APPENDIX A

SUMMARY OF EXISTING GEOTECHNICAL DATA

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TECHNICAL MEMORANDUM

TO: *Mr. Lance Hauer, GE* DATE: *August 12, 2013*

FROM: *Jason Cumbers, PE, MWH* REFERENCE: *1012376*

CC: *Toby Leeson, MWH*

SUBJECT: *Church Rock Mill Site Repository - Summary of Relevant Geotechnical Data*

Background

NRC and DOE comments on the MWH Draft Data Gaps Report (MWH, 2012) recommended a site geotechnical investigation of the foundation materials for the new repository. MWH evaluated existing geotechnical, geological and hydraulic data for the tailings and underlying materials in the vicinity of the proposed repository. Specifically, this information was evaluated relevant to the placement of mine spoils on top of the reclaimed tailings impoundment, in order to develop a focused geotechnical investigation program to obtain information to supplement existing information on the tailings, the underlying alluvium, and the Zone 3 Sandstone.

This memorandum provides a summary of existing data from the materials described above. This summary of data is focused on the area around the conceptual repository layouts and the specific data for the tailings, in the North and Central Cells. Pertinent geotechnical, geological and hydraulic information is summarized herein, and references, where specific test results and borehole information can be found, are presented. Figure 1 shows the locations of pertinent historic borings, wells, and geologic cross sections in the vicinity of the North and Central Cells. Figure 2 shows the locations of the currently existing wells at the site, as well as the locations of aquifer tests performed within the sandstone and alluvium, and permeability tests conducted at soil boring locations. Information on the borehole permeability tests is included in this summary and the existing information from the aquifer tests is further discussed in the documents included in Appendix B.

Table 1 provides a description of the existing relevant geotechnical data by study date and material type. This data summary includes available geotechnical data pertinent to loading of the tailings with mine spoils, and generally does not include data collected in the South Cell. Information in Table 1 is compiled from reports listed in the References section of this memorandum. Table 1 is not a comprehensive summary of all available geotechnical data from the North and Central Cells.

Tailings

Geotechnical data on the tailings in the North and Central Cells are available from several sources. Additional tailings data also exist for the tailings in the South Cell. During the preliminary geotechnical investigation for the impoundment in 1974 (SHB, 1974), a bulk sample

of the cycloned tailings sands was tested for gradation, permeability, and shear strength. The 1978 geotechnical investigation (SHB, 1978a) included drilling borings through the impoundment and through the tailings within the impoundment. Tailings samples were tested for Atterberg Limits, gradations, shear strength, and relative density. In 1979, UNC conducted a stability and integrity assessment of the dam (SHB, 1979). This assessment included a series of seven borings on the interior dikes (Northern Cross Dike and Southern Cross Dike) which separate the three cells. These borings were drilled through the existing tailings and provide thickness information and standard penetration test (SPT) data on the tailings. This investigation also includes data collected in the south cell.

A series of borings (658, 659, 660, and 662) were drilled through the tailings impoundment in 1985. Borings 658, 659, and 660 were located, west to east, across the Central Cell with 660 located within Borrow Pit No. 1. Boring 662 was drilled in the South Cell. These boring logs are included as attachments to a UNC memo (UNC, 1986) and provide tailings thickness information, as well as depths and thickness of fine-grained material within the profile. Testing on the samples collected from these boreholes include specific gravity, water content, dry density, and consolidation. This data was partially summarized in the impoundment Reclamation Plan (Canonie, 1991).

In 1992, a series of shallow borings were drilled in the tailings of the Central Cell, to aid in evaluation of the radon modeling (UNC, 1993). Geotechnical samples collected from shallow depths (less than 8 feet deep) were tested for specific gravity, water content, dry density, and gradation. No boring logs for this program were available for review. Interim stabilization of the Central Cell was completed in 1991, and tailings samples were collected in November 1992. Ground surface elevations are not provided; however, the borings appear to have been drilled from the interim cover surface. This tailings data was included in Appendix B of the Central Cell Final Reclamation As-Built Report (Canonie, 1995).

Based on the data for the North and Central Cells, the average specific gravity of the tailings samples is 2.71 and in general the samples are non-plastic. Fine-grained tailings samples have about twice the percentages (average by weight) passing the No. 100 (46 percent) and No. 200 (31 percent) sieves, and 6 percent finer than 0.001 mm, as compared with the coarse-grained samples. With the exception of one sample, both the coarse and fine fractions of the tailings samples were finer than the No. 10 sieve.

The water contents of the samples tested range from 4 to 60 percent with dry densities ranging from 73 to 118 pounds per cubic foot (pcf). Average water content of the coarser samples tested is 15 percent with an average dry density of 101 pcf. The average water content of the finer samples tested is 21 percent with an average dry density of 96 pcf. The reported coefficient of consolidation (C_c) results range from 0.018 to 1.00 for the tailings samples and the friction angles (from direct shear testing) range from 30° to 39°, with some results showing cohesion.

Embankment (North and Central Cells)
A series of borings (78a-15, 17, 18, 19, 20, 21) were drilled through the tailings embankment (SHB, 1978a), presumably to provide information on the materials and construction of the embankment. Borings 15, 17 and 18 were drilled adjacent to the Central Cell. Borings 19, 20, and 21 were drilled through the embankment on the north side of the North Cell. Data from these borings include SPT, torvane shear strength, Atterberg limits, gradations, water contents, dry density, triaxial and direct shear, and laboratory permeability.

The 33 samples from the embankment adjacent to the North and Central Cells are generally classified as low plasticity clay (CL). Atterberg limits for the embankment soils indicate the liquid limits range from 23 to 42 percent and the plasticity indices range from 8 to 22 percent. The average of the plastic Atterberg limits results is a liquid limit of 31 percent and a plasticity index of 13 percent. The percentage passing the No. 200 sieve (fines) ranges from 50 to 77 percent (by weight) and the percentage passing the No. 4 sieve (sand) ranges from 98 to 100 percent. The average of the embankment soils tested indicate 66 percent fines by weight and 100 percent sand size particles, or smaller, by weight. The water content for the embankment samples ranges from 5 to 24 percent with dry densities ranging from 107 to 126 pcf. The average water content is 13 percent and the average dry density is 114 pcf. Direct shear test results on the embankment materials include phi angles of 7°, 49°, and 38° with cohesions of 1.45 kips per square foot (ksf), 1.69 ksf and 0.31 ksf, respectively.

Alluvium

Many of the site drilling programs previously performed in the area of the North and Central Cells include information from both drilling and laboratory testing on the alluvium underlying the tailings, the embankment and the existing cover at the site. Extensive data was collected on the alluvium including field and laboratory permeabilities, Atterberg Limits, gradations, water contents, consolidation tests, Proctor compaction tests, and shear strength. The SHB investigations (SHB, 1974, 1976, 1978a, 1978b, 1979) include laboratory tests on more than 200 alluvium samples taken from the vicinity of the North and Central Cells. While portions of the alluvium were excavated for construction at the site, several of the borings appear to extend below the current depths of tailings in the area of interest and provide geotechnical data on materials still in-place below the impoundment. Borings with geotechnical data below the estimated tailings depths include SHB-74-04, SHB-76-08, 11, SHB-78a-76, 77, and SHB-78b-07.

The alluvium samples from the North and Central Cells are generally classified as low plasticity clay (CL), but also include plastic and non-plastic silts, as well as silty and clayey sands. Atterberg limits for the plastic alluvial soils indicate the liquid limits of the alluvium range from 20 to 67 percent. The plasticity indices range from 4 to 45 percent. The average of the plastic Atterberg limits results is a liquid limit of 36 percent and a plasticity index of 18 percent, which corresponds to a low plasticity clay. The percentage passing the No. 200 sieve (fines) ranges from 0 to 94 percent (by weight) and the percentage passing the No. 4 sieve (sand) ranges from 1 to 100 percent. The average of the alluvium results indicate 41 percent fines by weight and 80 percent sand size particles, or smaller, by weight. The water content for the alluvium samples ranges from 2 to 31 percent with dry densities ranging from 94 to 106 pcf.

Zone 3 Sandstone

More than 50 geotechnical borings were identified that extend into the Zone 3 Sandstone in the vicinity of the proposed repository (SHB, 1974, 1976, 1978a, 1978b, 1979 and CSI, 1980). The bulk of the sandstone data include SPT data, water contents, and the contact elevations. Geotechnical laboratory data includes gradations, water content and Atterberg limits. Field permeability tests were also performed in the sandstone. Laboratory data on samples from the Zone 3 Sandstone is limited; however, water content results range from 5 to 19 percent, and two Atterberg limits tests indicate the sandstone is non-plastic. Two gradation results indicate 27 percent and 25 percent (by weight) passing the no. 200 sieve and 68 percent and 54 percent passing the No. 4 sieve.

Proposed Borrow Areas
MWH identified nineteen borings previously drilled in/or near the proposed East and West Borrow Areas. These include ten borings (SHB78b-18,19,20,28,30,31,32,33,34 and DH-1,3) in the East Borrow (SHB, 1978b and CSI, 1980) and eight borings (SHB78a-52,53,54,55,56 and DH-6,7,8) in or near the West Borrow (SHB, 1978a and CSI, 1980). After reviewing surface elevations to account for previous borrow operations in these areas, the existing data on the remaining subsurface profile includes depth to rock, SPT, gradations, Atterberg limits, and water contents. Depth of alluvium above the sandstone or siltstone appears to vary between about 0 and 25 feet in the proposed West Borrow and between about 0 and 14 feet in the proposed East Borrow Area. The alluvium in the borrow areas is generally classified as silty clay, sandy clay, silty sand, clayey sand, or clayey silt.

Laboratory data on samples from the lower alluvium includes, water content results ranging from 4 to 9 percent, dry densities ranging from 82 to 103 pcf, and two Atterberg limits tests indicate CL or CL-ML classification (liquid limits of 29 and 25 percent, plasticity indices of 14 and 6 percent). Gradation results indicate between 37 percent and 61 percent (by weight) passing the no. 200 sieve. Strength and consolidation testing was conducted on alluvium samples from DH-1 and DH-3 (CSI, 1980), located in the proposed East Borrow. Visual classification of the alluvium and SPT data are included on the referenced boring logs.

Conclusions
Based on the available data, and the geologic mapping of impoundment Area (Appendix B), the sampling plan has been developed to collect additional stratigraphy data on the thickness of the tailings in areas, where data is limited, specifically Borrow Pit No. 1 and the center of the Central Cell. The laboratory data previously collected provides index properties for the tailings, the embankment, and the underlying alluvium. The objectives of the proposed investigation will be to confirm these index properties and collect additional data on the consolidation and strength properties of the tailings, the strength properties of the alluvium and the embankment, and hydraulic properties (conductivity and soil water characteristic curves (SWCC)) on the tailings, the alluvium, and the Zone 3 sandstone.

