October 2018

Evaluation of Aquifer Separation Distance

San Miguel Electric Cooperative, Inc.

Coal Combustion Residual Ash Ponds and Equalization Pond

Christine, Texas

PREPARED BY: POWER ENGINEERS, INC.
TEXAS REGISTERED ENGINEERING FIRM NO. F-000988
TEXAS REGISTERED GEOSCIENCE FIRM NO. 50585

PROJECT NUMBER:
150546.01.01

POWER ENGINEERS

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1.0 INTRODUCTION

POWER Engineers, Inc. (POWER) has performed an evaluation of the Coal Combustion Residual (CCR) surface impoundments located at the San Miguel Electric Cooperative, Inc. (SMEC) electric power generating plant located near Christine, Texas. The purpose of the evaluation, which included an assessment of available geologic and hydrogeologic data in conjunction with construction data for the CCR Ash Ponds and Equalization Pond, is to determine compliance with Title 40 Code of Federal Regulations Part 257.60 (40 CFR 257.60) "Placement above the uppermost aquifer." 40 CFR 257.60(a) provides as follows:

> *40 CFR 257.60 (a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.*

2.0 BACKGROUND

SMEC owns and operates a 440-megawatt lignite-fired power generating plant located approximately six miles south of Christine, Texas (Figure 1) along with the associated lignite mining facilities located near the plant. Geotechnical investigations of the plant began in 1976 and power generations began in 1982. As a coal fired power plant operating waste management units subject to the CCR regulations, SMEC is required to demonstrate compliance with certain regulations for existing CCR surface impoundments regarding construction, location, and groundwater quality or begin closure of those units.

3.0 HYDROGEOLOGIC EVALUATION

POWER reviewed historical documentation from geotechnical reports and boring logs advanced at the site prior to the construction of the facility and documentation on the construction of the liners in the Ash Ponds and Equalization Pond to aid in characterizing the elevation of the upper limit of the uppermost groundwater bearing unit beneath these CCR units. In addition, POWER reviewed a draft report prepared by Environmental Resources Management, Inc. (ERM) regarding the identification of the uppermost aquifer and the upper limit of this aquifer. The documents reviewed and relied upon for this evaluation include the following:

- ERM A8326 CCR Surface Impoundment History of Construction Documentation, October 14, 2016 that included:
    - Boring logs from a 2012 geotechnical study of the Ash Ponds and Equalization Pond conducted by Arias & Associates (Arias & Associates, 2012) (the Arias Report);
    - 1978 cross sections drawn by NFS/National Soil Services, Inc. (NFS) that were included in a 2013 assessment report of dam safety of the Ash Ponds and Equalization Pond by CDM Smith (CDM Smith, 2013) (the CDM Smith Report);

  - Soils Engineering Report from NFS Services, Inc. (NFS) to Tippett & Gee, Inc. dated Soils Engineering Report from NFS Services, Inc. (NFS) to Tippett & Gee, Inc. January 20, 1984;
  - A1977 as-built plan of the Ash Ponds and Equalization Pond, drafted by Tippet & Gee, Inc. (Tippet & Gee);
  - Volume II FIELD AND LABORATORY DATA GEOTECHNICAL INVESTIGATION PLANT ISLAND prepared by NFS/National Soil Services, Inc., submitted to Brazos Electric Power Cooperative on April 23, 1976; and
- ERM A7994 Draft Hydrogeologic Characterization report dated February 16, 2016.

According to the January 20, 1984 Soils Engineering Report from NFS Services, Inc. (NFS) to Tippett & Gee, Inc. the pre-construction subsurface conditions across the site were characterized as consisting of an upper clay stratum underlain by a sand stratum. This description was based upon soil boring logs advanced prior to construction of the plant. Copies of the NFS boring logs used in POWER's assessment of the elevation of the upper limit of uppermost groundwater aquifer, along with a figure illustrating the boring locations are included in Attachment A to this letter report. Geologic cross-sections generated as part of NFS's geotechnical evaluation of Ash Ponds A and B, and the Equalization Pond are included in Appendix B. The upper clay stratum described by NFS consists of "hard, medium to high-plasticity clays, sandy clays, and silty clays" having a falling head permeability ranging from 6.30 x 10-7 cm/sec to 4.29 x 10-9 cm/sec in the upper fifteen feet below original ground surface. According to NFS' evaluation of the boring log data, "the upper clay stratum extends to at or below Elev 288 or at least seven feet below the bottom of the ash ponds." A groundwater table was encountered at about Elev 268 which is approximately 27 feet below the bottom of Ash Ponds A and B. NFS describes the original ground surface elevations in the vicinity of the Ash Ponds as ranging from Elev 316 at the middle of the north dike of Pond A to a low of about Elev 292 at the southwestern corner of Pond B.

ERM performed hydrogeologic characterizations of the of the Ash Ponds and the Equalization Pond that were described in their A7994 Draft Report dated February 16, 2016. ERM performed a two-phase study of the groundwater bearing unit that included:

- A general assessment of the uppermost groundwater bearing unit,
- Collecting groundwater elevation measurements,
- Identifying the groundwater flow direction and velocity,
- Collecting groundwater samples for groundwater quality analyses,
- Collecting well yield data, and
- Assessing the geologic units above and below the uppermost groundwater bearing unit,

As part of their study, ERM utilized boring log information from a 2012 geotechnical engineering study by Arias Professionals (Arias) that were included in the Arias Job No. 2016-589 report dated October 11, 2016. ERM determined that their classification of geologic materials was consistent with the Arias descriptions of geologic materials. ERM constructed cross sections to illustrate the subsurface geology beneath the Ash Pile, Ash Ponds, and Equalization Pond utilizing boring logs from the NFS and Arias reports, in addition to the borings that ERM advanced. Copies of these cross sections are included in Appendix C. The lateral continuity of the subsurface stratigraphy is illustrated in Cross Sections A-A', B-B', C-C', and D-D'. Through these studies, ERM characterized the uppermost groundwater bearing

unit and the overlying and underlying geologic units that create confining conditions for the uppermost groundwater bearing unit.

ERM utilized the hydrogeologic characterizations of the uppermost groundwater bearing unit, along with data characterizing the overlying and underlying geologic units to identify the locations and depths for the CCR groundwater monitoring wells. ERM concluded that based upon these studies, the sand stratum found beneath the upper clay layer meets the EPA definition of an uppermost groundwater bearing unit and can be classified as an aquifer. This groundwater bearing sand unit is under confined conditions throughout the site. Because of the low permeability confining nature of the overlying clay unit, the interface between the bottom of the low permutability upper clay and the top of the sand layer was identified by ERM as the "uppermost extent" of the uppermost groundwater bearing unit. This interface was identified as the "Top of the Transmissive Sand Unit" on the boring logs for the groundwater monitoring wells installed for the CCR units. Copies of these boring logs are found in Appendix D. The "Top of the Transmissive Sand Unit" is equivalent to the term "the upper limit of the uppermost aquifer" used by EPA in 40 CFR 251.60.

POWER also reviewed the Arias boring logs presented in Appendix E as well as the cross sections generated for the dike stability studies performed by Arias. These boring logs illustrated a surface clay underlain by a sandy transmissive zone that is consistent with the geologic information on the NFS and ERM boring logs. The Arias boring logs identify the depth at which a "SILTY Fine Sand" was encountered. The depth to the SILTY fine Sand layer correlates to ERM's designation of the "Top of the Transmissive Sand Unit" on their boring logs.

In summary, the hydrogeologic characterizations performed by ERM established that the upper limit of the uppermost aquifer is the base of the overlying low-permeable clay. The groundwater does not rise around the base of the CCR units where it would come in contact with the waste in the unit because the groundwater is under confined conditions and the CCR units are located above the base of the confining clay layer.

4.0 AQUIFER SEPARTION DISTANCE DETERMINATION

Using the designation of "Top of Transmissive Sand Unit" shown on ERM's groundwater monitoring well boring logs included in Appendix D, POWER reviewed selected boring logs from the NFS geotechnical report that are included in Appendix A and the Arias boring logs included in Appendix E to identify the elevations of this boundary on these boring logs. Elevations of the upper limit of the uppermost aquifer (or Top of the Transmissive Sand Unit) for all the boring logs are summarized on Table 1 along with the coordinates for each boring location. The boring log coordinates and the elevations of the upper limit of the uppermost aquifer were inserted into a GIS program used to plot the wells on an aerial photograph of the site. The elevations for the top of the uppermost aquifer were inserted into a kriging program to interpolate the contour of the top of this unit. The contours for the elevations for the top of aquifer were overlain on the aerial photograph of the site (see Figure 2). The contours indicate that the sand unit gradually deepens from west to east beneath the CCR units from an Elev 300 in the vicinity of the Ash Pile to Elev 250 at the eastern side of the Equalization Pond.

Based upon the certification report dated October 30,1987 and prepared by Professional Services, Inc. (PSI) for the Ash Pond A clay liner and the certification report dated November 17, 2017 and prepared by Zephyr Environmental Corporation for Ash Pond B, the top of the three-foot clay liner in both ponds is at Elev 295. The top of the uppermost groundwater bearing unit at the northwestern corner of Ash Pond A

is approximately Elev 286. The top of the uppermost aquifer slopes to the east and southeast to Elev 264 (approximate) at the southeastern corner of Ash Pond B. Therefore, the upper limit of the uppermost groundwater bearing unit is separated from the top of the liner by 9 feet to 21 feet.

POWER performed a review of documentation contained in the ERM A8326 Surface Impoundment History of Construction Documentation report dated October 14, 2016 regarding the construction of the Equalization Pond. The NFS geotechnical evaluation of the plant prior to its construction, identified a thick, low permeability clay in the area where the Equalization Pond was constructed. The information in this report indicates that clay was removed from the area for construction activities including the berms around the Equalization Pond and leaving in-situ low permeability clay to serve as the liner for the Equalization Pond. The top of the liner in this is at Elev 275. As shown on Figure 2, the approximate elevation of the upper limit of the uppermost aquifer beneath the Equalization Pond ranges from approximately Elev 262 in the northwestern corner to Elev 250 near the southeastern end of the pond. There is a separation distance between the elevation of the upper limit of the uppermost aquifer beneath the Equalization Pond and the top of the pond's liner of approximately 13 feet to 25 feet.

