME: Not recorded			COMPLETION TIME: Not recorded			STARTING DEPTH (ft): 0			
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			COMPLETION DEPTH (ft): 200			
DRILLING METHOD: Hollow Stem Auger/Rock Core			HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 13			LOCATION OF BOREHOLE: Top of Fish Ladder			
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
INV/SCL RE16-05-55978	0'-1'	0.0	0-5	5	1		Sandy silt with gravel, soft, moist, medium yellowish brown (10YR 5/4), sandy silt with gravel to 1/4" diameter, fine to coarse grained, roots, and rootlets. <b>Alluvium</b>	ML	Hollow Stem Auger
					2				
					3				
					4				
			5-10	0	5		Hard, fresh greyish orange pink (10YR 7/2) medium grained welded tuff, horizontally laminated, quartz phenocrysts to 1/8" diameter, pumice clasts to 1/2" diameter. <b>Bandelier Tuff</b>	Qbt	Hollow Stem Auger <b>No recovery from 5' to 10'.</b> Drilled with a 10" auger to create pilot hole for coring setup.
					6				
					7				
					8				
					9				
					10				
INV/SCL RE16-05-55979	13'-15'	0.0	10-20	4.5	11		Hard, fresh greyish orange pink (10YR 7/2) fine to coarse grained welded tuff, horizontally laminated, trace quartz phenocrysts to 1/16" diameter, pumice clasts to 1" diameter, trace mafic minerals. <b>Bandelier Tuff</b>	Qbt	Rock Core Unable to determine if natural fractures are present - fractures exist every 1-4" and appear to be weak points in tuff (separated during coring activities). Cross-referenced with SCR/SCL RE16-05-56374.
					12				
					13				
					14				
			10-20	0	15		Flat pumices at 10.0' and open by 10.5'; moderately welded; clots of quartz within open pumices. <b>Qbt 4</b>		<b>No recovery from 15' to 20'.</b>
					16				
					17				
					18				
					19				
					20				
Soft zone from 18-20' bgs.									

DATE: 10-25-04		LITHOLOGIC BORING LOG					PAGE: 2 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23691			
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029				
START TIME: Not recorded			COMPLETION TIME: Not recorded			LOGGED BY: Jeff Sanders and Russell Lyon			
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			STARTING DEPTH (ft): 0			
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200				
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE:			
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 13			Top of Fish Ladder			
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
INV/SCL RE16-05-55980	20'-21'	0.0	20-30	1.1	21		Moderately hard, fresh, very pale orange (10YR 8/2), fine to coarse grained ash tuff, quartz phenocrysts to 1/16" diameter, pumice clasts to 1/2" diameter, very fissile.	Qbt	Rock Core
				0	22		<b>Bandelier Tuff</b> Very crystal rich; open pumices visible; minor clay on surface.  Qbt 4	Qbt	Bandelier Tuff from 20' to 21.1', very friable, turning to dust during coring - resulting in poor recovery.  <b>No Recovery from 21.1' to 30'.</b>
				23					
				24					
				25					
				26					
				27					
				28					
				29					
				30					
INV/SCL RE16-05-55981	30'-31'	0.7	30-40	1.3	31		Medium hardness, fresh greyish orange pink (10YR 8/2), fine to coarse grained welded tuff, quartz phenocrysts to 1/16" diameter, and pumice clasts to 1/2" diameter.	Qbt	Rock Core
				0	32		<b>Bandelier Tuff</b> Open pumices; clots of quartz crystals. Qbt 4	Qbt	<b>No Recovery from 31.3' to 40'.</b>
				33					
				34					
				35					
				36					
				37					
				38					
				39					
				40					