Attachments:
Figure 1 – Location of Historic Borings, Wells, and Geologic Cross Sections
Figure 2 – Location of Existing Wells, and Hydraulic Field Test Data
Table 1 – Church Rock Mill Site Impoundment - Summary of Relevant Existing Geotechnical Data for the North and Central Cells

References:

Canonie Environmental. 1991. *Tailings Reclamation Plan As Approved by NRC March 1, 1991, License No. SUA-1475, Church Rock Site, Gallup, New Mexico*. 3 Volumes. August.

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MWH. 2012. *Draft Supplemental Data Needs Evaluation and Work Plans For Removal Design, Northeast Church Rock Mine Site Removal Action.* November 9.

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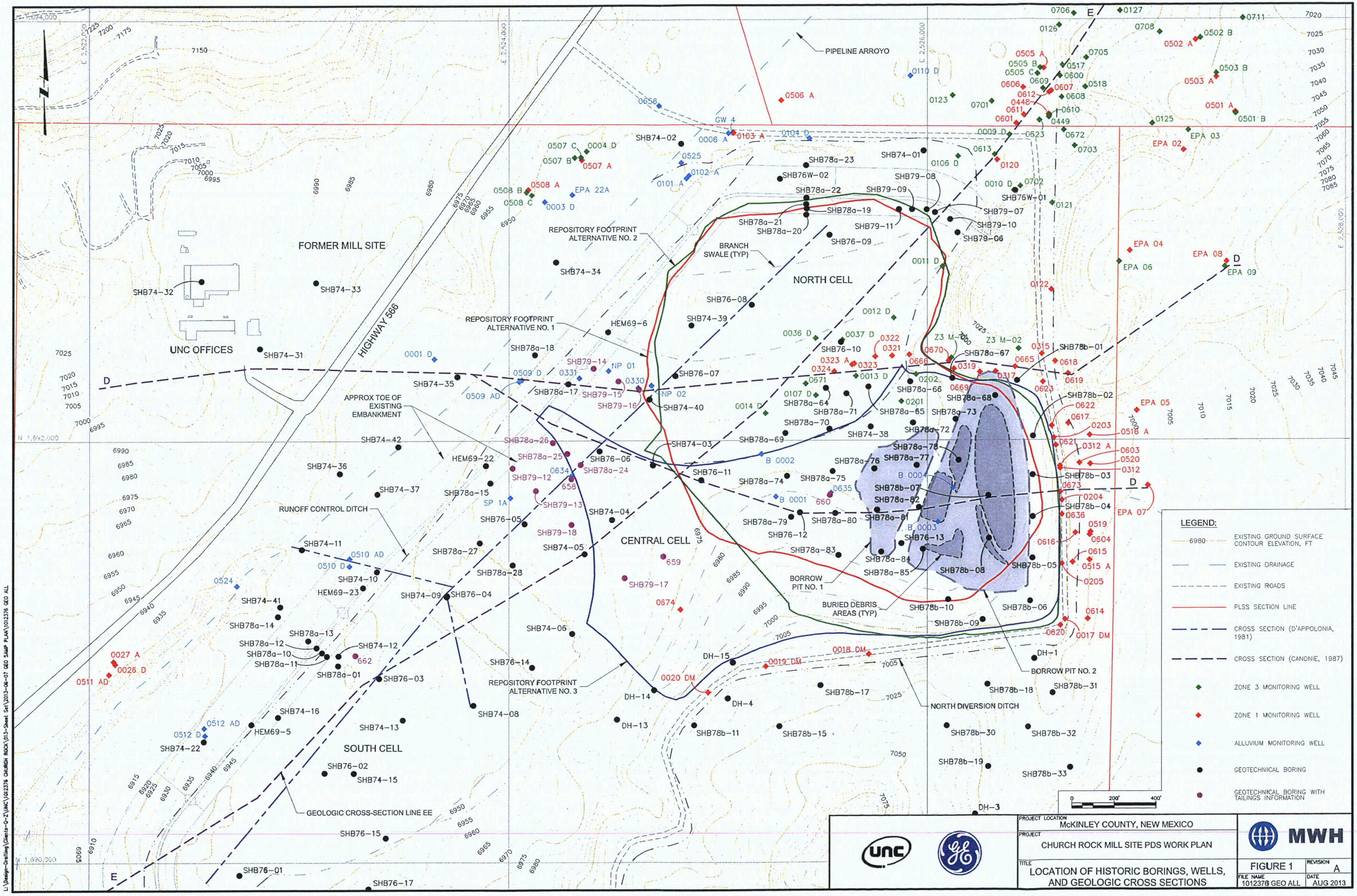
Sergent, Hauskins & Beckwith (SHB). 1979. *Geotechnical Investigation Report, Stability and Integrity Assessment, Church Rock Uranium Mill, United Nuclear Corporation.* Church Rock, New Mexico. Volume 1. July.

UNC Mining and Milling. 1986. *Letter to Canonie Environmental Services Corporation, Re: Previous Geotechnical Data – Tailings & NECR*. October 14.

United Nuclear Corporation. 1993. *Letter to Canonie Environmental Services Corporation.* September 28.


FORMER MILL SITE
UNC OFFICES
HIGHWAY 566
NORTH CELL
CENTRAL CELL
SOUTH CELL
PIPELINE ARROYO
REPOSITORY FOOTPRINT ALTERNATIVE NO. 2
REPOSITORY FOOTPRINT ALTERNATIVE NO. 1
REPOSITORY FOOTPRINT ALTERNATIVE NO. 3
BRANCH SWALE (TYP)
APPROX TOE OF EXISTING EMBANKMENT
RUNOFF CONTROL DITCH
BORROW PIT NO. 1
BORROW PIT NO. 2
BURIED DEBRIS AREAS (TYP)
NORTH DIVERSION DITCH
GEOLOGIC CROSS-SECTION LINE EE
LEGEND:
EXISTING GROUND SURFACE CONTOUR ELEVATION, FT
EXISTING DRAINAGE
EXISTING ROADS
PLSS SECTION LINE
CROSS SECTION (D'APPOLONIA, 1981)
CROSS SECTION (CANONIE, 1987)
ZONE 3 MONITORING WELL
ZONE 1 MONITORING WELL
ALLUVIUM MONITORING WELL
GEOTECHNICAL BORING
GEOTECHNICAL BORING WITH TAILINGS INFORMATION
0 200' 400'
PROJECT LOCATION
McKINLEY COUNTY, NEW MEXICO
PROJECT
CHURCH ROCK MILL SITE PDS WORK PLAN
TITLE
LOCATION OF HISTORIC BORINGS, WELLS, AND GEOLOGIC CROSS SECTIONS
MWH
FIGURE 1
REVISION A
FILE NAME 1012376 GEO ALL
DATE AUG 2013

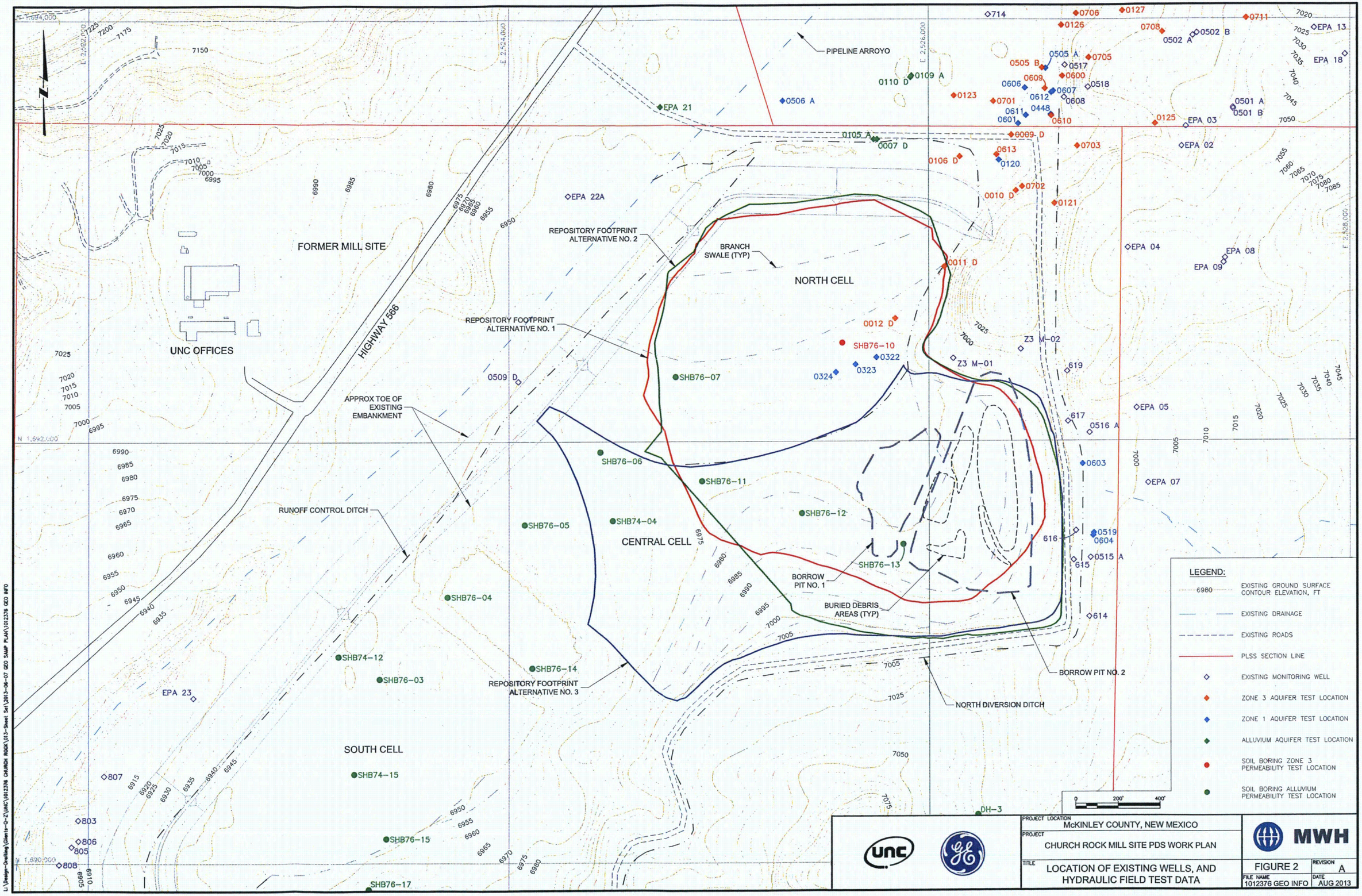

FORMER MILL SITE
UNC OFFICES
HIGHWAY 566
PIPELINE ARROYO
REPOSITORY FOOTPRINT ALTERNATIVE NO. 2
REPOSITORY FOOTPRINT ALTERNATIVE NO. 1
REPOSITORY FOOTPRINT ALTERNATIVE NO. 3
BRANCH SWALE (TYP)
NORTH CELL
CENTRAL CELL
SOUTH CELL
APPROX TOE OF EXISTING EMBANKMENT
RUNOFF CONTROL DITCH
BORROW PIT NO. 1
BURIED DEBRIS AREAS (TYP)
BORROW PIT NO. 2
NORTH DIVERSION DITCH
LEGEND:
6980 EXISTING GROUND SURFACE CONTOUR ELEVATION, FT
EXISTING DRAINAGE
EXISTING ROADS
PLSS SECTION LINE
EXISTING MONITORING WELL
ZONE 3 AQUIFER TEST LOCATION
ZONE 1 AQUIFER TEST LOCATION
ALLUVIUM AQUIFER TEST LOCATION
SOIL BORING ZONE 3 PERMEABILITY TEST LOCATION
SOIL BORING ALLUVIUM PERMEABILITY TEST LOCATION
0 200' 400'
PROJECT LOCATION
McKINLEY COUNTY, NEW MEXICO
PROJECT
CHURCH ROCK MILL SITE PDS WORK PLAN
TITLE
LOCATION OF EXISTING WELLS, AND HYDRAULIC FIELD TEST DATA
MWH
FIGURE 2
REVISION A
FILE NAME 1012376 GEO INFO
DATE AUG 2013