5.0 SUMMARY

The CCR regulations require a separation distance of 5 ft between the upper limit of the uppermost aquifer and the base of the waste management units. Based upon the geologic and hydrogeologic data reviewed for this project as described above, the SMEC power plant is located on a low-permeability clay layer that overlies a sandy transmissive zone. ERM characterized this sandy transmissive zone that is under confined conditions as the uppermost transmissive zone. The Ash Ponds are constructed with a three-foot thick compacted clay liner that has a minimum separation distance from the upper limit of the uppermost aquifer of approximately 9 feet. The Equalization Pond was constructed on low permeability in-situ clay that has a separation distance from the upper limit of the uppermost aquifer of a minimum of 13 feet. Although groundwater elevations measured during groundwater monitoring events are higher than the base of the ponds, this is due to the confined groundwater conditions. The groundwater does not rise around the base of the Ash Ponds due to the overlying confining low-permeability clay. Therefore, the construction of the Ash Ponds and Equalization Pond meets the requirements of 40 CFR 257.60(a) by having a minimum of a five-foot separation distance between the base of the units and the upper limit of the uppermost aquifer beneath the site.

6.0 ENGINEER CERTIFICATION

This document was prepared by POWER Engineers, Inc. under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that the Coal Combustion Residual units consisting of the Ash Ponds and the Equalization Pond located at the San Miguel Electric Cooperative, Inc. plant in Atascosa County, Texas meet the requirements of 40 CFR 257.60(a) Placement Above the Uppermost Aquifer.

David H. Sorrells, P.E.

Date 10/12/2018

Betty H. Moore, P.G. (TXPG-5292)

Date 10/11/2018

TABLE 1 SUMMARY OF TOP OF UPPERMOST TRANSMISSIVE ZONE ELEVATIONS

TABLE 1
SUMMARY OF
TOP OF UPPERMOST TRANSMISSIVE ZONE ELEVATIONS

Source of Boring Log	Boring ID	Type	Latitude (dd)	Longitude (dd)	Ground Surface Elevation (ft)	Top of Upper Transmissive Zone (ft)	Depth to Groundwater* (ft)	Depth to Groundwater Elevation* (ft)
Arias	B-3	Boring	28.699278	-98.478389	314	281	33	ND
	B-1	Boring	28.700444	-98.479167	315	287	28	ND
	B-2	Boring	28.700417	-98.479583	303	291	12	ND
	B-4	Boring	28.699	-98.478389	289	284	5	ND
	B-5	Boring	28.699217	-98.475436	314	276	38	ND
	B-6	Boring	28.699222	-98.472	315	263	52	ND
	B-7	Boring	28.698972	-98.472	289	260	29	ND
	B-8	Boring	28.699417	-98.468861	293	253	40	ND
	B-9	Boring	28.698889	-98.468861	276	256	20	ND
	B-10	Boring	28.699611	-98.466972	293	259	34	ND
	B-11	Boring	28.700133	-98.466774	273	246	27	ND
	B-12	Boring	28.700722	-98.466639	274	249	25	ND
	B-13	Boring	28.701778	-98.466861	294	253	41	ND
	B-14	Boring	28.701778	-98.466472	273	259.5	13.5	ND
	B-15	Boring	28.703056	-98.466583	273	259	14	ND
	B-16	Boring	28.703778	-98.467639	294	251	43	ND
	B-17	Boring	28.704222	-98.467639	273	246	27	ND
ERM	PZ-4	Observation	28.699561	-98.479427	300.63	290.33	10.3	291.72
	PZ-3	Background	28.701263	-98.477568	320.89	287.89	33	294.75
	PZ-2	Background	28.701331	-98.473484	315.86	272.86	43	289.75
	MW-1	Observation	28.704233	-98.468193	285.22	255.22	30	281.34
	MW-2	Observation	28.701044	-98.472514	314.73	272.73	42	286.92
	MW-3	Monitor	28.699009	-98.477574	293.74	283.74	10	285.26
	MW-4	Monitor	28.699011	-98.467771	275.83	256.58	19.25	277.31
	AP-31	Monitor	28.698992	-98.478643	290.59	287.59	3	286.28
	AP-32	Monitor	28.699001	-98.47655	295.84	280.84	15	284.65
	AP-33	Monitor	28.698997	-98.475585	301.62	279.62	22	285.18
	AP-34	Monitor	28.69898	-98.473443	293.91	275.41	18.5	283.39
	AP-35	Monitor	28.698985	-98.472427	293.85	271.85	22	284.46
	AP-36	Monitor	28.698962	-98.47098	284.05	263.05	21	282.55
	EP-31	Background	28.703945	-98.472632	313.23	270.73	42.5	292.66
	EP-32	Monitor	28.703487	-98.466366	273.26	252.01	21.25	275.72
	EP-33	Monitor	28.702586	-98.466371	273.66	252.66	21	277.04
	EP-34	Monitor	28.70169	-98.466382	274.62	250.62	24	277.77
	EP-35	Monitor	28.70079	-98.466433	275.71	251.71	24	277.85
	EP-36	Monitor	28.699866	-98.466437	275.58	250.58	25	275.89
	EP-37	Monitor	28.699117	-98.466759	275.02	252.02	23	275.84
	EP-38	Monitor	28.698979	-98.468475	276.97	254.97	22	278.26
	PZ-5	Monitor	28.69899	-98.474464	299.29	277.29	22	285.29
	PZ-6	Monitor	28.699697	-98.470957	292.79	266.79	26	283.73
	PZ-7	Observation	28.699133	-98.469334	279.54	256.54	23	279.54
ERM-SP	SP-3	Monitor	28.704521	-98.479162	328.6	291.6	37	302.4
	SP-2	Monitor	28.705149	-98.478615	330.2	301.2	29	303.88
	SP-31	Observation	28.705783	-98.477233	331.89	290.39	41.5	303.47
	SP-32	Monitor	28.704638	-98.479654	325.21	288.21	37	301.74
	SP-33	Monitor	28.706041	-98.479516	327.36	303.36	24	308.18
	SP-34	Background	28.705784	-98.478527	332	295	37	304.13
	SP-1	Monitor	28.705192	-98.479508	326.31	289.61	36.7	302.03
	B-35	Boring 1978	28.70088	-98.475298	316	274.5	41.5	ND
	B-42	Boring 1978	28.699406	-98.470951	285.6	264.6	21	ND
	B-43	Boring 1978	28.701078	-98.46999	294.5	259.5	35	ND
	B-44	Boring 1978	28.701654	-98.469461	283.5	258.5	25	ND
	B-45	Boring 1978	28.702724	-98.469425	291.8	261.8	30	ND
	B-107	Boring 1978	28.700672	-98.47688	302.9	280.9	22	ND
	B-105	Boring 1978	28.699257	-98.47901	290.8	273.8	17	ND
	B-108	Boring 1978	ND	ND	300.8	ND	ND	ND
	B-106	Boring 1978	ND	ND	312.2	ND	ND	ND

TABLE 1
SUMMARY OF
TOP OF UPPERMOST TRANSMISSIVE ZONE ELEVATIONS

Source of Boring Log	Boring ID	Type	Latitude (dd)	Longitude (dd)	Ground Surface Elevation (ft)	Top of Upper Transmissive Zone (ft)	Depth to Groundwater* (ft)	Depth to Groundwater Elevation* (ft)
	B-109	Boring 1978	ND	ND	<Null>	ND	ND	ND
	B-110	Boring 1978	ND	ND	317	ND	ND	ND
	B-46	Boring 1978	ND	ND	306.4	ND	ND	ND
	B-47	Boring 1978	ND	ND	307.9	ND	ND	ND
	B-74	Boring 1978	ND	ND	312.7	ND	ND	ND
	B-75	Boring 1978	ND	ND	315.4	ND	ND	ND
	B-76	Boring 1978	ND	ND	320.3	ND	ND	ND
	B-77	Boring 1978	ND	ND	310.5	ND	ND	ND
	B-48	Boring 1978	ND	ND	307.8	ND	ND	ND
	B-49	Boring 1978	ND	ND	324.2	ND	ND	ND
	B-41	Boring 1978	ND	ND	306.2	ND	ND	ND
	B-66	Boring 1978	ND	ND	295	ND	ND	ND
	B-71	Boring 1978	ND	ND	ND	ND	ND	ND
	B-72	Boring 1978	ND	ND	ND	ND	ND	ND
	B-10	Boring 1978	ND	ND	ND	ND	ND	ND
	B-64	Boring 1978	28.704105	-98.474382	311.2	278.2	33	ND
	B-67	Boring 1978	28.701145	-98.475576	318	276.5	41.5	ND
	B-34	Boring 1978	28.701535	-98.47563	320	273.5	46.5	ND
	B-68	Boring 1978	28.70161	-98.476111	319.1	276.6	42.5	ND
	B-33	Boring 1978	28.70184	-98.476365	316.6	285.6	31	ND
NFS	B-97	Boring 1978	28.702231	-98.476805	313.1	291.6	21.5	ND
	B-39	Boring 1978	28.700244	-98.479445	301	288	13	ND
	B-38	Boring 1978	28.699813	-98.480643	290.6	250.6	40	ND
	B-37	Boring 1978	28.700177	-98.48182	292.5	257.5	35	ND
	B-36	Boring 1978	28.701226	-98.482369	300.2	290.2	10	ND
	B-60	Boring 1978	28.700882	-98.477936	319.2	282.7	36.5	ND
	B-70	Boring 1978	28.701164	-98.478305	322.8	287.3	35.5	ND
	B-69	Boring 1978	28.70179	-98.478829	319.7	282.7	37	ND
	B-32	Boring 1978	28.701878	-98.479173	312.9	288.4	24.5	ND
	B-59	Boring 1978	28.70205	-98.479269	312.8	285.3	27.5	ND
	B-4	Boring 1978	28.703149	-98.477424	325.4	292.9	32.5	ND
	B-3	Boring 1978	28.702879	-98.475847	322.2	286.7	35.5	ND
	B-50	Boring 1978	28.703523	-98.476519	319.5	284.5	35	ND
	B-2	Boring 1978	28.703966	-98.47583	325.1	287.1	38	ND
	B-31	Boring 1978	28.704668	-98.475766	328	288.5	39.5	ND
	B-1	Boring 1978	28.70528	-98.475841	331.2	290.7	40.5	ND
	B-29	Boring 1978	28.704694	-98.476511	328.8	292.3	36.5	ND
	B-23	Boring 1978	28.704451	-98.477431	328.5	297	31.5	ND
	B-24	Boring 1978	28.704142	-98.477398	326.6	294.6	32	ND
	B-12	Boring 1978	28.705306	-98.479929	322.5	263	59.5	ND
	B-13	Boring 1978	28.705596	-98.479657	327.8	265.8	62	ND
	B-15	Boring 1978	28.705545	-98.478861	334.3	291.3	43	ND
	B-11	Boring 1978	28.706721	-98.477755	346.1	298.1	48	ND
	B-18	Boring 1978	28.704069	-98.478924	331.1	297.6	33.5	ND
	B-56	Boring 1978	28.70354	-98.478175	331	294	37	ND
	B-8R	Boring 1978	28.707535	-98.480256	332.2	293.7	38.5	ND
	B-8	Boring 1978	28.707525	-98.480791	332.2	298.2	34	ND
	B-7	Boring 1978	28.707311	-98.481056	329.3	295.8	33.5	ND
	B-6	Boring 1978	28.707411	-98.482172	334.6	302.6	32	ND
	B-9	Boring 1978	28.708078	-98.478758	351.5	300	51.5	ND

