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Submitted to: Environmental Remediation & Surveillance Program

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GEOTECHNICAL INVESTIGATION
RADIOLOGICAL LABORATORY, UTILITY AND OFFICE BUILDING
CHEMISTRY AND METALLURGICAL RESEARCH REPLACEMENT PROJECT
LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS, NEW MEXICO
KLEINFELDER PROJECT NO. 19435
REVISION 2

Contract No. 13568-109-02-CX, Task No. 109
Document Control No. ALB04RP001 Rev. 2

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TABLE OF CONTENTS

SECTION **PAGE**

LIST OF ACRONYMS AND ABBREVIATIONS iv
SUMMARY OF CONCLUSIONS v
1 INTRODUCTION 1
1.1 GENERAL DESCRIPTION OF PROJECT 1
1.2 PURPOSE AND CONTENT 2
2 SITE DESCRIPTION 3
3 SCOPE OF INVESTIGATIONS AND ANALYSES 3
3.1 DESCRIPTION OF INVESTIGATION 3
3.1.1 Existing Data Review 4
3.1.2 Subsurface Investigation 4
3.1.3 Test Trenches 8
3.1.4 Laboratory Testing of Samples 8
3.2 GEOTECHNICAL ANALYSES AND FINDINGS 10
3.2.1 Geologic Setting 10
3.2.2 Subsurface Conditions 11
3.2.3 Geotechnical Characterization of Soil and Tuff 13
3.2.3.1 Soil 13
3.2.3.2 Tuff 13
3.2.4 Excavation and Earthwork 15
3.2.4.1 Earthwork 15
4 CONCLUSIONS AND RECOMMENDATIONS 16
4.1 GENERAL 16
4.1.1 Foundations for Structural Elements 17
4.1.2 Excavation Slopes 18
4.2 RECOMMENDATIONS 18
4.2.1 Foundations 18
4.2.1.1 Shallow Foundations in Tuff 19
4.2.1.2 Resistance to Lateral Loads 20
4.2.1.3 Geochemical Properties 20
4.2.2 Lateral Earth Pressures on Basement Walls 20
4.2.3 Cut-and-Cover Tunnel 21
4.2.4 Earthwork 22
4.2.4.1 Surface Preparation 22
4.2.4.2 Excavation and Earthwork Methods 23
4.2.4.3 Material for Fill 23
4.2.4.4 Compaction Requirements 24
4.2.4.5 Weather Limitations 25
4.2.4.6 Construction Observation and Testing 25
4.3 SITE DRAINAGE AND MOISTURE PROTECTION 25
5 REFERENCES 26
6 LIMITATIONS 26

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TABLE OF CONTENTS (Continued)

APPENDIXES

Appendix A – Area of Investigation
Figure 1 – Subsurface Investigation Location Plan
~~Table 1 – Test Boring Summary Profiles~~

Appendix B – Boring Logs, Cross Sections, and Laboratory Test Results
Figure 2 – Cross Section, F Line Subsurface Investigation
Figure 3 – Cross Section, H Line Subsurface Investigation
Figure 4 – Cross Section, 2 Line, 3 Line, 4 Line Subsurface Investigations
Boring Logs
Figure 5 – Log of Test Trenches TT-3A and TT-3B
Figure 6 – Log of Test Trenches TT-3C and TT-4
Figure 7 – Log of Test Trench TT-4A
Table 2 – Laboratory Test Results – RLUOB Facility and Nearby Area

Appendix C – Results of In-Situ ~~Testing (Not Applicable)~~

Appendix D – Preliminary Calculations
Engineering Properties and Design Parameters
Bearing Capacity and Settlement on Bandelier Tuff
Slope Stability
Rock Fracture Data Reduction and Presentation
Table 3 – Summary of Recommended Engineering Properties of Recompacted Tuff Fill and Intact Tuff
Figure 8 – Earth Pressure Diagram for Cut-and-Cover Tunnel

Appendix E – Recommended Specifications and Field Control Requirements

Appendix F – Results of Soil Resistivity Measurements (Not Applicable)

Appendix G – Summary Description of Quality Control Plan

only piece included

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LIST OF ACRONYMS AND ABBREVIATIONS

Φ	angle of internal friction
amsl	above mean sea level
ASR	alkali-silica reactivity
ASTM	American Society for Testing and Materials
bgs	below ground surface (at time of measurement)
CME	Central Mining Equipment
CMR	Chemistry and Metallurgical Research Facility
CMRR	Chemistry and Metallurgy Research Facility Replacement
c	apparent cohesion
ECF	Entrance Control Facility
FIC	Facility Incident Command
ft	feet
GSI	Geological Strength Index
G/SIP	Geotechnical/Seismic Investigation Plan
HSA	hollow stem auger
ID	inside diameter
Kleinfelder	Kleinfelder, Inc.
ksf	kips per square foot
LANL	Los Alamos National Laboratory
O.D.	outside diameter
OPS	Operations Center
pcf	pounds per cubic foot
pci	pounds per cubic inch
PIDAS	Personnel Intrusion Detection Alarm System
psf	pounds per square foot
psi	pounds per square inch
QA	Quality Assurance
RFP	Request for Proposal
RLUOB	Radiological Laboratory, Utility, and Office Building
RQD	rock quality designation
RMR	rock mass rating
sf	square ft
SIC	seismically induced compaction
SSC	Shallow Seismic Characterization
SPT	Standard Penetration Test
TA	Technical Area
UB	Utility Building
USCS	Unified Soil Classification System

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BORING LOG GLOSSARY OF TERMS

Ash – pyroclastic material generally under 4 mm in size

Fill – soil or broken tuff material used to raise or restore ground surface

Lithic – tuff fragment included in the tuff derived from an earlier geologic process

Mafics – iron/magnesium rich minerals such as pyroxene

Mechanical fractures – fractures or breaks in the tuff due to the mechanical process of collecting the samples, i.e. not naturally occurring fractures

N/R – no recovery

Organics – vegetable matter including roots

Phenocrysts – larger individual mineral crystals in a finer grained matrix

Pumice - highly vesicular volcanic glass

Pyroclastic – Mineral fragments ejected into the air from volcanic eruptions and deposited as ashfalls or ashflows

Pyroxene – mafic silicate mineral

Qbt3 – Unit 3 of the Tshirege Member of the Bandelier Tuff of Quaternary age

Qbt4 – Unit 4 of the Tshirege Member of the Bandelier Tuff of Quaternary age

Quartz – naturally occurring crystalline form of silica

RMR – Rock Mass Rating (Bieniawski, 1989). A system that rates a rock mass using strength, RQD, joint (fracture) spacing, joint condition, and groundwater conditions. Total RMR rating can range from a low of 8 to 100 as the highest (best) rating. Orientation of joints can also be considered, as appropriate.

RQD – Tuff Quality Designation. A means of characterizing tuff mass quality of tuff core, expressed as the ratio (percentage) of the sum of the lengths of all pieces of sound tuff core greater than 4 inches divided by the total length of the run. In calculating the sum of pieces to be counted, only natural geologic fractures are considered; mechanical breaks caused by drilling or handling are disregarded.

Sanidine – feldspathic silicate mineral with a characteristic bluish play of colors

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Special Sample – samples collected for later testing

Strength – Ability of material to withstand stress with rupture. Descriptive terms are slight (SL), moderately strong (MOD), and high strength (H).

Tuff – indurated pyroclastic tuff consisting of grains generally finer than 4 mm. In this study the term tuff is used to include the ashy matrix as well as the pumice, lithic fragments, and phenocrysts.

Weathering – chemical or mechanical degradation of tuff and constituent minerals over time. Descriptive terms are fresh (FR), slightly weathered (SL), moderately weathered (MOD), and very (highly) weathered (H).

Welding – process which promotes the union or cohesion of glassy fragments by thermal fusion after deposition and subsequent cooling of tuff.

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KLEINFELDER BORING LOG

Boring # 1-F

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/21/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/21/2002		N/A	
Location: TA-55	Backfilled: 11/21/02	N/A		
Surface Elevation: 7271.4	Driller: Szpunar		Logged by: Ryan Merkley/Doug Young	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL (FILL)
										Qbt3 (TUFF)
5		R1	CORE	3.1	N/R					
		R2	CORE	1.5	16	8	1@10°	SL - MOD	S - MOD H	pale red, predominantly fine grained (ashy matrix with 25% pumice & 30% phenocrysts, pumice is light gray-mid gray, containing sanidine & quartz phenocrysts (2-6mm), 1:1-2:1, phenocrysts in matrix are predominantly sanidine & quartz, 1-2mm)
10		R3	CORE	.8	100	83	1@80°	SL	MOD H	pale red-gray, fracture at 11.5 ft @ 80°, 2-3mm wide; fracture @ 14.1 20° 2mm wide; slight increase in % pumice to 27% toward end of run
										Special Sample 12.4' - 14.7'
							1@20°			
15		R4	CORE	.5	100	84		SL	MOD H	Slightly higher degree of welding (slight to moderate) % of pumice that is 2:1 increases, 2-3% lithics Special Sample 15.6' - 16.1'
										Special Sample 19.3' - 20.1'
20		R5	CORE	.6	100	76	3	SL	MOD H	pale red, predominantly fine grained (ashy matrix, 27% pumice, 30% phenocrysts, pumice with sanidine & quartz phenocrysts, 1:1-3:1, up to 3cm in size, phenocrysts in matrix are predominantly sanidine & quartz, trace mafics (<5%), no noticeable lithics. fracture zone from 20.6' to 21.4'
							1X			
							2X			
25							2X			

Checked by: Joseph P. Lovato Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
- A - Auger Cuttings
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- CORE - HQ Wireline Core
- NR - No Recovery

KLEINFELDER BORING LOG

Boring # 1-F
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/21/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/21/2002		N/A	
Location: TA-55	Backfilled: 11/21/02	N/A		
Surface Elevation: 7271.4	Driller: Szpunar		Logged by: Ryan Merkley/Doug Young	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R6	CORE	1	100	76	2X	SL	MOD H	**Qbt3 (TUFF)** lithics reappear (1-2%), pumice remain the same
							2X			
							4X			
							1@85° 2X			
							4X			fracture from 28 4 - 28 8. 85°, 3mm wide, organics & staining in fracture
30		R7	CORE	1.1	96	72	1X	SL - MOD	MOD H	% increase in pumice to 30% & lithics to 2-4%, fracture at 31 3, 0°, 1mm wide, 31 9@90°, 2mm, .3ft long
							1X			
							3X			
							3X			Special Sample 33 3' - 33.8'
							3X			Special Sample 34.6' - 35.0'
35		R8	CORE	.7	94	94	2X	SL - MOD	MOD H	Note: Slight increase in weathering from slight to moderate. Slight increase in pumice size, some pumice up to 7cm, rock becoming softer, moderately hard - moderately soft, all fractures are mechanical
							>5X			
							4X			
							1X			
							2X			
40		R9	CORE	1.4	38	10	5X	MOD	MOD S	pale reddish brown, color change due to weathering, fracture at 42 ft .85" length, vertical, clay lined, unsure of width, whole run appears oxidized, very poor recovery
45		R10	CORE	1.1	70	70	17X	MOD	MOD S	pale red, predominantly fine grained ashy matrix with 30% pumice, 30-35% phenocrysts, pumice predominantly light gray, up to 2cm in size, 1:1, showing very slight welding, infilled with sanidine & quartz, phenocrysts are sanidine & quartz with <1% mafic, crystal rich zone at end of run (35-37%). all mechanical fractures.
50										
										Boring Terminated @ 50.6'

KLEINFELDER BORING LOG

Boring # 1-G

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/18/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/18/2002		N/A	
Location: TA-55	Backfilled: 11/18/02	N/A		
Surface Elevation: 7260.1	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL (FILL)
										Qbt3 (TUFF)(Augered, no sample)
5		R1	CORE	1.1	100	53	1@70° 1	SL - MOD	MOD H	pale red, ashy matrix, fine grained (25% pumice, light gray - medium gray, sometimes containing quartz & sanidine, 2mm-4mm, matrix 20% phenocrysts, predominantly sanidine & quartz, 1mm-2mm, trace mafic phenocrysts) slight degree of welding, 2% lithics
		R2	CORE	1 03	74	54		SL - MOD	MOD H	fracture at 70° >3mm wide, iron stained clay infilling % pumice increases to 27%, some pumice ratios as high as 3:1 indicating slight degree of welding, 2% lithics
							1@70°			
							1@0°			fracture at 70° greater than 3cm clay infilling, 0°>3cm iron staining
10										
		R3	CORE	.92	100	100		SL - MOD	MOD H	pale red, lithics increase to 3-4%, approx 2-4mm, large increase in pumice to 27-30% increase in phenocrysts to 25%
							1@80°			fracture from 12.7' to 13.3' @ 80°, 3mm wide, slight clay infilling iron stained
15										
		R4	CORE	1.2	64	40	2	MOD		changes to pale yellowish brown for .8ft, then back to pale red, fracture is 20° and >3mm wide fracture is 0° and >3mm wide, clay infilling and iron stained. other fractures are mechanical
							1X			
							2X			
20										
		R5	CORE	.85	100	100	2X	SL	MOD S	pale red, fine grained (ashy matrix with approx 30-32% pumice, predominantly light grey, ratios 1:1-2:1, degree of welding is slightly less than previous, matrix is 27% phenocrysts predominantly sanidine & quartz. some weathered mafics, 3% lithics; mechanical fractures
							2X			
							2X			
25							1X			