PROJECT: TA-16-340 Complex (Fish Ladder)	SITE ID: TA-16-340	BORING ID: 16-23691
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PROJECT MANAGER: Angelo Ortelli	PROJECT NO.: 109029
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START TIME: Not recorded	COMPLETION TIME: Not recorded	LOGGED BY: Jeff Sanders and Russell Lyon
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DRILLING COMPANY: Envirodrill	DRILLER: Matt Cain	STARTING DEPTH (ft): 0
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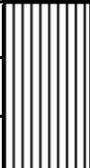
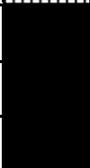
DRILLING METHOD: Hollow Stem Auger/Rock Core	COMPLETION DEPTH (ft): 200
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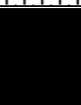
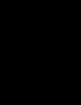
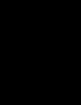
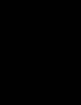
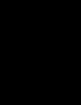
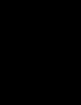
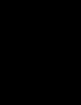
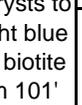
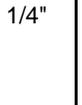
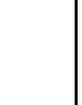
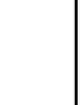
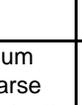
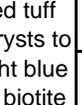
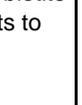
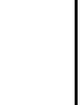
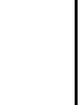
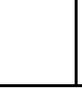
HOLE DIAMETER: 3.5"	SIZE/TYPE OF BIT: 3.5" ID Rock bit	LOCATION OF BOREHOLE:
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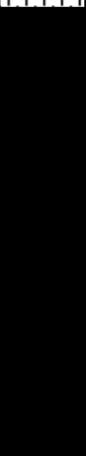
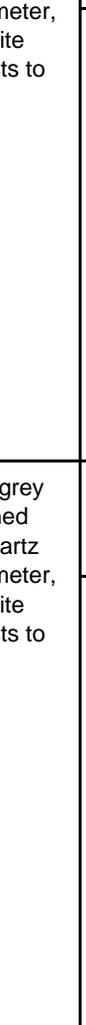
DRILLING ANGLE: Vertical	TOTAL # OF SAMPLES: 13	Top of Fish Ladder
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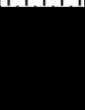
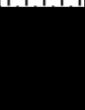
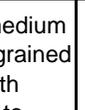
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			40-50	0	41				Rock Core No Recovery from 40' to 50'.
					42				
					43				
					44				
					45				
					46				
					47				
					48				
					49				
					50				
			50-60	0	51				Rock Core No Recovery from 50' to 60'.
					52				
					53				
					54				
					55				
					56				
					57				
					58				
					59				
					60				
									Qbt 4/Qbt 3t contact should be near this depth

DATE: 10-25-04		LITHOLOGIC BORING LOG					PAGE: 4 of 10			
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23691				
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029					
START TIME: Not recorded			COMPLETION TIME: Not recorded			LOGGED BY: Jeff Sanders and Russell Lyon				
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			STARTING DEPTH (ft): 0				
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200					
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE:				
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 13			Top of Fish Ladder				
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS	
				0	61				Rock Core No Recovery from 60' to 64'.	
					62					
					63					
					64					
INV/SCL RE16-05-55982	64'-67'	0.0	60-70	6	65		Hard, fresh brownish grey (5YR 4/1), fine to coarse grained welded tuff, quartz and plagioclase phenocrysts to 1/16" diameter, and trace pumice clasts to 1/4" diameter.		Fracture with clay at 65' bgs	
					66					
					67					
					68			<b>Bandelier Tuff</b>		
					69			Very competent; abundant quartz and plagioclase; few if any pumice. Minor weathered mafics.		
					70		Qbt 3T		Rock Core	
SCR/SCL RE16-05-56371	70'-72'	0.0			71			Qbt	Moderately welded from 70' to 71'.	
					72					
					73					
					74					
			70-80	9	75		Hard, fresh medium bluish grey (5B 5/1), medium to coarse grained welded tuff, some quartz and plagioclase phenocrysts to 1/16" diameter, trace pumice clasts to 1/16" diameter, and trace biotite.			
					76					
					77					
					78					
INV/SCL RE16-05-55984	77'-79'	0.0			79		<b>Bandelier Tuff</b> Becoming more strongly welded; plagioclase crystals prominent and numerous; large quartz crystals; no visible pumice.		Cross-referenced with SCR/SCL RE16-05-56372.	
					80		Qbt 3T		No Recovery from 79' to 80'.	