ND - No Data
(dd) - Decimal Degrees

FIGURE 1 SITE LOCATION MAP

Datum: GCS NAD 1983 Map Sources: ESRI Bing Hybrid & Streets Basemaps

Property Boundary

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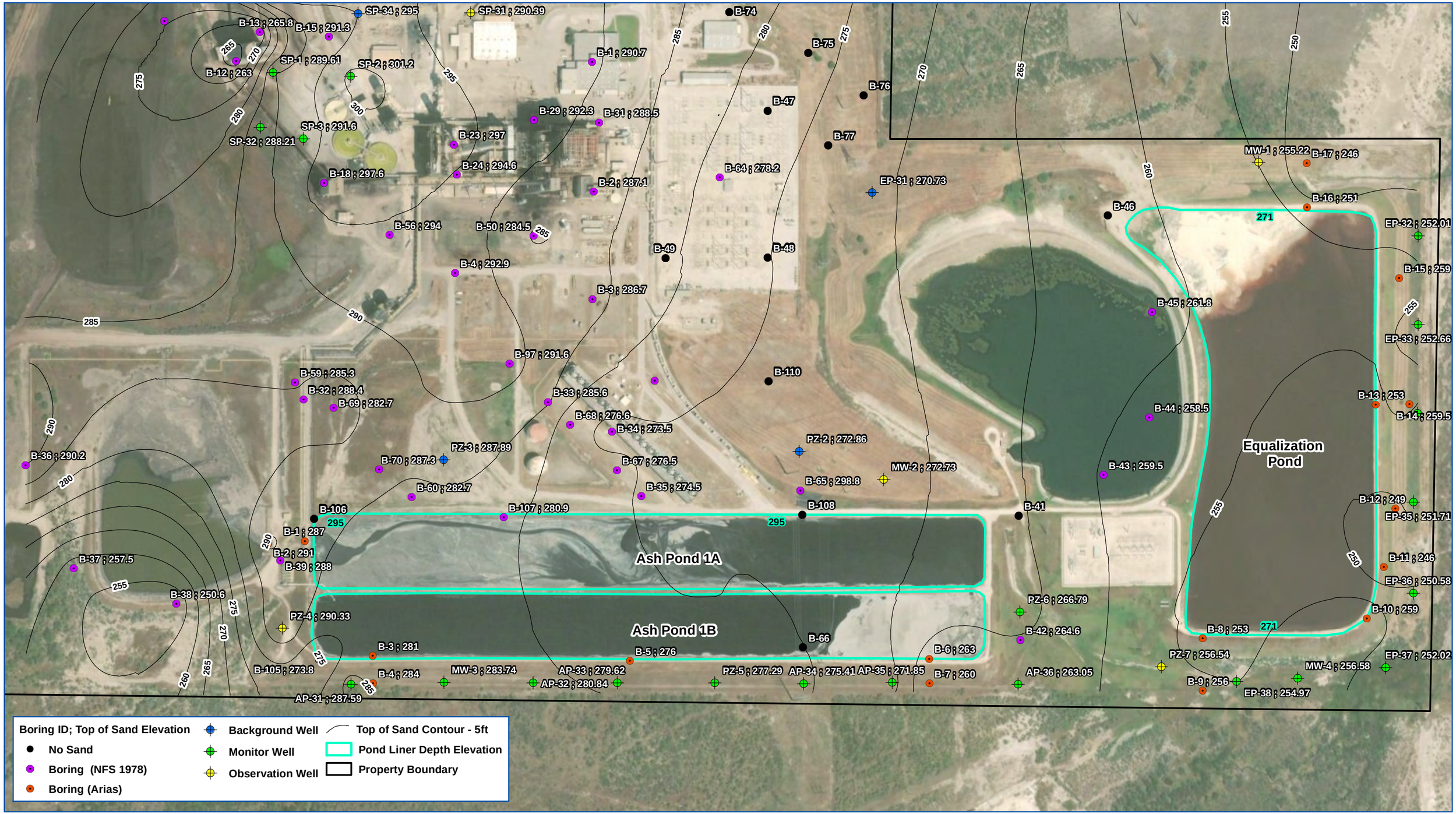
FIGURE 1 - Site Location Map

San Miguel Electric Cooperative, Inc.
Atascosa County, Texas

H:\San Miguel Electric\2018 Water Projects\150546 Aquifer Separation\GIS\1_AreaMap.mxd

Drafted By:	Reviewed By:	Project No.:	Date:
J. Knowles	B. Moore	150546	8/7/2018

FIGURE 2 ELEVATION OF THE UPPER EXTENT OF UPPER TRANSMISSIVE ZONE



Map Sources:
ESRI - World Imagery Basemap
Facility Borings-Multiple Reports

0 150 300 Meters

0 500 1,000 Feet

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FIGURE 2 - Upper Limit of Uppermost Aquifer

San Miguel Electric Cooperative, Inc.
Atascosa County, Texas

Document Path: H:\San Miguel Electric\2018 Water Projects\150546 Aquifer Separation\GIS\2_Uppermost_Aquifer.mxd

Drafted By: J. Knowles	Reviewed By: B. Moore	Project No.: 150546	Date: 8/7/2018

APPENDIX A NFS BORING LOGS

STUDY OF ASH POND LEAKAGE
SAN MIGUEL STEAM ELECTRIC STATION
JOURDANTON, TEXAS

Report to

TIPPETT & GEE, INC.
Consulting Engineers
Abilene, Texas

By

NFS SERVICES, INC.
Consulting Engineers
Dallas, Texas

January, 1984

NFS SERVICES, INC.
CONSULTING ENGINEERS

P.O. BOX 24596
DALLAS, TEXAS 75224
4087 SHILLING WAY
214-330-9211 (Office) 214-330-8953 (Telecopy)

SOILS ENGINEERING REPORT

STUDY OF ASH POND LEAKAGE
SAN MIGUEL STEAM ELECTRIC STATION
JOURDANTON, TEXAS

January 20, 1984
Report No. D-75285-13A

Tippett & Gee, Inc.
Consulting Engineers
502 North Willis Street
Abilene, Texas 79603

Attention: Mr. M. L. Hughes, P. E.

Gentlemen:

Submitted here is our report of our study of the ash pond leakage at the above-referenced facility. This study was requested by your letter of October 21, 1983.

DISCUSSION OF LEAKAGE PROBLEM

The San Miguel Steam Electric Station has two ash disposal ponds, identified as ponds "A" and "B," which are located south of the plant power block as shown on the Plan of Borings, Plate 1, in the illustrations section of the report. Both of these ash disposal ponds are rectangular impoundments, 2,475 feet long by 265 feet wide (measured along center line of embankment crest) with a common dike separating the north pond (pond "A") from the south pond (pond "B"). Construction of the ash disposal ponds started in July, 1977, and was completed in May, 1978.

In early June of 1978, extremely heavy rainfall associated with a tropical storm was experienced throughout South Texas. A substantial amount of water accumulated in both ash disposal ponds as a result of this storm, with the ponds remaining partially filled with

surface water for a long period thereafter. Pond "A" was placed into service in 1981 and has been full of liquid ash waste for approximately two years. Pond "B" has not had significant use to date and contains only a few feet of liquid ash waste.

In July, 1983, San Miguel Electric Cooperative, Inc., was notified by the Texas Department of Water Resources (TDWR) that, as a result of a routine industrial wastewater inspection made on May 26, 1983 by a TDWR representative, the west and east side outer banks of ash pond "A" were apparently leaking contents. TDWR requested that the reason for the pond leakage be identified and proposals made for correction of the problem. A copy of the TDWR correspondence, together with copies of all other correspondence related to the ash ponds, are included in the appendix to this report.

Subsequent inspections and tests made by San Miguel plant personnel revealed seven suspected leakage areas around the ash ponds. The areas are designated as areas "A" through "G" and are shown on Plate 2. Areas "A," "C," and "D" correspond to the locations of leakage cited by TDWR. Samples of surface water were analyzed for evidence of contamination with the following results:

Date	Sampling Point	pH	Specific Conductance (umhos/cm)	Sulfate (ppm)	Chloride (ppm)
10/15/83	A	7.45	4,700	1,964	749
	B	8.3	5,400	2,357	760
	C	7.5	8,600	5,108	737
	D	7.4	6,800	2,750	760
	E	7.4	4,700	2,200	647
	F	7.4	6,200	2,652	1,010
	G	7.95	4,500	2,122	318
	Ash Pond "A"	7.8	8,100	3,929	964
	Ash Pond "B"	8.3	7,900	4,518	783
10/30/83	A	7.2	4,300	2,161	629
	B	8.1	1,800	668	33
	C	8.4	7,000	12,573	1,953
	D	7.5	8,000	2,947	835
	E	8.0	7,000	2,357	391
	F	----------Not Tested----------			
	G	7.9	7,000	1,650	532
	Ash Pond "A"	7.2	7,000	4,479	1,020
	Ash Pond "B"	8.4	7,000	4,322	781

Comparison of the parameters defining the surface water quality with those characterizing the quality of the wastewater in the ponds indicates the probability of contamination of the surface water at the seven sampling points.