Checked by: Joseph P. Lewis Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
ST - 3" O.D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 1-G
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/18/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/18/2002		N/A	
Location: TA-55	Backfilled: 11/18/02	N/A		
Surface Elevation: 7260.1	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock Minutes/Foot	Rock % Recovery	Rock RQD	Rock Fractures/Foot	Rock Weathering	Rock Strength	Description
							1X			
		R6	CORE	.82	100	94	1X	SL	S - MOD H	all fractures are mechanical
							2X			Qbt3 (TUFF)pale red, fine grained, ashy matrix, slight increase in degree of welding from 27 2' to 30.0' (pumice in this area is 2:1)
30							3X			
		R7	CORE	8	100	100	2X	SL	MOD H	degree of welding has increased throughout this run, all fractures are mechanical
							2X			very large pumice (approx 8cmX8cm)
							3X			very large pumice (approx 8cmX8cm) very large pumice (approx 8cmX8cm) % pumice drops to approx. 27-30%
							1X			
35							2X			
		R8	CORE	.85	100	90	2X	SL	S - MOD H	pumice is approx 30%, % of phenocrysts at 30%, degree of welding slight-moderate, some pumice at ratios of 3:1
							1X			
							2X			
40						2X	1@90°			90° > 3cm wide, no infilling
		R9	CORE	.81	88	52		SL - MOD	MOD H - H	moderate reddish brown, color change because of weathering, % increase in phenocrysts, to 30-33%, run becoming more weakened towards the end
							1			20° & 4mm wide
							1			
45										50° & 4mm wide
		R10	CORE	.85	N/R	0				Note: end of sample showing signs of weathering, perhaps rock became more weathered. no recovery
50										
										Boring Terminated @ 51.1'

LANL BORING LOG CMRR.GPJ NEWKALOG.GDT 3/11/04

KLEINFELDER BORING LOG

Boring # 1-H

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/14/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/15/2002		N/A	
Location: TA-55	Backfilled: 11/15/02	N/A		
Surface Elevation: 7260.8	Driller: Szpunar/Stames		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL (FILL) auger down to set casing for core, no sample, fill was silty clay with sand
		R1	CORE		N/R	0				
5		R2	CORE	73	96	66	1	SL	MOD H	Qbt3 (TUFF) - grayish red, fine grained ashy matrix with 20-25% pumice. Pumice is light gray to moderate gray with phenocrysts of sanidine & quartz, range in size from 2-5cm, aspect ratios of 1:1-3:1. Phenocrysts (mostly quartz & sanidine with some weathered pyroxene) make up 25% of sample.
							2			
							4			
							2X			
10		R3	CORE	.70	100	80	2X	SL	MOD H	pale red, increase in % pumice to 30%, fracture at 11.6 ft is .3mm wide, all other fractures are mechanical Increase in % lithics to 5% at about 11ft.
							1@0°			
							1X			
							2X			
15		R4	CORE	.70	88	87		SL	MOD H	slightly weathered
										lithic 2cm x 4cm
							1@10°			fracture, no infilling 5mm wide @ 10°
20		R5	CORE	70	99	95	1X	MOD	MOD S	pale red, fine grained ashy matrix. pumice makes up 27-30% of sample, pumice 1-4cm in size & light to medium gray. Phenocrysts (27-30% of sample) mostly sanidine & quartz with some weathered out pyroxenes. Lithics approx 1% of the sample.
							1X			
							2X			
25							2X			

Checked by: Joseph P Laird Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D tube sample
ST - 3" O.D thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 1-H

Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/14/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/15/2002		N/A	
Location: TA-55	Backfilled: 11/15/02	N/A		
Surface Elevation: 7260.8	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock Minutes/Foot	Rock % Recovery	Rock RQD	Rock Fractures/Foot	Rock Weathering	Rock Strength	Description
		R6	CORE	73	96	67	3 (1X)	MOD	MOD S	Qbt3 (TUFF) -all natural fractures have clay infilling. 1st fracture is mechanical in 1st ft, 2nd 2 fractures in 1st ft are 60° - 3mm wide & 0° @ 3cm wide
							2X			2nd ft 1st fracture and 2nd are mechanical
							1			fracture in 3rd ft is 40°, 5mm wide
							4			last 4 fractures are 50°, 1 @ 90° and 2mm-2cm wide.
30		R7	CORE	.70	100	74		SL	MOD H	% pumice is the same but pumice aspect ratios appear to be predominantly 2:1-3:1 indicating a sl higher degree of welding. All fractures have a slight clay infilling, appears to be a fracture (0°) at end of run
							1			0° & 2mm wide
							1			
							2			0° & 4mm wide
35		R8	CORE	.75	97	84	1	SL	MOD H	0° & 4mm wide 0° & 7mm wide pumice is still predominantly 2:1-3:1 showing moderate welding, % of pyroxene has diminished, 95% phenocrysts is sanidine & quartz, lithics have disappeared
							1			fracture 5° > 2cm fracture 0° > 2cm width
							1			fracture 5° 4mm wide
40										correction in depth (measure in hole)
		R9	CORE	?	86	46	1X	SL	MOD H - H	pale reddish brown, pumice, aspect ratios are 1:1-2:1, trace 3:1 so degree of welding is decreasing Phenocryst % & characteristics are unchanged.
							1			fracture 0° 4mm wide
							1, 1X			
							>5X			fracture 0-5° > 3cm wide, trace infilling
45							1X			lithics reappear at about 3% large lithics (5cm x 5cm)
		R10	CORE	1 1	80	54		SL	MOD H - H	pale reddish brown. fine grained ashy matrix w/ 30% pumice, (light gray-medium gray with sanidine) ratios of 1:1-2:1, 30% phenocrysts, (sanidine & quartz, trace pyroxene) 1mm-2mm Lithics compose 2-3% of matrix degree of welding is moderate-slight decreasing down hole
							1			fracture is 30-50° 3mm, infilled with clay.
50										
										Boring Terminated @ 51.0'

KLEINFELDER BORING LOG

Boring # 1-I

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/13/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/14/2002		N/A	
Location: TA-55	Backfilled: 11/14/02	N/A		
Surface Elevation: 7264 2	Driller: Szpunar/Stames		Logged by: Ryan Merkley/Jeremy Hoover	

Drilling Method: Continuous sampler / HQ Wireline

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R1	CS		100					FILL (FILL)
		R2	CS		100			SL - MOD	SL - MOD	
5										QBT3 (TUFF) -greyish orange pink, fine grained ashy matrix with 25% pumice, medium gray, with phenocrysts of sanidine & quartz. matrix supports 30% phenocrysts of predominantly sanidine & quartz & trace orthopyroxene, pumice is 3mm - 3cm & phenocrysts are 1mm-2mm
										Note: drillers reamed hole to 9.5 ft
10		R1	CORE	.49	73	0				Note: getting core started, not a full run
		R2	CORE	42	24	8		SL - MOD	S - MOD H	greyish orange pink, fine grained ashy matrix with 30% pumice, very light gray - moderate gray with 5% phenocrysts of sanidine, 2mm-3cm, matrix has 25-30% phenocrysts of predominantly sanidine & quartz with trace orthopyrexene, no noticable fractures or infilling, poor recovery, fractures are mechanical.
15		R3	CORE	1.05	54	44		SL	S - MOD H	pale red, fracture at end of core (unsure of depth) 10°, opening is undetermined, signs of infilling (clay, residue, organic material), other fractures are mechanical
20		R4	CORE	65	96	90	1@5°	SL	MOD H	(Note: switched from geo-barrel to conventional core)
							1X			
							0X			pale red, fine grained ashy matrix with 30% pumice, light gray to medium gray, 2mm-3cm, with phenocrysts of sanidine, matrix has 25-30% phenocrysts of predominantly sanidine and quartz
							2X			
25										

Checked by: Joseph P. Lavin Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
- A - Auger Cuttings
- S - SPT 2" O.D. 1 38" I.D tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- ST - 3" O.D thin-walled Shelby tube
- CORE - HQ Wireline Core
- NR - No Recovery

KLEINFELDER BORING LOG

Boring # 1-I
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/13/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/14/2002		N/A	
Location: TA-55	Backfilled: 11/14/02	N/A		
Surface Elevation: 7264.2	Driller: Szpunar/Stames		Logged by: Ryan Merkley/Jeremy Hoover	

Drilling Method: Continuous sampler / HQ Wireline

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
							1X			
		R5	CORE	45	92	52		SL - MOD	MOD H	QBT3 (TUFF) -fracture towards end of run is 5° width of 3mm Note: core was blown out onto ground, discoloration was noticed in other parts of run but is impossible to note locations of other fractures. RQD & recovery are estimates
30							1@5°			
		R6	CORE	.7	99	99	0	SL	MOD H	grayish red, pumice & phenocryst inside matrix are at 30% & 27% respectively with the same characteristic as above
35										
		R7	CORE	.73	100	97		SL - MOD		
							2 @ 20°, 40°			fracture 20° 5mm-8mm wide
							1 @ 0°			fracture 40° 2mm wide pale red, fracture 0° 3mm-5mm wide
40										
		R8	CORE	.7	100	95		SL - MOD	MOD H	sl increase in % phenocrysts to 30%, pumice is as above, all other fractures are mechanical
							1@15°			15° 0.5-1 5cm wide
45							1X			
							1X			
		R9	CORE	7	100	80		SL	MOD H	pale red, fine grained ashy matrix with 27%-30% pumice, 2mm-8cm, with phenocrysts of sanidine, light gray-medium gray, phenocrysts are at 30-32% of matrix from 2mm-3mm, 5% lithics, all fractures appear to be mechanical
							1X			
							1X			
50							1X			
										Boring Terminated @ 51.4'

KLEINFELDER BORING LOG

Boring # 2-F
Sheet 1 of 2

Project Name: LANL CMRR	Started: 12/7/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/7/2002		N/A	
Location: TA-55	Backfilled: 12/07/02	N/A		
Surface Elevation: 7282.7	Driller: Starnes	Logged by: William P Murphy		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL (RECENT)
										Qbt4 (TUFF) pale red (5R6/2), ashy matrix, 10% pumice, devitrified, dark brown, 15% qtz & sanidine phenocrysts
5		R1	CORE	49	94	62	1@20°		MOD S	
10		R2	CORE	52	94	28	3	MOD - H	MOD S	surge deposits crossbedding, clay red brown **Qbt3 (TUFF)** ashy fine grained matrix, 16% pumice phenocrysts, 15% quartz & sanidine phenocrysts, pumice devitrified dark brown, much pumice weathered out, pock-marked appearance
							3			
							2			
							3			
							2			
15		R3	CORE	57	100	88		MOD	MOD S	blue-gray, fine grained matrix, pumice 30%, pumice grey devitrified, 2mm 1:1, phenocrysts of quartz & sanidine 30%
20		R4	CORE		96	96		MOD	MOD S	greyish-blue (10R6/2), predominately fine grained phenocrysts qtz & sanidine 30% pumice
25		R5	CORE	57	100	100	1	SL	MOD S	pale red (10R6/2), predominately fine grained phenocrysts

Checked by: Joseph P. Lavid Date: 3/11/04

Reviewed by: Allen Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
- A - Auger Cuttings
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- CORE - HQ Wireline Core
- NR - No Recovery

KLEINFELDER BORING LOG

Boring # 2-F

Sheet 2 of 2

Project Name: LANL CMRR	Started: 12/7/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/7/2002		N/A	
Location: TA-55	Backfilled: 12/07/02	N/A		
Surface Elevation: 7282.7	Driller: Starnes		Logged by: William P Murphy	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
							0			quartz & sanidine 30-35% phenocrysts pumice 30%, lithic of dacite
							3			
							1			
							0			
30		R6	CORE	.58	100	100		SL	MOD S	**Qbt3 (TUFF3)** pale red (10R6/2). predominately fine grained phenocrysts pumice 35% qtz & sanidine 30% large phenocrysts of pumice
							1X			
							0			
							1X			
							1X			
35		R7	CORE	.57	100	100	2X			pale red (10R6/2), predominately fine grained phenocrysts of quartz & sanidine to 1mm, 30% pumice 30-35%, dark brown.
							3X			
							1X			
							2X			
40		R8	CORE	.57	88	62	4X	MOD	MOD S	pale red (10R6/2), predominately fine grained, phenocrysts of pumice 30-35% qtz & sanidine 30%
							1X			
										pale red (10R6/2), predominately fine grained phenocrysts of qtz & sanidine, pumice 30-40% with large pumice 2 6cm-1 2cm at 42-44 ft
45		R9	CORE	50	N/R	0				no recovery, dropped core inner barrel in hole, boring terminated at 45 ft, driller accidentally dropped inner barrel, sample crushed
50										**Boring Terminated @ 49.5'**