DATE: 10-25-04		LITHOLOGIC BORING LOG				PAGE: 5 of 10			
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340		BORING ID: 16-23691					
PROJECT MANAGER: Angelo Ortelli				PROJECT NO.: 109029					
START TIME: Not recorded		COMPLETION TIME: Not recorded		LOGGED BY: Jeff Sanders and Russell Lyon					
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0					
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200					
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE:					
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 13		Top of Fish Ladder					
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			80-90	0	81		Clay and silt wedged in sample core		Rock Core <b>No Recovery from 80' to 84'.</b>  Very easy drilling from 82-87'
					82				
					83				
					84				
INV/SCL RE16-05-55904	84'-86'	0.2	80-90	3	85		<b>Inferred contact</b> Silt, medium, dense, light brown (5YR 5/6), silt with fine to coarse grained sand, trace of gravel to 1" diameter, and interbedded fat clay (wet)	ML	Cross-referenced with SCR/SCL RE16-05-56373
					86				
					87				
			90-100	0	88				<b>No Recovery from 87' to 90'.</b>  Qbt 3t/Qbt 3 contact should be near this depth Rock Core
					89				
					90				
SCR/SCL RE16-05-56375	90'-92'	0.2	90-100	2	91		Medium hard, fresh, pale brown (5YR 5/2), fine to coarse grained moderately welded tuff, interbedded fat clay collecting within fractures.	Qbt	Two natural clay-filled fractures, numerous mechanical fractures. Cross-refernced with SCR/SCL RE16-05-56375.
					92				
			90-100	0	93		<b>Bandelier Tuff</b>		<b>No Recovery from 92' to 100'.</b>
					94				
					95				
					96				
					97				
					98				
					99				
					100				

DATE: 10-25-04		LITHOLOGIC BORING LOG				PAGE: 6 of 10			
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340			BORING ID: 16-23691				
PROJECT MANAGER: Angelo Ortelli				PROJECT NO.: 109029					
START TIME: Not recorded		COMPLETION TIME: Not recorded		LOGGED BY: Jeff Sanders and Russell Lyon					
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0					
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200					
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE: Top of Fish Ladder					
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 13							
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
SCR/SCL RE16-05-56376	100'- 102'	0.0	100-110	2	101		Medium hard, fresh, medium light grey (NG), fine to coarse grained moderately welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite crystals, trace biotite crystals, 3" clay zone from 101' bgs, and pumice clasts to 1/4" diameter.	Qbt	Rock Core Sample stuck in corebarrel due to clay lens at approximately 101' bgs.
					102				
					0	103		<b>Bandelier Tuff</b>	<b>No Recovery from 102' to 110'.</b>
					104				
					105				
					106				
					107				
					108				
					109				
					110				
SCR/SCL RE16-05-56377	110'- 112'	0.0	110-120	2	111		Medium hard, fresh, medium light grey (NG), fine to coarse grained moderately welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite crystals, trace biotite crystals, and pumice clasts to 1/4" diameter.	Qbt	Rock Core Sample stuck in corebarrel due to clay lens at approximately 101' bgs.
					112				
					0	113		<b>Bandelier Tuff</b>	<b>No Recovery from 112' to 120'.</b>
					114				
					115				
					116				
					117				
					118				
					119				
					120				

