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General Separations Area (GSA) Groundwater Flow Model Update:

Hydrostratigraphic Data

Laura A. Bagwell
Patti L. Bennett
Gregory P. Flach

February 2017

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EXECUTIVE SUMMARY

As part of the effort to update and calibrate the General Separations Area groundwater model, the hydrogeologic data constituent to the existing model were reviewed, new borehole data interpreted, and a new larger dataset created to support the model. This activity improved the resolution of the model by adding more than 200 new borehole control points and more than 600 new hydrostratigraphic interpretations ("picks") to the model dataset.

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LIST OF ABBREVIATIONS

CBCU	Crouch Branch Confining Unit
CPT	cone penetrometer test
DOE	US Department of Energy
FACT	Subsurface Flow and Contaminant Transport
GAU	Gordon Aquifer Unit
GCU	Gordon Confining Unit
GSA	General Separations Area
LAZ	Upper Three Runs Aquifer Unit – Lower Aquifer Zone
SRS	Savannah River Site
TCCZ	Tan Clay Confining Zone

1.0 Introduction

This document describes the assembly, selection, and interpretation of hydrostratigraphic data for input to an updated groundwater flow model for the General Separations Area (GSA; Figure 1) at the Department of Energy's (DOE) Savannah River Site (SRS). This report is one of several discrete but interrelated tasks that support development of an updated groundwater model (Bagwell and Flach, 2016).

2.0 Study Area and Previous Models

The GSA model area (Figure 1) is bounded by Upper Three Runs to the north, Fourmile Branch to the south, McQueen Branch to the east, and, on the west, by an arbitrary straight line connecting the northern and southern drainage boundaries. Several previous groundwater models of the GSA have been constructed; the current effort builds upon and adds hydrostratigraphic detail to previous models, especially those of Flach (2004), Flach and Harris (1997, 1999), and Smits et al. (1997).

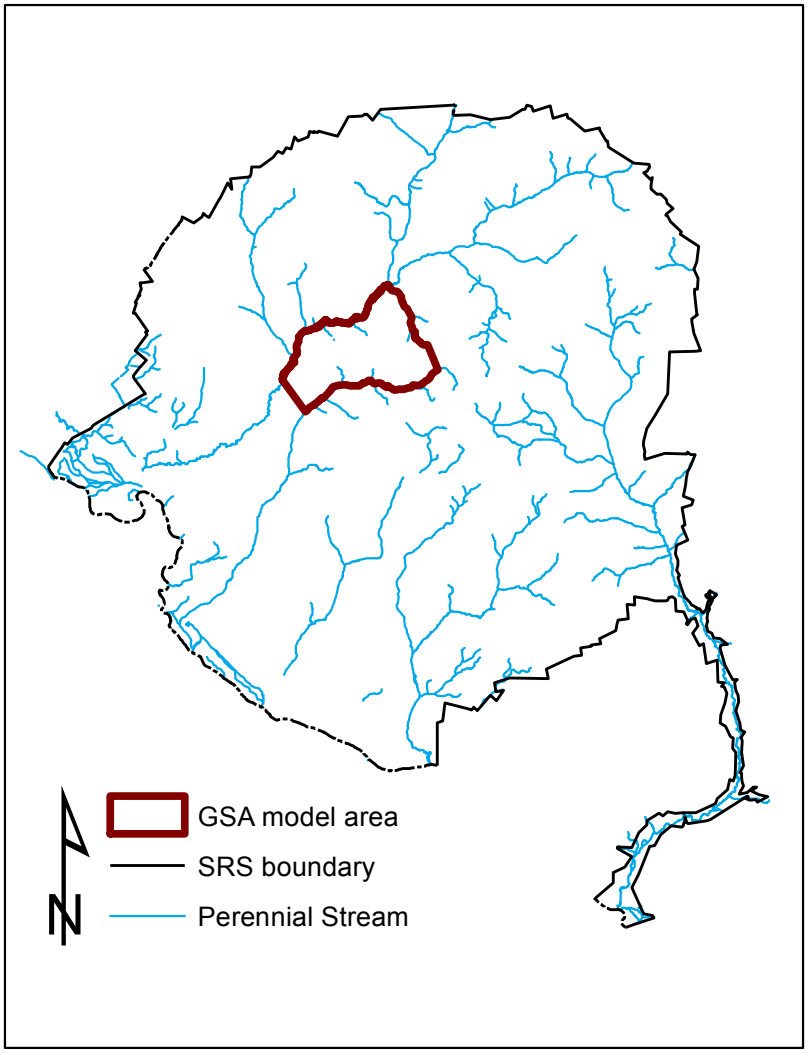


Figure 1. Map of SRS showing the GSA model area (polygon) and major streams.

3.0 Updating the Hydrostratigraphic Dataset

The original GSA/FACT groundwater model (Flach and Harris, 1997; Smits et al., 1997) incorporated hydrostratigraphic data from more than 200 core descriptions and borehole geophysical logs. The model was converted to PORFLOW (Flach, 2004) and additional water level data were subsequently added to the project database, primarily to support performance assessments and composite analyses for various facilities within the GSA study area. The baseline dataset retrieved for this effort (Flach, email communication, file "HYDRO.CSV") included more than 1300 hydrostratigraphic "picks" (elevations of multiple hydrostratigraphic surfaces) at more than 400 borehole locations (Figure 2).

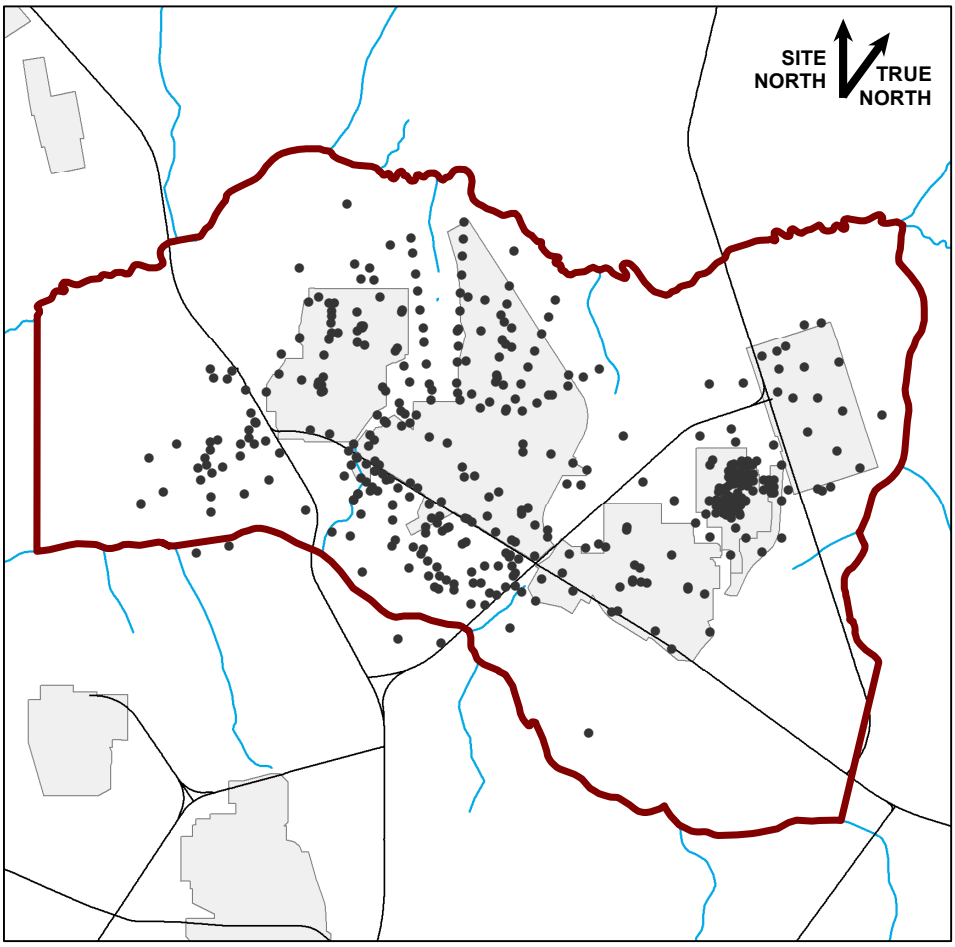


Figure 2. Map of GSA model area showing borehole locations of baseline hydrostratigraphic picks dataset.

As part of this task, new borehole data – cone penetrometer test (CPT) curves, geophysical logs, and lithologic core descriptions – throughout the model area were reviewed, down-selected, and incorporated into the hydrostratigraphic model. The goal of down-selection was to add 2-D and 3-D detail to the existing geologic model, especially in areas where borehole control points were originally sparse. New borehole data were selected primarily based on 2-D spatial distribution and on the length, depth, and continuity of borehole records available for interpretation; longer, deeper, and more continuous borehole data were preferentially selected over shorter, shallower, and less continuous data.

Although more new CPT data than geophysical or lithologic data were available for addition to the model, the down-selection process did not discriminate on this factor.

The down-selected borehole data as well as the baseline hydrostratigraphic dataset (borehole data and picks) were uploaded into the RockWorks software to create a merged dataset for interpretation. Working along section lines oriented according to geologic strike and dip (Figure 3), the new borehole data were interpreted using the baseline dataset as a guide. Elevations of five hydrostratigraphic units – Tan Clay Confining Zone (TCCZ), Lower Aquifer Zone (LAZ) of the Upper Three Runs Aquifer Unit, Gordon Confining Unit (GCU), Gordon Aquifer Unit (GAU), and Crouch Branch Confining Unit (CBCU) – were interpreted using professional judgment and the weight of all available data. Boreholes along each section line were interpreted first, followed by surrounding boreholes. Figure 4 illustrates a typical graphical interpretation and the resultant pick elevation table. Where deemed necessary, some baseline picks were adjusted. The merged and interpreted (+/- reinterpreted) dataset includes more than 600 borehole locations and more than 1900 hydrostratigraphic picks (Appendix 1), including 611 picks for the TCCZ, 576 for the LAZ, 378 for the GCU, 303 for the GAU, and 89 for the CBCU.