LANL BORING LOG CMRR.GPJ NEWKALOG.GDT 3/11/04

KLEINFELDER BORING LOG

Boring # 2-G

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/26/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/26/2002		N/A	
Location: TA-55	Backfilled: 11/26/02	N/A		
Surface Elevation: 7277.6	Driller: Starnes/Groover		Logged by: Doug Young	
Drilling Method: CME 75				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R1	CS	9	34	34	1X	MOD	MOD S	Qbt4 (TUFF)-moderate yellowish brown, ashy matrix with 10% pumice to 1 cm, brown color. ratio 1:1, sanidine & quartz up to 2mm, trace organics with root structures, fine grained, moderate weathering, low-moderate strength
5		R2	CS	7	50	50		MOD	MOD S	moderate reddish orange, ashy matrix, color change at 7ft to greyish pink. 15% pumice between 1-2cm, 20% sanidine and quartz, root structures @ 2.5ft, up to 2mm thick, moderate weathering, moderate strength
										Qbt3 (TUFF) -grayish pink, 15% pumice
10		R3	CS	.6	100	100		H	MOD S	ashy matrix, 50% pumice to 3cm, devitrified, 25% sanidine & quartz to 2mm, ratio 1:1, fine grained, highly weathered moderate strength, root structures in fracture at 2 8 ft, trace mafic material to 1cm
15		R4	CS	.7	100	84		MOD	MOD S	moderate pink, increased in sanidine & quartz, 30%, fine grained
							1X			
20		R5	CS	7	100	100		MOD	MOD S	pale red, ashy matrix, fine grained, 35% pumice to 2cm, ratio 1:1 - 1:2, 30% sanidine and quartz to 2mm, trace mafics to 3mm, multi mechanical breaks
							1			
25							1			

Checked by: [signature] Date: 3/11/04

Reviewed by: [signature] Date: 3/11/04

SAMPLE TYPE LEGEND

A - Auger Cuttings
S - SPT 2" O.D. 1.38" I D tube sample
U - 3 " O.D. 2.42" I D. tube sample
ST - 3" O D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 2-G

Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/26/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/26/2002		N/A	
Location: TA-55	Backfilled: 11/26/02	N/A		
Surface Elevation: 7277.6	Driller: Starnes/Groover	Logged by: Doug Young		

Drilling Method: CME 75

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R6	CS	7	60	60		SL	MOD H	Qbt3 (TUFF3)pale red, slightly higher degree of welding,
30		R7	CS	1.2	100	100		SL	MOD H	pale yellowish brown, decrease in pumice to 30%, increase in sanidine and quartz size to 3mm, several mechanical breaks
							1X			
							1X			
							1X			
35		R8	CS	7	96	96		SL	MOD H	pumice to 3cm, increasing sanidine & quartz, size between 2-3mm, significant fractures throughout core, appears to be mechanical
							<10			
40		R9	CS	.8	N/R					pale yellowish brown in end of twisted core, Note: core lost, core barrel twisted in auger, 30% pumice to 2 0cm, 30% sanidine & quartz to 2mm
45		R10	CS	2.5	100	100	>10	SL	MOD H	pale red, ashy matrix, fine grained, 30% pumice to 2.5cm. 35% quartz & sanidine to 3 5mm, drilling refusal at total depth = 48 5 ft
50										Boring Terminated @ 48.5'

KLEINFELDER BORING LOG

Boring # 2-H

Sheet 1 of 2

		Groundwater encountered:		
Project Name: LANL CMRR	Started: 11/26/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/26/2002		N/A	
Location: TA-55	Backfilled: 11/26/02	N/A		
Surface Elevation: 7271.3	Driller: Starnes		Logged by: Doug Young	

Drilling Method: Continuous sampler

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R1	CS	93	50	30	>10X	MOD	S - MOD H	Qbt3 (TUFF) greyish orange pink, fine grained, ashy matrix 10% pumice to 1cm, ratio 1:1, 25% sanidine & quartz to 2mm, trace root structures
5		R2	CS	86	80	80		MOD	S - MOD H	
							1X			
							1X			reddish orange,
10		R3	CS	88	98	98	>10X	MOD - H	MOD S	greyish orange pink, fine grained, ashy matrix, 30% pumice to 3cm, 25% sanidine & quartz to 3mm
15		R4	CS	80	80	80	>10X	MOD	MOD S	moderate orange pink, fine grained, ashy matrix, 30% pumice to 4cm, ratio 1:1, 20% sanidine & quartz to 2mm
20		R5	CS	77	98	98	>10X	MOD	MOD S	greyish orange pink, fine grained, 30% pumice to 1cm, 35% sanidine & quartz to 5mm
25										

Checked by: Joseph P. Lomo Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D tube sample
U - 3" O.D. 2.42" I.D. tube sample
ST - 3" O.D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 2-H

Project Name: LANL CMRR	Started: 11/26/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/26/2002		N/A	
Location: TA-55	Backfilled: 11/26/02	N/A		
Surface Elevation: 7271.3	Driller: Starnes		Logged by: Doug Young	

Drilling Method: Continuous sampler

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R6	CS	88	86	86	>10X	SL	MOD S	Qbt3 (TUFF) decrease pumice to 20%, decrease sanidine & quartz to 25%
30		R7	CS	9	70	70	>10X	SL	MOD H	greyish orange pink, fine grained, 25% pumice to 1.5cm, 25% sanidine & quartz to 2mm, appears more welded
35		R8	CS	1.15	80	80	>10X	SL	MOD H - H	increase in pumice to 30%, size ratio of pumice 2:1, sanidine & quartz to 4mm
40		R9	CS	1 1	0	0				greyish orange pink, Note: Core lost, core barrel twisted in auger, sample in end of twisted sample core, Qbt3, fine grained, similar to sample at 30'
45		R10	SPT		100	0		SL	S	greyish orange pink, fine grained, 20% pumice, 25% sanidine & quartz to 2mm, most of core broken up. 50 blows / 4" No sample collected
50		R11	SPT		100	0				greyish orange pink, sample core broken up in sampler 50 blows / 6".
										Boring Terminated @ 51.0'

KLEINFELDER BORING LOG

Boring # 2-I
Sheet 1 of 2

Project Name: LANL CMRR	Started: 12/2/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/2/2002		N/A	
Location: TA-55	Backfilled: 12/2/02	N/A		
Surface Elevation: 7267.0	Driller: Starnes		Logged by: Doug Young/William P Murphy	

Drilling Method: Continuous sampler / HQ Wireline

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	% Recovery	RQD	Fractures/Foot	Weathering	Strength	Description
		R1	CS	1 3	50	50	1X	MOD - H	MOD	Qbt4 (TUFF)pale yellowish brown, ashy matrix, fine grained, 10% pumice to 3cm, 20% sanidine & quartz to 2mm
5		R2	CS	1 3	40	40	>10	MOD	MOD	Qbt3 (TUFF) increasing pumice to 15%, increasing quartz & sanidine to 25%, color change in cuttings @ 8 5 to pale red, driller noting harder drilling
10		R3	CS	1 3	50	50		MOD	MOD	grey yellow pink, fine grained, 30% pumice to 3cm, 25% sanidine & quartz to 3mm, pumice ratio 1:1
							1X			
							1X			
15		R4	CS	1 2	60	52		MOD	MOD	light brown, fine grained, 35% pumice to 4cm, 30% sanidine & quartz to 4mm, pumice aspect ratio 1:1
							1X			
		R5	CS	1.1	92	92	1 @ 70°,90°	MOD	MOD	pale red, fine grained, 30% pumice to 3cm, 30% sanidine & quartz to 2mm, pumice aspect ratio 1:1
20		R6	CS	1.2	44	44		MOD	MOD	greyish orange pink, fine grained, 30% pumice to 2 5cm, 30% sanidine & quartz to 3mm, pumice ratio of 1:1,
25										

Checked by: Joseph P Lovi Date: 3/1/04

Reviewed by: Alan Kulm Date: 3/11/04

SAMPLE TYPE LEGEND
A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D tube sample
U - 3 " O.D. 2.42" I.D tube sample
ST - 3" O.D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 2-I

Sheet 2 of 2

Project Name: LANL CMRR	Started: 12/2/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/2/2002		N/A	
Location: TA-55	Backfilled: 12/2/02	N/A		
Surface Elevation: 7267.0	Driller: Stames	Logged by: Doug Young/William P Murphy		

Drilling Method: Continuous sampler / HQ Wireline

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R7	CS	1 3						Qbt3 (TUFF) greyish orange pink, fine grained, 30% pumice to 2.5 cm, 1:1, 30% sanidine, quartz to 3mm
30		R8	CS	1.1						twisted barrel, no recovery, switch over to nx core, begin redrilling 12/02/02 3:48pm
35		R9	CORE	1 6	68	0	10X	SL	MOD	greyish orange pink, ashy matrix, fine grained, 35% pumice to 4cm, 30% quartz & sanidine, pumice ratio 1:1, highly fractured, <1" in length
		R10	CORE	1.1	20	20	12X	SL	MOD	greyish orange pink, fine grained, ashy matrix, 20-25% pumice to 5mm, 1:1 ratio, 30% sanidine & quartz phenocrysts, mechanical breaks, sample highly fractured (mechanical), <1" in length
40										
		R11	CORE	1 2	96	70		SL	MOD	pale red, fine grained, ashy matrix, 30% pumice to 2cm, 30% quartz & sanidine to 3mm. ratio 1:1, trace lithics, sample highly disturbed <2.5" pieces
							1@90°			vertical 90° edge of core to 4mm, clay infilling
45							1@70°			70°, sl clay residue & oxidation stains
		R12	CORE	1 2	79	79	25	SL	MOD	pale red, fine grained, ashy matrix. no single intact piece >2 inches. 30% pumice, to 2cm, 30% quartz & sanidine, ratio is 1:1. no sample preserved for testing
50										
										Boring Terminated @ 52.2'

KLEINFELDER BORING LOG

Boring # 3-F

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/20/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/20/2002		N/A	
Location: TA-55	Backfilled: 11/20/02	N/A		
Surface Elevation: 7288.7	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
			A							BASECOURSE augered, no sample
										Qbt 4 (TUFF)moderate orange pink, predominantly fine grained, ashy matrix with 5-7% pumice, brown to orange, 9mm-1cm with 1:1 ratios phenocrysts are predominantly sanidine & quartz, about 5% trace mafic phenocrysts have weathered out, no apparent lithics
		R1	CORE	1.07	67	0		MOD	MOD S	
5		R2	CORE	.85	100	64	2X	H	MOD S	predominantly fine grained with iron banding in matrix, possibly creating color changes, fracture @ 7 8-8.2 ft is 2mm wide, @ 8.8-10.8 ft is 2-4mm wide, @ 9 3 ft is 1cm wide, all fractures filled w/ clay silt, organic material
							1@70°			
							1@70°	H		moderate reddish-orange,
							1@80°	H		
							1@0°	H		
10										greyish-pink, lost air circulation from 10-15 ft
		R3	CORE	.36	100	100	1@90°	H	MOD S	vertical color banding in matrix, fracture @ 10.8 ft >1cm wide infilled with organics (root structures) silt & clay
		R4	CORE	3.1	14	0		H	S	very poor recovery, believe Qbt4 is from upper part of run, roots come up with core believed to be contact between Unit 4 & 3; core was moist
										Qbt 3 (TUFF)pale red, predominantly fine grained, ashy matrix with 30% pumice & 27% phenocrysts, pumice is light-medium gray, some infilled with sanidine & quartz, 5mm-7cm, ratios 1:1-2:1 showing slight welding, phenocrysts predominantly sanidine & quartz with trace mafic minerals weathered out, 1-2mm
15		R5	CORE	1.7	98	73		MOD	MOD S	
							1@20°	MOD		
							1@10°	MOD		
20							1@30°	MOD		
		R6	CORE	1.4	93	84	1@60-50°	MOD	S	pale red, predominantly fine grained, ashy matrix with 20-30% pumice, very light-moderate gray. infilled with sanidine & quartz, trace mafic minerals, 1mm-2mm, lots of iron staining, fracture @ 21 6 ft is 1-2cm, infilling with root structures & silt, clay, other fractures mechanical
							10X			
25										