DATE: 10-25-04		LITHOLOGIC BORING LOG					PAGE: 7 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23691			
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029				
START TIME: Not recorded			COMPLETION TIME: Not recorded			LOGGED BY: Jeff Sanders and Russell Lyon			
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			STARTING DEPTH (ft): 0			
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200				
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE:			
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 13			Top of Fish Ladder			
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
INV/SCL RE16-0-55905	120'- 122'	0.0	120-130	2	121		Soft, fresh, medium light grey (NG), fine to coarse grained lightly welded tuff with quartz phenocrysts to 1/16" diameter, trace bright blue labradorite crystals, and pumice clasts to 1/4" diameter. <b>Bandelier Tuff</b>	Qbt	Rock Core Poor recovery due to friable nature of material. Cross-referenced with SCR/SCL RE16-05-56378.  <b>No Recovery from 122' to 130'.</b>
					122				
				123					
				124					
				125					
				126					
				127					
				128					
				129					
				130					
SCR/SCL RE16-05-56379	130'- 132'	0.0	130-140	2	131		Soft, fresh, medium light grey (NG), fine to coarse grained lightly welded tuff with quartz phenocrysts to 1/16" diameter, trace bright blue labradorite crystals, and pumice clasts to 1/4" diameter. <b>Bandelier Tuff</b>	Qbt	Rock Core Poor recovery due to friable nature of material. Trace clay surrounding core - clay interval cannot be identified.  <b>No Recovery from 132' to 140'.</b>
					132				
				133					
				134					
				135					
				136					
				137					
				138					
				139					
				140					

DATE: 10-25-04		LITHOLOGIC BORING LOG				PAGE: 8 of 10			
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340			BORING ID: 16-23691				
PROJECT MANAGER: Angelo Ortelli				PROJECT NO.: 109029					
START TIME: Not recorded		COMPLETION TIME: Not recorded		LOGGED BY: Jeff Sanders and Russell Lyon					
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0					
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200					
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE: Top of Fish Ladder					
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 13							
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
SCR/SCL RE16-05-56380	140'- 142'	0.0	140-150	2	141		Moderately hard, fresh, medium grey (N5), fine to coarse grained moderately welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite tp 1/32", and trace pumice clasts to 1/16" diameter.	Qbt	Rock Core Poor recovery due to friable nature of material. Clay (fat) surrounding core - interval cannot be determined. <b>No Recovery from 142' to 150'.</b>
					142				
			140-150	0	143		<b>Bandelier Tuff</b> Condensation in core bag. Moderate to poor welding. Abundant quartz and sanidine phenocrysts. Minor altered lithics. Some pumice. Qbt 3		
					144				
					145				
					146				
					147				
					148				
					149				
					150				
			150-160	10	151		Moderately hard, fresh, medium grey (N5), fine to coarse grained moderately welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite tp 1/32", and trace pumice clasts to 1/16" diameter.	Qbt	Rock Core
					152				
					153				
					154				
					155				
					156				
					157				
INV/SCL RE16-05-55906	157' - 160'	0.2	150-160	10	158				Coss-referenced with SCR/SCL RE16-05-56381
					159				
					160				

DATE: 10-25-04		LITHOLOGIC BORING LOG					PAGE: 9 of 10					
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23691						
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029							
START TIME: Not recorded			COMPLETION TIME: Not recorded			LOGGED BY: Jeff Sanders and Russell Lyon						
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			STARTING DEPTH (ft): 0						
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200							
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE:						
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 13			Top of Fish Ladder						
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS			
			160-170	2	161		Moderately hard, fresh, medium grey (N5), fine to coarse grained moderately welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite tp 1/32", and trace pumice clasts to 1/16" diameter.  <b>Bandelier Tuff</b> Sanidine and quartz. Minor accidental lithics with alteration. Sandy texture. Qbt 3	Qbt	Rock Core Poor recovery due to friable nature of material. Clay (fat) surrounding core - interval cannot be determined. <b>No Recovery from 162' to 170'.</b>			
										162		
				0				163				
								164				
								165				
								166				
								167				
								168				
								169				
								170				
			170-180	10	171		Hard, fresh, greyish orange pink (5YR 7/2), fine to coarse grained welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite crystals, and trace pumice clasts to 1/4" diameter.  <b>Bandelier Tuff</b> Welding decreases at 173.5' depth (open pumices). Abundant quartz and sanidine, large phenocrysts and porphyry. Qbt 3	Qbt	Rock Core Core stuck in core barrel. Mechanical structures visible, there is no evidence of natural fractures.			
										172		
										173		
										174		
										175		
SCR/SCL RE16-05-56382	175'- 177'	0.0								176		
										177		
										178		
										179		
										180		