A site meeting was held on November 9, 1983 to permit assessment of the pond leakage by representatives of NFS Services, Inc. Those in attendance were:

NFS Services, Inc.	Mr. R. F. Reuss Mr. W. C. Worley Mr. G. G. LaFrance
San Miguel Electric Cooperative, Inc.	Mr. Robert Cmiel
Tippett & Gee, Inc.	Mr. E. G. Peveler

A second site inspection was made on January 9, 1984, to determine locations of proposed seepage collection lines and sumps. Messrs. Robert Cmiel and Wade Sebby of the San Miguel Station and G. G. LaFrance of NFS participated in this latter inspection.

PREVIOUS INVESTIGATIONS

Geotechnical parameters relating to design and construction of the ash disposal ponds are presented in Volume I, Foundation Design Analysis and Recommendations for the Plant Island, and Volume II, Field and Laboratory Data for the Plant Island, of NFS Report No. 75285, dated May 14, 1978. Records of field inspections and tests performed by NFS Services, Inc., during construction of the ash disposal ponds are summarized in NFS Inspection Report Nos. 194 (dated July 28, 1977) through 361 (dated June 8, 1978).

Additional geotechnical studies were performed by NFS Services, Inc., relative to certification of the ash disposal ponds, as well as the other plant site ponds. The initial certification plan for the ash disposal ponds was developed in November, 1977 and was based on drilling ten borings in the pond bottom (five in each pond) to a depth of five feet below the pond bottom. In addition, eight borings were to be drilled along the embankment crest of the dikes. Samples obtained from these borings were to be used for the determination of

dry unit weight, grain-size distribution, coefficient of permeability, and liquid and plastic limits for each of the soil types encountered. In addition, the information from this investigation was to be correlated with the previously developed soils data.

Due to the prolonged wet conditions in the ash disposal ponds, as well as the other plant site ponds, an alternate certification plan was proposed by NFS Services, Inc., based on drilling borings on the down dip side and partial perimeter of the various ponds shown on Plate 1 of the illustrations for this report. Both the initial certification plan and the revised certification plan are explained in detail in the NFS correspondence dated September 25, 1978, a copy of which is included in the appendix.

Subsequently, a field representative for TDWR recommended certification of the plant site ponds, including the ash disposal ponds, based on a field inspection performed by TDWR prior to January 30, 1979. Final certification of the ponds, including the ash disposal ponds, by TDWR was based in part on representations made by NFS as to the construction of the ponds as outlined in the NFS letter dated March 19, 1979 (refer to the appendix for a copy of this letter) in lieu of implementation of either the original or the revised certification programs.

SUBSURFACE CONDITIONS AND POND CONSTRUCTION

Preconstruction subsurface conditions in the vicinity of the ash disposal ponds are represented by the logs of borings B-35, B-39, B-41, B-42, B-60, B-65, B-66, B-105, B-106, B-107, and B-108. Locations of the borings are shown on Plate 1, with the logs of the referenced borings being presented on Plates 3 through 15. Logs of these borings are also illustrated in graphical form on Sections A-A', B-B', C-C', and D-D' of the Generalized Soils Profiles, Plates 16 through 19.

In general, the preconstruction subsurface soil formations consisted of an upper clay stratum underlain by a sand stratum. The upper clay stratum was comprised of hard, medium to high-plasticity clays, sandy clays, and silty clays having some evidence of jointing

and slickensides. Results of six falling-head permeability tests performed on undisturbed clay specimens situated within the uppermost 15 feet below the original ground surface showed coefficient of permeability values ranging from 6.30×10^{-7} cm/sec to 4.29×10^{-9} cm/sec. The lower sand stratum consists of very dense, green to light brown and light gray, silty fine sand. Based on the boring data, the upper clay stratum extends to at or below Elev 288, or at least seven feet below the bottom of the ash ponds. Piezometric data developed during the geotechnical investigation for the plant site indicated the existence of a very deep groundwater table at about Elev 268 or approximately 27 feet below the bottom of the ash ponds.

Original ground surface elevations in the vicinity of the ash disposal ponds varied from a high of about Elev 316 at the middle of the north dike of pond "A" to a low of about Elev 292 at the southwestern corner of pond "B." The top of dike elevation is 315, with the bottom of the ponds being at Elev 295. Except for previously noted areas of high and low original ground elevations, the dikes of ponds "A" and B" are comprised of a lower section of in-situ clay and an upper section of compacted clay. A five-foot-deep inspection trench was opened and backfilled with compacted clay along the toe of the interior slope except in areas where the dike is composed entirely of compacted clay embankment, in which case the inspection trench was positioned beneath the embankment crest. Interior and exterior slopes of the dikes are 2.5 H:1 V.

Field inspection records verify that no pervious soil strata were encountered in either the inspection trenches or the pond bottoms. Above-ground portions of the dikes consist of compacted medium to high-plasticity clays, sandy clays, and silty clays obtained from excavations made in the interior of the ash ponds. The clay fill was placed in maximum nine-inch loose lifts and compacted at a moisture content ranging from minus one to plus four percentage points above the optimum moisture content to at least 95 percent of the maximum dry density determined by THD Method TEX 113-E.

ANALYSES AND RECOMMENDATIONS

Areas of suspected pond leakage, identified as areas "A" through "G" and shown on Plate 2, were observed by NFS personnel during the November 9, 1983 site inspection. Based on the visual observations made at that time and also during the January 9, 1984 inspection, it is very probable that, with the exception of areas "B" and "G", the identified wet areas do result from pond leakage. In the case of suspected leakage area "B", the absence of seepage emerging from the outer dike slope at this location makes it less clear as to the probable source of the contaminated surface water sampled from the deep swale near the northwest corner of pond "A". With respect to suspected leakage area "G", this wet area appears to result from surface water being discharged from the nearby culvert. Both areas "B" and "G" should be assessed further during a dry period when the effects of surface water are absent.

The geotechnical parameters recommended by this firm for use in designing the ash ponds were based on the assumption the medium to high-plasticity clays comprising the dikes and bottom of the ponds would have a permeability of less than 1×10^{-7} cm/sec when wetted. For the most part, field performance of the ash ponds has verified the initial design assumption. At the locations of the suspected leakage areas, subsurface conditions are different than previously assumed due to localized variations in soil types or structure, such as the presence of continuous joints. Based on the observed pattern of lateral movement of fluid from the ponds at several locations of leakage, it is likely that jointing of the in-situ clays at certain locations has provided a continuous flow path instead of a discontinuous flow path. The presence of massive clay formations beneath the bottom of the ponds and decreased jointing with depth warrant the conclusion that downward migration is negligible. Consequently, the leakage problem essentially involves lateral movement of pond fluid through localized discontinuities.

Recommended remedial work to control the pond leakage and to eliminate the possibility of contaminating surface water consists of installing seepage collection pipes, channeling the seepage to sumps, and pumping the accumulated seepage back into the ponds. A suggested plan and details for the collection system are shown on Plate 20. This recommended collection system, however, will not alleviate the leakage, if any, at area "B" inasmuch as any seepage emerging from or at the toe of slope would immediately enter the culvert and be discharged to the area west of ash disposal pond "B". If further assessment of the "B" area during a dry period confirms the likelihood of pond leakage at this location, a pipe toe drain and sump, constituting a closed system in order to separate seepage from the surface water runoff in the swale, will be required at this location. If required, typical design details will be furnished at a later date.

We trust that the information presented in this report satisfies the recent inquiries made about the ash pond leakage and provides a reasonable solution for correcting the problem. Please call us if there are any questions or if we may be of additional assistance.

Very truly yours,

NFS SERVICES, INC.

Gary G. LaFrance, P. E.
Manager of Engineering

Ralph F. Reuss /GL
Ralph F. Reuss, P. E.
President

GGL/RFR/lcr

Copies submitted: 3

LIST OF STRUCTURES

1. Lignite receiving hopper.
2. Lignite storage silos.
3. Limestone receiving hopper.
4. Stacker-reclaimer.
5. Ready pile reclaiming hopper.
6. Conveyor drive room.
7. Crusher house.
8. Chimney Unit No.1
9. Fly ash silos.
10. Bottom ash dewatering tank.
11. Fuel oil storage tank.
12. Service buildings.
13. Ash pond.
14. Elevated water tank.
15. Switch yard.
16. Boiler.
17. Pollution equipment control room.
18. Scrubbers.
19. Turbine generators.
20. Warehouse.
21. Well water storage pond.
22. Yard drainage retention pond.
23. Cooling tower.
24. Lime slurry thickeners.
25. Dead storage pile.
26. Plant control room.
27. Primary breaker.
28. Precipitator.
29. Conveyor transfer tower.