Checked by: Joseph P Lovid Date: 3/11/04

Reviewed by: Allan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND

- A - Auger Cuttings
- S - SPT 2" O.D. 1.38" I.D tube sample
- U - 3 " O.D. 2.42" I D tube sample
- ST - 3" O D. thin-walled Shelby tube
- CORE - HQ Wireline Core
- NR - No Recovery

KLEINFELDER BORING LOG

Boring # 3-F

Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/20/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/20/2002		N/A	
Location: TA-55	Backfilled: 11/20/02	N/A		
Surface Elevation: 7288.7	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R7	CORE	1.8	100	87	1X 1@15° 1@10° 2X 1X	SL	MOD S - MOD H	Qbt 3 (TUFF) trace pumice ratio 3:1, indicating slightly higher degree of welding, fractures @ 26.8 ft 15° 4mm, @ 26.9 ft 10° 2mm wide, faint staining in fractures, all other fractures mechanical
30		R8	CORE	1.6	93	76	2X 1X 2X 1@30° 2X	SL	MOD H - MOD S	phenocrysts slight increase to 30%, fracture @ 33.2 ft 30° 3mm, no noticeable infilling, @ 34 2 ft fracture broke when moving sample, all other fractures mechanical
35		R9	CORE	1.6	100	52	3X 1@30° 1@55°	SL	MOD H - H	fracture zone from 36.2-37.7 ft, 2 main fractures, long fracture 70-90° length of zone, 4cm, @ 36.2 ft 3mm wide, @ 37.8 ft 1-3mm, @ 39.8-40.1 ft 1-3mm, less pumice @ 25%
40		R10	CORE	5 2	96		1@75° 1@35°	SL	S - MOD H	slight decrease in pumice to 25%, phenocrysts remain 30%. degree of welding slight to moderate, fracture @42.8 ft 2-3mm wide with secondary fracture
45		R11	CORE	1.1	100	100	1X			pale red, predominently fine grained, ashy matrix with 25% pumice, 2mm to 4-6cm, decreasing from 30-25% since 35ft, infilling of sanidine & quartz, some with slight green tint, trace mafic materials, slight-moderately welded, no visible fractures
50										
										Boring Terminated @ 50.8'

KLEINFELDER BORING LOG

Boring # 3-G
Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/22/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/22/2002		N/A	
Location: TA-55	Backfilled: 11/22/02	N/A		
Surface Elevation: 7290.8	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Doug Young	
Drilling Method: HQ Wireline Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										Qbt4 (TUFF) -grayish-orange, predominantly fine grained, ashy matrix with 5-7% pumice, 8-10% phenocrysts, pumice 2-5mm average, phenocrysts 1-2mm
		R1	CORE	1.3	13	0		MOD - H	MOD S	
5		R2	CORE	2.3	74	6	3X	SL - MOD	MOD H	greyish-orange pink, fine grained, ashy matrix, with 5% pumice & 15% phenocrysts, 2-4mm, orange brown, phenocrysts predominantly sanidine & quartz, matrix shows horizontal oxidation on banding, fractures @ 7.3-7 9 ft 2mm, @ 8 3-9 ft 1mm, infilling of organics, clay
							1			
							2X			
							1			
10							4X			
		R3	CORE	1 8	16	0	>7X	MOD	MOD S	greyish-orange pink, fine grained, ashy matrix with 5% pumice, 15% phenocrysts, pumice 2-4mm, orange brown, poor recovery, noticeable clay on some pieces, all breaks mechanical
15										
		R4	CORE	7	24	12	6X	MOD	MOD S	Qbt3 (TUFF) -pale red, poor recovery, predominantly fine grained, ashy matrix 30% pumice, 30% phenocrysts
20		R5	CORE	95	100	100	>3X	SL - MOD	MOD S	predominantly fine grained, ashy matrix with 30-35% pumice, 30% phenocrysts. pumice predominantly medium gray 2mm-3cm. ratio 1:1-2:1, infilled with sanidine & quartz, phenocrysts predominantly sanidine & quartz 1mm, no noticeable lithics, all fractures mechanical
							>3X			
							4X			
							4X			
25										

Checked by: Joseph P. Laird Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND

A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D tube sample
U - 3 " O.D. 2.42" I.D. tube sample
ST - 3" O D thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 3-G
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/22/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/22/2002		N/A	
Location: TA-55	Backfilled: 11/22/02	N/A		
Surface Elevation: 7290.8	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Doug Young	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
							1X			
		R6	CORE	.95	100	100	>10X	SL	S - MOD H	Qbt3 (TUFF) - slightly higher degree of welding, increase in lithics to 2-3% 2-5mm, oxidation band from 26 4-27 ft, all breaks mechanical
30		R7	CORE	1.2	34	34	>7X	SL - MOD	S - MOD H	lost circulation, poor recovery, though sample appears as above, all breaks mechanical
35		R8	CORE	1.9	100	100	7X	SL - MOD	MOD H	recovery returned, core is same as previous, slight decrease in pumice to 30%
							6X			
							5X			
							5X			
40							2X			
		R9	CORE	1.7	96	96	4X			large lithic - 3x10cm - at 42.2 ft, slight increase in degree of welding, pumice ratios 1:1-2:1, all fractures mechanical
							4X			
							3X			
							3X			
45							1X			
		R10	CORE	1.6	100	100	2X	SL	MOD H	predominantly fine grained, ashy matrix with 30% pumice & 30% phenocrysts, pumice light-medium gray, 2mm-2cm, ratios 1:1-2:1, phenocrysts predominantly sanidine & quartz, 1-2mm, 1% lithics, fracture @ 48.1 ft 3mm, soft, 40°, 1mm with stained infilling
							2X			
							1, 1X			
							1			
50							1,1X			
										Boring Terminated @ 50.9'

KLEINFELDER BORING LOG

Boring # 3-H

Sheet 1 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/19/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/19/2002		N/A	
Location: TA-55	Backfilled: 11/19/02	N/A		
Surface Elevation: 7287.8	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL
										Qbt4 (TUFF) -moderate orange pink, predominantly fine grained, ashy matrix with 5-7% pumice & 10% phenocrysts, pumice brown, 5-7mm, phenocrysts predominantly sanidine & quartz, some weathered out mafic minerals, no noticeable lithics, 2 fractures @ 5.2 ft 0° & 50° infilled with clay & organic material
		R1	CORE		84	30	3X	SL - MOD	MOD H	
5		R2	CORE	1 1	100	96	1X	MOD	MOD H	greyish-orange pink to light brown, iron staining on core, pumice sllightly increased to 5-10mm, slight-moderate welding, fracture @ 10 ft 2mm wide, slight infilling of organic material
							1X			
						2X	1@50°			
10		R3	CORE	2 2	60	0	1@20°	MOD	MOD S	fracture width 2-4mm, poor recovery
										Qbt3 (TUFF) -pale red, predominantly fine grained, ashy matrix with 25-30% pumice, 25% phenocrysts & 1-3% lithics, pumice predominantly light gray, some infilled with sanidine & quartz, 4-10mm, some slightly larger, phenocrysts predominantly sanidine & quartz with trace orthopyroxene weathered out, lithics dacitic
15		R4	CORE	76	68	20	>10X	MOD	MOD S	
20		R5	CORE	7	88	16	>10X	SL - MOD	MOD S	predominantly fine grained, ashy matrix with 25% pumice, 30% phenocrysts, pumice predominantly light gray, 5-20mm with trace larger, ratios 1:1-2:1, slight degree welding, phenocrysts predominantly sanidine & quartz, trace mafic minerals weathered out, no visible lithics, all fractures mechanical
		R6	CORE	4	63	52	1X			Auger reamed out, mechanical fractures
25							1X			

Checked by: Joseph P. Laird Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND

A - Auger Cuttings
S - SPT 2" O.D. 1 38" I.D tube sample
U - 3 " O.D. 2.42" I.D. tube sample
ST - 3" O.D thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 3-H
Sheet 2 of 2

Project Name: LANL CMRR	Started: 11/19/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/19/2002		N/A	
Location: TA-55	Backfilled: 11/19/02	N/A		
Surface Elevation: 7287.8	Driller: Szpunar/Stames	Logged by: Ryan Merkley		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R7	CORE	1	100	68	1@70°			Qbt3 (TUFF) -pale red, pumice becoming larger, up to 7 cm, some ratios up to 3:1, degree of welding increasing slightly, frac @ 26 ft 3mm, 2nd 3mm width
							1@50°			
							2X			
							1X			
30		R8	CORE	1.2	100	76		SL - MOD	MOD S	increase in lithics to 2-4%, pumice up to 10cm, all fractures mechanical, no visible alteration on run
							4X			
							1X			
							2X			
35		R9	CORE	1.1	94	52	3X	SL - MOD	MOD H	moderate red, large pumice disappeared, degree of welding slightly less, phenocrysts slightly increased to 30-33%, fractures mechanical
							0X			
							2X			
							3X			pale red,
							4X			
40		R10	CORE	1.1	100	88	2X	SL	MOD H	phenocrysts 30%, large pumice reappear but not as abundant, lens of 100% phenocrysts @ 43.4 ft, fracture 10° >3cm, no secondary coloration, lithics 2%
							2X			
							1 1X			
45		R11	CORE	1.4	100	94	1X	SL	MOD	fine grained, ashy matrix with 27-30% pumice, 25% phenocrysts, pumice 5mm-8cm, infilled with sanidine & quartz in larger pumice, ratios 1:1-2:1 with trace 3:1 slight-moderate degree welding, phenocrysts predominantly sanidine & quartz with trace mafic minerals. all fractures mechanical
							2X			
							1X			
							2X			
							1X			
50										**Boring Terminated @ 50.4'**

KLEINFELDER BORING LOG

Boring # 3-I
Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/18/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/25/2002		N/A	
Location: TA-55	Backfilled: 11/25/02	N/A		
Surface Elevation: 7285.6	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Doug Young	
Drilling Method: HQ Wireline Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL: SILTY SAND - no sample
5		R1	CORE		73	0	>5X	MOD - H	S - MOD H	Qbt4 (TUFF) -greyish orange pink, fine grained, ashy matrix with pumice at around 5-7%, light gray, phenocrysts at approx 10%, quartz and sanidine, Note: color change at end of run to moderate red, fractures are mechanical
		R2	CORE	1 0	72	24	>10X	MOD - H	MOD S	moderate orange pink, increase in phenocrysts to 15-20%, end of run is weathered, run is soft with lots of mechanical fractures
10		R3	CORE	1 0	10	0		MOD - H	MOD S	moderate brown, amphibole inside pumice , cannot tell fractures because of poor recovery but there is clay infilling. Note: one core piece is very high in phenocrysts (90%), surge zone? Note: drillers losing air circulation
15		R4	CORE	1 0	62	15	>15X	MOD - H	MOD S	Qbt3 (TUFF) -pale red, fine grained, ashy matrix is made of 30% pumice and 25% phenocrysts, pumice is light gray-moderate gray, containing sanidine & quartz, is 2mm - 4cm with ratio 1:1 - 2:1, phenocrysts are predominantly sanidine & quartz, trace mafic minerals
20		R5	CORE	0 7	100	70	1X	SL - MOD	MOD S	pale red, Note: still no circulation, hole beginning to collapse around rod fine grained, ashy matrix with 30% pumice & 27% phenocrysts, contains sanidine & quartz, 2mm-1cm. phenocrysts predominantly sanidine & quartz, 1mm-2mm, trace mafic minerals
							1X			
		R6	CORE	2 4						Note: still very hard to get air circulation, drillers constantly fighting to keep hole open, no recovery, hole keeps collapsing. 11/25 - move over hole with CME75, auger to 25'. continuous core to TD.
25										

Checked by: Joseph F Lair Date: 3/4/04

Reviewed by: Alan Kuhn Date: 3/4/04

SAMPLE TYPE LEGEND
- A - Auger Cuttings
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3 " O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- CORE - HQ Wireline Core
- NR - No Recovery

KLEINFELDER BORING LOG

Boring # 3-I

Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/18/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/25/2002		N/A	
Location: TA-55	Backfilled: 11/25/02	N/A		
Surface Elevation: 7285.6	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Doug Young	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R7	CS	1.4	46%	46%	1X	MOD	S	Qbt3 (TUFF) -moderate reddish brown, 25% pumice, 15% phenocrysts, grading to pale yellow-brown @ 26 2', quartz to 2mm, pumice to 2.5 cm, trace mafic minerals,
							1X			
30		R8	CS	1 1	96	96	1X	SL - MOD	MOD S	greyish orange pink, ashy matrix with 30% pumice up to 2cm, 15% phenocrysts, quartz & sanidine between 1-2mm
							1X			
							1X			
35							1X			
		R9	CS	1.2	100	100	1X	MOD	MOD S	pale yellowish brown, 35% pumice to 1 5 cm, sanidine & quartz to 1mm
							1X			
							1X			
							1X			
40							1X			
		R10	CS	0.9	96	96	1X	MOD	MOD	greyish orange pink, ashy matrix, 30% pumice to 2.0cm, 25%, sanidine & quartz up to 2mm
							1X			
							1X			
							1X			
45							1X			
		R11	CS	1 0	94	94	1X	MOD	MOD	greyish orange pink, ashy matrix, 20% pumice to 1 5cm, fine grained matrix. 30% sanidine & quartz up to 2mm, pumice ratio 1:2
50										
										Boring Terminated @ 50.9'