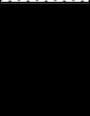
DATE: 10-25-04		LITHOLOGIC BORING LOG					PAGE: 10 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23691			
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029				
START TIME: Not recorded			COMPLETION TIME: Not recorded			LOGGED BY: Jeff Sanders and Russell Lyon			
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain			STARTING DEPTH (ft): 0				
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200				
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE:			
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 13			Top of Fish Ladder			
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			180-190	4	181		Moderately hard, fresh, medium grey (N5), fine to coarse grained, lightly welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite tp 1/32", and trace pumice clasts to 1/16" diameter.	Qbt	Rock Core Poor recovery due to friable nature of material. Clay (fat) surrounding core - interval cannot be determined.
					182				
					183				
					184				
				0		185		<b>Bandelier Tuff</b>	No Recovery from 184' to 190'.
					186				
					187				
					188				
					189				
					190				
INV/SCL RE16-05-55907	190' - 191'	0.0	190-200	0	191		Hard, fresh, greyish orange pink (10YR 7/2), fine to coarse grained welded tuff with some quartz phenocrysts to 1/16" diameter, trace bright blue labradorite crystals, and trace pumice clasts to 1/2" diameter.	Qbt	Rock Core Core stuck in core barrel. Mechanical structures visible, there is no evidense of natural fractures. Cross-referenced with SCR/SCL RE16-05-56383.  No Recovery from 191' to 200'.
					192				
					193				
					194				
					195				
					196				
					197				
					198				
					199				
					200				

Total Depth = 200' bgs

**D-2.0 LITHOLOGIC BOREHOLE LOG 16-23692, RELOGGED 11/16–11/20 BY EMILY SCHULTZ**

DATE: 11-12-04		LITHOLOGIC BORING LOG				PAGE: 1 of 10				
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340		BORING ID: 16-23692						
PROJECT MANAGER: Angelo Orтели				PROJECT NO.: 109029						
START TIME: Not recorded		COMPLETION TIME: 11:00 am		LOGGED BY: Russell Lyon						
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0						
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200						
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE:						
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 17		Bottom of Fish Ladder						
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS	
INV/SCL RE16-05-55983	0'-1'	0.8	0-5	1	1		Sandy silt with gravel, soft, moist, dark yellowish brown (10YR 4/2), sandy silt with gravel to 1/2" diameter, well graded sand, moist, medium grey (N5), coarse to fine grained sand with trace of gravel to 1/4" diameter.	ML	<b>No Recovery from 1' to 5'.</b> Qbt 4/Qbt 3t contact should be near this depth	
				0	2					
					3					
					4					
					5					
INV/SCL RE16-05-55985	5'-7'	0.0	5-7	2	6		<b>Inferred contact</b> Hard, fresh, red gray (N5), fine grained, welded tuff.	Qbt	Fractured from 5' to 7' (one horizontal angle and one 45 degree angle), trace clays and rootlets in fractures.	
			7-12		7					
					8		<b>Strongly welded numerous quartz phenocrysts. Obliquely fractured abundant plagioclase. Some minor pumice.</b>			
					9					
					10		Hard, fresh, medium dark gray (N4), fine-grained welded tuff, one 45 degree fracture at 11', trace quartz phenocrysts to 1/4" diameter.			
SCR/SCL RE16-05-56415	10'-12'	0.0	7-12		11					
					12					
					13		13' - Trace blue phenocrysts to 1/16" diameter.			
			12-20	8	14					
						15				Hard, fresh, light gray (N7), fine grained welded tuff, 45 degree oxidized fracture area from 15' to 17', trace quartz phenocrysts to 1/16" diameter.
SCR/SCL RE16-05-56416	15'-17'	0.0				16				
						17				
INV/SCL RE16-05-56417	17.5'-19'	0.0	12-20		18		<b>Bandelier Tuff</b>			
					19		<b>Qbt 3T</b>			
					20					