Table 1 - Church Rock Mill Site Impoundment - Summary of Relevant Existing Geotechnical Data for the North and Central Cells

							Field Data			Lab Data																
Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
Hemphill 1969	6	6950	7.5-9	alluvium	Silt	SC					37	15		47				13								Central
	6	6950	40.5-41	sandstone	-	-																	UC = 296 ksf			Central
SHB 1974	SHB74-03	6954	5	alluvium	Sandy Clay	CH	18				62	45		70	87	99	100	6								Central
	SHB74-03	6954	10	alluvium	Sandy Clay	CL	46				44	27		77	93	99	100	10								Central
	SHB74-03	6954	15	alluvium	Sandy Silt	CL-ML	20				21	4		70	93			8								Central
	SHB74-03	6954	20	alluvium	Sandy Silt	CL-ML	16											4								Central
	SHB74-03	6954	25	alluvium	Sandy Silt	CL-ML	23											3								Central
	SHB74-04	6949	5	alluvium	Sandy Silt	ML	8				-	NP		55	82	99	99	5								Central
	SHB74-04	6949	10	alluvium	Clay	CL	56		4		46	29		98	99			12	104	X						Central
	SHB74-04	6949	15	alluvium	Clay	CL	45				23	4		53	82	97	100	14	104	X				42.5		Central
	SHB74-04	6949	20	alluvium	Clayey Sand	SC	11				29	11		39	79	99	100	5								Central
	SHB74-04	6949	25	alluvium	Clayey Sand	SC	15											5								Central
	SHB74-04	6949	30	alluvium	Clayey Sand	SC	15											4								Central
	SHB74-05	6946	5	alluvium	Silty Sand	SM	15				-	-		-				6	91	X				30.5		Central
	SHB74-05	6946	10	alluvium	Silty Sand	SM	24				-	-		-				10	105	X						Central
	SHB74-05	6946	15	alluvium	Sandy Silt	ML	34				23	4		53				8								Central
	SHB74-05	6946	20	sandstone	-	-	40											5								Central
	SHB74-05	6946	25	sandstone	-	-	24											10								Central
	SHB74-05	6946	30	sandstone	-	-	28											13								Central
	SHB74-06	6946	14	sandstone	-	-	-																			Central
	SHB74-39	6946	8.25	sandstone	End of Boring	SC	50/1																			North
		-	-	tailings	Cycloned Sands	-								4	9									38.5	2375	-
SHB 1976	SHB76-05		0	alluvium	Sandy Silt	ML	2											8								Central
	SHB76-05		5	alluvium	Sandy Silt	ML	3											20								Central
	SHB76-05		10	alluvium	Sandy Clay	CL	9				36	15		98	99			29								Central
	SHB76-05		9-18.5	alluvium	Clay	CH	13		0.0									22								Central
	SHB76-05		19-25	alluvium	Silty Sand	SM	9		1.7		-	NP		44	87			13								Central
	SHB76-05		25	alluvium	Silty Sand	SM	9											16								Central
	SHB76-05		30	alluvium	Silty Sand	SM	12											8								Central
	SHB76-06		0	alluvium	Silty Sand	SM	6											8								Central
	SHB76-06		5	alluvium	Sandy Clay	CL	12				32	13		81	96	100		9								Central
	SHB76-06		10	alluvium	Sandy Clay	CL	45											8								Central
	SHB76-06		9-16.5	alluvium	Sandy Silt	ML	33		5.5		39	9		87	98			11								Central
	SHB76-06		20	alluvium	Sandy SIlt	CL-ML	11											6								Central
	SHB76-06		25	alluvium	Sandy SIlt	CL-ML	6											8								Central
	SHB76-06		19-24.5	alluvium	Sandy SIlt	CL-ML	7		5.1									6								Central
	SHB76-06		35	alluvium	Sandy SIlt	CL-ML	10											8								Central
	SHB76-06		40	alluvium	Sandy SIlt	CL-ML	8											14								Central
	SHB76-06		45	alluvium	Sandy Silt	CL-ML	11											25								Central
	SHB76-06		50	alluvium	Sandy Silt	CL-ML	10											22								Central
	SHB76-06		55	alluvium	Sandy Silt	CL-ML	16											21								Central
	SHB76-06		60	alluvium	Sandy Silt	CL-ML	8											26								Central
	SHB76-06		70	alluvium	Sandy Silt	CL-ML	9											25								Central
	SHB76-07		0	alluvium	Sandy Silt	ML	2											18								North
	SHB76-07		5	alluvium	Sandy Clay	CL	4				31	12		79	95	100		25								North
	SHB76-07		10-20	alluvium	Sandy Silt	CL-ML	5		1.1		21	4		52	77			14			124.2@11				0.179	North
	SHB76-07		15	alluvium	Sandy Silt	ML	7				-	NP		57	88	100		15								North
	SHB76-07		18.5-27.5	alluvium	Sandy Silt	ML	3		1.0									26								North
	SHB76-07		25	alluvium	Sandy Silt	ML	6											20								North
	SHB76-07		30	sandstone	-	-	50/1																			North
	SHB76-07		35	sandstone	-	-	50																			North
	SHB76-08		0	alluvium	Silty Sand	SM	3											9								North

Table 1 - Church Rock Mill Site Impoundment - Summary of Relevant Existing Geotechnical Data for the North and Central Cells

							Field Data			Lab Data																
Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	SHB76-08		5	alluvium	Silty Sand	SM	2											22								North
	SHB76-08		10	alluvium	Silty Sand	SM	2											23								North
	SHB76-08		15	alluvium	Clay	CL	11											26								North
	SHB76-08		20	alluvium	Clay	CL	13				46	25		97	99			22								North
	SHB76-08		25	sandstone	-	-	23											17								North
	SHB76-08		30	shale	-	-	50/5											17								North
	SHB76-08		35	sandstone	-	-	50/0																			North
	SHB76-09		0	alluvium	Silty Sand	SM	2											12								North
	SHB76-09		5	alluvium	Silty Clay	CL	7											29								North
	SHB76-09		10	alluvium	Sandy Silt	ML	5											22								North
	SHB76-09		15-25	alluvium	Clay	CL	13				38	21		78	94	100		25								North
	SHB76-09		20	alluvium	Clay	CL	21				46	25		94	98	100		21								North
	SHB76-09		25	alluvium	Clay	CL	22											22								North
	SHB76-09		30	alluvium	Sandy Clay	CL	10											31								North
	SHB76-09		35	alluvium	Clay	CH	14											26								North
	SHB76-09		40	alluvium	Sandy Silt	ML	1																			North
	SHB76-09		45	alluvium	Clay	CH	11											30								North
	SHB76-09		50	alluvium	Clay	CH	5											31								North
	SHB76-09		55	alluvium	Silty Sand	SM	36											23								North
	SHB76-09		60	alluvium	Silty Sand	SM	13											24								North
	SHB76-09		65	alluvium	Silty Sand	SM	10											21								North
	SHB76-09		70	alluvium	Sandy Clay	SC	13											20								North
	SHB76-09		75	alluvium	Sandy Clay	SC	45											18								North
	SHB76-10		1.5-7.5	sandstone 3	-	-	50/3		15.3									9								North
	SHB76-10		5	sandstone 3	-	-	50/5											8								North
	SHB76-11	6957	0	alluvium	Sandy Silt	ML	6											9								Central
	SHB76-11	6957	5	alluvium	Sandy Silt	ML	10											6								Central
	SHB76-11	6957	10	alluvium	Sandy Clay	CL	26				27	10		67	90	100		10								Central
	SHB76-11	6957	9-18	alluvium	Sandy Clay	CL	25		1.1		26	10		78	94	100		16								Central
	SHB76-11	6957	18.5-27.5	alluvium	Sandy Silt	ML	12		1.0									5								Central
	SHB76-11	6957	25	alluvium	Sandy Clay	CL	14											22								Central
	SHB76-11	6957	30	alluvium	Sandy Silt	ML	11											10								Central
	SHB76-11	6957	35	alluvium	Sandy Silt	ML	9					NP		55	94	100		10								Central
	SHB76-11	6957	40	alluvium	Sandy Silt	ML	9											11								Central
	SHB76-11	6957	45	alluvium	Sandy Silt	CL-ML	12											18								Central
	SHB76-11	6957	50	alluvium	Sandy Silt	CL-ML	15											9								Central
	SHB76-11	6957	55	alluvium	Sandy Silt	CL-ML	21											10								Central
	SHB76-11	6957	60	alluvium	Sandy Silt	CL-ML	10											24								Central
	SHB76-11	6957	65	alluvium	Sandy Silt	CL-ML	7											21								Central
	SHB76-11	6957	70	alluvium	Sandy Silt	CL-ML	2											22								Central
	SHB76-11	6957	75	sandstone	-	-	38											13								Central
	SHB76-12		0	alluvium	Silty Sand	SM	16											12								Central
	SHB76-12		5	alluvium	Sandy Clay		21											6								Central
	SHB76-12		9-16	alluvium	Sandy Clay		27		12.0									10								Central
	SHB76-12		15	alluvium	Sandy Clay		6											6								Central
	SHB76-12		18.5-25	alluvium	Sandy Clay		16		14.5		-	NP		61	91	100		8								Central
	SHB76-12		25	alluvium	Sandy Clay		13											6								Central
	SHB76-12		30	alluvium	Sandy SIlt	ML	21											5								Central
	SHB76-12		35	alluvium	Sandy Clay	CL	54											12								Central
	SHB76-12		40	alluvium	Sandy SIlt	CL-ML	34											8								Central
	SHB76-12		45	alluvium	Sandy Silt	CL-ML	23											4								Central
	SHB76-12		50	alluvium	Sandy Silt	CL-ML	18											5								Central