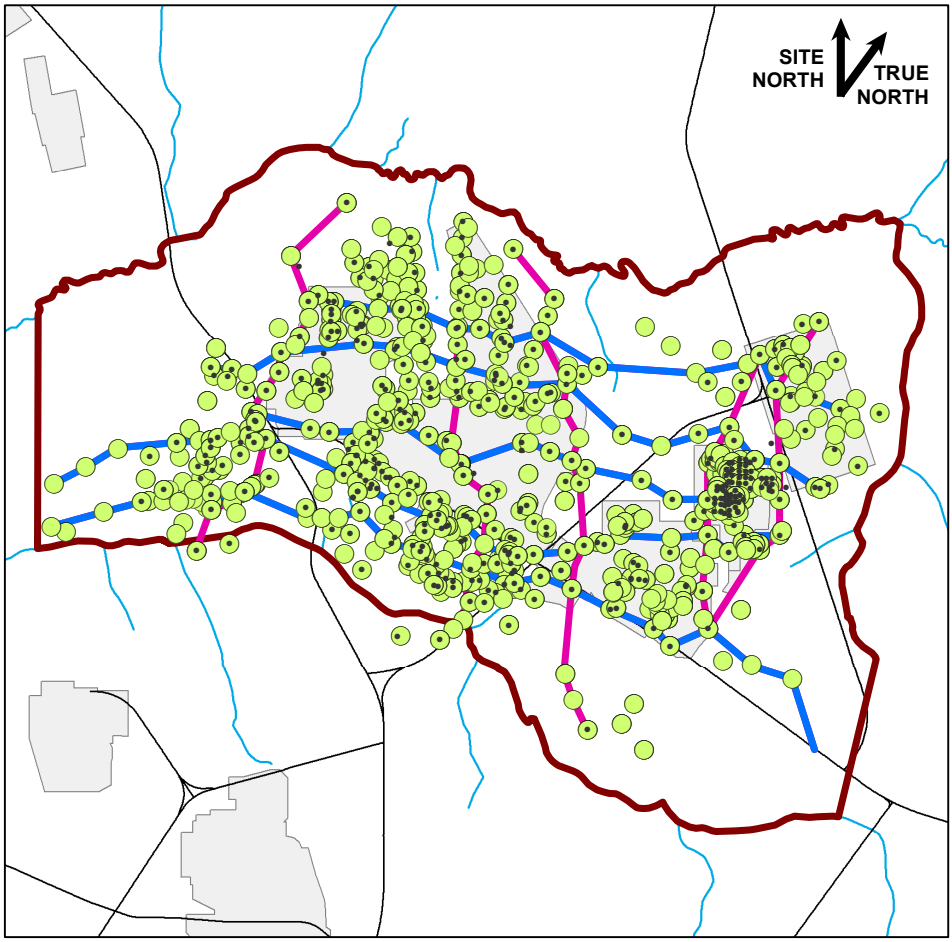
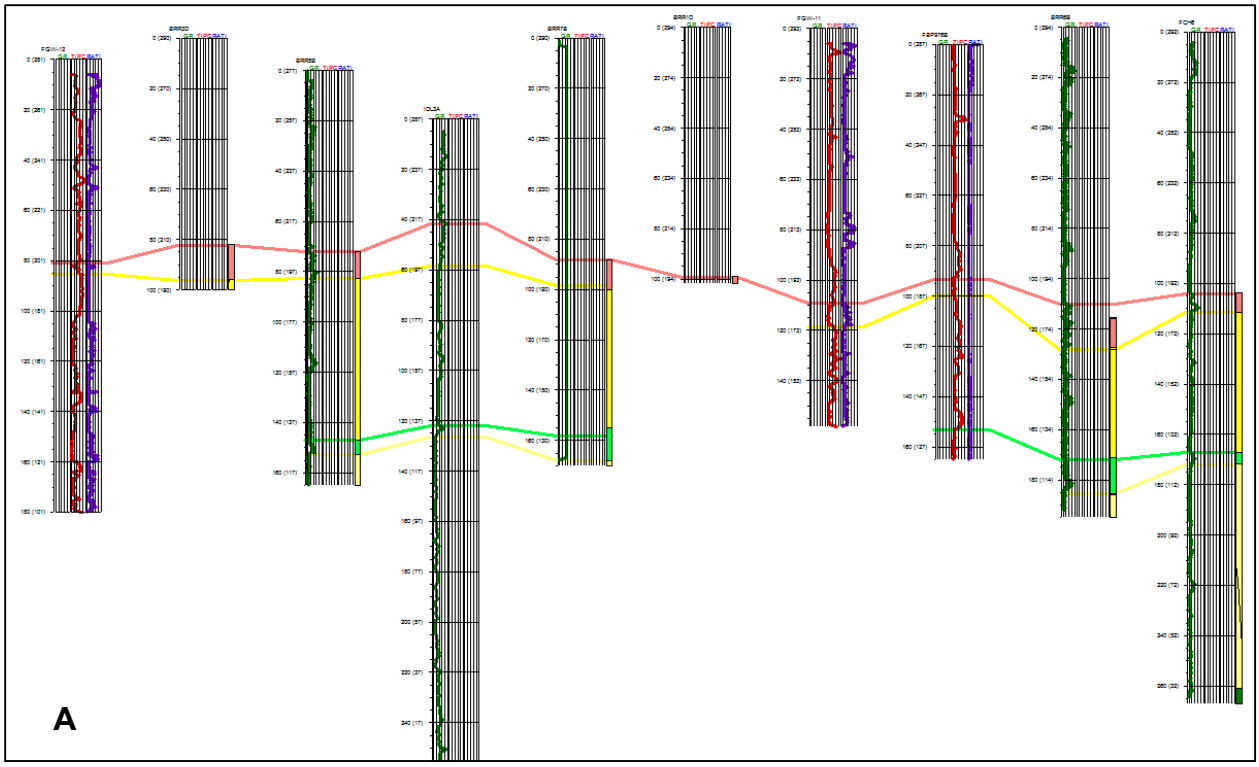
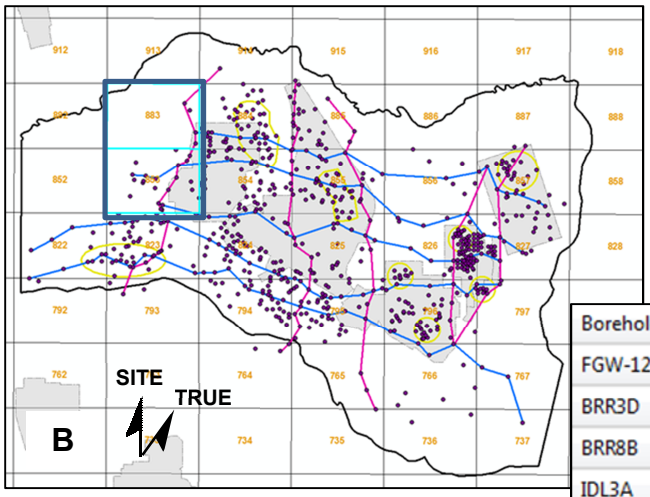


Figure 3. Map of GSA model area showing merged dataset (larger green dots), baseline dataset (smaller black dots), and lines of section.





Borehole	TCCZ Top	LAZ_UTRA	GCU Top	GAU Top	CBCU Top
FGW-12	80.85	85.37	148.28	159.96	
BRR3D	82.0	96.0			
BRR8B	72.0	82.65	146.81	152.62	
IDL3A	41.58	58.44	121.82	126.29	249.85
BRR7B	88.0	98.39	158	168.0	
BRR1D	99.0				
FGW-11	109.14	118.44			
FBP976B	93.23	99.93	152.89		
BRR6B	110	127.79	171.74	185.33	
FCH6	103.75	111.32	167.12	171.88	260.47

C

Figure 4. Typical RockWorks and ArcGIS graphical interpretation environment showing borehole data (A) for a sub-region (B) of the GSA model area and the resultant pick elevation table (C).

4.0 Creating Hydrostratigraphic Grids

Using the RockWorks software, the picks for the five hydrostratigraphic surfaces -- TCCZ, LAZ, GCU, GAU, and CBCU -- were gridded to produce altitude-contour maps (Figures 5 through 9). The cell size for each grid was 20m square. Each hydrostratigraphic surface was krigged using the RockWorks high-fidelity option. The GAU and CBCU surfaces were "pre-modeled" (in RockWorks parlance) to yield a better fit for the fewer data points at depth; the surface of the GAU was also smoothed for best fit. Appendix 2 shows the model statistics for each grid.

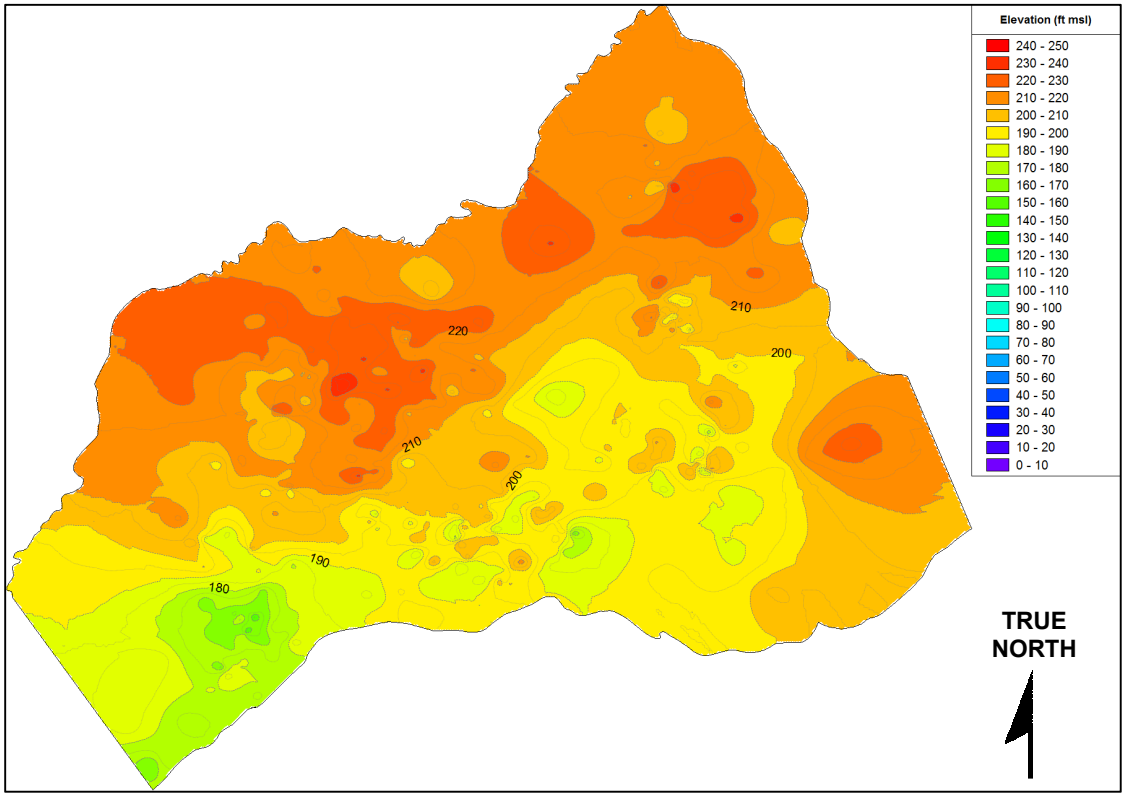


Figure 5. Altitude-contour map of the Tan Clay Confining Zone in the GSA.

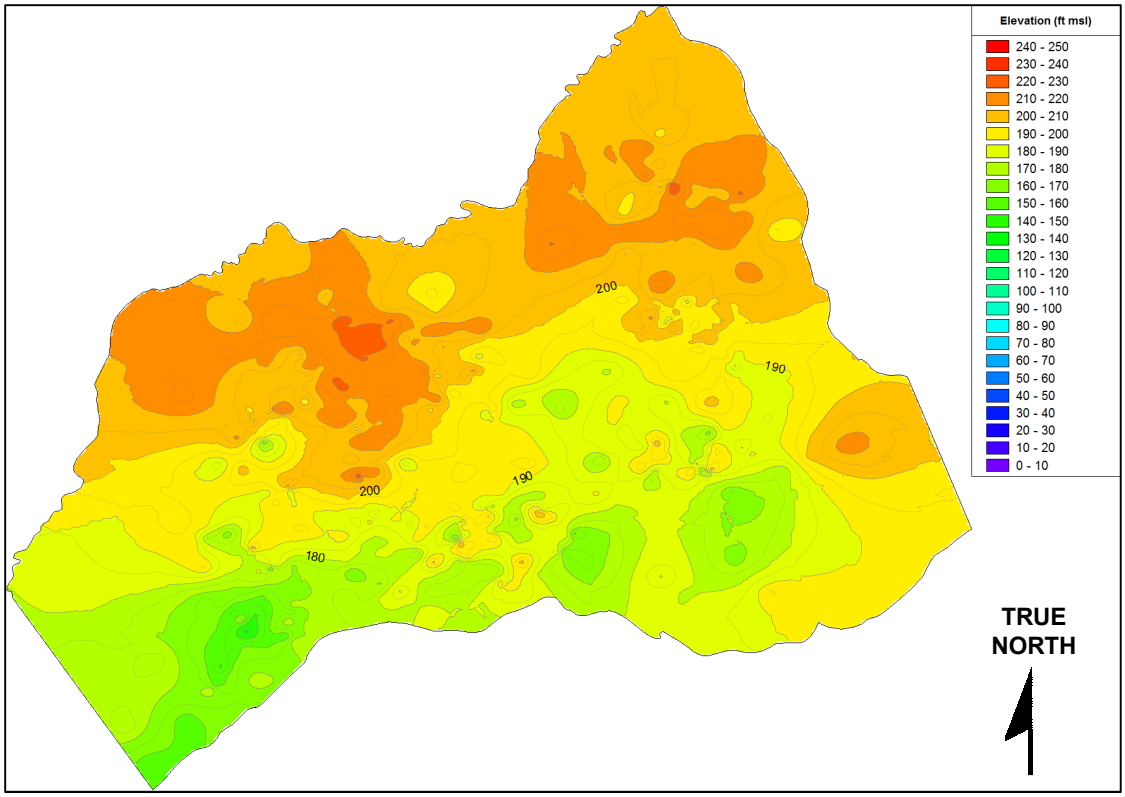


Figure 6. Altitude-contour map of the Upper Three Runs Aquifer – Lower Aquifer Zone in the GSA.