KLEINFELDER BORING LOG

Boring # 4-F

Sheet 1 of 2

Project Name: LANL CMRR	Started: 12/6/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/6/2002		N/A	
Location: TA-55	Backfilled: 12/06/02	N/A		
Surface Elevation: 7291 8	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										ASPHALT
										FILL brown, silty sand, some clay & gravel
		R1	CORE	83	N/R					Qbt4 (TUFF4) - no recovery 3 2-5 9 ft
5		R2	CORE	1 1	100	56	>30	MOD - H	MOD S	greyish-orange pink, predominantly fine grained, ashy matrix with 5-7% pumice & 8% phenocrysts, pumice brown, 2-3mm, ratios 1:1, phenocrysts predominantly sanidine & quartz with trace pyroxene, 1% lithics, highly to moderately weathered, 5 9-7.4 ft highly oxidized & fractured
							3X			
							1			
							1@10"			
10							2X			
		R3	CORE	70	88	88	1X	MOD	MOD S	greyish-orange-pink, predominantly fine grained, noticeable oxidation banding in matrix, phenocrysts increased to 12%
							2X			
							1X			
							1X			
15							1X			Qbt3 (TUFF) - pale red, predominantly fine grained, ashy matrix, 25% pumice, 30% phenocrysts
		R4	CORE	60	20	20	5X	MOD	S - MOD H	
										highly oxidized, only 1 ft of recovery, moderately hard at end of run
20		R5	CORE	71	100	100	2X	MOD	MOD S	pale red, predominantly fine grained, ashy matrix with 25% pumice & 30% phenocrysts, pumice light gray, infilled with sanidine & quartz, 2mm-2cm, ratios 1:1-3:1, slight degree of welding, phenocrysts predominantly sanidine & quartz, trace pyroxene, 1-2mm. fracture @ end of run 50°
							3X			
							1X			
							3X			
25										

Checked by: Joseph P. Laird Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND

A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D tube sample
U - 3 " O.D. 2.42" I.D tube sample
ST - 3" O D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 4-F
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 12/6/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/6/2002		N/A	
Location: TA-55	Backfilled: 12/06/02	N/A		
Surface Elevation: 7291.8	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
							1X			
		R6	CORE	65	88	50	2X	MOD - H	MOD S	Qbt3 (TUFF3) - slight increase in pumice size overall, fracture @ 28 1 - 29 9 ft 80°, 1-3mm wide with trace of clay infilling & highly oxidized, run highly weathered around the fracture
							4X			
							1			
30										
		R7	CORE	70	72	16	1	H	MOD S	oxidation banding throughout core run, fracture @ 31 4-32 2 ft 80° 5mm wide with clay infilling, @ 34.6 ft pumice increases to 30% ratios 1:1-3:1, slightly higher degree of welding at end of run; lost air circulation
							>6X			
							4X			
							1X			
35										
		R8	CORE	.62	100	54	2X	MOD	MOD H	increase in lithics to 3-5% occasional large pumice, fractures @ 38.6-40.9 ft 85° 5mm wide, infilled with clay @ 39 9-40.9 ft, @38 6-39.9 ft part of fractures missing, end of run includes numerous secondary fractures
							1X			
							1			
40										
		R9	CORE	.83	100	92	3X	MOD	MOD H	slight decrease in pumice to 27%, ratios increased to 2:1-4:1. slight increase in welding. oxidation bands gone, fracture @ 42 9 ft 45° 2mm wide, large pumice @ 45.7 ft (8 5x4.5cm)
							1			
							3X			
45										
		R10	CORE	.8	50	42	4X	MOD	MOD H	predominantly fine grained, ashy matrix with 28% pumice & 30% phenocrysts, pumice light gray, 2mm-2cm, ratios 1:1-5:1, sl-mod welding, phenocrysts predominantly sanidine & quartz with trace pyroxene. 1-2mm. fracture @ 49 ft 0°, 3-5mm, @ 49 2 ft 20° 2mm wide
50										
										Boring Terminated @ 50.9'

KLEINFELDER BORING LOG

Boring # 4-G
Sheet 1 of 2

Project Name: LANL CMRR	Started: 12/6/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/7/2002		N/A	
Location: TA-55	Backfilled: 12/07/02	N/A		
Surface Elevation: 7289.5	Driller: Starnes/Groover	Logged by: Doug Young/William P Murphy		
Drilling Method: Air HQ Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										ASPHALT
										FILL moderate brown, silty sandy clay, 15% silt, 30% fine to very fine sand, 55% clay, trace gravels <5% subrounded to angular
		R1	CORE	2:5	75					Qbt4 (TUFF) - moderate brown, highly weathered tuff consisting of increasing gravel content to 15%, gravels subrounded to rounded to 1cm, 30% silt, 55% very fine to fine grained sand
5		R2	CORE		54	28	3X	H - DEC	MOD S	pale yellowish-brown, predominantly fine grained, ashy matrix with 3-5% pumice & 8-10% phenocrysts, pumice brown devitrified 2mm, phenocrysts predominantly sanidine & quartz, bottom of run highly fractured with clay infilling
10		R3	CORE		43	0	1X 2X 2X			light grey, fine grained, ashy matrix with 3-5% pumice, 5% phenocrysts, pumice brown 2mm, phenocrysts predominantly sanidine & quartz, entire run moderate fractures with clay infilling in fracture @ 10.4 ft
		R4	CORE	2:30	85		7X			pale red, fine grained, ashy matrix with 3-5% pumice, <5% phenocrysts, pumice brown, 2mm, phenocrysts predominantly quartz & sanidine
15		R5	CORE	4:50	80	62	1@60°			fine grained, ashy matrix with 5-8% pumice, 10-15% phenocrysts, predominantly quartz & sanidine, pumice brown
										Qbt3 (TUFF) - pale greyish-yellow, fine grained, 30% phenocrysts
20		R6	CORE		96	0	3X	MOD		pale grey yellowish-brown (10YR6/2), fine grained with 15% brown pumice, phenocrysts are10-15% quartz & sanidine
							1@60°			
							1@60°			
25										

Checked by: [signature] Date: 3/11/04

Reviewed by: [signature] Date: 3/11/04

SAMPLE TYPE LEGEND
A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D. tube sample
U - 3 " O.D. 2.42" I.D. tube sample
ST - 3" O.D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 4-G
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 12/6/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/7/2002		N/A	
Location: TA-55	Backfilled: 12/07/02	N/A		
Surface Elevation: 7289.5	Driller: Starnes/Groover	Logged by: Doug Young/William P Murphy		
Drilling Method: Air HQ Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R7	CORE	2:30	82		2X			
							1@70°			
30		R8	CORE	2:30	98	84	3X	SL	MOD H	Qbt3 (TUFF) -pale red 10R6/2, predominantly fine grained, phenocrysts 30% quartz & sanidine, with 20% pumice, brown, to 1mm, 1:1, widely fractured
							1X			
							1@50°			occasional pumice 3-5mm
35		R9	CORE	2:30	94	51		MOD	MOD	35 3 ft dacite xenolith , 35 5 ft dark gray lens
40		R10	CORE	2:45	92	74	1@40°	MOD - SL	MOD H	light gray-pale blue, fine grained, ashy matrix, 25% pumice, 30% quartz & sanidine, pumice devitrified, fracture clay filled, extends 40.2-41.0 ft, clay red brown, highly plastic
45		R11	CORE	2:40	96	68	3X	SL - MOD	MOD	very light gray, predominantly fine grained ashy matrix, 30% quartz & sanidine phenocrysts, pumice 30% light-medium brown, 0.3mm, 1:1, fracture filled with red brown clay, highly plastic 49.5-49.65 ft
							2X			
							0			
							4X			
							2@50°			
50										Boring Terminated @ 50.0'

KLEINFELDER BORING LOG

Boring # 4-H

Sheet 1 of 2

		Groundwater encountered:		
Project Name: LANL CMRR	Started: 12/6/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/6/2002		N/A	
Location: TA-55	Backfilled: 12/06/02	N/A		
Surface Elevation: 7286.5	Driller: Szpunar/Groover	Logged by: Ryan Merkley/Matt Rarity		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										ASPHALT
										brown,
										Qbt4 (TUFF) - greyish-orange pink, predominantly fine grained, ashy matrix with 3-4% pumice & 15% phenocrysts. pumice brown, 2mm-1cm, ratio 1:1, phenocrysts predominantly sanidine & quartz 1mm, no visible lithics, fracture @ 7.4-8.1 ft near vertical, 4cm wide, infilled with clay
5		R1	CORE	25	2					
		R2	CORE	96	100	50	2X	MOD - H	MOD S	
							2X			
							1X			
							1X			
10							2			
		R3	CORE	1.5	61	0		H	MOD S	highly fractured, driller having trouble with air circulation, rod locking up - fracture @ 10 ft 30°, 3-5mm wide, oxidized; fracture @ 10.6-10.9 ft 70°, 3mm wide, oxidized
										Qbt3 (TUFF) - pale red, predominantly fine grained, ashy matrix with 30% pumice & 25% phenocrysts, pumice infilled with sanidine & quartz, 2mm-1cm, ratio 1:1, phenocrysts predominantly sanidine & quartz, 1-2mm, no visible lithics, all fractures appear to be mechanical
		R4	CORE	60%	85	0	>10X	MOD - H	S - MOD H	
15		R5	CORE	1.7	68	56	1X	H	S - MOD H	pumice becoming much larger, average 8mm-1cm, pumice as high as 35%, fracture @ 17 ft 3°, 4mm wide
							2			
							2X			
20										
		R6	CORE	1.45	100	100	>10	MOD	MOD S	predominantly fine grained, ashy matrix with 25-27% pumice. 3m-2cm, ratio 1:1-1:3, 25% phenocrysts. 1-2mm, predominantly quartz & sanidine, 3% visible lithics, all fractures appear to be mechanical
							1X			
							1X			
							5X			
25										

Checked by: Joseph P. Lewis Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND

A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
ST - 3" O.D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 4-H

		Groundwater encountered:		
Project Name: LANL CMRR	Started: 12/6/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/6/2002		N/A	
Location: TA-55	Backfilled: 12/06/02	N/A		
Surface Elevation: 7286.5	Driller: Szpunar/Groover	Logged by: Ryan Merkley/Matt Rarity		

Drilling Method: HQ Wirellne Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
							4X			
		R7	CORE	1 4	98	98	3X	SL - MOD	S - MOD H	Qbt3 (TUFF) - slightly higher degree of welding, occasional pumice ratio 1:1, avg ratio 2:1, occasional oxidation banding in matrix
							3X			
							3X			
							3X			
30							1X			
		R8	CORE	95	100	100	3X	SL - MOD	S - MOD H	slight increase in lithics to 4%, mod degree of welding, pumice @32 9 ft is 20:1, all fractures mechanical
							1X			
							1X			
							0			
35							3X			
		R9	CORE	1 1	84	84	2X	SL	S - MOD H	very light gray, degree of welding slightly less, flatter pumice have disappeared, 3cm lithic at 38.5 ft, all fractures mechanical
							1X			
							3X			
							0			
40							1X			
		R10	CORE	83	100	96	2X			pumice decreased to 18%, phenocrysts avg slightly larger, flatter pumice reappears at end of run, ratio up to 4:1, fracture @ 44.7 ft. 25 °, 2.5 cm wide, aperture of fracture highly oxidized, oxidation band @ 43 9-44.2 ft
							0			
							0			
							1			
45							1X			
		R11	CORE	1	100	100	2X	SL - MOD	MOD H	light grey, predominantly fine grained, ashy matrix with 20% pumice to 6 cm, 30% quartz & sanidine, phenocrysts to 2mm, 5% pyroxene, and 5% lithics to 2cm pumice exhibits 1:1-4:1 ratio, infilled with quartz & sanidine phenocrysts, moderate welding, all fractures mechanical
							1X			
							3X			
50										
										Boring Terminated @ 50.9'