N

Scale 1"= 400'

LEGEND

- Existing Borings
- Proposed Borings

PLANT ENTRY

SEE DETAIL OR AND TURBINATOR AREA

PLATE LOAD TEST

DEAD STORAGE PILE 25

ROAD

HAUL

YARD DRAINAGE RETENTION POND 22

WATER WELL STORAGE POND 21

SLUDGE DISPOSAL BASIN

ASH DISPOSAL POND 13

ASH DISPOSAL POND

A

A'

B

B'

C

C'

D

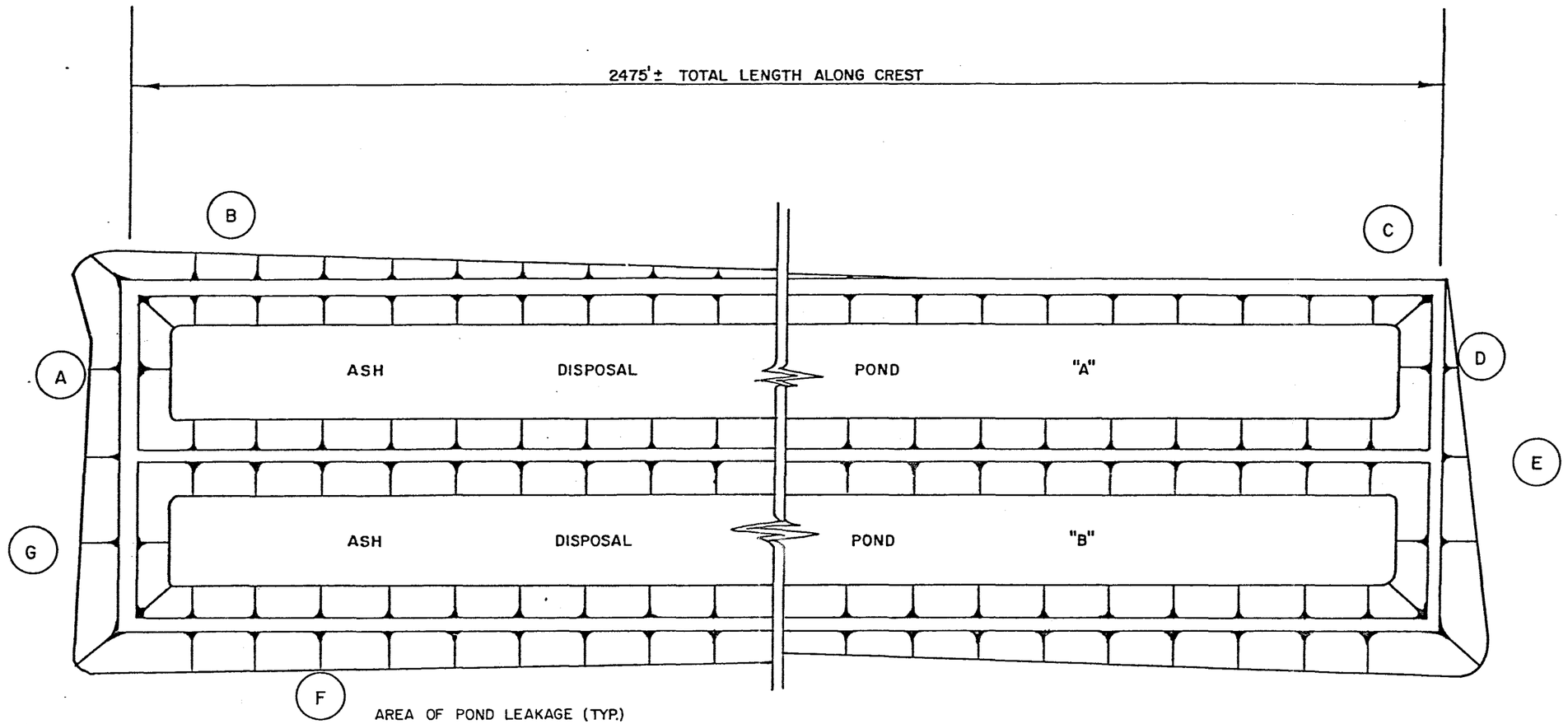
D'

△3 CORRECTIONS SEPT. 1, 1978
△2 CORRECTIONS JULY 12, 1978
△1 CORRECTIONS JUNE 10, 1978

PLAN OF BORINGS

N

Scale: 1" = 200'



LOCATION OF LEAKAGE AREAS

LOG OF BORING NO. B-SES-35
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	BLOWS PER FT.	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 316.0							
			Hard brawn clay (CH)						3+	
			Hard light tan silty clay w/calcareous packets							
5			-w/occasional course sand (CL - CH)						3+	
			Hard light gray sandy clay w/iron stains							
10									3+	
15			(CL)			55	15		3+	
			Hard light reddish-brown clay w/occasional silty clay seams w/limonite laminations							
20			-w/selenite pockets (CH)						3+	
			Hard light red and light gray silty clay w/iron laminations, selenite laminations w/some sand							
25			(CL)						3+	
			Hard light brownish-tan clay w/selenite seams							
30			-jointed						3+	
35			(CH)						3+	
			Hard tan sandy clay w/carbonaceous specks							
			-gray							
40			-w/iron stains (CL)						3+	
			Very dense green silty fine sand		50/2.5" seat					
45										
				29	50/5.5" seat					
50										

(Continued)

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

LOG OF BORING NO. B-SES-35 (Cont'd.)
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	BLOWS PER FT.	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55					50/5.5" seat					
			-w/occasional clayey sand pockets							
60					50/5.5" seat					
			(SM)							
			Hard gray sandy clay, w/4.0" silty sand seam at 64.5' -w/numerous clay laminations						4.5+	
65										
			(CL)						4.5+	
			Hard grayish-brown clay, w/numerous sand pockets, slightly slickensided							
70			(CH)						4.5+	
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 70.5'
DATE: 1-29-76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 4

LOG OF BORING NO. B-SES-39
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	%PASSING NO200 SIEVE	BLOWS PER FT.	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT,%	SHEAR STRENGTH IN TONS/SQ.FT. 0.5 1.0 1.5	UNIT DR. WT. LBS./CU FT.
			ELEVATION: 301.0							
			Hard dark brown sandy clay (CL)							
5			Hard light brownish-tan clay, jointed -w/selenite seams and limonite pockets (CH)							
10			Hard reddish-brown sandy clay, w/occasional limonite pockets (CL)							
15			Very dense light gray and light brown silty fine sand, w/light brown clay seams, clayey fine sand seams and occasional selenite seams							
20					87/10"					
25			(SM)							
30										
35										
40										
45										
50										

COMPLETION DEPTH: 25.0'
DATE: 1/15/76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 5

LOG OF BORING NO. B-SES-41
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 306.2						
			Hard dark brown clay (CH)					0+	
5			Hard reddish-tan and light gray silty clay, w/selenite seams and pockets					0+	
10								0+	
15			(CL) Hard light reddish-brown clay, jointed -w/iron laminations and selenite seams					0+	
20			-w/silty clay seams at 20.0' -w/iron laminations (CH)					0+	
25									
30									
35									
40									
45									
50									

COMPLETION DEPTH: 21.5'
DATE: 1/14/76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 6

LOG OF BORING NO. B-SES-42
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 285.6						
			Hard dark brown clay (CH)						
5			Hard light reddish-tan and light gray silty clay, w/numerous clay laminations and seams (CL)						
10			Hard light brownish-tan clay, w/selenite seams, jointed						
15			-turning slightly sandy at 15.0' -w/occasional iron stains (CH)						
20			Hard brown sandy clay (CL)						
25			Very dense gray clayey fine sand, w/occasional dark gray clay balls (SC)						
30									
35									
40									
45									
50									

COMPLETION DEPTH: 21.5'
DATE: 1/15/76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 7

LOG OF BORING NO. B-SES-60

G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	%PASSING NO.200 SIEVE	BLOWS PER FT.	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ.FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU.FT.
			ELEVATION: 319.2							
			Hard brown sandy clay						0.5+	
			(CL)							
5			Hard light gray silty clay w/numerous selenite pockets						0.5+	
			(CL)							
			Hard light red clay w/selenite seams						0.5+	
10										
			-w/numerous iron laminations						0.5+	
15			(CH)							
			Hard light gray silty clay w/occasional clayey pockets						0.5+	
20			(CL)							
			Hard light brownish-tan clay w/iron stains, jointed						0.5+	
25			-w/selenite pockets							
			(CH)							
			Hard light brown sandy clay w/clay pockets and iron stains						0.5+	
35			(CL)							
			Very dense light green silty fine sand, w/iron stains		50/3.5" seat					
40										
45			-w/occosional red clay seams							
			-w/occasional sandy silt laminations below 48'							
50										

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 8

LOG OF BORING NO. B-SES-60 (Cont'd.)
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SM)						
			Hard gray clay w/accasional sandy clay pockets to 65'						
55			-w/occasional sand pockets						
60									
65			-slightly slickensided						
70			(CH)						
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 70.0'
DATE: 1-31-76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 9

LOG OF BORING NO. B-SES-65
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION		% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 304.8							
			Hard dark brown clay	(CH)					0+	
5			Hard light red and light gray silty clay	(CL)					0+	
			Very dense light gray clayey fine sand	(SC)						
			Hard light reddish-brown clay							
10			-w/silty clay laminations and pockets -jointed -w/limonite seams						0+	
15									0+	
20			-selenite seams	(CH)					0+	
25										
30										
35										
40										
45										
50										

COMPLETION DEPTH: 21.5'
DATE: 1-15-76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 10

LOG OF BORING NO. B-SES-66
G&T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 295.0						
			Hard dark brown clay (CH)					P*	
5			Hard light reddish-brown silty clay, jointed, w/numerous clay laminations and iron stains (CL)					P*	
10			Hard light reddish-tan clay, w/silty clay laminations (CH)					P*	
15			Hard light brownish-tan clay, w/selenite seams, jointed -slightly slickensided					P*	
20			-w/sandy clay laminations and pockets below 20.8' (CH)					P	
25									
30									
35									
40									
45									
50									

COMPLETION DEPTH: 21.5'
DATE: 1/15/74

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 11

LOG OF BORING NO. B-105
G & T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	%PASSING NO.200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ.FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 290.8'						
			Stiff brown silty clay (CL)		-				
5			Tan clay, w/occasional crystal material (CL)	55	34	15			
			Dense tan sandy silt	54	28	19			
10			-iron stained		31	18			
15			(ML)						
			Dense tan silty fine sand, iron stained						
20									
25			(SM)						
30									
35									
40									
45									
50									

COMPLETION DEPTH: 25.0'
DATE: 7/20/76

LOG OF BORING NO. B-106
G & T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 312.2'						
			Very stiff dark brown clay (CH)						
5			Hard tan fine silty clay -iron stains (CL)		44	27			
10			Hard tan clay, w/occasional selenite (CH)						
15			Very stiff light brown clay, w/occasional selenite (CH)						
20			Hard tan silty clay, w/occasional calcareous material (CL)	62	61	24			
25									
30									
35									
40									
45									
50									