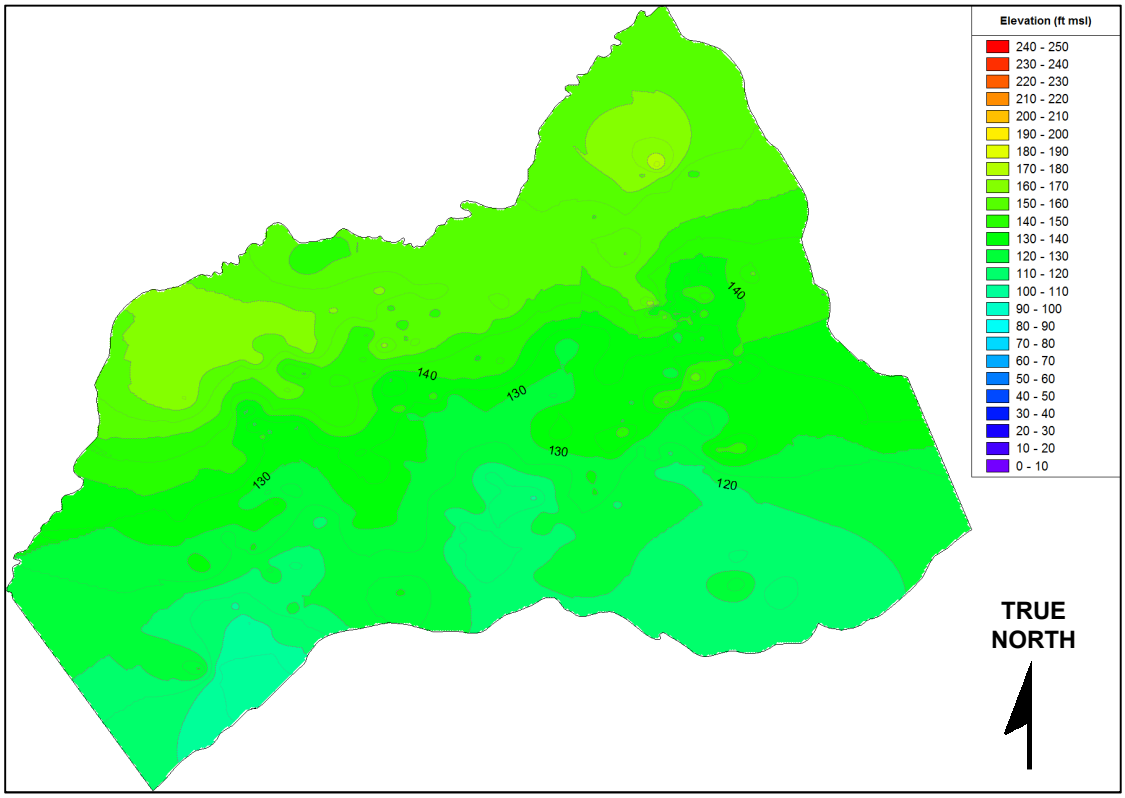


Figure 7. Altitude-contour map of the Gordon Confining Unit in the GSA.

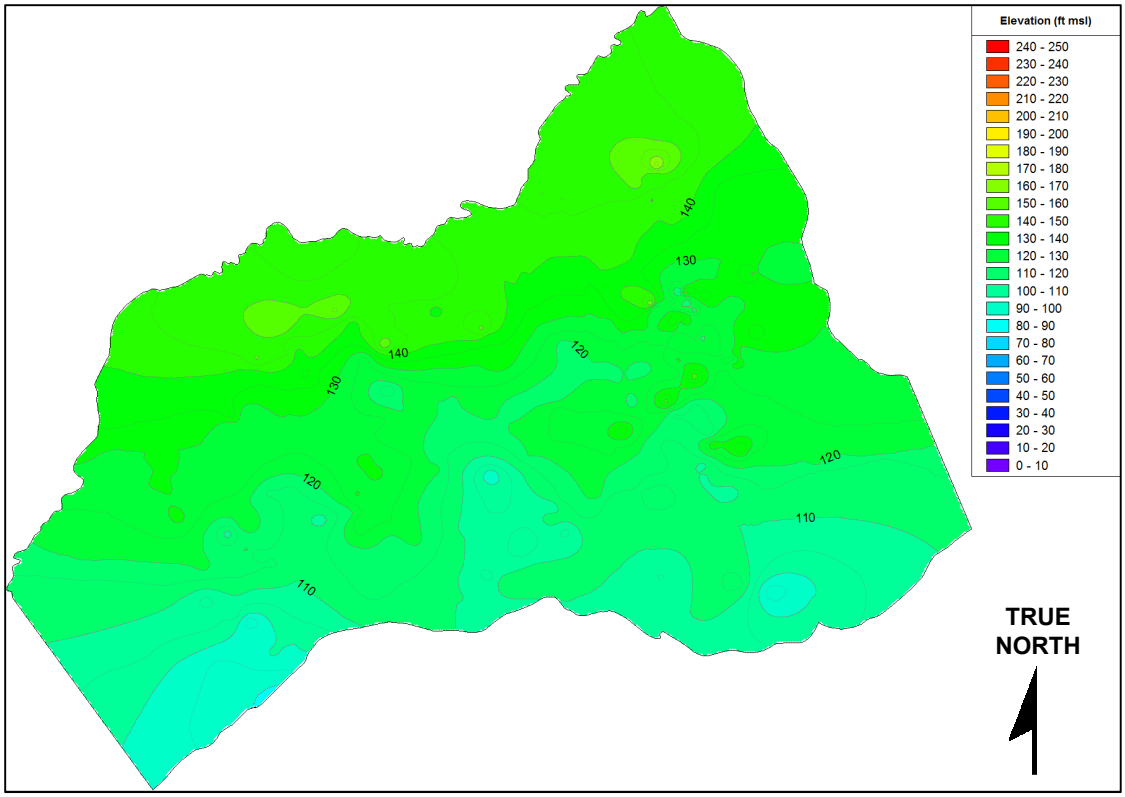


Figure 8. Altitude-contour map of the Gordon Aquifer in the GSA.

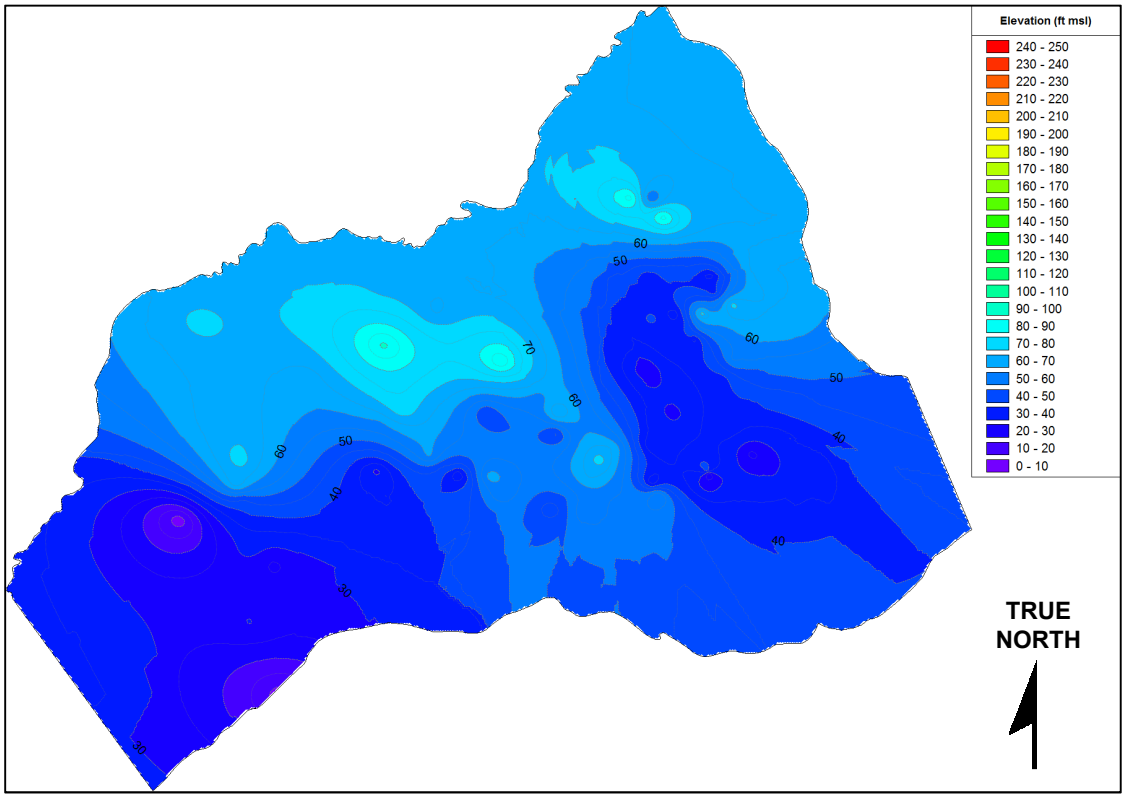


Figure 9. Altitude-contour map of the Crouch Branch Confining Unit in the GSA.

5.0 Interpolating Surface Elevations at PORFLOW Model Nodes

The gridded surfaces for each hydrostratigraphic unit were exported from RockWorks, imported into ArcGIS, and converted to raster datasets. Using the "extract" spatial analysis function in ArcGIS, the raster datasets were interpolated to calculate the hydrostratigraphic surface elevation at each of the (more than 45,000) model nodes. The resultant datasets (Bagwell, email communication, files "TCCZ_tab-delim_m_to_ft_HiFi_20160921.TXT" …) constitute the inputs for subsequent modeling in PORFLOW; that work is summarized in a separate document (Flach et al., 2017).

6.0 References

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Appendix 1. Interpreted surface elevations (picks) and calculated thicknesses for hydrostratigraphic units.