KLEINFELDER BORING LOG

Boring # 5-F

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/22/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/22/2002		N/A	
Location: TA-55	Backfilled: 11/22/02	N/A		
Surface Elevation: 7288.7	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Doug Young	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										ASPHALT
										FILL brown, clayey silt, trace rounded gravel
		R1	CORE	91	N/R					drillers losing circulation of air
5		R2	CORE	2.5	0					still having trouble with circulation, no recovery, possibly still in fill or rough part of Qbt4 - fire line and hydrant 10 ft from hole possible cause of extra fill
		R3	CORE	.96	0					
10		R4	CORE	2.45	4	0		MOD	MOD S	
										Qbt4 (TUFF) - moderate orange pink, fine grained, ashy matrix with 5-6% pumice, 3% phenocrysts, pumice brown, phenocrysts quartz & sanidine, amphibole, very poor recovery, piece of plywood found in core that may have been impeding recovery, cannot tell fractures
15		R5	CORE	1.1	71	0	4X	MOD - H	MOD S	Qbt3 (TUFF) - pale yellowish-brown to pale red at bottom of run, predominantly fine grained, ashy matrix with 30% pumice, 30% phenocrysts, pumice infilled with sanidine & quartz, 2mm-3cm, 1:1-2:1 ratio, slight degree welding, phenocrysts predominantly sanidine & quartz, 1-2mm, fracture @ 19.4-19.7 ft 10°, 1-2mm
		R6	CORE	63	100	68	1			pale yellowish-brown, predominantly fine grained, ashy matrix with 25% pumice, 25% phenocrysts, very weathered, includes surge bed, clay invades core.
							1			
							2			
20		R7	CORE	2.5	58	52	1X	MOD	MOD S	pale red, predominantly fine grained, ashy matrix with 30% pumice, 33% phenocrysts, pumice light gray, 2mm-6cm, predominantly 1:1-2:1 ratio, showing slight welding, phenocrysts predominantly sanidine & quartz, trace mafic minerals, 1-2mm. fracture @ 21.6 ft 20° 2mm, @ 21.7 ft, 3mm wide
							2			
							2			
							1			
25										

Checked by: Joseph P Lovid Date: 3/1/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND

A - Auger Cuttings
S - SPT 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
ST - 3" O.D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 5-F
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/22/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/22/2002		N/A	
Location: TA-55	Backfilled: 11/22/02	N/A		
Surface Elevation: 7288.7	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Doug Young	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R8	CORE	1	56	56	5X	MOD	MOD S	Qbt3 (TUFF) weathering bands - oxidation - on core, all fractures mechanical, lithics at 1%, avg pumice size increasing to about 5mm
30		R9	CORE	.83	100	96	1X	MOD	MOD S	slight increase in pumice to 30-32%, 2cm, oxidation throughout core, highly fractured at end of run
							2X			
							3X	H		
							>4X			
35		R10	CORE	9	100	100	1X	MOD	MOD S - S	core becoming more brittle with depth
							3X			
							4X			
							2X			
40							>4X			
		R11	CORE	.9	100	100	4X	SL - MOD	MOD S	large pumice have disappeared, amphibole rich pumice @ 42 7 ft, 5 cm, decrease in pumice to 28-30%
							4X			
							6X			
							3X			
45							3X			
		R12	CORE	9	85	85	5X	MOD	MOD S	predominantly fine grained, ashy matrix with 28% pumice, 28-30% phenocrysts, no visible lithics, pumice light grey, 2mm-2cm, infilled with sanidine & quartz, some weathered out, phenocrysts predominantly sanidine & quartz, 1-2mm
							5X			
							4X			
							7X			
50										
										Boring Terminated @ 51.0'

KLEINFELDER BORING LOG

Boring # 5-G
Sheet 1 of 2

		Groundwater encountered:		
Project Name: LANL CMRR	Started: 12/6/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/6/2002		N/A	
Location: TA-55	Backfilled: 12/6/02	N/A		
Surface Elevation: 7287.3	Driller: Starnes/Grover		Logged by: Doug Young	
Drilling Method: CME 75				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										ASPHALT
										FILL dark yellowish-brown,moist gravelly silty sand, 10% gravels to 2cm, 30% silt, 60% fine to very fine sand
		R1	CORE							no recovery, free water in hole appears to be related to fire hydrant system either from pipes or storm water in backfill, no circulation, fill clogging up flow
5		R2	CORE				•			no recovery, silty sand clogging in bit and cutting off circulation, pulled out set conductor casing, no sample in barrel
10		R3	CORE	1.4	22	22		SL - MOD	MOD H	Qbt4 (TUFF) - pale yellowish-brown, fine grained, ashy matrix with 10% pumice, 1mm-2cm,
15		R4	CORE	1.3	50	46	3X	MOD	MOD H	Qbt3 (TUFF) - pale red, fine grained, ashy matrix with 30% pumice at 2cm, with ratio 1:1-1:2, 30-35% quartz & sanidine to 3mm, trace lithics, fracture @ 16.8 ft 55° 2mm, high oxidation & weathering, @ 17.3 ft 20° 2mm, high oxidation & weathering, oxidation banding 15° 15.3-16.8 ft
							1X			
							1@55°			
							1@20°			
							1X			
20		R5	CORE	0.5	100	100	2X	MOD	MOD H	pale red, fine grained, ashy matrix with 30% pumice to 6cm, 1:1-3:1 ratio, 35% quartz & sanidine to 3mm, trace lithics
							3X			
							3X			
							3X			
25							1X			

Checked by: Joseph P Lovin Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND

- A - Auger Cuttings
- S - SPT 2" O.D. 1.38" I.D tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- CORE - HQ Wireline Core
- NR - No Recovery

KLEINFELDER BORING LOG

Boring # 5-G

Sheet 2 of 2

Project Name: LANL CMRR	Started: 12/6/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/6/2002		N/A	
Location: TA-55	Backfilled: 12/6/02	N/A		
Surface Elevation: 7287.3	Driller: Starnes/Grover		Logged by: Doug Young	
Drilling Method: CME 75				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R6	CORE	0.3	100		1@60	SL - MOD	MOD H	Qbt3 (TUFF) - pale red, fine grained, ashy matrix with 30% pumice to 6cm, 1:1-3:1 ratio, 35% qtz & sanidine to 3mm, fracture @ 27.5 ft 60° 3mm, high oxidation in fracture
30		R7	CORE	0.4	96	96	2X	SL - MOD	MOD H	pale red, fine grained, ashy matrix with 30% pumice to 4cm, ratio 1:1-2:1, 30% quartz & sanidine to 2mm, trace lithics
							1X			
							1X			
35		R8	CORE	0.5	100	100	1X	SL	MOD H	pale red, fine grained, ashy matrix with 30% pumice to 5cm, ratio 1:1-2:1, 35% qtz & sanidine to 3mm, trace lithics
							1X			
							1X			
40		R9	CORE	0.5	100	100	1X	SL	MOD H	pale red, fine grained, ashy matrix with 30% pumice to 7cm, ratio 1:1-3:1, 35% quartz & sanidine to 2mm, trace lithics
							1X			
							1X			
							1X			
45		R10	CORE	0.5	96	96	1X	SL	MOD	pale red, fine grained, ashy matrix with 25% pumice to 3cm, ratio 1:1-2:1, 30% quartz & sanidine to 2mm
							4X			
							3X			
							1X			
50							1X			
										Boring Terminated @ 50.3'

KLEINFELDER BORING LOG

Boring # 5-H

Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/13/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/13/2002		N/A	
Location: TA-55	Backfilled: 11/13/02	N/A		
Surface Elevation: 7286.0	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Jeremy Hoover	

Drilling Method: Continuous sampler

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										ASPHALT
		R1	CS		97					Qbt4 (TUFF) - greyish orange-pink, fine grained, ashy matrix with sparse (<5%) pumice, phenocrysts at 5%, mostly sanidine, some altered pyroxene, non-welded, no noticable fractures, alterations minimal
5		R2	CS		70					same as above
10		R3	CS		94			MOD	MOD S - MOD H	increase in phenocrysts to 7%
										bed with noticable banding
										Qbt3 (TUFF) - greyish pink, fine grained, ashy matrix with 20% pumice, whitish, phenocrysts are predominantly sanidine & quartz 20-25%, no noticable fractures
15		R4	CS		96			SL	MOD S	
20		R5	CS		100			SL	MOD S	greyish pink, fine grained, ashy matrix w/ 30% pumice very light gray-light gray, can contain phenocrysts, pumice size 0.5cm-2cm, ratios 1:1, phenocrysts predominantly sanidine & quartz at 30%, 1mm-2mm
25										

Checked by: Joseph P. Lourd Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
A - Auger Cuttings
S - SPT 2" O.D. 1 38" I D tube sample
U - 3 " O D. 2.42" I.D. tube sample
ST - 3" O.D. thin-walled Shelby tube
CORE - HQ Wireline Core
NR - No Recovery

KLEINFELDER BORING LOG

Boring # 5-H
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/13/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/13/2002		N/A	
Location: TA-55	Backfilled: 11/13/02	N/A		
Surface Elevation: 7286.0	Driller: Szpunar/Starnes		Logged by: Ryan Merkley/Jeremy Hoover	

Drilling Method: Continuous sampler

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R6	CS		62			SL - MOD		Qbt3 (TUFF) - lithic appeared at bottom of run, bands of clay appearing more frequently - driller noted that rock was becoming harder
30		R7	CS		96			SL	MOD S - MOD H	pumice up to 4 cm
35		R8	CS		96			SL		pumice color is predominantly medium gray, frequently with phenocrysts
40		R9	CS		34					fracture at bottom of run was about 0 8 ft long at 60°, roughness not noticeable, fracture open very wide, clay infilling - significant portion of sample was lost because tubes melted
45			CS		70			SL - MOD	MOD S - MOD H	fine grained, ashy matrix, 30% pumice, medium gray with phenocrysts of quartz & sanidine, 30% phenocrysts of sanidine & quartz in matrix with minor weathered out orthopyroxene 1mm-2mm, pumice 2mm-7cm, fracture @ 48 ft through bottom of run, 90° with 2.5-3cm, clay filled bed with noticable banding
50										**Boring Terminated @ 50.0'**

KLEINFELDER BORING LOG

Boring # 6-F

Sheet 1 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/15/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/15/2002		N/A	
Location: TA-55	Backfilled: 11/15/02	N/A		
Surface Elevation: 7287.6	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL - clay sand with silt, tuff began to show about 3.5 ft
5		R1	CORE	1 4	92	6	5X+	MOD	MOD H - MOD S	Qbt4 (TUFF) - greyish orange-pink, fine grained, ashy matrix with 7% pumice, 2mm-5mm, 1:1 ratio, 10% phenocrysts predominantly sanidine & quartz, trace pyroxene, predominantly 1mm, all breaks mechanical
		R2	CORE	8	95	74		MOD	MOD H - MOD S	slight increase in phenocrysts to 10%, some very weathered out, fracture @ 6.2 ft is 0° 2mm wide, @ 8.7 ft is 50° 3mm wide, 9 ft is 0° 5 mm wide, 10.2 ft is 30° 2 mm wide, fractures have iron staining
							0 @ 0°			
							1			
							0 @ 50°			
10							1 @ 30°			
		R3	CORE	2 4						drillers had problems with getting blocked off, no recovery - measured depth after this run may have been off
15		R4	CORE	87	100	70	3X	MOD	MOD S	Qbt3 (TUFF) - pale red, fine grained, ashy matrix with 35% pumice, pumice is 1cm-7cm, pred 1:1 ratio, some pumice contain sanidine & quartz, 25% phenocrysts predominantly quartz & sanidine trace pyroxene that weathers out, 1-2% lithics, matrix slightly welded, all breaks mechanical
							>5X			
							0			
							2X			
							1X			
20		R5	CORE	1 5	60	30	9X	MOD	MOD S	pale red, fine grained (driller having trouble getting plugged off) ashy matrix with 35% pumice, pumice is light gray-medium gray, devitrified 1cm-4cm, some contain phenocrysts of sanidine & qtz, 25% phenocrysts 1mm-2mm predominantly sanidine & quartz, lithics disappeared, all breaks mechanical
25		R6	CORE	.85	66	46	>6X	MOD - SL	MOD S	pale red, pumice becoming slightly flatter (1:1-2:1), degree of

Checked by: Joseph P Lavin Date: 3/11/04

Reviewed by: Alan Kubin Date: 3/11/04

SAMPLE TYPE LEGEND
- **A** - Auger Cuttings
- **S** - SPT 2" O.D. 1.38" I.D. tube sample
- **U** - 3" O.D. 2.42" I.D. tube sample
- **ST** - 3" O.D. thin-walled Shelby tube
- **CORE** - HQ Wireline Core
- **NR** - No Recovery