COMPLETION DEPTH: 25.0'
DATE: 7/20/76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

PLATE 12

LOG OF BORING NO. B-107
G & T COOPERATIVE PROJECT
PLEASANTON, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 302.9'						
			Stiff dark brown clay (CH)						
			Hard light tan clay, w/iron stain		83	28			
5				71					
			-light brown						
10			-occasional very stiff selenite	67	52	22			
			(CH)						
			Hard tan clay		89	31			
15									
			-occasional crystal material						
20									
			(CH)						
			Very dense silty fine sand						
25			(SM)						
30									
35									
40									
45									
50									

COMPLETION DEPTH: 25.0'
DATE: 7/20/76

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

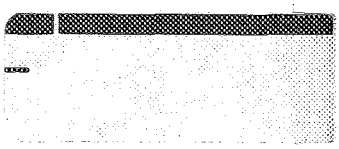
PLATE 14

LOG OF BORING NO. B-108
G & T COOPERATIVE PROJECT
PLEASANTON, TEXAS

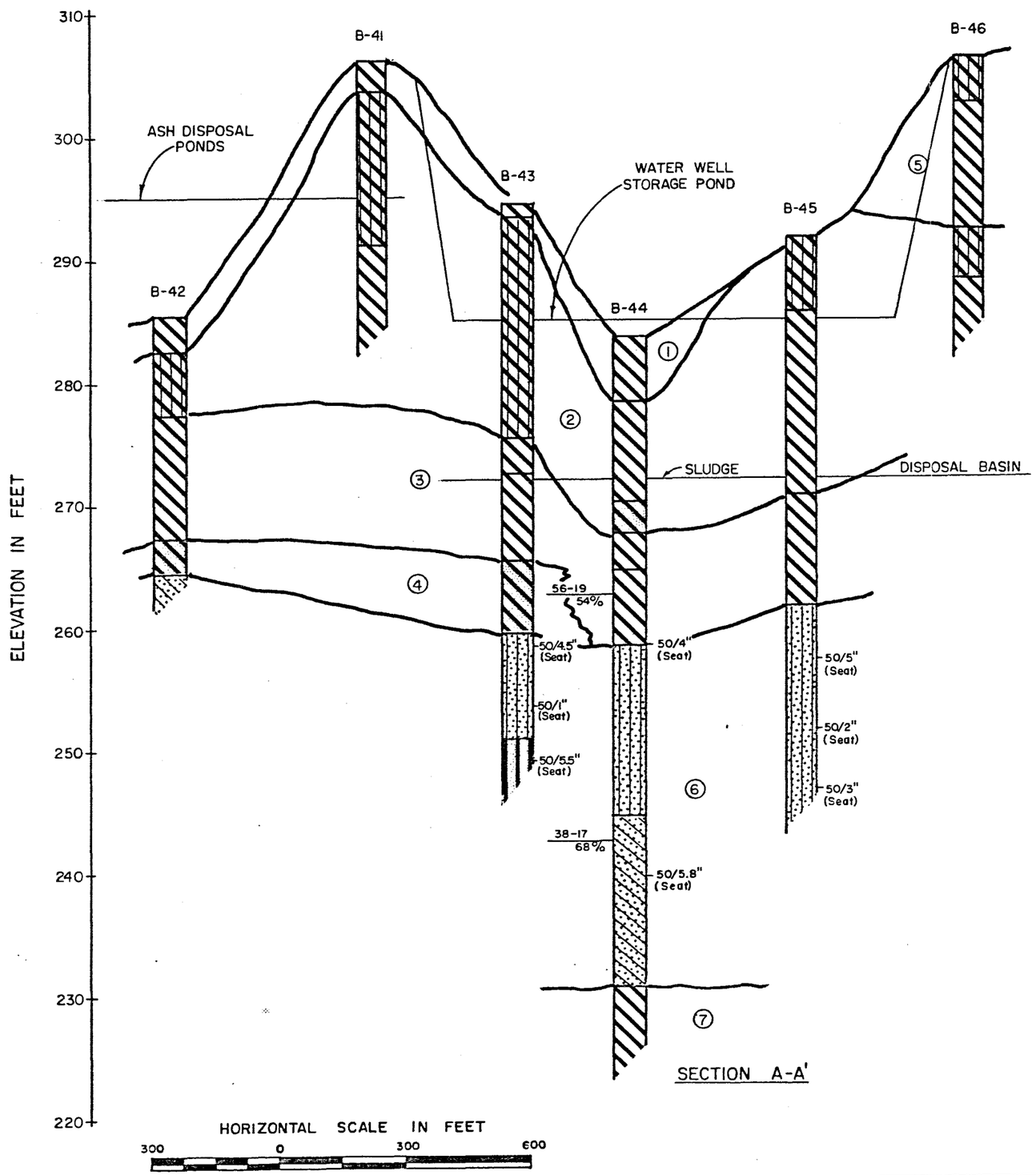
TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

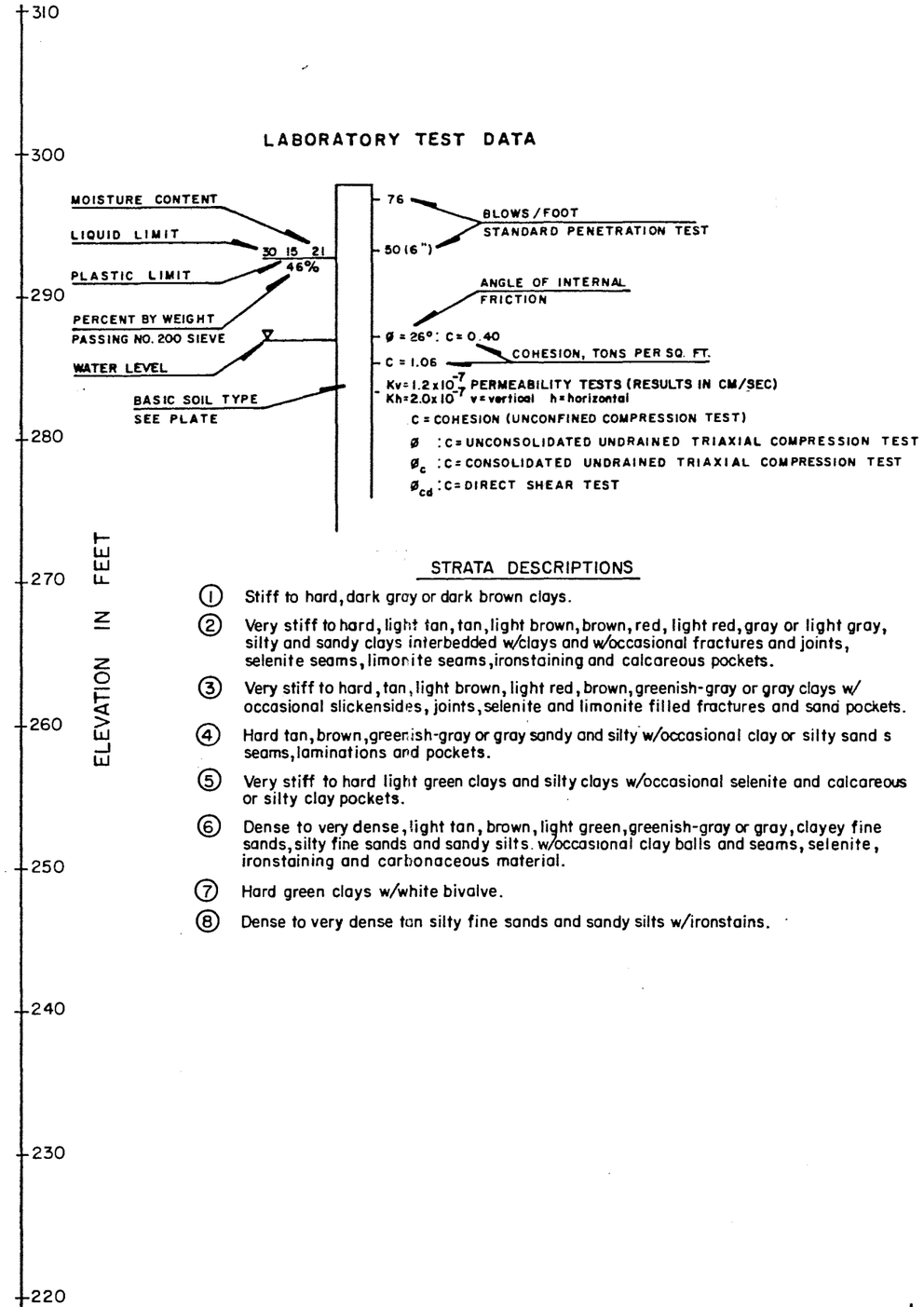
DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ. FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 300.8'						
			Stiff dark brown clay						
			-very stiff						
5			(CH)						
			Very stiff brown clay, iron stained		67	24			
10									
			-tan						
15									
20			(CH)						
			Hard light brown clay, iron stained						
25			(CH)						
30									
35									
40									
45									
50									

COMPLETION DEPTH: 25.0'
DATE: 7/17/76



ILLUSTRATIONS





STRATA DESCRIPTIONS

① Stiff to hard, dark gray or dark brown clays.

② Very stiff to hard, light tan, tan, light brown, brown, red, light red, gray or light gray, silty and sandy clays interbedded w/clays and w/occasional fractures and joints, selenite seams, limonite seams, ironstaining and calcareous pockets.

③ Very stiff to hard, tan, light brown, light red, brown, greenish-gray or gray clays w/ occasional slickensides, joints, selenite and limonite filled fractures and sand pockets.

④ Hard tan, brown, greenish-gray or gray sandy and silty w/occasional clay or silty sand s seams, laminations and pockets.

⑤ Very stiff to hard light green clays and silty clays w/occasional selenite and calcareous or silty clay pockets.