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
200FB24	223.40	218.40				5.00			
200FB25	223.50	213.40				10.10			
200FB26	225.00	210.00				15.00			
235H6C1	193.64	181.22	145.85	138.03		12.42	35.37	7.82	
244HC1	195.18	181.87	123.31			13.31	58.56		
2545HC3A	196.17	191.04	121.48	113.10		5.13	69.56	8.38	
905-5Z	225.27	215.22	149.20	143.48		10.05	66.02	5.72	
BGC1A	199.00	183.79	125.33			15.21	58.46		
BGC2A	199.80	191.80	125.30	118.00		8.00	66.50	7.30	
BGC3A	183.80	179.50				4.30			
BGO10A	209.10	207.10	131.10	124.10		2.00	76.00	7.00	
BGO10AA	218.80	208.27	143.92	119.56	73.80	10.53	64.35	24.36	45.76
BGO12A	226.40	215.95	137.40	121.03		10.45	78.55	16.37	
BGO14A	220.20	209.47	133.20	127.20		10.73	76.27	6.00	
BGO16A	195.80	182.80	130.80	125.80		13.00	52.00	5.00	
BGO18A	204.24	198.90	131.20	123.64		5.34	67.70	7.56	
BGO20A	206.30	194.30	125.30	114.30	43.30	12.00	69.00	11.00	71.00
BGO20AA	206.30	194.30	126.61	114.30	43.30	12.00	67.69	12.31	71.00
BGO23D	216.74								
BGO25A	214.65	200.70	138.07	127.70		13.95	62.63	10.37	
BGO26A	220.20	211.69	134.93	129.10		8.51	76.76	5.83	
BGO27C	198.90	191.90				7.00			
BGO29A	196.10	185.10	127.09	116.90		11.00	58.01	10.19	
BGO31C	198.10	187.70				10.40			
BGO33C	203.34	191.40				11.94			
BGO35C	205.59	196.40				9.19			
BGO37C	202.71	191.30				11.41			
BGO39A	207.17	193.57	114.91	102.37	58.15	13.60	78.66	12.54	44.22
BGO3A	198.29	188.00	130.00	121.00	45.99	10.29	58.00	9.00	75.01
BGO41A	217.30	206.14	138.30	131.30		11.16	67.84	7.00	
BGO42C	216.69	206.88				9.81			
BGO43AA	222.05	208.18	136.68	127.20	58.53	13.87	71.50	9.48	68.67
BGO44AA	221.90	212.57	142.30	120.30	68.07	9.33	70.27	22.00	52.23
BGO45A	206.90	200.03	133.90	129.90		6.87	66.13	4.00	
BGO46B	201.17	191.43	131.89	126.40		9.74	59.54	5.49	
BGO47A	197.80	189.80	130.80	124.80		8.00	59.00	6.00	
BGO48C	199.42	190.77				8.65			
BGO49A	201.10	192.10	121.08	114.10		9.00	71.02	6.98	

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
BGO50A	195.10	183.50	132.50	126.49		11.60	51.00	6.01	
BGO51AA	205.87	194.20	112.79	96.20	62.20	11.67	81.41	16.59	34.00
BGO52AA	206.60	196.60	124.60	111.72	31.80	10.00	72.00	12.88	79.92
BGO53AA	222.42	214.65	138.29	131.90	29.13	7.77	76.36	6.39	102.77
BGO5C	219.74	199.37				20.37			
BGO6A	211.66	194.80	125.87	119.61		16.86	68.93	6.26	
BGO6B	202.50	191.50	136.50	122.50		11.00	55.00	14.00	
BGO8A	213.30	199.30	130.30	120.30		14.00	69.00	10.00	
BGO9AA	223.80	210.80	134.80	124.80		13.00	76.00	10.00	
BGSG1	220.65	209.96				10.69			
BGSG15	224.69	219.65				5.04			
BGSG19	215.90	206.61				9.29			
BGSG22	215.33	198.45	141.07			16.88	57.38		
BGSG23	203.83	197.99				5.84			
BGSG27	203.96	193.19	126.30	120.06		10.77	66.89	6.24	
BGSG33	210.20	193.14	126.87	119.87		17.06	66.27	7.00	
BGSG35	218.94	217.18				1.76			
BGSG42	202.78	195.18				7.60			
BGSG5	220.08	215.87				4.21			
BGSG60	206.42	199.70				6.72			
BGSG68	224.08	210.40				13.68			
BGSG8	223.34	219.28				4.06			
BGT1	221.45	211.37				10.08			
BGT10	200.88	193.11	157.60	147.97		7.77	35.51	9.63	
BGT11	206.56	199.50	152.50	146.29	72.50	7.06	47.00	6.21	73.79
BGT12	225.20	214.20				11.00			
BGT13	232.53	215.97				16.56			
BGT14	214.82	209.15				5.67			
BGT15	208.50	200.50	149.50			8.00	51.00		
BGT16	230.70	217.23	149.10	143.77		13.47	68.13	5.33	
BGT17	222.59	199.98	149.20	144.70		22.60	50.79	4.49	
BGT18	211.01	204.06	161.46	148.09	69.40	6.95	42.60	13.37	78.69
BGT2	213.40	189.99				23.41			
BGT20			150.30	145.55	77.30			4.75	68.25
BGT21	223.20	214.06				9.14			
BGT22	231.26	216.58	131.47	111.35	75.33	14.68	85.11	20.12	36.02
BGT23	216.84	210.00	149.87			6.84	60.13		
BGT24	226.80	219.80				7.00			
BGT25	228.80	223.80				5.00			

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
BGT26	226.44	220.11				6.33			
BGT27	213.40	208.90	160.53	155.40		4.50	48.37	5.13	
BGT28	212.30	204.85	156.71	148.93	70.76	7.45	48.14	7.78	78.17
BGT29	219.00	215.23				3.77			
BGT3	211.70	199.26	142.88	137.18		12.44	56.38	5.70	
BGT30	210.81	205.70	147.00	141.00		5.11	58.70	6.00	
BGT31	219.76	212.57				7.19			
BGT32	214.71	206.15				8.56			
BGT33	238.73	223.42				15.31			
BGT34	227.76	217.76				10.00			
BGT35	216.73	211.73	151.45			5.00	60.28		
BGT36	226.36	214.72	161.26	143.49		11.64	53.46	17.77	
BGT37	221.60	214.60	162.24			7.00	52.36		
BGT38	225.94	219.82	160.22			6.12	59.60		
BGT39	229.13		162.56	151.86				10.70	
BGT4	219.03	208.41	149.20			10.62	59.21		
BGT40	211.95	198.20				13.75			
BGT41	224.37	219.37	149.37	143.25		5.00	70.00	6.12	
BGT42	223.92	210.49				13.43			
BGT43	206.08	201.08				5.00			
BGT44	214.20	209.20				5.00			
BGT45	217.84	209.28	164.69	150.22		8.56	44.59	14.47	
BGT46	218.07	208.55	134.00	125.31		9.52	74.55	8.69	
BGT47	216.69	207.25	137.32	128.32		9.44	69.93	9.00	
BGT48	218.54	209.33	134.12	128.56		9.21	75.21	5.56	
BGT49	233.45	227.21	135.25	126.26		6.23	91.96	8.99	
BGT5	217.99	207.22	156.79	140.76	65.86	10.77	50.43	16.03	74.90
BGT50	225.19	214.47	133.27	126.18		10.72	81.20	7.09	
BGT51	194.27	190.50				3.77			
BGT53	206.25	186.40	118.25	108.25	46.25	19.85	68.15	10.00	62.00
BGT54	209.96	196.96				13.00			
BGT56	181.94	175.24	120.40	113.17		6.70	54.84	7.23	
BGT57	178.01	162.76	119.25	113.17		15.25	43.51	6.08	
BGT58	191.76	179.32	111.30	103.86		12.44	68.02	7.44	
BGT59	181.28	176.88				4.40			
BGT6	218.20								
BGT60	186.42	176.42				10.00			
BGT61	184.30	176.30	108.30	94.30		8.00	68.00	14.00	
BGT62	190.03	177.03				13.00			

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
BGT63	199.67	188.67				11.00			
BGT63A	197.79	185.79				12.00			
BGT64	195.25	188.25	123.25			7.00	65.00		
BGT66	194.33	188.04				6.29			
BGT67	186.56	172.49	135.03	127.03	69.81	14.07	37.46	8.00	57.22
BGT7	212.96	199.40				13.56			
BGT8	221.30	215.32	152.30	144.30		5.98	63.02	8.00	
BGT9	221.37	198.64	149.00	138.29	64.43	22.73	49.64	10.71	73.86
BGX11D	193.57	177.00	126.82	117.80		16.57	50.18	9.02	
BGX1A	211.43	202.90	139.86	127.46		8.53	63.04	12.40	
BGX2B	216.20	198.20	140.20	127.20		18.00	58.00	13.00	
BGX4A	220.76	212.80	129.80	123.80		7.96	83.00	6.00	
BGX7D	227.16	210.88	157.10	144.10		16.28	53.78	13.00	
BGX8D	213.47	203.01				10.46			
BGX9D	207.00	187.08	139.40	130.99		19.92	47.68	8.41	
BH13	200.20	195.20	155.03	142.11		5.00	40.17	12.92	
BH14	204.10	197.10	133.10	126.10	36.10	7.00	64.00	7.00	90.00
BH15	203.10	198.10	141.60	137.30		5.00	56.50	4.30	
BH17	198.20	195.20				3.00			
BH2	221.00	212.19	148.03	128.18	40.90	8.81	64.16	19.85	87.28
BH20A	208.90	204.90	146.90	141.90	41.90	4.00	58.00	5.00	100.00
BH21	199.40	194.40				5.00			
BH23A			133.90	113.90				20.00	
BH3	206.40	202.40	136.40	126.40	34.40	4.00	66.00	10.00	92.00
BH4	205.90	200.90	143.90	138.90	38.90	5.00	57.00	5.00	100.00
BH48B	208.90	203.90	148.90	137.40	45.90	5.00	55.00	11.50	91.50
BH50A			137.90	132.90	37.90			5.00	95.00
BH6	208.00	201.00	141.50	137.00	36.50	7.00	59.50	4.50	100.50
BH62A	201.90		129.90	120.90				9.00	
BH64A	211.60	206.60	136.60	131.60		5.00	70.00	5.00	
BH69A	200.70		140.70						
BH8	202.30	197.30	132.30	124.80	40.30	5.00	65.00	7.50	84.50
BH86A	202.20		130.50						
BH9	203.90	198.90	131.90		40.90	5.00	67.00		
BH90A	208.80	205.30	135.30	125.30	34.30	3.50	70.00	10.00	91.00
BPSC15	226.29	211.18				15.11			
BRR1D	194.80								
BRR3D	207.50	193.50				14.00			
BRR6B	183.90	166.11	122.16	108.57		17.79	43.95	13.59	

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
BRR7B	201.60	191.21	131.60	121.60		10.39	59.61	10.00	
BRR8B	204.70	194.05	129.89	124.08		10.65	64.16	5.81	
BSE1C1	207.24	200.58				6.66			
BSE3C1	201.07	196.19				4.88			
DRB2	203.89	197.00	114.71	108.63		6.89	82.29	6.08	
DRB3	207.18	197.22	129.10	115.47	60.63	9.96	68.12	13.63	54.84
DRB6	192.80	184.92	137.30	126.49	44.86	7.88	47.62	10.81	81.63
EAVZCPT11	223.25								
ECP6CP1	229.91	226.46	160.08			3.45	66.38		
ECP8SB1	228.54	224.33	144.46			4.21	79.87		
F-10	207.13	202.13	130.03	128.03		5.00	72.10	2.00	
F-14	204.77	199.77	139.77	134.77		5.00	60.00	5.00	
F-20	199.97	191.25				8.72			
F-22	214.13	206.63				7.50			
F-25	205.94	203.44				2.50			
F-26	215.07	202.57				12.50			
F-28	199.96	192.09	129.96	127.96		7.87	62.13	2.00	
F-30	216.48	211.48				5.00			
F-31	212.76	202.76				10.00			
F-32	212.76	202.76				10.00			
F-6	205.15	199.15	129.95	127.95		6.00	69.20	2.00	
F-8	200.67	168.23	134.47	129.48		32.45	33.76	4.99	
F-9	216.16	203.66	129.96	127.96		12.50	73.70	2.00	
F235C3	206.17	199.67	143.75			6.50	55.92		
F235C42	219.22	206.55	156.12			12.67	50.43		
FAC1SB	224.20	218.35	149.20			5.85	69.15		
FB30	209.58	203.74	138.85			5.84	64.89		
FBP973	198.31	183.18				15.13			
FBP976B	193.77	187.07	134.11			6.70	52.96		
FC1A	214.70	208.70	148.70	137.70		6.00	60.00	11.00	
FC2A	209.10	202.10	148.10	138.10		7.00	54.00	10.00	
FC3A	228.42	222.35	162.35	152.47	91.22	6.07	60.01	9.88	61.25
FC4A	222.87	211.21	162.36	149.25	71.81	11.66	48.85	13.11	77.44
FCB2CP	212.25	200.22				12.03			
FCH1	214.00	205.00	145.00	127.59	69.25	9.00	60.00	17.41	58.34
FCH2	216.62	193.61	142.00	129.35	72.13	23.01	51.61	12.65	57.22
FCH3	207.00	196.25	138.92	129.28	67.45	10.75	57.33	9.64	61.83
FCH4	202.48	187.78	128.00	121.00	44.55	14.70	59.78	7.00	76.45
FCH5	198.29	182.95	131.43	124.16	36.00	15.34	51.52	7.27	88.16