Table 1 - Church Rock Mill Site Impoundment - Summary of Relevant Existing Geotechnical Data for the North and Central Cells

							Field Data			Lab Data																
Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	SHB76-12		55	alluvium	Sandy Silt	CL-ML	40											7								Central
	SHB76-12		60	sandstone	-	-	50/1											9								Central
	SHB76-13		0	alluvium	Sandy Clay	CL	13											9								Central
	SHB76-13		9-17.5	alluvium	Sandy Clay	CL	31		8.0		35	17		82	97			8								Central
	SHB76-13		10	alluvium	Sandy Silt	ML	40											4								Central
	SHB76-13		15	alluvium	Sandy Clay	CL	59											9								Central
	SHB76-13		18.5-25	alluvium	Sandy Silt	CL-ML	24		1.3									10								Central
	SHB76-13		25	alluvium	Sandy Silt	CL-ML	22											4								Central
	SHB76-13		30	alluvium	Sandy Silt	CL-ML	22											8								Central
	SHB76-13		35	alluvium	Sandy Silt	CL-ML	28											6								Central
	SHB76-13		40	alluvium	Sandy Silt	CL-ML	26											8								Central
	SHB76-13		45	alluvium	Sandy Silt	CL-ML	29											8								Central
	SHB76-13		50	alluvium	Sandy Silt	CL-ML	24											5								Central
	SHB76-13		55	alluvium	Sandy Silt	CL-ML	30											7								Central
	SHB76-13		60	sandstone	-	-	50/4											16								Central
SHB 1978a	SHB-78a-15	6964	0-2	dam	Sandy Clay	-	9											11								Central
	SHB-78a-15	6964	4.5-6	dam	Sandy Clay	-	21											16								Central
	SHB-78a-15	6964	9.5-10.5	dam	Sandy Clay	CL	35	0.89			32	10		75	93	100		14	114			1 pt (15 deg.), c=1600 psf				Central
	SHB-78a-15	6964	14.5-16	dam	Sandy Clay	CL	58	0.99										13								Central
	SHB-78a-15	6964	18.5-21	dam	Sandy Clay	CL	75											13								Central
	SHB-78a-15	6964	24.5-25	dam	Sandy Clay	CL	44	0.95			42	22		75	90	99	100	16	116							Central
	SHB-78a-15	6964	28.5-31	dam	Sandy Clay	CL	25	0.60										16								Central
	SHB-78a-15	6964	34.5-36	dam	Sandy Clay	CL	12											21								Central
	SHB-78a-15	6964	39.5-40.5	dam	Sandy Clay	CL	22	0.99										18	110					7, 1.45		Central
	SHB-78a-15	6964	44.5-45.5	dam	Sandy Clay	CL	26	0.67										23								Central
	SHB-78a-17	6962	0-1	dam	Sandy Clay	CL	14	0.42										10	110							North
	SHB-78a-17	6962	4.5-6	dam	Sandy Clay	CL	27											15								North
	SHB-78a-17	6962	9.5-11	dam	Sandy Clay	CL	38	0.79										12								North
	SHB-78a-17	6962	14.5-16	dam	Sandy Clay	CL	41											11								North
	SHB-78a-17	6962	19.5-20.5	dam	Sandy Clay	CL	85	0.92			30	12		63	88	99	100	11	124				1 pt			North
	SHB-78a-17	6962	24.5-26	dam	Sandy Clay	CL	20	0.6										12								North
	SHB-78a-17	6962	29.5-31	dam	Sandy Clay	CL	12											24								North
	SHB-78a-17	6962	34.5-36	dam	Sandy Clay	CL	18	0.52										20	107							North
	SHB-78a-17	6962	39.5-41	alluvium	Silty Sand	SM	19	0.2										19								North
	SHB-78a-17	6962	44.5-46	alluvium	Clay	CL	15											24								North
	SHB-78a-18	6959	0-1.5	dam	Clay	CL-SC	10											12								North
	SHB-78a-18	6959	4.5-6	dam	Clay	CL-SC	52											12								North
	SHB-78a-18	6959	9.5-11	dam	Clay	CL-SC	30											12	115							North
	SHB-78a-18	6959	14.5-16	alluvium	Sandy Clay	CL	4											30								North
	SHB-78a-18	6959	19.5-20.5	alluvium	Silty Sand	SM	3											27								North
	SHB-78a-19	6965	0-2	dam	Sandy Clay	CL												12								North
	SHB-78a-19	6965	2-3.5	dam	Sandy Clay	CL	125	0.99			29	13		61	86	100		10	126					49, 1.69		North
	SHB-78a-19	6965	3.5-4.5	dam	Sandy Clay	CL	50	0.83										10								North
	SHB-78a-19	6965	4.5-7	dam	Sandy Clay	CL	43											12								North
	SHB-78a-19	6965	7-9.5	dam	Sandy Clay	CL												10								North
	SHB-78a-19	6965	9.5-11	dam	Sandy Clay	CL	82	0.69			23	8		50	72	97	98	10	114					38, 0.31		North
	SHB-78a-19	6965	11-13.5	dam	Sandy Clay	CL	30											8								North
	SHB-78a-19	6965	13.5-16	alluvium	Silty Sand	CL	-											18								North
	SHB-78a-19	6965	17.5-21	alluvium	Silty Sand	SM	3											21								North
	SHB-78a-19	6965	20-21.5	alluvium	Silty Sand	SM	10											27	94	X						North
	SHB-78a-19	6965	24-25.5	alluvium	Silty Sand	CL	32											28								North
	SHB-78a-19	6965	25.5-28	alluvium	Clay	CL	22											26								North

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Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	SHB-78a-19	6965	28-29.5	alluvium	Clay	CL	28																			North
	SHB-78a-19	6965	29.5-32	alluvium	Clay	CL	20											26								North
	SHB-78a-19	6965	32-33.5	alluvium	Silty Sand	SM	13	0.16				NP		46	88	100		20	111							North
	SHB-78a-19	6965	33.5-36	alluvium	Silty Sand	SM	16											25								North
	SHB-78a-19	6965	36-37.5	alluvium	Silty Sand	CL	51				41	22		74	94	100		23	100							North
	SHB-78a-19	6965	37.5-40	alluvium	Clay	CH	43											24								North
	SHB-78a-19	6965	40-41.5	alluvium	Clay	CH	34	0.83			61	38		73	80	100		25	99				1 pt			North
	SHB-78a-19	6965	41.5-44	alluvium	Clay	CH	22											28								North
	SHB-78a-19	6965	44-45	alluvium	Clay	CH	22	0.13			67	41		78	87	100		27	96							North
	SHB-78a-20	6964	0-1.5	dam	Clay	CL	7											15								North
	SHB-78a-20	6964	4.5-6	dam	Clay	CL	49	0.79										11								North
	SHB-78a-20	6964	9.5-10.5	dam	Clay	CL	40	0.67			28	13		63	86	99	100	10	111							North
	SHB-78a-20	6964	14.5-16	alluvium	Silty Sand	SM	19											10								North
	SHB-78a-20	6964	19.5-20.5	alluvium	Silty Sand	SM	5					NP		16	35			23	96						5.5	North
	SHB-78a-20	6964	24.5-25.5	alluvium	Silty Sand	CH	15	0.33										29	93							North
	SHB-78a-20	6964	29.5-31	alluvium	Clay	CH	12																			North
	SHB-78a-20	6964	34.5-35.5	alluvium	Clay	CH	12	0.84										26								North
	SHB-78a-20	6964	39.5-40.5	alluvium	Clay	CH	13	0.93			57	31		93	96	97	98	26	97				1 pt			North
	SHB-78a-20	6964	44.5-46	alluvium	Clay	CH	17											27								North
	SHB-78a-21	6964	0-1.5	dam	Sandy Clay	CL	16											14								North
	SHB-78a-21	6964	4.5-6	dam	Sandy Clay	CL	55				34	16		77	90			13								North
	SHB-78a-21	6964	9.5-10.5	dam	Sandy Clay	CL	51	0.55										5	107							North
	SHB-78a-21	6964	14.5-15.5	alluvium	Sandy Clay	CL	13	0.67										12								North
	SHB-78a-21	6964	19.5-21	alluvium	Sandy Clay	CL	4				39	21		72	88			29								North
	SHB-78a-21	6964	24.5-25.5	alluvium	Sandy Clay	CL	18	0.96										22	105					25.5, 0.05		North
	SHB-78a-21	6964	29.5-30.5	alluvium	Clay	CH	19	0.73										24								North
	SHB-78a-21	6964	34.5-36	alluvium	Clay	CH	17											23								North
	SHB-78a-21	6964	39.5-40.5	alluvium	Clay	CH	27	0.72			50	32		84	94			22	102				1 pt			North
	SHB-78a-21	6964	44.5-45.5	alluvium	Clay	CH	19	0.87										19								North
	SHB-78a-22	6956	0-1.0	alluvium	Silty Sand	SM	4											6	93							North
	SHB-78a-22	6956	1.0-3.0	alluvium	Silty Sand	SM	9											9								North
	SHB-78a-22	6956	3.0-5.0	alluvium	Silty Sand	SM	11											11	100							North
	SHB-78a-22	6956	5.0-7.0	alluvium	Sandy Clay	CL	3											12								North
	SHB-78a-22	6956	7.0-9.0	alluvium	Sandy Clay	CL	10				26	10		55	78	100		21	103				1 pt			North
	SHB-78a-22	6956	9.0-11.0	alluvium	Sandy Clay	CL	3				27	10		56	69			31								North
	SHB-78a-22	6956	11-13.0	alluvium	Sandy Clay	CL	10											34	105							North
	SHB-78a-22	6956	13-15.0	alluvium	Sandy Clay	CL	3																			North
	SHB-78a-24	6955	0-1.5	tailings	Silty Sand	SM												9	84							Central
	SHB-78a-24	6955	1.5-3.5	tailings	Silty Sand	SM	4																			Central
	SHB-78a-24	6955	3.5-5.5	tailings	Silty Sand	SM	2/30											23								Central
	SHB-78a-24	6955	5.5-8	tailings	Silty Sand	SM						NP		13	25	100		19								Central
	SHB-78a-24	6955	8-10.0	tailings	Silty Sand	SM	3/18											36								Central
	SHB-78a-24	6955	10.0-12	alluvium	Silty Sand	SM	7											27								Central
	SHB-78a-24	6955	12-14.5	alluvium	Sandy Clay	CL												24								Central
	SHB-78a-24	6955	14.5-16.5	alluvium	Sandy Clay	CL	14	0.43			42	23		83	93			24	99				1 pt			Central
	SHB-78a-24	6955	16.5-18.5	alluvium	Sandy Clay	CL	2											29								Central
	SHB-78a-24	6955	18.5-21	alluvium	Sandy Clay	CL												22	81							Central
	SHB-78a-24	6955	21-23.0	alluvium	Clay	CL	39	0.69			42	21		87	97	98	100	21	106				1 pt			Central
	SHB-78a-24	6955	23.0-25	alluvium	Clay	CL	15											19								Central
	SHB-78a-24	6955	25-27.5	alluvium	Clay	CL												23	83							Central
	SHB-78a-24	6955	27.5-30	alluvium	Silty Sand	SM	9											24								Central
	SHB-78a-25	6958	6-8.5	tailings	Silty Sand	SM	20	0.06				NP		14	25	98	100	9								Central