KLEINFELDER BORING LOG

Boring # 6-F

Sheet 2 of 2

Project Name: LANL CMRR	Started: 11/15/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/15/2002		N/A	
Location: TA-55	Backfilled: 11/15/02	N/A		
Surface Elevation: 7287.6	Driller: Szpunar/Starnes		Logged by: Ryan Merkley	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										welding slightly increasing, lithics reappear at 2% pred 5mmx5mm, all breaks mechanical except last 20° 4mm-1cm
										drillers still having problems with blocking off, losing air into formation
30		R7	CORE	93	80	46	11X	MOD - SL	MOD S	Qbt3 (TUFF) - pale red, slight decrease in pumice to about 30%, breaks appear mechanical
35		R8	CORE	92	100	90	1X@10°	MOD - SL	MOD S - MOD H	pale red, fine grain, ashy matrix, formation uniform, 1st fracture @ 34.8 ft is 15° >1cmm wide, fracture @ 35.8 ft is 10° >1cmm wide, some iron staining no infilling
40		R9	CORE	90	60	54	6X	SL	MOD S	formation becoming mod soft, not as welded, all breaks mechanical
45		R10	CORE	99	100	90	2X	SL	MOD S - MOD H	pale red. fine grained, ashy matrix with 27-30% pumice, ratios 1:1-3:1, showing slight degree of welding, devitrified w/ trace sanidine & qtz, 25% phenocrysts predominantly sanidine & qtz, all fractures mechanical, lithics is about 5%, usually 5mm-1.5cm
							2X			
							3X			
							2X			
							1X			
50										Boring Terminated @ 49.0'

KLEINFELDER BORING LOG

Boring # 6-H
Sheet 1 of 2

Project Name: LANL CMRR	Started: 11/25/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/25/2002		N/A	
Location: TA-55	Backfilled: 11/25/02	N/A		
Surface Elevation: 7282.6	Driller: Szpunar/Starnes	Logged by: Ryan Merkley/Doug Young		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										ASPHALT
										Qbt4 (TUFF) - greyish orange-pink, predominantly fine grained, ashy matrix with 7-10% pumice, 10% phenocrysts, pumice is devitrified, brown, 2mm-4mm in size, phencrysts are quartz, sanidine, no visible lithics,
		R1	CORE	.73	0					no recovery. Believed to still be Qbt4.
5		R2	CORE	2	55	42	6X	SL - MOD	MOD S	
							(1@70°)			fracture at about 9 ft @ 70°, 2mm wide, stained infilling
10		R3	CORE	1.2	62	62	13X	SL - MOD	MOD S	
										Qbt3 (TUFF) - pale red, predominantly fine grained, ashy matrix with 33% pumice & 30% phenocrysts, pumice is 2mm-2 cm, ratios 1:1-2:1, sl welded, light grey, phenocrysts predominantly sanidine & quartz trace <3% mafic weathered out minerals, no visible lithics, all fractures mechanical
15		R4	CORE	1.1	100	100	3X	SL	MOD H	sl increase in size & amount of pumice (33-35%), sl increase in degree of welding (some 3:1) from 15-19 ft, then core becomes soft again, staining oxidation band from 18.2-18.8 ft
							2X			
							3X			
							3X		S	
							>10X			
20		R5	CORE	1.1	96	96	2X	SL	MOD H - MOD S	ashy matrix with 28-30% pumice, 30% phenocrysts, pumice is light to medium gray, 2mm-3cm, with ratios of 1:1-2:1 trace 3:1, sl to mod welded, phenocrysts predominantly sanidine & qtz, 1mm-2mm, trace lithics, all fractures mechanical
							2X			
							3X			
							2X			
							4X			
25										

Checked by: Joseph P. Zavid Date: 3/11/04

Reviewed by: Allan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
- **A** - Auger Cuttings
- **S** - SPT 2" O.D. 1.38" I.D. tube sample
- **U** - 3" O.D. 2.42" I.D. tube sample
- **ST** - 3" O.D. thin-walled Shelby tube
- **CORE** - HQ Wireline Core
- **NR** - No Recovery

KLEINFELDER BORING LOG

Boring # 6-H
Sheet 2 of 2

Groundwater encountered:

Project Name: LANL CMRR	Started: 11/25/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 11/25/2002		N/A	
Location: TA-55	Backfilled: 11/25/02	N/A		
Surface Elevation: 7282.6	Driller: Szpunar/Starnes	Logged by: Ryan Merkley/Doug Young		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R6	CORE	1	100	100	4X	SL	MOD H	Qbt3 (TUFF) - pumice at 27.8 ft shows 6:1 ratio pumice increases to 30%, lithics up to 3%, all fractures mechanical
							3X			
							5X			
							2X			
							1X			
30		R7	CORE	1.3	84	84	3X	SL	MOD H	pumice ratios of 3:1 in places, degree of welding is mod, lithic at 30 6 ft is 6cm, sl decrease in pumice (28-30%)
							2X			
							3X			
							2X			
35		R8	CORE	93	100	100	3X	SL	MOD H	sl increase in lithics to 3-5%, decrease in degree of welding at about 39.4 ft to sl, pumice ratios back to 2:1-1:1
							4X			
							2X			
							3X			
							>5X		MOD S	
40		R9	CORE	1.2	100	100	2X			6cm pumice at 40.0 ft, 2 5cm lithic at 43 8 ft, welding sl to mod, 3:1 ratio pumice has disappeared
							4X			
							4X			
							3X			
							2X			
45		R10	CORE	1 1	100	100	2X	SL	MOD H	ashy matrix with 30% pumice & 30% phenocrysts, pumice 2mm to 7cm, light gray-medium gray, 1:1-3:1 ratio, moderately welded, infilled with sanidine & quartz, phenocrysts predominantly sanidine & quartz trace (<5%) mafic minerals, 1mm-2mm. lithics about 2%
							2X			
							1X			
							3X			
							2X			
50										**Boring Terminated @ 50.0'**

KLEINFELDER BORING LOG

Boring # SSC-3
Sheet 1 of 6

Project Name: LANL CMRR	Started: 12/16/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/16/2002		N/A	
Location: TA-55	Backfilled: 12/16/02	N/A		
Surface Elevation: 7296.1	Driller: Szpunar/Price	Logged by: Ryan Merkley/Matt Rarity		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
										FILL brown, gravelly silty sand with clay, low to non-plastic
		R1	CORE	.68	100	36	4x	MOD	MOD S	Note: starting with geobarrel
5		R2		.45	96	84	1 1x	MOD	MOD S	Qbt4 - grayish orange pink (5 YR 7/2), fine grained, ashy matrix, 7% pumice is brown, 1 mm to 8 mm, ratios of 1:1, 10% sanidine and quartz, 1 mm to 2 mm, fracture at 5 1', 15°, 1 to 2 mm wide, organic infilling
							1x 1			15% sanidine and quartz with some pyroxene or hornblende, fracture at 6.8', 20°, 1 to 2 mm, clay infilling, fracture at 19 8', 80°, 1 to 2 mm, clay infilling, fracture at 12.4', 60°, with clay, fracture at 14 5', 0°, 1 mm wide
							1			
							2x 1 1			
10		R3	CORE	.4	4	0				very poor recovery Note: switched to conventional barrel
15		R4	CORE							no recovery Note: lost air flow at approximately 16', had to trip out to clean hole
20		R5	CORE	7	4	0		H	MOD S	Qbt3 pale red (5 R 6/2), fine grained, ashy matrix Note: very poor recovery
25										

Checked by: Joseph F. Louis Date: 3/11/04

Reviewed by: Alan Kulm Date: 3/11/04

SAMPLE TYPE LEGEND
- **A** - Auger Cuttings
- **S** - SPT 2" O.D. 1.38" I.D. tube sample
- **U** - 3" O.D. 2.42" I.D. tube sample
- **ST** - 3" O.D. thin-walled Shelby tube
- **CORE** - HQ Wireline Core
- **NR** - No Recovery

KLEINFELDER BORING LOG

Boring # SSC-3

Sheet 2 of 6

Project Name: LANL CMRR	Started: 12/16/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/16/2002		N/A	
Location: TA-55	Backfilled: 12/16/02	N/A		
Surface Elevation: 7296.1	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R6	CORE	.65	68	34	10x	MOD	MOD S - MOD H	Qbt3 pale red (5 R 6/2), 25% pumice from 1 to 3 cm, ratios of 1:1 to 3:1, pumice is light gray to brown with slight welding, 30% sanidine and quartz, 1 mm to 2 mm
30		R7	CORE	3' 10"	100	100	1x	SL - MOD	MOD H	pumice from 28 to 30%, 2 mm to 4 cm, 2% lithics, trace weathered out pyroxene
							1x			
							1x			
							1x			
35		R8	CORE	2' 45"	100	98		SL - MOD	MOD H	oxidation throughout matrix, pumice ratios to 5:1, fracture at 38.0', 25°, 2 mm, oxidized Note: critical samples fom 35 4' to 37 6', 38 0' to 39 5'
							1/1x			
							2x			
40		R9	CORE	2:45	100	100		SL	MOD H	pumice ratios to 6:1 Note: critical samples from 40 4' to 41.4', 42 0' to 42 8', 42.8' to 45 4'
							2x			
							1x			
45		R10	CORE	.55	96	94	1	SL	MOD H	30% pumice from 2 mm to 6 mm with ratios of 1:1 to 6:1, pumice is devitrified, pumice is light gray to white with occasional red-brown, moderate welding, 30% sanidine and quartz, trace weathered out pyroxene or horneblende, fracture at 46 4', 30°, 2 mm to 3 mm Note: critical samples at 45 4' to 46.3', 46 4' to 47 1', 49 0' to 50 2'
							2x			
							2x			
							2x			
50		R11	CORE	.58	62	36	>10x	SL	MOD H	28% pumice, 32% sanidine and quartz, welding decreases

KLEINFELDER BORING LOG

Boring # SSC-3
Sheet 3 of 6

Groundwater encountered:

Project Name: LANL CMRR	Started: 12/16/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/16/2002		N/A	
Location: TA-55	Backfilled: 12/16/02	N/A		
Surface Elevation: 7296.1	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
55		R12	CORE	.57	98	94	2x	SL	MOD H	Qbt3 pale red (5 R 6/2), ratios to 6:1, moderate welding, greenish tint to pumice, fracture at 58 2', 45°, 2 to 3 mm
							1x 1f			
							1x			
60		R13	CORE	.7	100	98	1	SL	MOD H	28 to 30% pumice between 61.4' to 62.8', 2 to 3 % lithics, fracture at 63 5', 50°, 1 m, 61.1', 50°, 2 to 3 mm
							2x			
							1			
65		R14	CORE	.73	94	42	2x	SL - MOD	MOD H	grades to moderate red (5 R 5/4), at 66 5' is the start of a large vertical fracture, aperture unknown, clay infilled, clay is light brown, ratios are 1:1 to 7:1
							1f			
70		R15	CORE	.6	94	92	1	SL - MOD	MOD H	grades to pale red (5 R 6/2), 28 to 30% pumice from 2 mm to 6 mm ratios of 1:1 to 4:1, pumice is white to light gray, occasional brownish red, greenish tint has disappeared, 5 to 7% sanidine and quartz from 1 mm to 2 mm, fracture from run 14 is present until 70.5'
							2x 1x			
75		R16	CORE	43	28	7	1x 6x	SL	MOD S - MOD H	2% lithics, slight welding, ratios from 1:1 to 3:1 Note: switched to geobarrel
80		R17	CORE	.5	44	8	>10x	SL	DEC - S	25% pumice, non-welded zone is between 76.8' to 80.4' Note: now using lexan tube

KLEINFELDER BORING LOG

Boring # SSC-3
Sheet 4 of 6

Project Name: LANL CMRR	Started: 12/16/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/16/2002		N/A	
Location: TA-55	Backfilled: 12/16/02	N/A		
Surface Elevation: 7296.1	Driller: Szpunar/Price	Logged by: Ryan Merkley/Matt Rarity		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
85		R18	CORE	38	20	0		SL	Friable	15 to 25% pumice, very poor recovery
90		R19	CORE	48	14	0		SL	Friable	pale yellowish brown (10 YR 5/4), 1 to 3% lithics Note: formation is so soft, driller is pushing through, so time is approximate
95		R20	CORE	7	70	0		SL	Friable	15% pumice, 30% sanidine and quartz, trace weathered out pyroxene Note: still pushing through formation
100		R21	CORE	7	70	0		SL	Friable	pumice from 2 mm to 6 mm
105		R22	CORE	7	30	0		SL	Friable	Note: driller still pushing bit, pumice is scarcely visible
110		R23	CORE	7	18	0		SL	Friable	large lithic in run (5 5 cm). 30% quartz and sanidine