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
FCH6	188.25	180.68	124.88	120.12	31.53	7.57	55.80	4.76	88.59
FCPT112	179.22	155.78	105.19			23.44	50.59		
FCPT114	183.92	172.74	120.64			11.18	52.10		
FCPT115	181.40	165.17	122.45	106.51		16.23	42.72	15.94	
FCPT116	177.60	163.12	121.22	106.65		14.48	41.90	14.57	
FCPT119	179.00	173.50	110.14	104.31		5.50	63.36	5.83	
FCPT24	185.26	164.43	127.62			20.83	36.81		
FCPT26	180.14	174.37				5.77			
FCPT27	174.17	166.60				7.57			
FCPT31	169.02	153.96				15.06			
FCPT35	167.30	160.91				6.39			
FCPT36	176.60	165.10	130.83			11.50	34.27		
FCPT39	186.46	159.90				26.56			
FCPT41	189.70	178.04				11.66			
FCPT43	172.41	156.27				16.14			
FCPT45	187.28	173.53				13.75			
FCPT46	178.56	158.55				20.01			
FCPT47	188.33	177.99				10.34			
FCPT50	167.13	162.29	114.57	103.49		4.84	47.72	11.08	
FCPT52	165.28	155.34				9.94			
FCPT54	154.13	148.24	111.71			5.89	36.53		
FCPT80	171.03	155.03	113.30	100.76		16.00	41.73	12.54	
FDH4	195.00	186.50	122.00	113.65		8.50	64.50	8.35	
FDH5	196.77	187.17	124.30	114.90		9.60	62.87	9.40	
FEX1	171.62								
FEX2	173.17								
FEX3	178.71								
FEX4	175.42								
FEX5	181.31								
FEX7	179.56								
FEX9	155.00	137.51	106.35			17.49	31.16		
FGW-05	213.91	211.51	138.78			2.40	72.73		
FGW-06	214.91	203.90				11.01			
FGW-10	205.99	203.18	131.73			2.81	71.45		
FGW-11	184.26	174.96				9.30			
FGW-12	200.25	195.73	132.82	121.14		4.52	62.91	11.68	
FGW-19	222.15	216.93	164.89	141.18		5.22	52.04	23.71	
FIN10	171.60	167.14				4.46			
FIW1MC	190.30	179.23	121.30			11.07	57.93		

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
FIW2MA	188.50	179.50	120.50	116.50		9.00	59.00	4.00	
FMOX109	219.19	211.57	157.71			7.62	53.86		
FMOX119	212.38	205.85	151.92	145.38		6.53	53.93	6.54	
FMOX16S	220.83	214.03	163.26	142.12		6.80	50.77	21.14	
FMOX1S	225.37	218.68	161.94	154.95		6.69	56.74	6.99	
FMOX37S	214.72	199.54	157.76	137.68		15.18	41.78	20.08	
FMOX4R	216.20	212.29	155.71	146.78		3.91	56.58	8.93	
FNB11	222.56	216.20	158.73			6.36	57.47		
FNB1A	208.40	202.40	151.40	137.40		6.00	51.00	14.00	
FNB3A	211.66	206.78	154.08	141.28		4.88	52.70	12.80	
FNBCPT13		203.04	160.09				42.95		
FNBCPT15	217.32	215.40	162.76			1.92	52.64		
FNBCPT9	222.42	216.92	164.48			5.50	52.44		
FNEC115	209.81	202.34	140.71			7.47	61.63		
FNG1CPTARA	202.49	193.12				9.37			
FNG8CPTARA	188.69	165.49				23.20			
FPDCA25	220.19	212.43				7.76			
FPDCA36	217.52	211.92				5.60			
FPDCA37	223.59	218.22				5.37			
FPDCA42	238.01	219.68				18.33			
FPDCBA1	214.25	208.88	149.12			5.37	59.76		
FPDCBA13	217.05	212.38	147.25			4.67	65.13		
FPDCBA17	216.77	206.78	149.59			9.99	57.19		
FPDCBA5	222.57	216.87	145.70			5.70	71.17		
FPDCBA7A	234.18	221.32	143.14			12.86	78.18		
FPDCF-SZ32	233.97	215.95				18.02			
FPDCF-SZ38	216.48	208.29	148.25	125.31		8.19	60.04	22.94	
FPSC3	203.00	195.97				7.03			
FPSC5	216.15	205.02				11.13			
FSB0PC	166.25	156.80				9.45			
FSB0PD	169.54								
FSB100A	186.01	175.87	117.80	113.80		10.14	58.07	4.00	
FSB101A	190.90	180.87	118.90	114.57		10.03	61.97	4.33	
FSB102C	186.63	172.56				14.07			
FSB103C	174.91	162.83				12.08			
FSB104C	179.75	167.46				12.29			
FSB106C	180.00	166.00				14.00			
FSB112A	164.00	149.41	104.00	93.00		14.59	45.41	11.00	
FSB113A	179.78	171.30	110.19	102.86	22.30	8.48	61.11	7.33	80.56

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
FSB114A	179.75	170.40	114.00	110.67		9.35	56.40	3.33	
FSB115C	180.80	166.62	102.44	85.80	5.80	14.18	64.18	16.64	80.00
FSB116C	175.50	170.50				5.00			
FSB120A	172.14	164.91	112.23	108.64		7.23	52.68	3.59	
FSB121C	173.91	164.25				9.66			
FSB122C	180.50	172.00	105.55			8.50	66.45		
FSB123C	184.77	167.46				17.31			
FSB1TA	191.40	187.40	117.40	115.40	24.40	4.00	70.00	2.00	91.00
FSB76A	191.01	181.14	123.09	112.93		9.87	58.05	10.16	
FSB78A	163.13	148.59	104.50	92.50	30.17	14.54	44.09	12.00	62.33
FSB79A	173.10	163.73	104.60	100.10	18.10	9.37	59.13	4.50	82.00
FSB87A	175.60	167.61	114.60	108.60	26.90	7.99	53.01	6.00	81.70
FSB89C	186.10	180.10				6.00			
FSB91C	168.00	161.75				6.25			
FSB93C	166.00	151.00				15.00			
FSB95C	176.12	169.88				6.24			
FSB96A	169.55	153.70	108.94	100.70		15.85	44.76	8.24	
FSB97A	163.83	151.80	110.80	106.80		12.03	41.00	4.00	
FSB98A	171.70	159.70	109.29	106.70		12.00	50.41	2.59	
FSB99A	180.58	167.29	115.78	112.30		13.29	51.51	3.48	
FSBCPT2	187.73	175.99				11.74			
FSEPC13	230.08	216.09	145.38			13.99	70.71		
FSEPC14	207.07	196.25				10.82			
FSEPC16	212.25	202.07				10.18			
FSW4CP	188.25	175.68				12.57			
FTNKC16	210.95	193.19				17.76			
FTNKC17	214.63	197.08				17.55			
FTNKC3	205.43	196.64	136.06	124.30		8.79	60.58	11.76	
FTNKC6	201.24	189.59	127.59			11.65	62.00		
FU1	213.02	210.52	130.02	128.02		2.50	80.50	2.00	
FU2	207.07	196.80	142.59	125.09		10.27	54.21	17.50	
FU3	208.40	203.40	130.00	128.00		5.00	73.40	2.00	
GSA10CP	211.02	197.14	155.17	140.25		13.88	41.97	14.92	
GSA11CP	218.96	212.30	149.79			6.66	62.51		
GSA13CP	211.72	199.68	160.30	141.84		12.04	39.38	18.46	
GSA15CP	197.46	190.70	116.78	104.81		6.76	73.92	11.97	
GSA16CP	188.02	166.44	114.00			21.58	52.44		
GSA17CP	195.11	179.37	128.62	117.28		15.74	50.75	11.34	
GSA18CP	217.77	201.75				16.02			

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
GSA19CP	195.36	184.05	131.06	123.49		11.31	52.99	7.57	
GSA2CP	222.35	207.04				15.31			
GSA3CP	195.55	179.26				16.29			
GSA4CP	206.36	195.46	112.44	92.24		10.90	83.02	20.20	
GSA5CP	193.76	175.32				18.44			
GSA6CP	228.03	215.42				12.61			
GSA8CP	231.12	220.83				10.29			
GSA9CP	220.17	211.51				8.66			
HAA1TA	185.51	163.71	117.20	108.37	34.20	21.80	46.51	8.83	74.17
HAA2AA	192.40	184.40	124.40	118.40	59.40	8.00	60.00	6.00	59.00
HAA3AA	194.50	180.50	119.19	110.50	53.86	14.00	61.31	8.69	56.64
HAA4AA	202.20	193.20	127.20	116.20	31.20	9.00	66.00	11.00	85.00
HAA5A	182.28	169.92	118.34	109.28		12.36	51.58	9.06	
HAA5B	199.20	188.47				10.73			
HAA6AA	209.80	194.03	129.80	119.80	39.37	15.77	64.23	10.00	80.43
HAT-CPT1	203.06	198.86				4.20			
HBOR34	193.00	182.00	119.00	108.00	41.00	11.00	63.00	11.00	67.00
HBOR44	211.29	201.71	124.02	112.01	35.63	9.58	77.69	12.01	76.38
HBOR50	203.69	193.39	122.27	112.17	44.04	10.30	71.12	10.10	68.13
HC 015 A	182.00	180.00				2.00			
HC10A	200.38	191.88	127.17	118.32		8.50	64.71	8.85	
HC11A	190.80	179.00	138.72			11.80	40.28		
HC12A	195.30								
HC13A	202.00	200.00	125.30	122.30		2.00	74.70	3.00	
HC14A	195.50	183.00	116.50	111.50		12.50	66.50	5.00	
HC15A	188.66	181.30				7.36			
HC16A	200.38	192.96	131.00	125.60		7.42	61.96	5.40	
HC17A	193.00	187.00	129.00			6.00	58.00		
HC18A	176.00	167.00	123.00	113.00		9.00	44.00	10.00	
HC1A	204.50	196.17	123.00	119.04		8.33	73.17	3.96	
HC2A	208.70	198.37	128.20	118.70		10.33	70.17	9.50	
HC35D	196.80	184.00	118.80	108.80		12.80	65.20	10.00	
HC3A	201.60	186.60	119.60	110.60		15.00	67.00	9.00	
HC4A	183.00	173.00				10.00			
HC5A	196.00	187.00				9.00			
HC6A	211.20	204.60				6.60			
HC7A	223.00	216.00	151.77	140.00		7.00	64.23	11.77	
HC8A	223.76	217.18	153.00	150.00		6.58	64.18	3.00	
HC9A	213.30	206.30	134.00	129.30		7.00	72.30	4.70	