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	SHB-78a-25	6958	17-18.0	tailings	Silty Sand	SM	7					NP		14	25	99	100	20								Central
	SHB-78a-25	6958	19.5-22	alluvium	Sandy Clay-Clayey Sand	CL-SC	2											27								Central
	SHB-78a-25	6958	22.0-24	alluvium	Sandy Clay-Clayey Sand	CL-SC	5				35	17		59	81			27								Central
	SHB-78a-25	6958	24.0-26	alluvium	Sandy Clay-Clayey Sand	CL-SC	8	0.1										29	93							Central
	SHB-78a-25	6958	26-28.5	alluvium	Sandy Clay-Clayey Sand	CL-SC		0.32										21	64							Central
	SHB-78a-25	6958	28.5-30.5	alluvium	Sandy Clay-Clayey Sand	CL-SC	4				28	12		42	79			21								Central
	SHB-78a-25	6958	30.5-32.5	alluvium	Sandy Clay-Clayey Sand	CL-SC	16											21								Central
	SHB-78a-25	6958	32.5-33.5	alluvium	Sandy Clay-Clayey Sand	CL-SC		0.8										19	108					30, 0		Central
	SHB-78a-26	6962	6.5-9	tailings	Silty Sand	SM	8					NP		22	43			10	96					30, 0		Central
	SHB-78a-26	6962	8.0-10.5	tailings	Silty Sand	SM												19								Central
	SHB-78a-26	6962	10.5-12.5	tailings	Silty Sand	SM	2											21						33, 0		Central
	SHB-78a-26	6962	12.5-14.5	tailings	Silty Sand	SM	9											12	99							Central
	SHB-78a-26	6962	15.5-18	tailings	Silty Sand	SM	3					NP		14	23	100		17								Central
	SHB-78a-26	6962	19.5-22	tailings	Silty Sand	SM	2/18"					NP		20	33			18								Central
	SHB-78a-26	6962	21-23	tailings	Silty Sand	SM												24								Central
	SHB-78a-26	6962	23-25.5	alluvium	Sandy Clay	CL	10											27								Central
	SHB-78a-26	6962	25.5-27.5	alluvium	Sandy Clay	CL	10											27								Central
	SHB-78a-26	6962	27.5-30	alluvium	Sandy Clay	CL												23	83							Central
	SHB-78a-26	6962	31-32.5	alluvium	Sandy Clay	CL	7				39	22		78	91	100		26								Central
	SHB-78a-26	6962	32-34	alluvium	Sandy Clay	CL	7	0.55										22								Central
	SHB-78a-26	6962	34-36.5	alluvium	Sandy Clay	CL		0.92										20	110							Central
	SHB-78a-26	6962	36.5-37.5	alluvium	Sandy Clay	CL	14											22								Central
	SHB-78a-27	6957	3.5-5	alluvium	Silty Clay	CL	10											20								Central
	SHB-78a-27	6957	5-10.5	alluvium	Silty Clay	CL	13											17	95							Central
	SHB-78a-27	6957	9.5-11	alluvium	Silty Clay	CL	3				37	15		86	95			29								Central
	SHB-78a-27	6957	14.5-15.5	alluvium	Silty Clay	CL	16				42	21		66	78	92	94	24	94							Central
	SHB-78a-27	6957	19.5-21	alluvium	Silty Clay	CL	2				31	11		89	98			31								Central
	SHB-78a-27	6957	25-30.5	alluvium	Silty Clay	CL	7											27	94							Central
	SHB-78a-27	6957	30.5-35	alluvium	Silty Clay	CL	8											25								Central
	SHB-78a-27	6957	35-40.5	alluvium	Silty Clay	CL	20											22	100							Central
	SHB-78a-27	6957	40.5-45	alluvium	Silty Clay	CL	7											22								Central
	SHB-78a-27	6957	44.5-45.5	alluvium	Silty Clay	CL	9				40	20		80	93			21								Central
	SHB-78a-27	6957	50.5-51	alluvium	Silty Sand	SM	3											24								Central
	SHB-78a-28	6955	4.5-6	alluvium	Silty Clay	CL	15				41	21		92	98			21	101							Central
	SHB-78a-28	6955	5.5-10	alluvium	Silty Clay	CL	19											17								Central
	SHB-78a-28	6955	10-15.5	alluvium	Silty Clay	CL	7											18	102							Central
	SHB-78a-28	6955	15.5-20	alluvium	Silty Sand	SM	15											15								Central
	SHB-78a-28	6955	20-25.5	alluvium	Silty Sand	SM	4											31	85							Central
	SHB-78a-28	6955	25.5-30	alluvium	Silty Clay	CL	3											30								Central
	SHB-78a-28	6955	30-35.5	alluvium	Silty Clay	CL	10											26	97							Central
	SHB-78a-28	6955	34.5-36	alluvium	Silty Clay	CL	3				36	16		90	98			23								Central
	SHB-78a-28	6955	40.5-45.5	alluvium	Silty Clay	CL	8											24	95							Central
	SHB-78a-28	6955	45.5-49.5	alluvium	Silty Sand	SM	19											25								Central
	SHB-78a-28	6955	49.5-49.6	sandstone	-	-	50/1"																			Central
			bulk	tailings		SM-SP						NP		5	11			18	98			90.5 / 107.8		34.5, 0.13		Central
			bulk	tailings														18	100					37, 0.22		Central
			bulk	tailings														18	102					39, 0.15		Central
	SHB-78a-52	6988	5.0-10	alluvium	Clayey Sand	SC					27	11		43	73	95	98	7								W. Borrow
	SHB-78a-52	6988	20	alluvium	Silty Clay	CL																				W. Borrow
	SHB-78a-52	6988	25	alluvium	Silty Clay	CL																				W. Borrow
	SHB-78a-52	6988	30	alluvium	Silty Sand	SM																				W. Borrow
	SHB-78a-52	6988	35	alluvium	Silty Clay	CL																				W. Borrow

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	SHB-78a-52	6988	39.5	total depth	Silty Clay	CL	-																			W. Borrow
	SHB-78a-53	6985	0	alluvium	Silty Clay	CL	5											8								
	SHB-78a-53	6985	5	alluvium	Silty Sand	SM	3											6								W. Borrow
	SHB-78a-53	6985	10	alluvium	Silty Sand	SM	7											7								W. Borrow
	SHB-78a-53	6985	15	alluvium	Silty Sand & Gravel	SM	14											6								W. Borrow
	SHB-78a-53	6985	20	alluvium	Silty Sand & Gravel	SM	14											4								W. Borrow
	SHB-78a-53	6985	25	alluvium	Silty Sand	SM	19											6								W. Borrow
	SHB-78a-53	6985	30	alluvium	Silty Sand	SM	22											9								W. Borrow
	SHB-78a-53	6985	35	alluvium	Silty Sand	SM	20											7								W. Borrow
	SHB-78a-53	6985	40	alluvium	Silty Sand & Gravel	SM	24											6								W. Borrow
	SHB-78a-53	6985	41	total depth	Silty Sand & Gravel	SM	-																			W. Borrow
	SHB-78a-54	6985	4.5-8.5	sandstone	-	-	-																			W. Borrow
	SHB-78a-55	6995	0	alluvium	Silty Sand	SM	5																			W. Borrow
	SHB-78a-55	6995	5	alluvium	Silty Sand	SM	9																			W. Borrow
	SHB-78a-55	6995	10	alluvium	Silty Sand	SM	17																			W. Borrow
	SHB-78a-55	6995	15	alluvium	Silty Sand	SM	25																			W. Borrow
	SHB-78a-55	6995	20	alluvium	Clayey Sand	SC	30																			W. Borrow
	SHB-78a-55	6995	24.5-26	alluvium	Clayey Sand	SC	41				29	14		49	72	95	98	8								W. Borrow
	SHB-78a-55	6995	30	alluvium	Silty Sand	SM	39																			W. Borrow
	SHB-78a-55	6995	35	alluvium	Silty Sand	SM	42																			W. Borrow
	SHB-78a-55	6995	40	alluvium	Silty Clay	CL	38																			W. Borrow
	SHB-78a-55	6995	45	alluvium	Silty Clay	CL	47																			W. Borrow
	SHB-78a-55	6995	50-51	alluvium	Silty Sand	SM	30																			W. Borrow
	SHB-78a-56	6993	0-4.5	sandstone	-	-																				W. Borrow
	SHB-78a-64	6973	.5-2	alluvium	Silty Sand & Gravel	SC-SM	81				23	7		46	64	87	94	7								North
	SHB-78a-64	6973	2-4.5	sandstone	-	SM						NP		27	54	64	68	7								North
	SHB-78a-64	6973	4.5-6	sandstone	-	GM	50/.5"				20	NP		25	28	46	54	5								North
	SHB-78a-68	6989	1-5.5	alluvium	Silty Sand	SM	20												5							Central
	SHB-78a-68	6989	4.5-6	alluvium	Silty Sand	SM	18				20	NP		31	48	67	74		4							Central
	SHB-78a-68	6989	9.5-11	alluvium	Silty Sand	SM	17				21	NP		40	60	70	80		6							Central
	SHB-78a-68	6989	14.5-16	alluvium	Clayey Silt	CL	88				32	12		93	95	100			9							Central
	SHB-78a-68	6989	19.5-22	Sandstone	-	-	50/3"												8							Central
	SHB-78a-68	6989	22.5-24.5	Sandstone	-	-	50/3"												9							Central
	SHB-78a-74	6963	0-10	alluvium	Silty Clay	CL					31	31		72	86	100		9								Central
	SHB-78a-76	6965	0-5	alluvium	Silty Clay	CL					33	16		71	77	100		7								Central
	SHB-78a-76	6965	5-10	alluvium	Silty Clay	CL					42	21		79	92			10								Central
	SHB-78a-76	6965	16-19.5	alluvium	Sandy Silt	ML					23	NP		52	84	100		6								Central
	SHB-78a-78	6980	6-10	alluvium	Silty Sand	SM					23	NP		48	81	98	100	7								Central
	SHB-78a-78	6980	17-20	alluvium	Clayey Sand	SC					26	9		49	67	83	87	10								Central
	SHB-78a-78	6980	22-25	alluvium	Clayey Silt	CL					33	15		75	90	99	100	15								Central
	SHB78a-81	6975	0.5-2	alluvium	Silty Clay	CL	15											7								Central
	SHB78a-81	6975	4.5-6	alluvium	Silty Clay	CL	30											9								Central
	SHB78a-81	6975	9.5-11	alluvium	Silty Sand	SM	21											4								Central
	SHB78a-81	6975	14.5-16	alluvium	Silty Sand	SM	9											7								Central
	SHB78a-81	6975	19.5-21	alluvium	Silty Clay	CL	28											10								Central
	SHB78a-81	6975	24.5-26	alluvium	Silty Sand	SM	23											5								Central
	SHB-78a-83	6985	0.5-2	alluvium	Silty Sand	SM	10											4								Central
	SHB-78a-83	6985	4.5-6	alluvium	Silty Sand	SM	20				-	NP		26	51	87	94	2								Central
	SHB-78a-83	6985	9.5-11	alluvium	Silty Sand	SM	14				-	NP		24	49	94	97	4								Central
	SHB-78a-83	6985	12-14.5	sandstone	-	-	50/1"																			Central
	SHB-78a-85	6983	0.5-2	alluvium	Silty Sand	SM	9											3								Central
	SHB-78a-85	6983	4.5-6	alluvium	Silty Clay	CL	17				33	15		60	77	100		6								Central