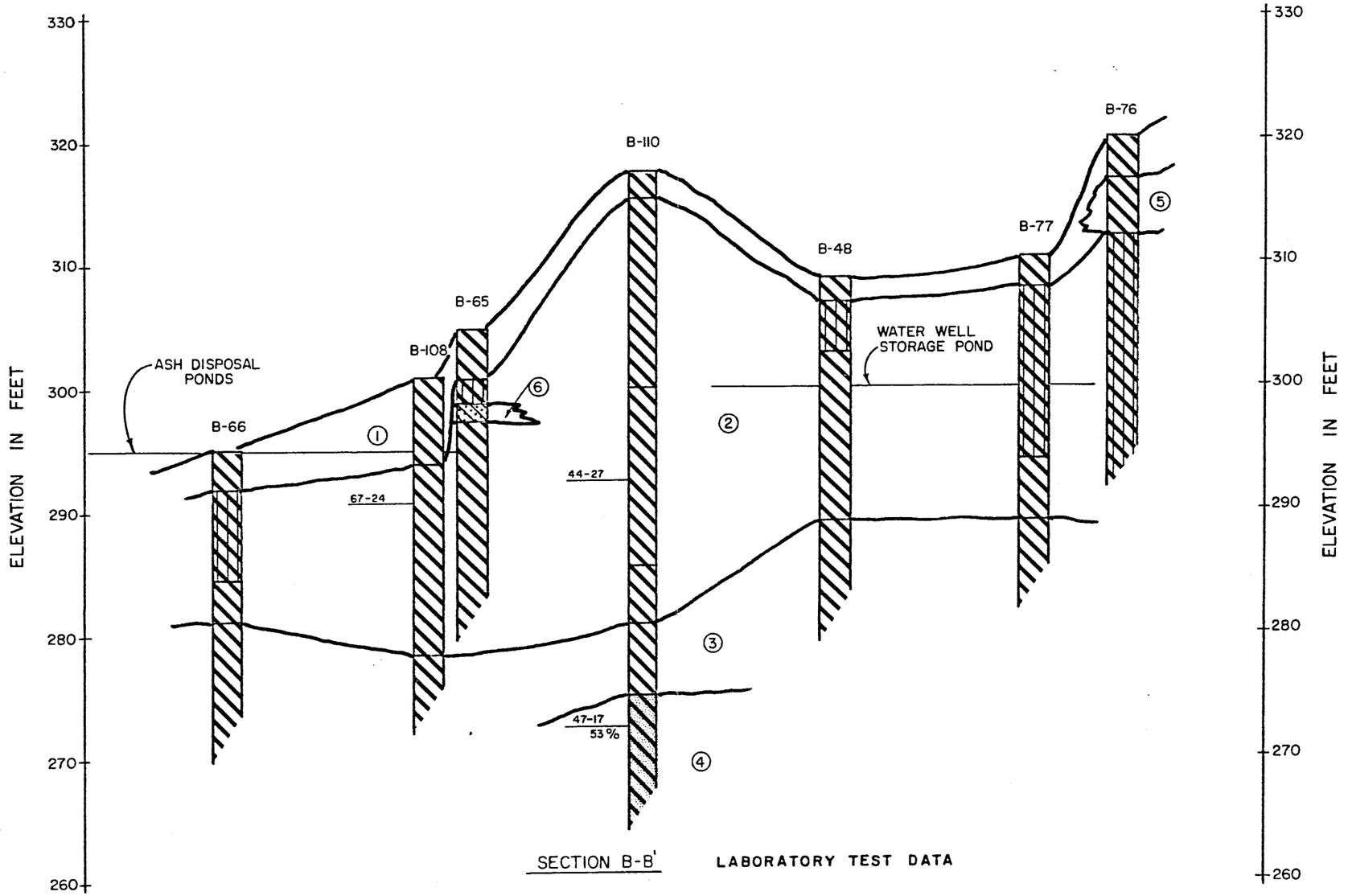
⑥ Dense to very dense, light tan, brown, light green, greenish-gray or gray, clayey fine sands, silty fine sands and sandy silts w/occasional clay balls and seams, selenite, ironstaining and carbonaceous material.

⑦ Hard green clays w/white bivalve.

⑧ Dense to very dense tan silty fine sands and sandy silts w/ironstains.

SECTION A-A'
GENERALIZED SOILS PROFILE

PLATE 16



SECTION B-B'

NOTE: For Strata Descriptions see Section A-A'

HORIZONTAL SCALE IN FEET

300 0 300 600

LABORATORY TEST DATA

MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT
PERCENT BY WEIGHT PASSING NO. 200 SIEVE
WATER LEVEL
BASIC SOIL TYPE SEE PLATE

30 15 21
46%

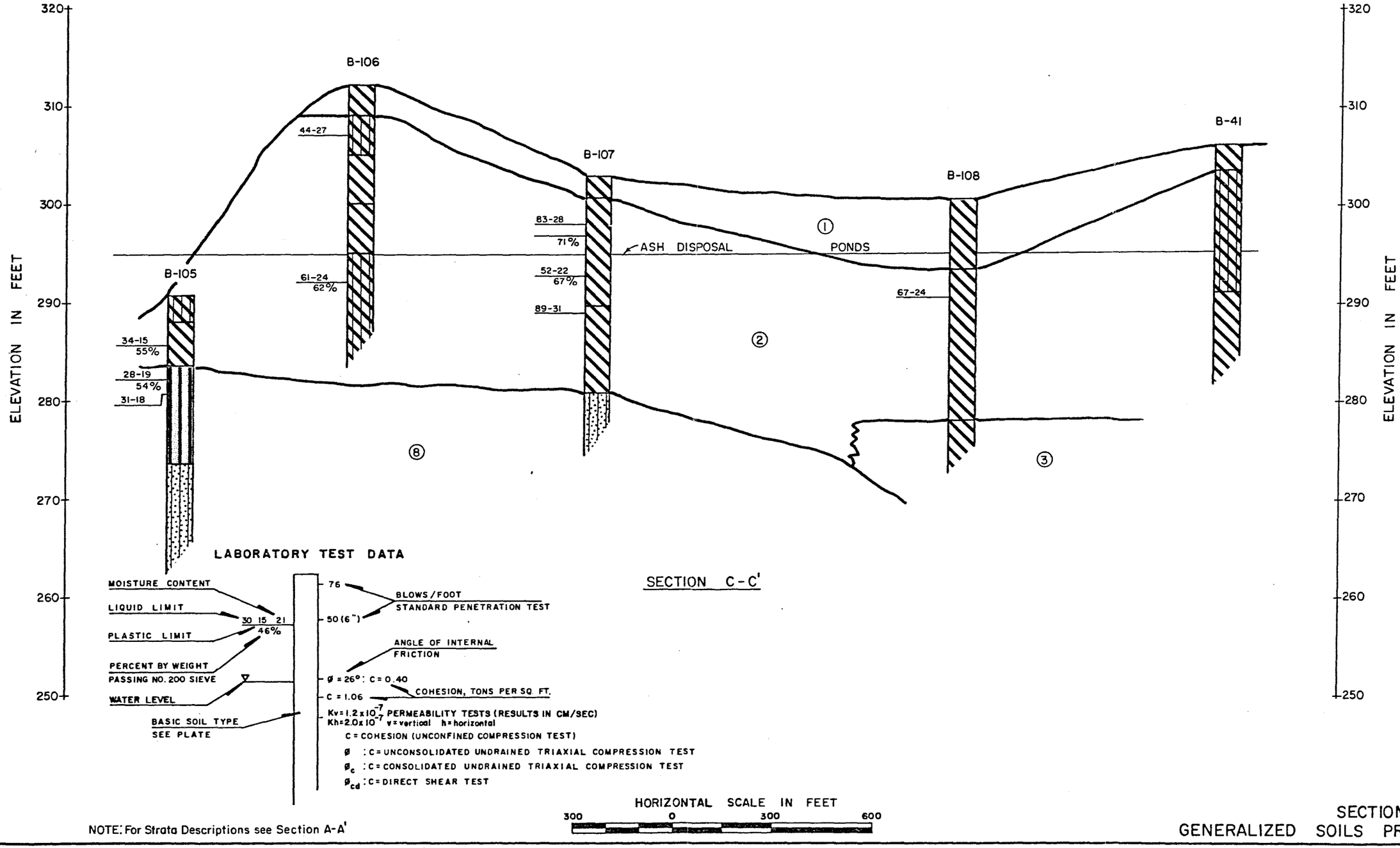
76 — BLOWS/FOOT STANDARD PENETRATION TEST
50 (6") —

ANGLE OF INTERNAL FRICTION
ø = 26°: C = 0.40
C = 1.06 — COHESION, TONS PER SQ. FT.
Kv = 1.2×10^{-7} PERMEABILITY TESTS (RESULTS IN CM/SEC)
Kh = 2.0×10^{-7} v = vertical h = horizontal

C = COHESION (UNCONFINED COMPRESSION TEST)
ø : C = UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
$ø_c$: C = CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
$ø_{cd}$: C = DIRECT SHEAR TEST

SECTION B-B'
GENERALIZED SOILS PROFILE

PLATE 17



LABORATORY TEST DATA

MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT
PERCENT BY WEIGHT PASSING NO. 200 SIEVE
WATER LEVEL
BASIC SOIL TYPE SEE PLATE
30 15 21 46%
76 BLOWS/FOOT STANDARD PENETRATION TEST
50(6") BLOWS/FOOT STANDARD PENETRATION TEST
ANGLE OF INTERNAL FRICTION
ø = 26°: C = 0.40 COHESION, TONS PER SQ. FT.
C = 1.06 COHESION, TONS PER SQ. FT.
Kv = 1.2 x 10⁻⁷ PERMEABILITY TESTS (RESULTS IN CM/SEC)
Kh = 2.0 x 10⁻⁷ v = vertical h = horizontal
C = COHESION (UNCONFINED COMPRESSION TEST)
ø : C = UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
$ø_c$: C = CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
$ø_{cd}$: C = DIRECT SHEAR TEST