KLEINFELDER BORING LOG

Boring # SSC-3
Sheet 5 of 6

Project Name: LANL CMRR	Started: 12/16/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/16/2002		N/A	
Location: TA-55	Backfilled: 12/16/02	N/A		
Surface Elevation: 7296.1	Driller: Szpunar/Price	Logged by: Ryan Merkley/Matt Rarity		
Drilling Method: HQ Wireline Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	% Recovery	RQD	Fractures/Foot	Weathering	Strength	Description
										Note: driller still pushing through
115		R24	CORE	.7	70	0				Qbt3 very light gray to light gray, 10 to 15% pumice from 5 mm to 1 cm, light gray pumice Note: driller still pushing
120		R25	CORE	6	20	0		SL	Friable	pumice is white to light gray from 2 mm to 5 mm, 30% sanidine and quartz Note: driller drilled through run instead of pushed
125		R26	CORE	35	46	12	>4x	SL	Friable	Qbt2 pale red (5 R 6/2), fine grained, ashy matrix with 23% pumice, pumice is white to light gray, from 2 mm to 6 cm, ratios of 1:1 to 2:1, 28% sanidine and quartz, 3% lithics, non-welded to slightly welded Note: special sample approximately 127.0' to 127 6'
130		R27	CORE	.42	82	42	>15x	SL	MOD S	moderate pink (5 R 7/4) to pale red (5 R 6/2), 25% pumice, ratios of 1:1 to 3:1, slightly welded
135		R28	CORE	48	94	94	2x	SL	MOD H	pale red (5 R 6/2), moderate welding Note: critical samples at 136 7' to 137 9'. 139 1' to 140.1', and 137.9' to 139.1'
							1x			
							1x			
							1x			

KLEINFELDER BORING LOG

Boring # SSC-3
Sheet 6 of 6

Groundwater encountered:

Project Name: LANL CMRR	Started: 12/16/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/16/2002		N/A	
Location: TA-55	Backfilled: 12/16/02	N/A		
Surface Elevation: 7296.1	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
140		R29	CORE	.43	100	100	1x	SL	H	**Qbt2** pale red (5 R 6/2), 20% pumice, ratios are 2:1 to 6:1, welded, trace pyroxene and horneblende Note: special samples at 140.7' to 142 0', 142 0' to 143.6'
							1x			
							1x			
145		R30	CORE	.45	100	100		SL	H - VH	**Qbt2** pale red (5 R 6/2), pumice is white to light gray, occasionally moderately red, pumice is 2 mm to 4 cm with ratios of 2:1 to 4:1, 28% sanidine and quartz with trace weathered horneblende and pyroxene, 2 to 3% lithics
							1x			
							1x			
150										**Boring Terminated @ 150.4'**
155										
160										
165										

KLEINFELDER BORING LOG

Boring # SSC-4
Sheet 1 of 6

Project Name: LANL CMRR	Started: 12/7/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/10/2002		N/A	
Location: TA-55	Backfilled: 12/10/02	N/A		
Surface Elevation: 7291.6	Driller: Szpunar/Price	Logged by: Ryan Merkley/Matt Rarity		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	% Recovery	RQD	Fractures/Foot	Weathering	Strength	Description
										FILL 6" road base, 6" brown silty sand with trace clay and fine grained gravel
										NOTE: run 1 was geo-barrel then switched to conventional core
5		R1	CORE	.97	83	0	3x	H	S	Qbt4 (TUFF) grayish orange pink (5 YR 7/2), fine grained ashy matrix, 3% pumice and 10% sanidine and quartz
		R2	CORE	1	86	68	1	MOD	S	grayish orange pink (5 YR 7/2) to grayish orange (10 YR 7/4), 10% pumice from 5 mm to 1 cm with ratios of 1:1 to 2:1, pumice is brown, 15% sanidine and quartz to 1 mm, fracture at 6 0', 20°, 2 mm to 4 mm wide, organic infilling, 9 0', 75°, 1 mm wide, organic infilling
							15x			NOTE: Special sample from about 8 1 to 8 6'
10							1			
		R3	CORE	.8	72	56	17x	MOD	S	grayish orange (10 YR 7/4) to pinkish gray (5 YR 8/1), oxidation banding, fracture at 15', 5°, 3 to 5 mm wide, oxidized, roots at end of run
							17x			NOTE: run was very broken up
							17x			
							17x			
15							1			
		R4	CORE	.92	14	0	2x	H	S	Qbt3 (TUFF) pale red (5 R 6/2), fine grained, ashy matrix, 28% pumice from 2 mm to 1.5 cm with ratios from 1:1 to 3:1, pumice is light gray, 30% sanidine and quartz from 1 mm to 2 mm
							2x			
							2x			NOTE: switched back to geo-barrel
							2x			
20							2x			
		R5	CORE	1.05	54	54	>10x	MOD - H	S	pale red (5 R 6/2), ratios from 1:1 to 2:1, infilled with sanidine and quartz; 2% lithics
							>10x			
							>10x			
25							>10x			

Checked by: Justin P Laird Date: 3/11/04

Reviewed by: Alan Kuhn Date: 3/11/04

SAMPLE TYPE LEGEND
- A - Auger Cuttings
- S - SPT 2" O.D. 1.38" I D tube sample
- U - 3 " O D. 2.42" I D tube sample
- ST - 3" O.D. thin-walled Shelby tube
- CORE - HQ Wireline Core
- NR - No Recovery

KLEINFELDER BORING LOG

Boring # SSC-4
Sheet 2 of 6

Project Name: LANL CMRR	Started: 12/7/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/10/2002		N/A	
Location: TA-55	Backfilled: 12/10/02	N/A		
Surface Elevation: 7291.6	Driller: Szpunar/Price	Logged by: Ryan Merkley/Matt Rarity		

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
							>10x			
		R6	CORE	9	56	56		MOD	S - MOD H	Qbt3 (TUFF) pale red (5 R 6/2), 1st 2.5' of the run became harder, rest of the run was lost, pumice ratios in the final 2 5' from 1:1 to 4:1
										NOTE: Critical sample from about 27' to 28'
										NOTE: Switched back to conventional core
30										
		R7	CORE	9	100	100	1x	MOD	MOD H	moderately welded, at 35' ratios to 10:1, 4 mm to 2 cm
							2x			NOTE: Critical samples at 31.0' to 31 7', 31 7' to 32.5', and 34.2' to 35.3'
							1x			
							1x			
35							1x			
		R8	CORE	.8	96	96	3x	MOD	MOD H	27% pumice, 3 to 4% lithics, oxidation band from 38.0' to 40 5'
							2x			NOTE: Special sample from 37 6' to 40.2'
40							1x			
		R9	CORE	9	100	100	2x	MOD	MOD H	oxidation bands have disappeared, occasional large pumice
							3x			
							3x			
							2x			
45							4x			
		R10	CORE	9	100	100	2x	MOD	MOD H	25% pumice from 2 mm to 3 cm with ratios of 2:1 to 6:1, infilled with quartz and sanidine, pumice is very light gray to medium gray, occasional horseshoe shaped pumice. 30% sanidine and quartz from 1 to 2 mm. 3% lithics
							1x			
							1x			
50							3x			
		R11	CORE	.93	100	80	1x	MOD - H	MOD H	Qbt3 pumice to 6 cm, increase in percentage of infilling of phenocrysts in pumice, oxidation banding, 2 parallel fractures 52.1'. both 50°, 3 mm wide, fracture at 55 2' to 55.6', 70°, 1 cm wide
							1,2x			NOTE: Critical sample at 51 2' to 52.1'

KLEINFELDER BORING LOG

Boring # SSC-4

Project Name: LANL CMRR	Started: 12/7/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/10/2002		N/A	
Location: TA-55	Backfilled: 12/10/02	N/A		
Surface Elevation: 7291.6	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	
Drilling Method: HQ Wireline Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
							2x			
							3x			
55							1,1x			
		R12	CORE	9	100	100	2x	MOD	MOD H	Qbt3 (TUFF) pale red (5 R 6/2), 30% pumice, pumice tint is greenish, moderately welded
										NOTE: Critical samples from 56.7' to 58 8', 58.8' to 59 4'
							3x			
60							3x			
		R13	CORE	85	60	60	10x	MOD	MOD H	25% pumice, ratios from 1:1 to 3:1, welding decreases
							10x			
							10x			
							10x			
65							10x			27% pumice, ratios from 1:1 to 2:1, welding decreases with depth
		R14	CORE	.75	82	82	>10x	MOD - H	MOD H	NOTE: Critical samples from about 68.4' to 68.9', 68.9' to 69.4', 69 4' to 69 8'
70										
		R15	CORE	.75	58	58	>10x	MOD - H	S	pinkish gray (5 YR 8/1), 28% pumice from 2 mm to 2 cm, pumice is light gray, infilled with sanidine and quartz, slightly welded, 30% sanidine and quartz, no visible lithics
							>10x			NOTE: Switched to geo-barrel on R16
							>10x			
							>10x			
75							>10x			
		R16	CORE	1 38	50	0	>10x	H	S	non-welded
							>10x			
							>10x			
							>10x			
80							>10x			
		R17	CORE	6	80	0		H - DEC	S	sample highly disturbed, area of oxidation is a possible fracture, non-welded

KLEINFELDER BORING LOG

Boring # SSC-4

Project Name: LANL CMRR	Started: 12/7/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/10/2002		N/A	
Location: TA-55	Backfilled: 12/10/02	N/A		
Surface Elevation: 7291.6	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	
Drilling Method: HQ Wireline Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
85										
		R18	CORE	55	40	0		H - DEC	S	Qbt3 (TUFF) pinkish gray (5 YR 8/1), 35% pumice, pumice is white in color NOTE: Special sample taken in this interval, impossible to tell depth
90										
		R19	CORE	33	40	0		DEC	S	increase in oxidation and mafic minerals
95										
		R20	CORE	.3	20	0		DEC	S	highly disturbed sample, no characterization possible
100										
		R21	CORE	.17	80	0		DEC	S	highly disturbed sample, no characterization possible NOTE: trying shorter runs to improve recovery
		R22		9	60	0		DEC	S	highly disturbed sample. no characterization possible NOTE: Switched from a stratopack bit to a face discharge bit
105										
		R23	CORE	2.6	70	0		DEC	S	pinkish gray (5 YR 8/1), coarser matrix, possible increase in sanidine and quartz NOTE: Collecting sample in lexan tube
110										

KLEINFELDER BORING LOG

Boring # SSC-4

Project Name: LANL CMRR	Started: 12/7/2002	Groundwater encountered: Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/10/2002		N/A	
Location: TA-55	Backfilled: 12/10/02	N/A		
Surface Elevation: 7291.6	Driller: Szpunar/Price	Logged by: Ryan Merkley/Matt Rarity		
Drilling Method: HQ Wireline Core				

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
		R24	CORE	2	35	0		DEC	S	Qbt3 (TUFF) pinkish gray (5 YR 8/1), non-welded since 81.0'
115		R25	CORE	4	0	0			S	no recovery, cuttings showed Qbt3 NOTE: Still using lexan tube
120		R26	CORE	1.8	40	0		SL	S	pale red (5 R 6/2), fine grained, ashy matrix, 30% pumice and 30% phenocrysts, non-welded to slightly welded, formation becoming slightly harder
		R27		1.0						NOTE: Formation became much harder at 123.5' no recovery
125										
		R28	CORE	1 7	94	94	3x	SL	S - MOD H	Qbt2 (TUFF) pale red (5 R 6/2), fine grained, ashy matrix, 20% pumice to 2 cm with ratios from 2:1 to 5:1, pumice is light gray to white, 1 to 2% pyroxene and 3% lithics, 25% quartz and sanidine from 1 to 2 mm, slight to moderate welding
							5x			
							3x			
							4x			
130							2x			
		R29	CORE	2	100	100	4x	SL	MOD H	pumcie ratio from 3:1 to 10:1
							5x			NOTE: Increase in mechanical fractures may be due to face discharge bit
							5x			NOTE: Switched back to stratapak bit
							4x			
135							6x			
		R30	CORE	1 7	100	100	1x	SL	H	moderate to densely welded NOTE: Special sample from 136 6' to 140 8'

KLEINFELDER BORING LOG

Boring # SSC-4
Sheet 6 of 6

Groundwater encountered:

Project Name: LANL CMRR	Started: 12/7/2002	Depth (ft)	Hour	Date
Project Number: 19435	Completed: 12/10/2002		N/A	
Location: TA-55	Backfilled: 12/10/02	N/A		
Surface Elevation: 7291.6	Driller: Szpunar/Price		Logged by: Ryan Merkley/Matt Rarity	

Drilling Method: HQ Wireline Core

Depth, feet	Graphic Log	Sample No.	Sample Type	Rock: Minutes/Foot	Rock: % Recovery	Rock: RQD	Rock: Fractures/Foot	Rock: Weathering	Rock: Strength	Description
140										
		R31	CORE	1.8	100	100		SL	H	Qbt2 (TUFF) pale red (5 R 6/2), 18 to 20% pumice NOTE: Special sample 141.0' to 146.0'
							1x			
							1x			
145		R32	CORE	1.7	100	100		UN - SL	H	18% pumice from 4 mm to 5 cm with ratios of 2:1 to 6:1, pumice is light gray, 25% quartz and sanidine from 1 to 2 mm, 2 to 3% lithics, moderately to densely welded
150							1x			
155										Boring Terminated @ 151.0'
160										
165										