Table 1 - Church Rock Mill Site Impoundment - Summary of Relevant Existing Geotechnical Data for the North and Central Cells

							Field Data			Lab Data																
Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	SHB-78a-85	6983	9.5-11	alluvium	Silty Sand	SM	17					NP		34	62	94	97	3								Central
	SHB-78a-85	6983	14.5-16	alluvium	Silty Clay	CL	26				35	16		80	93	100		8								Central
	SHB-78a-85	6983	19.5-21	alluvium	Silty Clay	CL	16				34	15		74	87	98	99	8								Central
	SHB-78a-85	6983	24.5-26	alluvium	Silty Sand	SM	23											4								Central
	SHB-78a-85	6983	29.5-31	alluvium	Silty Clay	CL	21											7								Central
SHB, 1978b	SHB78b-1	6996	0	alluvium	Sandy Silt	ML	32																			Central
	SHB78b-1	6996	5	alluvium	Sandy Silt	ML	14				26	NP		54	85	98	100	6								Central
	SHB78b-1	6996	10	alluvium	Sandy Silt	ML	24																			Central
	SHB78b-1	6996	15	sandstone	-	-	50/0.5"																			Central
	SHB78b-1	6996	20	sandstone	-	-	50/1"																			Central
	SHB78b-1	6996	25	Shale	-	-	50/2"																			Central
	SHB78b-2	6990	0	alluvium	Sandy Clay	CL	7																			Central
	SHB78b-2	6990	5	alluvium	Sandy Clay	CL	36																			Central
	SHB78b-2	6990	10	alluvium	Sandy Clay	CL	37				25	10		53	72	90	95	7								Central
	SHB78b-2	6990	15	alluvium	Silty Sand	SM	17																			Central
	SHB78b-2	6990	20	alluvium	Silty Sand	SM-SC	15																			Central
	SHB78b-2	6990	25	alluvium	Clayey Sand	SC	10																			Central
	SHB78b-2	6990	30	alluvium	Clayey Sand	SC	18																			Central
	SHB78b-3	6991	0	alluvium	Sandy Clay	CL	8																			Central
	SHB78b-3	6991	5	alluvium	Sandy Clay	CL	32																			Central
	SHB78b-3	6991	10	alluvium	Sandy Clay	CL	24																			Central
	SHB78b-3	6991	15	alluvium	Silty Sand	SM	15				-	NP		48	91	100		5								Central
	SHB78b-3	6991	20	alluvium	Silty Sand	SM	18																			Central
	SHB78b-3	6991	25	alluvium	Sandy Clay	CL	20																			Central
	SHB78b-3	6991	30	alluvium	Silty Sand	SM	27																			Central
	SHB78b-4	6994	0	alluvium	Sandy Clay	CL	10																			Central
	SHB78b-4	6994	5	alluvium	Sandy Clay	CL	40				34	16		79	95	100		8								Central
	SHB78b-4	6994	10	alluvium	Silty Sand	SM	11																			Central
	SHB78b-4	6994	15	alluvium	Silty Sand	SM	12																			Central
	SHB78b-4	6994	25	alluvium	Silty Sand	SM-SC	21																			Central
	SHB78b-4	6994	30	alluvium	Clayey Sand	SC	33																			Central
	SHB78b-5	6998	0	alluvium	Clayey Sand	SC	7																			Central
	SHB78b-5	6998	5	alluvium	Sandy Clay	CL	39				32	15		76	91	100		7								Central
	SHB78b-5	6998	10	alluvium	Sandy Clay	CL	21																			Central
	SHB78b-5	6998	15	alluvium	Sandy Clay	CL	16				30	13		62	80	100		8								Central
	SHB78b-5	6998	20	alluvium	Sandy Clay	CL	19																			Central
	SHB78b-5	6998	25	alluvium	Sandy Clay	CL	29																			Central
	SHB78b-5	6998	30	alluvium	Silty Sand	SM-SC	24																			Central
	SHB78b-6	7002	0	alluvium	Sandy Clay	CL-ML	10																			Central
	SHB78b-6	7002	5	alluvium	Sandy Clay	CL-ML	12				24	5		61	84	98	100	5								Central
	SHB78b-6	7002	10	alluvium	Silty Sand	SM	38																			Central
	SHB78b-6	7002	15	alluvium	Clayey Sand	SC	15																			Central
	SHB78b-6	7002	20	alluvium	Clayey Sand	SC	55																			Central
	SHB78b-6	7002	25	alluvium	Silty Sand	SM-SC	31																			Central
	SHB78b-6	7002	30	alluvium	Silty Sand	SM-SC	19																			Central
	SHB78b-7	6987	0	alluvium	Sandy Clay	CL	23																			Central
	SHB78b-7	6987	5	alluvium	Sandy Clay	CL	44																			Central
	SHB78b-7	6987	10	alluvium	Silty Sand	SM	18				23	NP		44	85	99		5								Central
	SHB78b-7	6987	15	alluvium	Silty Sand	SM	26																			Central
	SHB78b-7	6987	20	alluvium	Sandy Clay	CL	56																			Central
	SHB78b-7	6987	25	alluvium	Silty Sand	SM	23																			Central
	SHB78b-7	6987	30	alluvium	Clayey Sand	SM	53																			Central

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Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	SHB78b-7	6987	35	alluvium	Silty Sand	SM-SC	35																			Central
	SHB78b-7	6987	40	alluvium	Silty Sand	SM-SC	72																			Central
	SHB78b-7	6987	45	alluvium	Silty Sand	SM-SC	26																			Central
	SHB78b-7	6987	50	alluvium	Silty Sand	SM-SC	40																			Central
	SHB78b-7	6987	55	alluvium	Silty Sand	SM-SC	21																			Central
	SHB78b-7	6987	60	alluvium	Silty Sand	SM-SC	37																			Central
	SHB78b-8	6985	0	alluvium	Sandy Clay	CL	10																			Central
	SHB78b-8	6985	5	alluvium	Silty Sand	SM	14																			Central
	SHB78b-8	6985	10	alluvium	Silty Sand	SM	16																			Central
	SHB78b-8	6985	15	alluvium	Silty Sand	SM	14																			Central
	SHB78b-8	6985	20	alluvium	Silty Clay	CL	18																			Central
	SHB78b-8	6985	25	alluvium	Silty Clay	CL	21				33	14		94	99			13								Central
	SHB78b-8	6985	30	alluvium	Silty Sand	SM	42																			Central
	SHB78b-9	7007	0	alluvium	Silty Sand	SM-SC	27																			Central
	SHB78b-9	7007	5	alluvium	Clay	CH	48																			Central
	SHB78b-9	7007	10	alluvium	Silty Sand	CL	50				42	18		93	94	98	100	11								Central
	SHB78b-9	7007	15	shale	Silty Sand	CL	27																			Central
	SHB78b-10	7000	0	alluvium	Silty Sand	SM	9																			Central
	SHB78b-10	7000	5	alluvium	Silty Sand	SM	2																			Central
	SHB78b-10	7000	10	alluvium	Silty Sand	SM	18				-	NP		22	43	69	87	4								Central
	SHB78b-10	7000	15	alluvium	Silty Sand	SM	12																			Central
	SHB78b-10	7000	20	sandstone	-	-	100/1"																			Central
	SHB78b-18	7018	0	alluvium	Silty Sand	SM	8																			E. Borrow
	SHB78b-18	7018	4.5	alluvium	Sandy Clay	CL	14				26	11		52	79	95	99	4								E. Borrow
	SHB78b-18	7018	12	alluvium	Clay	CH	41																			E. Borrow
	SHB78b-18	7018	14.5	shale	-	-	100/6				32	11		92	98	100		38								E. Borrow
	SHB78b-18	7018	20	shale	-	-	100/8"																			E. Borrow
	SHB78b-18	7018	25	shale	-	-	100/5"																			E. Borrow
	SHB78b-19	7032	0	alluvium	Silty Sand	SM	7																			E. Borrow
	SHB78b-19	7032	4.5	alluvium	Silty Sand	SM	24				22	NP		41	64	88	94	5								E. Borrow
	SHB78b-19	7032	9	sandstone	-	-	100/0"																			E. Borrow
	SHB78b-20	7053	3	sandstone	Silty Sand	SM-SC	9																			E. Borrow
	SHB78b-28	7052	0	alluvium	Silty Sand	SM	27																			E. Borrow
	SHB78b-28	7052	7	sandstone	-	-	100/8"																			E. Borrow
	SHB78b-30	7045	0	alluvium	Sandy Clay	CL	15																			E. Borrow
	SHB78b-30	7045	4.5	alluvium	Sandy Clay	CL	39				27	11		55	73	86	92	8								E. Borrow
	SHB78b-30	7045	7	sandstone	-	-	100/0"																			E. Borrow
	SHB78b-30	7045	15	sandstone	-	-	100/0"																			E. Borrow
	SHB78b-31	7016	0	alluvium	Silty Sand	SM-SC	6																			E. Borrow
	SHB78b-31	7016	5	alluvium	Silty Sand	SM	16																			E. Borrow
	SHB78b-31	7016	9.5	alluvium	Sandy Clay	CL	42				26	11		52	83	99	100	5								E. Borrow
	SHB78b-31	7016	15	alluvium	Sandy Clay	CL	26																			E. Borrow
	SHB78b-31	7016	20	alluvium	Silty Sand	SM	35																			E. Borrow
	SHB78b-31	7016	25	alluvium	Silty Sand	SM	35																			E. Borrow
	SHB78b-31	7016	30	alluvium	Silty Clay	CL	43																			E. Borrow
	SHB78b-32	7023	0	alluvium	Silty Sand	SM-SC	7																			E. Borrow
	SHB78b-32	7023	4.5	alluvium	Silty Sand	SM	13				-	NP		29	70	100										E. Borrow
	SHB78b-32	7023	10	alluvium	Sandy Clay	CL-ML	23																			E. Borrow
	SHB78b-32	7023	15	alluvium	Sandy Clay	CL-ML	26																			E. Borrow
	SHB78b-32	7023	20	alluvium	Sandy Clay	CL-ML	26																			E. Borrow
	SHB78b-32	7023	24.5	alluvium	Sandy Clay	CL-ML	50				25	6		61	92	100		6								E. Borrow