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
HCA4AA	193.60	181.60	125.60	115.60	28.72	12.00	56.00	10.00	86.88
HCH1	202.00	189.00	137.00	127.50	66.00	13.00	52.00	9.50	61.50
HCH2	196.00	181.05	131.00	122.00	66.00	14.95	50.05	9.00	56.00
HCH3	205.00	191.00	130.50	122.00		14.00	60.50	8.50	
HCH4	197.00	184.00	124.00	116.50	49.01	13.00	60.00	7.50	67.49
HCH5	194.00	182.00	125.00	117.06	58.00	12.00	57.00	7.94	59.06
HCIFC6	199.51	193.19	139.12	127.33		6.32	54.07	11.79	
HCYNC10	197.82	194.34	125.64	113.48		3.48	68.70	12.16	
HCYNC12	196.36	171.99				24.37			
HCYNC13	195.99	178.58	129.12	117.97		17.41	49.46	11.15	
HCYNC6	194.32	179.18	151.63	140.92		15.14	27.55	10.71	
HCYNC7	216.60	204.06				12.54			
HDH2	201.90	196.90	120.40			5.00	76.50		
HDH3	200.00								
HIN1	195.79								
HIN2	201.39								
HIN3	206.39	202.20				4.19			
HITPC14	209.55	199.35				10.20			
HITPC23	204.84	191.50				13.34			
HITPC34	188.11	185.16	117.39			2.95	67.77		
HITPC5	179.46	168.08				11.38			
HITPC7	207.00	192.09				14.91			
HIW1BD	206.80	203.80				3.00			
HIW1MC	197.30	181.30				16.00			
HIW2A	202.20	195.72	115.86	108.74		6.48	79.86	7.12	
HIW2MC	201.00	193.53				7.47			
HIW4MC	197.40	190.40	113.22			7.00	77.18		
HIW5MC	184.10	178.10				6.00			
HLWFC1	196.33	192.39	137.91	135.46		3.94	54.48	2.45	
HLWFC10	203.54	196.11	141.27	127.93		7.43	54.84	13.34	
HMD1C	232.62	221.56	144.10	123.74		11.06	77.46	20.36	
HMD2C	223.50	219.19	150.49	137.56		4.31	68.70	12.93	
HMD3C	224.09	218.23	157.00	149.00		5.86	61.23	8.00	
HMD4C	225.41	221.44	153.76	145.94		3.97	67.68	7.82	
HPC1	194.50	179.72	119.00	109.65	27.50	14.78	60.72	9.35	82.15
HPT1A	180.68	176.14	124.44	116.44	62.15	4.54	51.70	8.00	54.29
HPT2A	187.82	181.05	125.80	117.80	57.78	6.77	55.25	8.00	60.02
HRHLWE12	206.50	198.37	120.50			8.13	77.87		
HRTFB1	201.30	188.13	134.63	124.01		13.17	53.50	10.62	

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
HRTFB2	200.27	193.69	134.80	123.90		6.58	58.89	10.90	
HRTFB6A	194.41	186.59	132.37	120.92		7.82	54.22	11.45	
HRTFB7	197.60	189.06	128.90	117.45		8.54	60.16	11.45	
HSB0PC	186.16	172.38	119.17			13.78	53.21		
HSB101C	194.30	187.30				7.00			
HSB102C	191.70	184.20				7.50			
HSB103C	195.70	181.20				14.50			
HSB104C	193.50	184.50				9.00			
HSB105C	192.20	183.20				9.00			
HSB106C	192.70	182.70				10.00			
HSB107C	199.30	191.30				8.00			
HSB108C	213.54	202.61				10.93			
HSB109C	203.40	189.40				14.00			
HSB110C	190.40	181.19				9.21			
HSB111C	187.70	171.70				16.00			
HSB112C	190.60	174.57				16.03			
HSB113C	187.70	173.70				14.00			
HSB114C	187.97	177.70				10.27			
HSB115C	208.80	196.80				12.00			
HSB116C	200.65	195.25				5.40			
HSB117A	186.80	177.80	122.80	112.80		9.00	55.00	10.00	
HSB118A	189.57	174.17	118.00	112.00		15.40	56.17	6.00	
HSB119A	209.57	202.95	114.80	110.80		6.62	88.15	4.00	
HSB120A	201.32	192.74	111.37	106.11		8.58	81.37	5.26	
HSB121A	199.40	184.30	114.80	101.37		15.10	69.50	13.43	
HSB122A	190.32	177.40	118.40	103.40		12.92	59.00	15.00	
HSB123A	198.00	186.10	122.60	107.60		11.90	63.50	15.00	
HSB124A	203.36	196.36	123.02	113.78		7.00	73.34	9.24	
HSB125C	187.60	179.60				8.00			
HSB126C	190.30	182.30				8.00			
HSB131C	195.66	181.55				14.11			
HSB132C	163.30	158.31				4.99			
HSB134C	175.90	160.97				14.93			
HSB135C	200.65	193.90				6.75			
HSB136C	182.41	175.11				7.30			
HSB137C	185.80	173.80				12.00			
HSB139A	189.50	178.50	121.50	114.50		11.00	57.00	7.00	
HSB140A	190.37	182.37	113.46	105.00		8.00	68.91	8.46	
HSB141A	180.60	166.60	120.60	112.60		14.00	46.00	8.00	

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
HSB142C	189.03	182.82				6.21			
HSB143C	187.53	179.78				7.75			
HSB144A	185.60	170.10	110.60	103.60		15.50	59.50	7.00	
HSB145C	183.70	174.20				9.50			
HSB146A	185.39	164.50	124.50	112.50		20.89	40.00	12.00	
HSB148C	186.90	170.90				16.00			
HSB151C	195.92	191.19	131.06			4.73	60.13		
HSB152C	198.10	184.10				14.00			
HSB65A	208.20	198.70	120.70	108.70		9.50	78.00	12.00	
HSB68A	198.40	193.40	116.40	110.40		5.00	77.00	6.00	
HSB69A	191.10	181.10	117.10	112.10		10.00	64.00	5.00	
HSB70C	181.19	176.19				5.00			
HSB83A	194.90	183.90	118.90	103.90	34.90	11.00	65.00	15.00	69.00
HSB84A	202.27	191.60	119.85	110.70		10.67	71.75	9.15	
HSB85A	207.36	200.10	126.18	116.40		7.26	73.92	9.78	
HSB86A	188.00	174.78	113.00	107.00	55.00	13.22	61.78	6.00	52.00
HSBCPT20	192.08	178.11				13.97			
HSBCPT62	192.14	184.37				7.77			
HSBCPT9	182.93	168.87				14.06			
HSBTB	207.10	186.22	117.06	106.10	42.10	20.88	69.16	10.96	64.00
HSL6AA	188.16	170.04	127.91	121.36	72.56	18.12	42.13	6.55	48.80
HSL8AA	196.19	187.00	136.69	125.28	62.70	9.19	50.31	11.41	62.58
HTEFC1	196.74	190.32	130.12			6.42	60.20		
HTEFC22	201.92	194.61	134.63	125.78		7.31	59.98	8.85	
HTEFC4	200.73	190.84	132.55			9.89	58.29		
HTF12	187.03	176.92				10.11			
HTFB1	183.41	170.70	120.59	113.69	20.65	12.71	50.11	6.90	93.04
HTFC5	181.42	175.05				6.37			
HTFC7	185.53	174.87				10.66			
HTFC8	192.27	181.60				10.67			
HTFC9	199.38	183.85				15.53			
HTRANC1	205.12	190.00	127.47	121.83		15.12	62.53	5.64	
HTRANC8	213.36	207.07				6.29			
IDL3A	215.82	198.96	135.58	131.11	7.55	16.86	63.38	4.47	123.56
MBG13	188.50	183.50	128.50	122.50		5.00	55.00	6.00	
MEGACPT4	218.72								
MEGACPT5	213.37								
MMCC2	189.84								
MMP2SB	184.41	173.40	123.40	113.40	32.40	11.01	50.00	10.00	81.00

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
MMP5SB	201.42	196.21	133.41			5.21	62.80		
MOXSW3b	209.58	201.41	154.25			8.17	47.16		
MOXSW4	208.26	203.85	152.39			4.41	51.46		
MOXSW5	220.39	215.04				5.35			
NEP1SB	206.52	193.96	146.12	134.67	88.58	12.57	47.83	11.45	46.10
OFS1SB	195.60	185.60	128.60	125.60		10.00	57.00	3.00	
OFS2SB	196.44	180.50	126.63	120.50		15.94	53.87	6.13	
OFS3SB	196.10	180.53	126.10	118.10		15.57	54.43	8.00	
OFS4SB	205.20	191.70	127.51	121.17		13.50	64.19	6.34	
OFS5SB	190.40	177.73	122.01	116.10		12.67	55.72	5.91	
ONBP-4	220.44	212.79				7.65			
ONBP-7	220.67	217.56				3.11			
ONBP-9	219.56	212.64				6.92			
P27TA	198.10	191.10	132.10	124.10	24.10	7.00	59.00	8.00	100.00
P28TA	214.77	207.57	140.60	132.60	62.55	7.20	66.97	8.00	70.05
PBE2A	198.42	192.08	117.14	112.73		6.34	74.94	4.41	
S-BH-160	199.70		139.70	129.70				10.00	
S-BH-37	191.40		132.40						
S-BH-55	204.40	200.90	132.40	127.80		3.50	68.50	4.60	
S-G1-C01	207.40	205.70	149.58	137.63		1.70	56.12	11.95	
S-G2-C02	205.48	194.31	152.15			11.17	42.16		
S-G2-C07	195.08	188.35				6.73			
S-G2-C09	194.12	185.26				8.86			
S-G3-B03	212.92	204.97	133.48	125.20		7.95	71.49	8.28	
S-G3-B04	211.64	203.94	133.29	123.66		7.70	70.65	9.63	
S-G3-B05	215.30	206.63	141.18	127.94		8.67	65.45	13.24	
S-G3-B06	215.68	203.94	135.60	127.13		11.74	68.34	8.47	
S-G3-B07	202.78	194.51	141.37	125.78		8.27	53.14	15.59	
S-G3-B08	217.61	207.02	136.47	127.90		10.59	70.55	8.57	
S-G3-B09	216.07	207.29	134.44	126.55		8.78	72.85	7.89	
S-G3-B10	214.91	206.25	135.02	126.16		8.66	71.23	8.86	
S-G3-C01	208.41	201.85	166.98	154.46		6.56	34.87	12.52	
S-G3-C05	210.08	206.90	144.84			3.18	62.06		
S-G3-C08	208.20	191.60	159.28			16.60	32.32		
S-G3-C28	202.59	195.85	136.75	128.86		6.74	59.10	7.89	
S-SDS-16	212.00	210.00				2.00			
SBH1	211.53	207.98	145.30	133.30	37.30	3.55	62.68	12.00	96.00
SBH10	205.30	197.82	134.10	125.07	56.86	7.48	63.72	9.03	68.21
SBH11	207.00	195.00	144.00	127.64	71.88	12.00	51.00	16.36	55.76