DATE: 11-12-04		LITHOLOGIC BORING LOG				PAGE: 2 of 10			
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340		BORING ID: 16-23692					
PROJECT MANAGER: Angelo Ortelli				PROJECT NO.: 109029					
START TIME: Not recorded		COMPLETION TIME: 11:00 am		LOGGED BY: Russell Lyon					
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0					
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200					
HOLE DIAMETER: 6.0"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE: Bottom of Fish Ladder					
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 17							
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			20-30	10	21		Hard, fresh, light gray (N7), fine grained welded tuff, 45 degree oxidized fracture area from 15' to 17', trace quartz phenocrysts to 1/16" diameter.		
					22				
					23				
					24				
					25				
					26				
					27				
					28				
					29				
					30				
			30-40	10	31		Strongly welded increasing sanidine, pumice content. Decreasing plagioclase (especially between 24'-26'). Very minor mafics. Qbt 3T	Qbt	
					32				
					33				
					34				
					35				
					36				
INV/SCL RE16-05-56418	36'-38'	0.0			37		Same as above, 45 degree fracture at 37', horizontal fracture at 37.5', both fractures are clay filled.		
38									
39									
40									

DATE: 11-12-04		LITHOLOGIC BORING LOG				PAGE: 3 of 10			
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340		BORING ID: 16-23692					
PROJECT MANAGER: Angelo Ortelli				PROJECT NO.: 109029					
START TIME: Not recorded		COMPLETION TIME: 11:00 am		LOGGED BY: Russell Lyon					
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0					
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200					
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE: Bottom of Fish Ladder					
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 17							
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			40-50	6	41		Medium, fresh, medium light gray (N6), fine grained welded tuff, trace quartz phenocrysts to 1/4" diameter.  <b>Bandelier Tuff</b> Less welded, decreasing plagioclase but still visible. More phenocrysts. Qbt 3	Qbt	Poor recovery 40'-42'. Textured change of core surface (from smooth to pocked or popcorn-like) between 38'-44'.
					42				
					43				
					44				
INV/SCL RE16-05-55965	44'-46'	0			45				
					46				
			50-60	0	47		Contact of Qbt 3T/Qbt 3 between 38'-44'		
					48				
					49				
					50				
					51				
			50-60	10	52		Moderately hard, fresh, medium light gray (N6), fine grained welded tuff with trace quartz phenocrysts to 1/4" in diameter.  <b>Bandelier Tuff</b> Less welded, texture change of core surface still predominant. Greater mafics content (biotite - minor). Qbt 3	Qbt	
					53				
					54				
					55				
					56				
SCR/SCL RE16-05-56420	56'-58'	0.9			57				
					58				
					59				
					60				

DATE: 11-12-04		LITHOLOGIC BORING LOG					PAGE: 4 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23692			
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029				
START TIME: Not recorded			COMPLETION TIME: 11:00 am			LOGGED BY: Russell Lyon			
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			STARTING DEPTH (ft): 0			
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200				
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE:			
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 17			Bottom of Fish Ladder			
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
INV/SCL RE16-05-55966	78'-80'	0.0	60-70	10	61		Moderately hard, fresh, medium light gray (N6), fine grained welded tuff with trace quartz phenocrysts to 1/4" in diameter.	Qbt	
					62				
					63				
					64				
					65				
					66				
					67				
					68				
					69				
					70				
			70-80	10	71		Hard, fresh, medium gray (N5), fine grained welded tuff, with few quartz phenocrysts to 1/4" diameter, trace blue crystals to 1/16" in diameter.	Qbt	
					72				
					73				
					74				
					75				
					76				
					77				
					78				
					79				
					80				
									Several horizontal fractures from 75' to 80'.
									Horizontal fracture and 45 degree angle fracture, clay filled. Cross-referenced with SCR/SCL RE16-05-56421.