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Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	SHB78b-32	7023	30	alluvium	Sandy Clay	CL-ML	50																			E. Borrow
	SHB78b-33	7025	0	alluvium	Silty Sand	SM-SC	7																			E. Borrow
	SHB78b-33	7025	4.5	alluvium	Sandy Clay	CL	19				27	9		51	77	100		7								E. Borrow
	SHB78b-33	7025	10	alluvium	Silty Sand	SM	19																			E. Borrow
	SHB78b-33	7025	14.5	alluvium	Silty Sand	SM	32				21	NP		47	86	100		5								E. Borrow
	SHB78b-33	7025	20	alluvium	Clayey Silt	ML	16																			E. Borrow
	SHB78b-33	7025	25	alluvium	Clayey Silt	ML	50																			E. Borrow
	SHB78b-34	7037	0	alluvium	Silty Sand	SM	10																			E. Borrow
	SHB78b-34	7037	5	alluvium	Clayey Silt	ML	15																			E. Borrow
	SHB78b-34	7037	10	alluvium	Silty Sand	SM-SC	39																			E. Borrow
	SHB78b-34	7037	14.5	alluvium	Silty Sand	SM-SC	12				18	NP		40	69	98	98	5								E. Borrow
	SHB78b-34	7037	20	alluvium	Silty Sand	SM-SC	40																			E. Borrow
	SHB78b-34	7037	25	alluvium	Silty Sand	SM	23																			E. Borrow
	SHB78b-34	7037	30	alluvium	Clayey Silt	ML-CL	20																			E. Borrow
SHB, 1979	SHB-79-9	6967	0	alluvium	Sandy Clay	CL	11											19								North
	SHB-79-9	6967	5	alluvium	Clayey Sand	SC	59											12								North
	SHB-79-9	6967	10	alluvium	Clayey Sand	SC	85																			North
	SHB-79-9	6967	15	alluvium	Silty Sand	SM	27											11								North
	SHB-79-9	6967	20	alluvium	Silty Sand	SM	11											5								North
	SHB-79-9	6967	25	alluvium	Clay	CH	11											21								North
	SHB-79-9	6967	30	alluvium	Clay	CH	31																			North
	SHB-79-9	6967	35	alluvium	Clay	CH	13											26								North
	SHB-79-9	6967	40	alluvium	Clay	CH	6											31								North
	SHB-79-9	6967	45	alluvium	Clayey Sand	SC	12											21								North
	SHB-79-9	6967	50	sandstone	-	-	17											19								North
	SHB-79-9	6967	55	sandstone	-	-	50/0"																			North
	SHB-79-10	6967	0	alluvium	Sandy Clay	CL	33											12								North
	SHB-79-10	6967	5	alluvium	Silty Sand	SC-SM	42											14								North
	SHB-79-10	6967	10	alluvium	Silty Sand	SC	54																			North
	SHB-79-10	6967	15	alluvium	Clayey Sand	SC	29											14								North
	SHB-79-10	6967	20	alluvium	Clayey Sand	SC	26																			North
	SHB-79-10	6967	25	sandstone	-	-	50/0"																			North
	SHB-79-11	6967	30	sandstone	-	-																				North
	SHB-79-12	6968	0	alluvium	Clayey Sand	SC	46																			Central
	SHB-79-12	6968	5	tailings	Sand	SP	11																			Central
	SHB-79-12	6968	10	tailings	Sand	SP	5																			Central
	SHB-79-12	6968	15	tailings	Sand	SP	2																			Central
	SHB-79-12	6968	20	tailings	Sand	SP	1																			Central
	SHB-79-12	6968	25	tailings	Sand	SP	12																			Central
	SHB-79-12	6968	30	tailings	Sand	SP	9																			Central
	SHB-79-12	6968	35	tailings	Sand	SP	13																			Central
	SHB-79-12	6968	40	alluvium	Clay	CH	16																			Central
	SHB-79-12	6968	45	alluvium	Sand	SP	5																			Central
	SHB-79-12	6968	50	alluvium	Silty Sand	SM-SC	8																			Central
	SHB-79-12	6968	55	alluvium	Sandy Clay	CL	6																			Central
	SHB-79-13	6968	0	alluvium	Clayey Sand	SC	35																			Central
	SHB-79-13	6968	5	alluvium	Clayey Sand	SC	7																			Central
	SHB-79-13	6968	10	Tailings	Sand	SP-SC	4																			Central
	SHB-79-13	6968	15	Tailings	Sand	SP-SC	1																			Central
	SHB-79-13	6968	20	Tailings	Sand	SP-SC	1																			Central
	SHB-79-13	6968	25	Tailings	Sand	SP-SC	1																			Central
	SHB-79-13	6968	30	Tailings	Sand	SP-SC	10																			Central

Table 1 - Church Rock Mill Site Impoundment - Summary of Relevant Existing Geotechnical Data for the North and Central Cells

							Field Data			Lab Data																
Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	SHB-79-13	6968	35	Tailings	Sand	SP-SC	19																			Central
	SHB-79-13	6968	40	alluvium	Clay	CH	8																			Central
	SHB-79-13	6968	45	alluvium	Silty Sand	SM	9																			Central
	SHB-79-14	6968	0	alluvium	Clay	CH	15											17								North
	SHB-79-14	6968	5	tailings	Sand	SP-SC	4											15								North
	SHB-79-14	6968	10	tailings	Sand	SP-SC	2											22								North
	SHB-79-14	6968	15	tailings	Sand	SP-SC	8											41								North
	SHB-79-14	6968	20	tailings	Sand	SP-SC	10											34								North
	SHB-79-14	6968	25	alluvium	Sandy Clay	CL	5											36								North
	SHB-79-14	6968	30	alluvium	Clayey Sand	SC	5											24								North
	SHB-79-14	6968	35	alluvium	Clayey Sand	SC	7											26								North
	SHB-79-14	6968	40	alluvium	Clay	CH	8											9								North
	SHB-79-14	6968	45	alluvium	Clay	CH	23											32								North
	SHB-79-15	6966	0	alluvium	Clayey Sand	SC	26											12								North
	SHB-79-15	6966	5	tailings	Sand	SP-SC	6											12								North
	SHB-79-15	6966	10	tailings	Sand	SP-SC	1																			North
	SHB-79-15	6966	15	tailings	Sand	SP-SC	2											45								North
	SHB-79-15	6966	20	alluvium	Sand	SP-SC	6											36								North
	SHB-79-15	6966	25	alluvium	Sand	SP-SC	6											28								North
	SHB-79-15	6966	30	alluvium	Sand	SP-SC	2											21								North
	SHB-79-15	6966	35	alluvium	Sand	SP-SC	4											22								North
	SHB-79-15	6966	40	alluvium	Sand	SP-SC	8											23								North
	SHB-79-15	6966	45	alluvium	Clay	CH	11											29								North
	SHB-79-16	6968	0	alluvium	Clayey Sand	SC	50/.5"											8								North
	SHB-79-16	6968	5	sandstone	-	-	50/2"											6								North
	SHB-79-17	6967	0	alluvium	Silty Sand	SM-SC	24																			Central
	SHB-79-17	6967	5	alluvium	Silty Sand	SM-SC	17																			Central
	SHB-79-17	6967	10	tailings	Sand	SP-SC	50/5"																			Central
	SHB-79-18	6967	0	alluvium	Silty Sand	SM-SC	57																			Central
	SHB-79-18	6967	5	alluvium	Silty Sand	SM-SC	8																			Central
	SHB-79-18	6967	10	tailings	Sand	SP-SC	4																			Central
	SHB-79-18	6967	15	tailings	Sand	SP-SC	19																			Central
	SHB-79-18	6967	20	tailings	Sand	SP-SC	11																			Central
	SHB-79-18	6967	25	tailings	Sand	SP-SC	27																			Central
	SHB-79-18	6967	30	tailings	Sand	SP-SC	9																			Central
	SHB-79-18	6967	35	tailings	Sand	SP-SC	10																			Central
	SHB-79-18	6967	40	tailings	Sand	SP-SC	19																			Central
	SHB-79-18	6967	45	tailings	Sand	CH	75																			Central
CSI, 1980	DH-1	7016	4	alluvium	Sandy Clayey Silt to Clayey Silty Sand	SM-SL	14																			E. Borrow
	DH-1	7016	6	alluvium		SM-SL	18																			E. Borrow
	DH-1	7016	8	alluvium		SM-SL	13																			E. Borrow
	DH-1	7016	12	alluvium	Sandy Clayey Silt	ML	13											6.1	91	X						E. Borrow
	DH-1	7016	15	alluvium	Sandy Clayey Silt	ML	18											5.2	82							E. Borrow
	DH-1	7016	19	alluvium	Sandy Clayey Silt	ML				2.65								5.5	88	C						E. Borrow
	DH-1	7016	20	alluvium	Sandy Clayey Silt	ML	18											5.5	85				CU			E. Borrow
	DH-1	7016	21	alluvium	Sandy Clayey Silt	ML												5.2	84							E. Borrow
	DH-1	7016	24	alluvium	Sandy Clayey Silt	ML	17																			E. Borrow
	DH-1	7016	29	alluvium	Sandy Clayey Silt	ML	19																			E. Borrow
	DH-1	7016	34	alluvium	Sandy Clayey Silt	ML																				E. Borrow
	DH-1	7016	39	alluvium	Sandy Clayey Silt	ML	22																			E. Borrow
	DH-1	7016	70	alluvium	Sandy Clayey Silt	ML	27																			E. Borrow
	DH-2	7082	2	alluvium	Sandy Silt	ML												18.4	101							S. Central