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
SBH12	211.20	199.20	136.88	126.78	70.98	12.00	62.32	10.10	55.80
SBH158	205.70	200.70				5.00			
SBH159	205.00		132.00	120.00				12.00	
SBH16	200.95	195.70	133.88	121.45	38.70	5.25	61.82	12.43	82.75
SBH22	197.50		133.50						
SBH24	203.10	196.62	132.10	121.74	37.10	6.48	64.52	10.36	84.64
SBH25	193.70		140.20	130.20				10.00	
SBH29	194.10		132.10						
SBH32	206.10		136.10						
SBH33	208.70	199.70	129.70	119.70		9.00	70.00	10.00	
SBH34	208.20	198.20				10.00			
SBH38	205.20	203.20	142.20	140.20	33.20	2.00	61.00	2.00	107.00
SBH39	204.30		140.30						
SBH4	208.78	203.97	135.35	128.13		4.81	68.62	7.22	
SBH41	197.10		130.10	120.10				10.00	
SBH42	192.20	187.20	132.20	117.20		5.00	55.00	15.00	
SBH43	206.30	201.30				5.00			
SBH44	206.90	201.90				5.00			
SBH45	204.00		132.60						
SBH46	201.40	196.90	136.90	130.40		4.50	60.00	6.50	
SBH49			147.90	136.40				11.50	
SBH5	210.00	205.00	135.00	128.50	34.00	5.00	70.00	6.50	94.50
SBH51	203.90	199.90				4.00			
SBH53	195.40	193.40				2.00			
SBH54	198.10		131.10	121.10				10.00	
SBH56	203.40		140.60	136.40				4.20	
SBH57	205.20	195.20	140.20	130.20		10.00	55.00	10.00	
SBH58	203.00	198.00	128.00	118.00		5.00	70.00	10.00	
SBH67	197.60								
SBH68	186.90								
SBH7	202.90	190.85	130.90	117.73	26.03	12.05	59.95	13.17	91.70
SBH70	202.90	192.90				10.00			
SBH72			135.50	130.50	53.50			5.00	77.00
SBH73	208.20	193.20				15.00			
SBH74		206.40							
SBH78	204.00	192.50	139.00	129.00		11.50	53.50	10.00	
SBH8	204.69	193.66	139.80	123.58	39.65	11.03	53.86	16.22	83.93
SBH81	203.30	198.30	134.30	128.30		5.00	64.00	6.00	
SBH83	214.90	209.90	137.90	131.90		5.00	72.00	6.00	

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
SBH84	203.70	199.70	126.70	121.70		4.00	73.00	5.00	
SBH87	206.90	205.40				1.50			
SBH89	203.70	202.40	133.70	123.70		1.30	68.70	10.00	
SBH92	209.00	208.20	129.00	119.00		0.80	79.20	10.00	
SDFBB1	200.00	190.00	130.00	123.00	55.00	10.00	60.00	7.00	68.00
SDFBC15	203.00	190.00	140.50	128.00		13.00	49.50	12.50	
SDS12A	215.00	206.69	155.28	144.40		8.31	51.41	10.88	
SDS13A	220.40	215.40				5.00			
SDS14	215.00	213.00				2.00			
SDS15	218.00	212.00				6.00			
SDS17	212.60	206.60				6.00			
SDS19	205.80	194.80				11.00			
SDS2	222.60	218.60				4.00			
SDS21A	204.10	198.10	163.96	147.10		6.00	34.14	16.86	
SDS22A			152.00	141.00				11.00	
SDS3A	230.50	218.50				12.00			
SDS4	200.40	193.40				7.00			
SDS5	229.65	220.00				9.65			
SDS6	228.90								
SDS7A	229.95	208.14	152.06	130.73		21.81	56.08	21.33	
SDS8	222.98	210.83				12.15			
SDSSC02	204.15	200.00	144.81	135.53		4.15	55.19	9.28	
SP-10	216.05	213.70				2.35			
SP-14	221.00	217.23				3.77			
SP-15	216.78	213.34				3.44			
SWC1	183.36	171.42	125.03	115.30		11.94	46.39	9.73	
SWC15	206.73	201.60				5.13			
SWC16	192.30	181.27				11.03			
SWC21	180.15	170.84				9.31			
SWC24	195.00	180.00	120.00			15.00	60.00		
SWC25	192.52	176.20				16.32			
SWC34	201.51	196.59				4.92			
SWC36ARA	189.18	181.74				7.44			
SWC38ARA	197.68	177.55				20.13			
SWC4	185.00	170.92				14.08			
SWC9	191.33	182.00	136.00			9.33	46.00		
SWPA503	189.82	169.62				20.20			
SWPFC2A	191.95	180.12	143.43	139.31		11.83	36.69	4.12	
SWPFC45	199.37	186.54	145.30	134.60		12.83	41.24	10.70	

BOREHOLE NAME	ELEVATIONS (ft msl)					THICKNESSES (ft)			
	TCCZ	LAZ_UTRA	GCU	GAU	CBCU	TCCZ	LAZ	GCU	GAU
SWPFC47	197.80	191.80	146.42	124.15		6.00	45.38	22.27	
SWPFC59	196.92	185.42	134.91	130.02		11.50	50.51	4.89	
SWPFC64	192.50	186.44	140.50	129.95		6.06	45.94	10.55	
SWPFC68	194.89	187.56	141.22	131.70		7.33	46.34	9.52	
SWPFC72	187.93	179.40	137.90	130.90		8.53	41.50	7.00	
U5	194.50	182.50	124.50	118.50		12.00	58.00	6.00	
YSC1A	209.90	198.90	158.90	147.11	85.53	11.00	40.00	11.79	61.58
YSC1C	212.19	200.97	163.50	151.77		11.22	37.47	11.73	
YSC2A	219.70	214.70	161.70	150.70		5.00	53.00	11.00	
YSC3SB	211.00	205.00	151.89	139.97	56.19	6.00	53.11	11.92	83.78
YSC4A	223.16	212.65	150.32	140.08	86.35	10.51	62.33	10.24	53.73
YSC5A	221.95	210.50	141.33	128.00	69.10	11.45	69.17	13.33	58.90
Z-SD67-B05	220.13	208.37	162.06	147.92		11.76	46.31	14.14	
Z-SD67-C04	218.50	214.41	161.82	149.09		4.09	52.59	12.73	
Z-SD67-C06	217.91	215.38	161.47	148.85		2.53	53.91	12.62	
Z-SD67-C19	205.41	202.49				2.92			
Z-SDU6-B02B	236.73	228.43				8.30			
Z-SDU6-B03	204.36	199.45	157.27	145.23		4.91	42.18	12.04	
Z-SDU6-B04	207.51	202.72	156.10	144.53		4.79	46.62	11.57	
Z-SDU6-C03	233.22	225.62				7.60			
Z-V1-C-08	218.80	207.84				10.96			
Z2CP7	215.96	207.86				8.10			
ZCP1	216.23	204.87				11.36			
ZCP6	227.60	219.16				8.44			
ZCPT-01	227.61	213.12				14.49			
ZCPT-02	228.31	222.47				5.84			
ZCPT-04	226.79	206.11				20.68			
ZCPT-09	219.55	206.49				13.06			
ZCPT-14	233.59	219.73				13.86			
ZSDIPC01	227.14	216.74				10.40			
ZSDIPC02	226.91	218.73				8.18			
ZV2CP1	222.12	207.16				14.96			
ZV2CP15	223.17	209.03				14.14			
ZV2CP4	227.13	207.29				19.84			
ZV3V5C16	208.08	201.91	177.87	166.22		6.17	24.04	11.65	

Appendix 2. Statistics for grid models

Grid Model Statistics – surface of **Tan Clay Confining Zone**

Grid Name ..... Z:\Bennett\SRNL\GSA HydroModel-2016Update\GSA_RW17_Subproject\TCCZ_HiFi_20160921_ft_Clip.RwGrd
File date ..... 2/2/2017 11:11:14 AM

Dimensions:

X-Minimum (western-most node) ..... 434,600.0 Meters
X-Maximum (eastern-most node) ..... 442,760.0 Meters
X-Spacing (east/west node spacing) ..... 20.0 Meters
X-Nodes (east/west points) ..... 409 Nodes

Y-Minimum (southern-most node) ..... 3,680,120.0 Meters
Y-Maximum (northern-most node) ..... 3,686,760.0 Meters
Y-Spacing (north/south node spacing) ... 20.0 Meters
Y-Nodes (north/south points) ..... 333 Nodes

Total Nodes ..... 136,197 Nodes

Univariate Node Statistics:

Population (Non-Null) 67,465
Null Population (Value = -1.0e27) 68,732
Minimum Value 154.13
Maximum Value 238.73
Range 84.6
Mean 204.54
Standard Deviation 13.22
Standard Deviation Error 0.05
Average Deviation 11.01
Median 205.87
Sum 13,799,555.35
Sum of Squares 2,834,408,317.78
Variance 174.81
Skewness ..... -0.45
Kurtosis ..... -0.41
Coefficient of Variation 0.06
Population > Zero 67,465
Lowest Value > Zero 154.13

Statistical Classification Thresholds:

Mean - 1 Standard Deviations 191.32
Mean + 1 Standard Deviations 217.77
Mean - 2 Standard Deviations 178.1
Mean + 2 Standard Deviations 230.99
Mean - 3 Standard Deviations 164.88
Mean + 3 Standard Deviations 244.21
Mean - 4 Standard Deviations 151.66
Mean + 4 Standard Deviations 257.43

Statistical Classification Populations:

Background (Mean +/- 1SD) 44,428
Slightly Anomalous (Mean +/- 2SD) 20,438
Moderately Anomalous (Mean +/- 3SD) .. 2,532
Strongly Anomalous (Mean +/- 4SD) 67

```
         Extremely Anomalous (Mean +/- 5SD) ... 0

   Area/Volume:

      Center of Mass (x,y) ..................... 438,739.170219 Meters ,
3,683,259.110729 Meters
      Cell Area ................................ 400.0 Square Meters
      Map Area (X*Y) ........................... 54,182,400.0 Square Meters
      Grid Area (Sum(Cell Area))................ 54,478,800.0 Square Meters
      Model Volume (Sum(Cell Area*Z)) ........ 5,519,822,140.340716 Cubic Meters*
      Non-Zero node area ....................... 26,986,000.0 Square Meters

   Projection Information:

      XY (Horizontal) Units .................... UTM Meters
      Z (Vertical) Units ....................... Meters

      UTM (Universal Transverse Mercator):
         Datum (Spheriod) ...................... Datum = Airy 1830
         Zone .................................. Select UTM Zone

* Volumetric, slope, aspect, and strike computations assume that the z-values for the
grid nodes represent linear dimensions (i.e. elevations or depths in meters or feet).
These numbers do not apply to grids in which the z-values represent geochemical,
geophysical, geotechnical, etc. properties.

Notes (Metadata)
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Grid Model Statistics – surface of **Upper Three Runs Aquifer – Lower Aquifer Zone**

Grid Name ..... Z:\Bennett\SRNL\GSA HydroModel-2016Update\GSA_RW17_Subproject\LAZ_HiFi_20160922_ft_Clip.RwGrd
File date ..... 2/2/2017 11:09:12 AM

Dimensions:

X-Minimum (western-most node) ..... 434,600.0 Meters
X-Maximum (eastern-most node) ..... 442,760.0 Meters
X-Spacing (east/west node spacing) ..... 20.0 Meters
X-Nodes (east/west points) ..... 409 Nodes

Y-Minimum (southern-most node) ..... 3,680,120.0 Meters
Y-Maximum (northern-most node) ..... 3,686,760.0 Meters
Y-Spacing (north/south node spacing) ... 20.0 Meters
Y-Nodes (north/south points) ..... 333 Nodes

Total Nodes ..... 136,197 Nodes

Univariate Node Statistics:

Population (Non-Null) 67,465
Null Population (Value = -1.0e27) 68,732
Minimum Value 137.51
Maximum Value 228.43
Range 90.92
Mean 193.97
Standard Deviation 14.51
Standard Deviation Error 0.06
Average Deviation 12.15
Median 194.73
Sum 13,086,155.61
Sum of Squares 2,552,523,424.16
Variance 210.6
Skewness ..... -0.42
Kurtosis ..... -0.57
Coefficient of Variation 0.07
Population > Zero 67,465
Lowest Value > Zero 137.51

Statistical Classification Thresholds:

Mean - 1 Standard Deviations 179.46
Mean + 1 Standard Deviations 208.48
Mean - 2 Standard Deviations 164.95
Mean + 2 Standard Deviations 222.99
Mean - 3 Standard Deviations 150.43
Mean + 3 Standard Deviations 237.51
Mean - 4 Standard Deviations 135.92
Mean + 4 Standard Deviations 252.02

Statistical Classification Populations:

Background (Mean +/- 1SD) 42,966
Slightly Anomalous (Mean +/- 2SD) 22,405
Moderately Anomalous (Mean +/- 3SD) .. 2,030
Strongly Anomalous (Mean +/- 4SD) 64
Extremely Anomalous (Mean +/- 5SD) ... 0

Area/Volume:

```
      Center of Mass (x,y) ..................... 438,737.060149 Meters ,
3,683,273.954131 Meters
      Cell Area ................................ 400.0 Square Meters
      Map Area (X*Y) ........................... 54,182,400.0 Square Meters
      Grid Area (Sum(Cell Area))................ 54,478,800.0 Square Meters
      Model Volume (Sum(Cell Area*Z)) ......... 5,234,462,244.321927 Cubic Meters*
      Non-Zero node area ....................... 26,986,000.0 Square Meters

   Projection Information:

      XY (Horizontal) Units .................... UTM Meters
      Z (Vertical) Units ....................... Meters

      UTM (Universal Transverse Mercator):
         Datum (Spheriod) ...................... Datum = Airy 1830
         Zone .................................. Select UTM Zone

* Volumetric, slope, aspect, and strike computations assume that the z-values for the
grid nodes represent linear dimensions (i.e. elevations or depths in meters or feet).
These numbers do not apply to grids in which the z-values represent geochemical,
geophysical, geotechnical, etc. properties.

Notes (Metadata)
```

Grid Model Statistics – surface of **Gordon Confining Unit**

Grid Name ..... Z:\Bennett\SRNL\GSA HydroModel-2016Update\GSA_RW17_Subproject\GCU_HiFi_20160922_ft_Clip.RwGrd
File date ..... 2/2/2017 11:07:09 AM

Dimensions:

X-Minimum (western-most node) ..... 434,600.0 Meters
X-Maximum (eastern-most node) ..... 442,760.0 Meters
X-Spacing (east/west node spacing) ..... 20.0 Meters
X-Nodes (east/west points) ..... 409 Nodes

Y-Minimum (southern-most node) ..... 3,680,120.0 Meters
Y-Maximum (northern-most node) ..... 3,686,760.0 Meters
Y-Spacing (north/south node spacing) ... 20.0 Meters
Y-Nodes (north/south points) ..... 333 Nodes

Total Nodes ..... 136,197 Nodes

Univariate Node Statistics:

Population (Non-Null) 67,465
Null Population (Value = -1.0e27) 68,732
Minimum Value 103.1
Maximum Value 177.87
Range 74.77
Mean 135.18
Standard Deviation 15.55
Standard Deviation Error 0.06
Average Deviation 13.46
Median 132.88
Sum 9,120,225.55
Sum of Squares 1,249,227,458.16
Variance 241.82
Skewness 0.23
Kurtosis ..... -1.15
Coefficient of Variation 0.12
Population > Zero 67,465
Lowest Value > Zero 103.1

Statistical Classification Thresholds:

Mean - 1 Standard Deviations 119.63
Mean + 1 Standard Deviations 150.73
Mean - 2 Standard Deviations 104.08
Mean + 2 Standard Deviations 166.29
Mean - 3 Standard Deviations 88.53
Mean + 3 Standard Deviations 181.84
Mean - 4 Standard Deviations 72.98
Mean + 4 Standard Deviations 197.39

Statistical Classification Populations:

Background (Mean +/- 1SD) 38,755
Slightly Anomalous (Mean +/- 2SD) 28,419
Moderately Anomalous (Mean +/- 3SD) .. 291
Strongly Anomalous (Mean +/- 4SD) 0
Extremely Anomalous (Mean +/- 5SD) ... 0

Area/Volume:

```
      Center of Mass (x,y) ..................... 438,708.413745 Meters ,
3,683,327.872384 Meters
      Cell Area ................................ 400.0 Square Meters
      Map Area (X*Y) ........................... 54,182,400.0 Square Meters
      Grid Area (Sum(Cell Area))................ 54,478,800.0 Square Meters
      Model Volume (Sum(Cell Area*Z)) ........ 3,648,090,220.398095 Cubic Meters*
      Non-Zero node area ....................... 26,986,000.0 Square Meters

   Projection Information:

      XY (Horizontal) Units .................... UTM Meters
      Z (Vertical) Units ....................... Meters

      UTM (Universal Transverse Mercator):
         Datum (Spheriod) ..................... Datum = Airy 1830
         Zone ................................. Select UTM Zone

* Volumetric, slope, aspect, and strike computations assume that the z-values for the
grid nodes represent linear dimensions (i.e. elevations or depths in meters or feet).
These numbers do not apply to grids in which the z-values represent geochemical,
geophysical, geotechnical, etc. properties.

Notes (Metadata)
```

Grid Model Statistics – surface of **Gordon Aquifer Unit**

Grid Name ..... Z:\Bennett\SRNL\GSA HydroModel-2016Update\GSA_RW17_Subproject\GAU_HiFi_smooth_PreModel_20160922_ft_Clip.RwGrd
File date ..... 2/2/2017 10:52:41 AM

Dimensions:

X-Minimum (western-most node) ..... 434,600.0 Meters
X-Maximum (eastern-most node) ..... 442,760.0 Meters
X-Spacing (east/west node spacing) ..... 20.0 Meters
X-Nodes (east/west points) ..... 409 Nodes

Y-Minimum (southern-most node) ..... 3,680,120.0 Meters
Y-Maximum (northern-most node) ..... 3,686,760.0 Meters
Y-Spacing (north/south node spacing) ... 20.0 Meters
Y-Nodes (north/south points) ..... 333 Nodes

Total Nodes ..... 136,197 Nodes

Univariate Node Statistics:

Population (Non-Null) 67,465
Null Population (Value = -1.0e27) 68,732
Minimum Value 88.49
Maximum Value 166.22
Range 77.73
Mean 124.33
Standard Deviation 14.75
Standard Deviation Error 0.06
Average Deviation 12.53
Median 123.87
Sum 8,388,167.58
Sum of Squares 1,057,617,917.46
Variance 217.7
Skewness 0.04
Kurtosis ..... -0.98
Coefficient of Variation 0.12
Population > Zero 67,465
Lowest Value > Zero 88.49

Statistical Classification Thresholds:

Mean - 1 Standard Deviations 109.58
Mean + 1 Standard Deviations 139.09
Mean - 2 Standard Deviations 94.82
Mean + 2 Standard Deviations 153.84
Mean - 3 Standard Deviations 80.07
Mean + 3 Standard Deviations 168.6
Mean - 4 Standard Deviations 65.32
Mean + 4 Standard Deviations 183.35

Statistical Classification Populations:

Background (Mean +/- 1SD) 40,489
Slightly Anomalous (Mean +/- 2SD) 26,012
Moderately Anomalous (Mean +/- 3SD) .. 964
Strongly Anomalous (Mean +/- 4SD) 0
Extremely Anomalous (Mean +/- 5SD) ... 0

Area/Volume:

```
      Center of Mass (x,y) ..................... 438,716.637153 Meters ,
3,683,333.311292 Meters
      Cell Area ................................ 400.0 Square Meters
      Map Area (X*Y) ........................... 54,182,400.0 Square Meters
      Grid Area (Sum(Cell Area))................ 54,478,800.0 Square Meters
      Model Volume (Sum(Cell Area*Z)) ........ 3,355,267,032.791125 Cubic Meters*
      Non-Zero node area ....................... 26,986,000.0 Square Meters

   Projection Information:

      XY (Horizontal) Units .................... UTM Meters
      Z (Vertical) Units ....................... Meters

      UTM (Universal Transverse Mercator):
         Datum (Spheriod) ...................... Datum = Airy 1830
         Zone .................................. Select UTM Zone

* Volumetric, slope, aspect, and strike computations assume that the z-values for the
grid nodes represent linear dimensions (i.e. elevations or depths in meters or feet).
These numbers do not apply to grids in which the z-values represent geochemical,
geophysical, geotechnical, etc. properties.

Notes (Metadata)
```

Grid Model Statistics – surface of **Crouch Branch Confining Unit**

Grid Name ..... Z:\Bennett\SRNL\GSA HydroModel-2016Update\GSA_RW17_Subproject\CBCU_HiFi_PreModel_20160922_ft_Clip.RwGrd
File date ..... 2/2/2017 10:48:18 AM

Dimensions:

X-Minimum (western-most node) ..... 434,600.0 Meters
X-Maximum (eastern-most node) ..... 442,760.0 Meters
X-Spacing (east/west node spacing) ..... 20.0 Meters
X-Nodes (east/west points) ..... 409 Nodes

Y-Minimum (southern-most node) ..... 3,680,120.0 Meters
Y-Maximum (northern-most node) ..... 3,686,760.0 Meters
Y-Spacing (north/south node spacing) ... 20.0 Meters
Y-Nodes (north/south points) ..... 333 Nodes

Total Nodes ..... 136,197 Nodes

Univariate Node Statistics:

Population (Non-Null) 67,465
Null Population (Value = -1.0e27) 68,732
Minimum Value 7.54
Maximum Value 91.22
Range 83.68
Mean 49.76
Standard Deviation 15.48
Standard Deviation Error 0.06
Average Deviation 13.48
Median 48.85
Sum 3,357,025.83
Sum of Squares 183,217,495.93
Variance 239.74
Skewness ..... -0.05
Kurtosis ..... -1.06
Coefficient of Variation 0.31
Population > Zero 67,465
Lowest Value > Zero 7.54

Statistical Classification Thresholds:

Mean - 1 Standard Deviations 34.28
Mean + 1 Standard Deviations 65.24
Mean - 2 Standard Deviations 18.79
Mean + 2 Standard Deviations 80.73
Mean - 3 Standard Deviations 3.31
Mean + 3 Standard Deviations 96.21
Mean - 4 Standard Deviations ..... -12.17
Mean + 4 Standard Deviations 111.69

Statistical Classification Populations:

Background (Mean +/- 1SD) 39,711
Slightly Anomalous (Mean +/- 2SD) 26,585
Moderately Anomalous (Mean +/- 3SD) .. 1,169
Strongly Anomalous (Mean +/- 4SD) 0
Extremely Anomalous (Mean +/- 5SD) ... 0

Area/Volume:

```
      Center of Mass (x,y) ..................... 438,807.860929 Meters ,
3,683,497.351808 Meters
      Cell Area ................................ 400.0 Square Meters
      Map Area (X*Y) ........................... 54,182,400.0 Square Meters
      Grid Area (Sum(Cell Area))................ 54,478,800.0 Square Meters
      Model Volume (Sum(Cell Area*Z)) ........ 1,342,810,331.544364 Cubic Meters*
      Non-Zero node area ....................... 26,986,000.0 Square Meters

   Projection Information:

      XY (Horizontal) Units .................... UTM Meters
      Z (Vertical) Units ....................... Meters

      UTM (Universal Transverse Mercator):
         Datum (Spheriod) ..................... Datum = Airy 1830
         Zone ................................. Select UTM Zone

* Volumetric, slope, aspect, and strike computations assume that the z-values for the
grid nodes represent linear dimensions (i.e. elevations or depths in meters or feet).
These numbers do not apply to grids in which the z-values represent geochemical,
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Notes (Metadata)
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