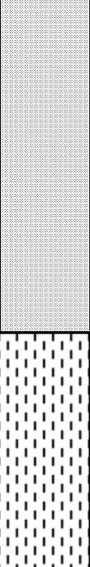
DATE: 11-12-04		LITHOLOGIC BORING LOG					PAGE: 5 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23692			
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029				
START TIME: Not recorded			COMPLETION TIME: 11:00 am			LOGGED BY: Russell Lyon			
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			STARTING DEPTH (ft): 0			
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200				
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE: Bottom of Fish Ladder			
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 17						
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			80-90	10	81		Hard, fresh, light brownish gray (5YR 6/1), fine grained welded tuff, with few quartz grains to 1/4" in diameter, trace blue crystals to 1/16" in diameter, pumice clasts.		
					82				
					83				
					84				
					85				
					86				
					87				
					88				
					89				
					90				
			90-100	10	91		Hard, fresh, light brownish gray (5YR 6/1), fine grained welded tuff, with few quartz grains to 1/4" in diameter, trace blue crystals to 1/16" in diameter, pumice clasts.	Qbt	
					92				
					93				
					94				
					95				
					96				
					97				
					98				
					99				
					100				
SCR/SCL RE16-05-56385	98'-100'	0.0							

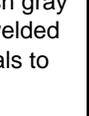
DATE: 11-12-04		LITHOLOGIC BORING LOG					PAGE: 6 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340			BORING ID: 16-23692			
PROJECT MANAGER: Angelo Ortelli					PROJECT NO.: 109029				
START TIME: Not recorded			COMPLETION TIME: 11:00 am			LOGGED BY: Russell Lyon			
DRILLING COMPANY: Envirodrill			DRILLER: Matt Cain			STARTING DEPTH (ft): 0			
DRILLING METHOD: Hollow Stem Auger/Rock Core					COMPLETION DEPTH (ft): 200				
HOLE DIAMETER: 3.5"			SIZE/TYPE OF BIT: 3.5" ID Rock bit			LOCATION OF BOREHOLE: Bottom of Fish Ladder			
DRILLING ANGLE: Vertical			TOTAL # OF SAMPLES: 17						
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
SCR/SCL RE16-05-56384	106'- 108'	0.0	100-110	9	101		Hard, fresh, light brownish gray (5YR 6/1), fine grained welded tuff, with few quartz grains to 1/4" in diameter, trace blue crystals to 1/16" in diameter, pumice clasts.	Qbt	
					102				
					103				
					104				
					105				
					106				
					107				
					108				
					109				
					110				
			110-120	6.5	111		Moderately hard, fresh, light brownish gray (5YR 6/1), fine grained welded tuff, with few quartz grains to 1/4" in diameter, trace blue crystals to 1/16" in diameter, pumice clasts.	Qbt	
112									
113									
114									
115									
116									
117									
118									
119									
120									

**Bandelier Tuff**  
Pumices beginning to open, including crystal clots within pumices. Quartz and sanidine, large phenocrysts.  
Qbt 3

No Recovery 109' to 110'.

DATE: 11-12-04		LITHOLOGIC BORING LOG				PAGE: 7 of 10		
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340		BORING ID: 16-23692				
PROJECT MANAGER: Angelo Ortelli		PROJECT NO.: 109029						
START TIME: Not recorded		COMPLETION TIME: 11:00 am		LOGGED BY: Russell Lyon				
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0				
DRILLING METHOD: Hollow Stem Auger/Rock Core		COMPLETION DEPTH (ft): 200						
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE: Bottom of Fish Ladder				
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 17						
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			120-130	0				No Recovery from 120' to 130'.
			130-140	0				No Recovery from 130' to 140'.
						Soft unconsolidated material at 137'. Possible surge?		Drill rod stuck at 137'. After drill rod was removed, the hole collapsed at 137'. Discontinue use of rock coring device and switch over to air rotary. Completed over-drilling to 150'.