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Report Reference	Boring no.	Surf. Elev. (ft)	Sample Depth (ft)	Formation	Material Type	USCS	SPT (bpf)	Torvane (tsf)	Perm (ft/year)	SG	LL (%)	PI (%)	(%) p.001 mm	(%) p.200	(%) p. 100	(%) p. No.10	(%) p. No.4	w.c. (%)	Dry Density (pcf)	Consol	Std. Proctor	rel. density (pcf) min-max	Triax.	Dir. Shear (phi, c (ksf)	Perm (ft/year)(1)	Location
	DH-2	7082	5	alluvium	Sandy Silt	ML	6											5.3	78							S. Central
	DH-2	7082	6	alluvium	Sandy Silt	ML												4.5	93				UU			S. Central
	DH-2	7082	8	alluvium	Sandy Silt	ML	8											4.6	88							S. Central
	DH-2	7082	11	alluvium	Sandy Silt	ML	17											4.9	105							S. Central
	DH-2	7082	15	alluvium	Sandy Silt	ML	17											7.8	88							S. Central
	DH-2	7082	22	sandstone	Silty Sand	-	50/1"																			S. Central
	DH-2	7082	25	sandstone	-	-	50/1"																			S. Central
	DH-2	7082	30	sandstone	-	-	50/1"																			S. Central
	DH-3	7043	2	alluvium		SM-ML								37	76		100	11.7	105	C						E. Borrow
	DH-3	7043	5	alluvium	Sandy Clayey Silt to	SM-ML	12			2.66								6.5	97	S						E. Borrow
	DH-3	7043	6	alluvium	Clayey Silty Sand	SM-ML	12																			E. Borrow
	DH-3	7043	8	alluvium		SM-ML	13																			E. Borrow
	DH-3	7043	12	alluvium	Sandy Clayey Silt	ML	9						24	87	96		99	9.4	90							E. Borrow
	DH-3	7043	13	alluvium	Sandy Clayey Silt	ML												7.1	83	C						E. Borrow
	DH-3	7043	16	alluvium	Sandy Clayey Silt	ML	10											5.8	94							E. Borrow
	DH-3	7043	20	alluvium	Sandy Clayey Silt	ML	11							37	66		90	5.5	103				CU		416	E. Borrow
	DH-3	7043	25	alluvium	Sandy Clayey Silt	ML	14											6.1	87							E. Borrow
	DH-3	7043	26	alluvium	Sandy Clayey Silt	ML												5.4	88				UU			E. Borrow
	DH-3	7043	29	alluvium	Sandy Clayey Silt	ML							14	55	91		100									E. Borrow
	DH-3	7043	31	alluvium	Sandy Clayey Silt	ML	12											6.5	90							E. Borrow
	DH-3	7043	35	alluvium	Sandy Clayey Silt	ML	16																			E. Borrow
	DH-3	7043	46	total depth	Sandy Silt to Silty Sand	SM-ML	46																			E. Borrow
	DH-4	7019	4	alluvium	Silty Sand to Sandy Silt	SM-ML	50																			S. Central
	DH-4	7019	6	siltstone	-	-	50																			S. Central
	DH-4	7019	8	siltstone	-	-	50																			S. Central
	DH-4	7019	10	siltstone	-	-	100																			S. Central
	DH-4	7019	15	siltstone	-	-	50																			S. Central
	DH-4	7019	20	siltstone	-	-	50																			S. Central
	DH-4	7019	25	siltstone	-	-	50																			S. Central
	DH-4	7019	29	sandstone	-	-	100																			S. Central
	DH-4	7019	40	total depth	-	-	100																			S. Central
	DH-6	7012	4	alluvium	Sandy Clayey Silt	ML	17																			W. Borrow
	DH-6	7012	6	alluvium	Sandy Clayey Silt	ML	50																			W. Borrow
	DH-6	7012	8	alluvium	Sandy Clayey Silt	ML	50																			W. Borrow
	DH-6	7012	10	alluvium	Sandy Clayey Silt	ML	50																			W. Borrow
	DH-6	7012	15	siltstone	-	-	50																			W. Borrow
	DH-6	7012	20	siltstone	-	-	50																			W. Borrow
	DH-6	7012	25	siltstone	-	-	100																			W. Borrow
	DH-6	7012	30	siltstone	-	-	100																			W. Borrow
	DH-6	7012	40	total depth	-	-	100																			W. Borrow
	DH-7	7022	4	alluvium	Clayey Silt to Sandy Clayey Silt	ML	50																			W. Borrow
	DH-7	7022	6	siltstone	-	-	50																			W. Borrow
	DH-7	7022	9	siltstone	-	-	50																			W. Borrow
	DH-7	7022	11	siltstone	-	-	50																			W. Borrow
	DH-7	7022	15	siltstone	-	-	50																			W. Borrow
	DH-7	7022	20	sandstone	-	-	50																			W. Borrow
	DH-7	7022	25	siltstone	-	-	50																			W. Borrow
	DH-7	7022	30	siltstone	-	-	50																			W. Borrow
	DH-7	7022	40	siltstone	-	-	50																			W. Borrow
	DH-7	7022	50	total depth	-	-	50																			W. Borrow
	DH-8	6998	4	alluvium	Clayey Silt	ML-CL	50																			W. Borrow

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	DH-8	6998	6	alluvium	Clayey Silt	ML-CL	50																			W. Borrow
	DH-8	6998	8	siltstone	-		50																			W. Borrow
	DH-8	6998	11	siltstone	-		50																			W. Borrow
	DH-8	6998	15	siltstone	-		50																			W. Borrow
	DH-8	6998	20	shale	-		X																			W. Borrow
	DH-8	6998	25	siltstone	-		100																			W. Borrow
	DH-8	6998	30	siltstone	-		50																			W. Borrow
	DH-8	6998	40	siltstone	-		50																			W. Borrow
	DH-8	6998	50	total depth	-		50																			W. Borrow
Canonie, 1986	658	6976	7.5-10	tailings	Fine					2.81								17.4	88							Central
&1991	658		12.5-15	tailings						-								21.5	105	0.018						Central
	658		17.5-20	tailings	Fine/Coarse mixed					2.83								23.5	104							Central
	658		27.5-30	tailings	Coarse					2.81								23.4	98							Central
	658		30-32.5	tailings	Coarse					-								43.6	97	0.055						Central
	658		37.5-40	tailings	Coarse					2.89								31.2	92							Central
	659	6990	7.5-10	tailings	Coarse					2.84								6.1	95							Central
	659		17.5-20	tailings	Coarse					2.83								10.5	94							Central
	659		27.5-30	tailings	Coarse					2.74								13.1	97							Central
	659		30-32.5	tailings	Coarse					-								32	106	0.022						Central
	659		35-37.5	tailings	Fine/Coarse mixed					2.72								29.6	78							Central
	660	6975	8	tailings	Fine					2.81								44.2	74							Central
	660		12.5-15	tailings	Fine					2.84								60	94							Central
	660		25-27.5	tailings	Fine					2.75								32.2	89	sample disturbed						Central
	660		35-37.5	tailings	Fine					2.84								41.4	79							Central
	660		38	tailings	Fine													44.5	73	Cc=1.0						Central
	662	6957	17.5-20	tailings	Sandy, coarse													34.1	97	Cc=0.043						South
	662		25	tailings	Coarse					2.78								25.1	96							South
	662		30	tailings	Coarse					2.79								29.6	94							South
	662		32.5	tailings	Coarse					-								34.1	97							South
	662		37.5-40	tailings	Fine					2.72								36.4	84	0.068						South
	662		40-42.5	tailings	Fine/Coarse mixed					-								43.8	89	0.082						South
Canonie, 1993	5M		5-5.8	tailings	Coarse					2.63			5	20	28	100		8.5	90							Central
	5M		6.8-7.5	tailings	Coarse					2.65			2	11	22	100		6.4	103							Central
	9M		3.3-4	tailings	Coarse					2.68			3	9	15	100		6.9	105							Central
	9M		5-5.5	tailings	Coarse					2.68			4	15	17	100		7.1	-							Central
	9M		6.2-7	tailings	Coarse					2.65			2	10	17	100		7.1	112							Central
	9G		3.3-4	tailings	Coarse					2.68			4	18	29	100		9.8	113							Central
	9G		4-5	tailings	Coarse					2.64			2	10	20	100		7.5	-							Central
	9G		5.8-6.5	tailings	Coarse with slime					2.65			6	22	32	100		27.3	78							Central
	11M		2.5-5	tailings	Coarse					2.68			3	16	22	100		4.9	101							Central
	11M		4-5	tailings	Coarse					2.64			2	9	15	100		5	-							Central
	11M		6.4-7.5	tailings	Coarse					2.69			3	11	17	100		4.7	102							Central
	13K		3.3-4	tailings	Sand					2.67			2	8	16	100		5.2	109							Central
	13K		4-5	tailings	Sand					2.65			2	10	17	100		7.2	-							Central
	13K		5.8-6.5	tailings	Sand Trace Slime					2.64			3	10	14	100		7.8	102							Central
	17A		1.8-2.4	tailings	Coarse with clay					2.69			6	26	38	100		11.1	117							Central
	17A		3.2-4	tailings	Coarse with clay					2.63			3	21	29	100		13.4	113							Central
	17A		4-5	tailings	Coarse with slime					2.69			5	25	37	100		14.1	-							Central
	17A		5.8-6.5	tailings	Coarse with slime					2.66			6	25	36	100		13.7	115							Central
	11K		3.3-4	tailings	Coarse					2.68			3	12	18	100		10.7	101							Central
	11K		4-4.7	tailings	Fine with clay					2.66			2	12	15	100		7.0	96							Central
	11K		6.3-7	tailings	Fine with clay					2.67			5	22	29	100		9.3	95							Central

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	13G		1-1.5	tailings	Fine with slime					2.69			26	76	92	100		12.0	117							Central
	13G		3.3-4	tailings	Fine with slime					2.66			4	17	25	100		12.8	100							Central
	13G		4-4.9	tailings	Fine					2.67			3	12	41	100		8.0	101							Central
	13G		5.8-6.5	tailings	Fine					2.65			6	17	52	100		5.9	95							Central
	15C		2.9-3.6	tailings	Fine with slime					2.67			3	24	34	100		14.4	110							Central
	15C		4.1-4.8	tailings	Fine with slime					2.68			4	23	38	100		14.0	112							Central
	15C		6.3-7.0	tailings	Fine with slime					2.67			4	23	38	100		19.0	98							Central
	17I		3.0-4.1	tailings	Fine with slime					2.67			3	45	59	100		11.5	112							Central
	17I		4.1-4.8	tailings	Fine with slime					2.67			4	31	47	100		17.1	110							Central
	17I		6.1-6.8	tailings	Fine with slime					2.69			3	39	52	100		13.3	94							Central

Notes: (1) remolded to 95% of ASTM D698,
c=cohesion, UC=unconfined compression, CU=consolidated undrained
UU=unconsolidated undrained, C=collapse, S=swell, NP=non-plastic