DATE: 11-12-04		LITHOLOGIC BORING LOG				PAGE: 8 of 10			
PROJECT: TA-16-340 Complex (Fish Ladder)			SITE ID: TA-16-340		BORING ID: 16-23692				
PROJECT MANAGER: Angelo Ortelli				PROJECT NO.: 109029					
START TIME: Not recorded		COMPLETION TIME: 11:00 am		LOGGED BY: Russell Lyon					
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0					
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200					
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE: Bottom of Fish Ladder					
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 17							
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS
			140-150	10	141		Soft, unconsolidated "sands" from 140' to 148', high silica glass content, slightly rounded. Surge deposit? Base of Qbt 3 (best estimate using description - N.R.)  Silty sand, olive in color.	SM	Completed over-drilling to 150'.
					142				
					143				
					144				
					145				
					146				
					147				
					148				
			150-160	10	149		Hard, fresh, light gray tuff, with small amount of purple color, trace quartz phenocrysts to 1/4" diameter.  Very consolidated, fresh, brownish gray welded tuff, with quartz crystals up to 10 mm in diameter, coarsening of crystals with depth.  Very strongly welded; dense increasing plagioclase. Decreasing sanidine. No pumice visible. Qbt 2	Qbt	Qbt 3/Qbt 2 contact should be near this depth
					150				
					151				
					152				
					153				
					154				
					155				
					156				
					157				
					158				
					159				
					160				
INV/SCL RE16-05-55960	159'-160'	0.0							Cross-reference SCR/SCL RE16-05-56422

DATE: 11-12-04		LITHOLOGIC BORING LOG				PAGE: 9 of 10							
PROJECT: TA-16-340 Complex (Fish Ladder)		SITE ID: TA-16-340		BORING ID: 16-23692									
PROJECT MANAGER: Angelo Ortelli				PROJECT NO.: 109029									
START TIME: Not recorded		COMPLETION TIME: 11:00 am		LOGGED BY: Russell Lyon									
DRILLING COMPANY: Envirodrill		DRILLER: Matt Cain		STARTING DEPTH (ft): 0									
DRILLING METHOD: Hollow Stem Auger/Rock Core				COMPLETION DEPTH (ft): 200									
HOLE DIAMETER: 3.5"		SIZE/TYPE OF BIT: 3.5" ID Rock bit		LOCATION OF BOREHOLE: Bottom of Fish Ladder									
DRILLING ANGLE: Vertical		TOTAL # OF SAMPLES: 17											
SAMPLE ID	SAMPLE DEPTH	PID-SAMPLE (ppm)	RUN (FT)	RECOVERY (FT)	DEPTH (ft. bgs)	GRAPHIC LOG	DESCRIPTION	SOIL/ROCK TYPE	COMMENTS				
			160-170	5	161		Hard, fresh, medium gray (N5), fine grained welded tuff, with few quartz grains to 1/4" diameter, pumice clasts.  <b>Bandelier Tuff</b> Very strongly welded plagioclase. Qbt 2	Qbt	All mechanical fractures, no samples were taken.				
					162								
					163								
					164								
					165								
			170-180	10	166				No recovery from 165' to 170'.				
					167								
					168								
					169								
					170								
					171						Hard, fresh, light brownish gray (5YR 6/1), fine grained welded tuff, with few quartz cystals to 1/4" diameter.  <b>Bandelier Tuff</b> Very strongly welded decreasing crystal content. Increasing plagioclase. Qbt 2	Qbt	Several mechanical fractures from 170' to 175'.
					172								
					173								
					174								
					175								
			176										
			177										
			178										
			179										
			180										
SCR/SCL RE16-05-56423	178'-180'	0.0					Hard, fresh, light brownish gray (5YR 6/1), fine grained welded tuff, with few quartz cystals to 1/4" diameter.						