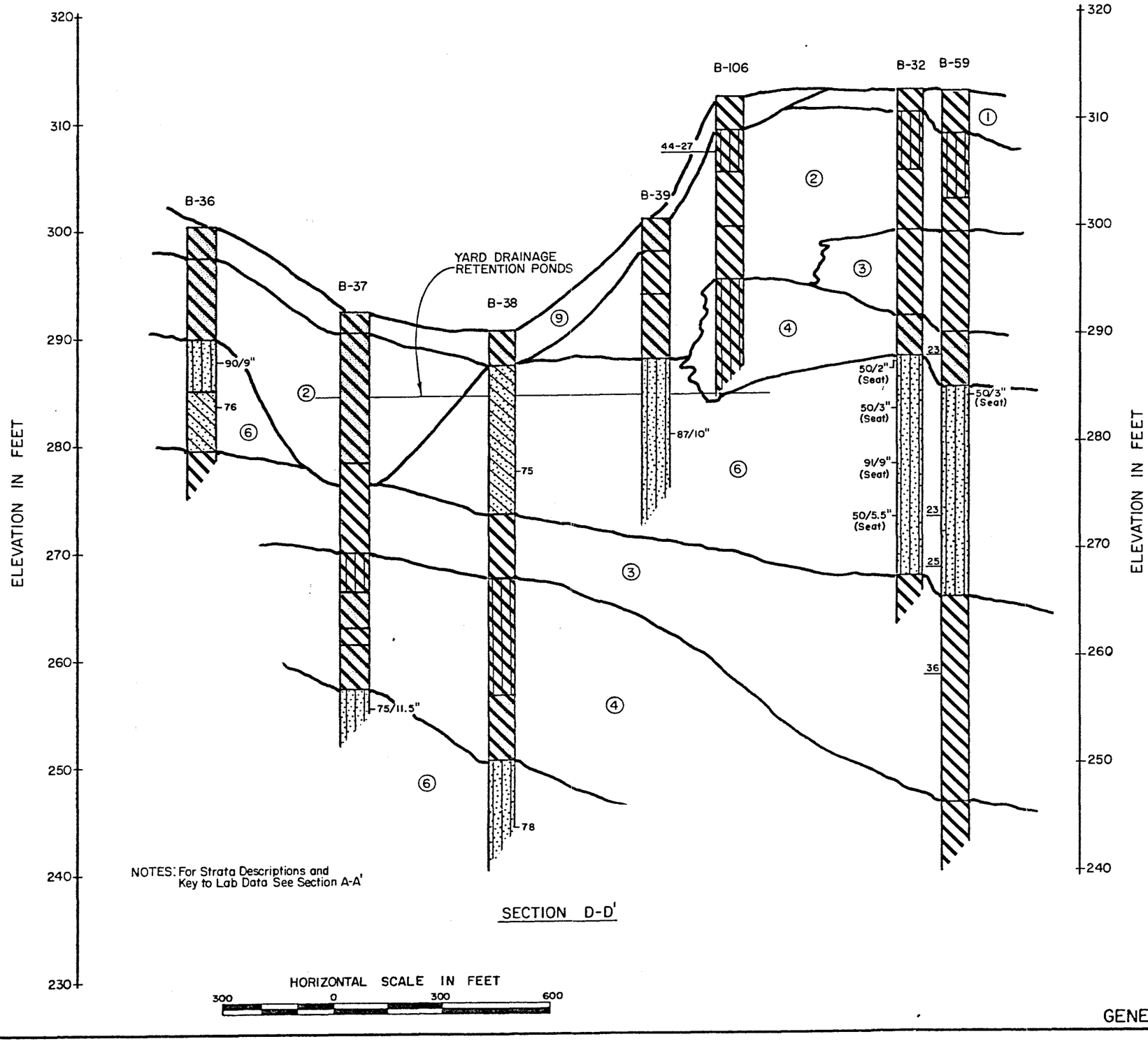
SECTION C-C'

HORIZONTAL SCALE IN FEET
300 0 300 600

NOTE: For Strata Descriptions see Section A-A'

SECTION C-C'
GENERALIZED SOILS PROFILE

PLATE 18



SECTION D-D'
GENERALIZED SOILS PROFILE

PLATE 19

N

Not to Scale

2475'± TOTAL LENGTH ALONG CREST

Wet Area "C"
Locate sump at edge of swale in line with the dike crest. Extend drain line to west 150'. Ground elevation difference between sump location and upper end of drain line is about one foot.

SUMP (TYP.)

SEEPAGE COLLECTION PIPE (TYP.)

Wet Area "A"
Position sump at toe of slope midway between wet area and pump foundation slab. Upper edge of wet area is about 8' higher than toe of slope. North drain line to sump (100'±) should extend through wet area. South drain line to sump (45'±) will collect runoff from pump area. Relocate existing compressed air lines at southern edge of wet area.

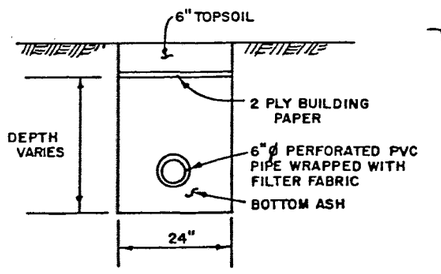
ASH DISPOSAL POND "A"

ASH DISPOSAL POND "B"

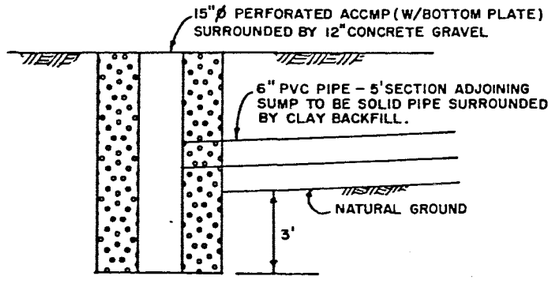
Wet Area "D"
Locate sump in level area beyond toe of slope about 40' north of common dike. Extend drain line 200' ± northwest to beyond limits of wet area. Ground elevation difference between sump location and upper limit of wet area is about 8'.

EXISTING FENCE

Wet Area "F"
Wet area extends beyond fence. Locate sump on west side of wet area midway between fence and north edge of wet area. Extend drain to the east beyond limits of wet area (250'±). Ground elevation difference between sump location and upper end of drain line is about one foot.



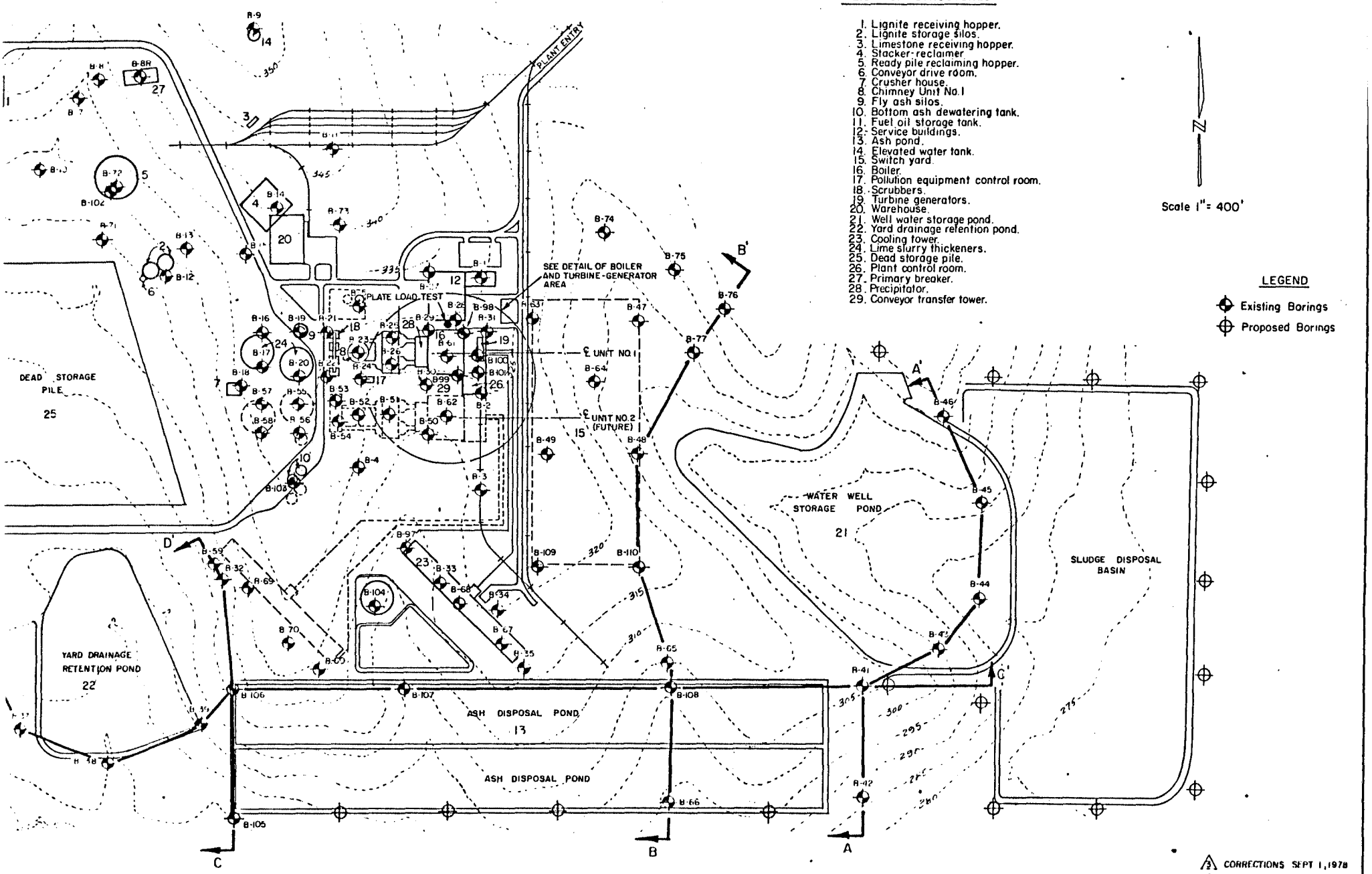
SEEPAGE COLLECTION PIPE DETAIL
Not to Scale



SUMP DETAIL
Not to Scale

PLAN AND DETAILS OF SEEPAGE COLLECTION PIPE AND SUMPS

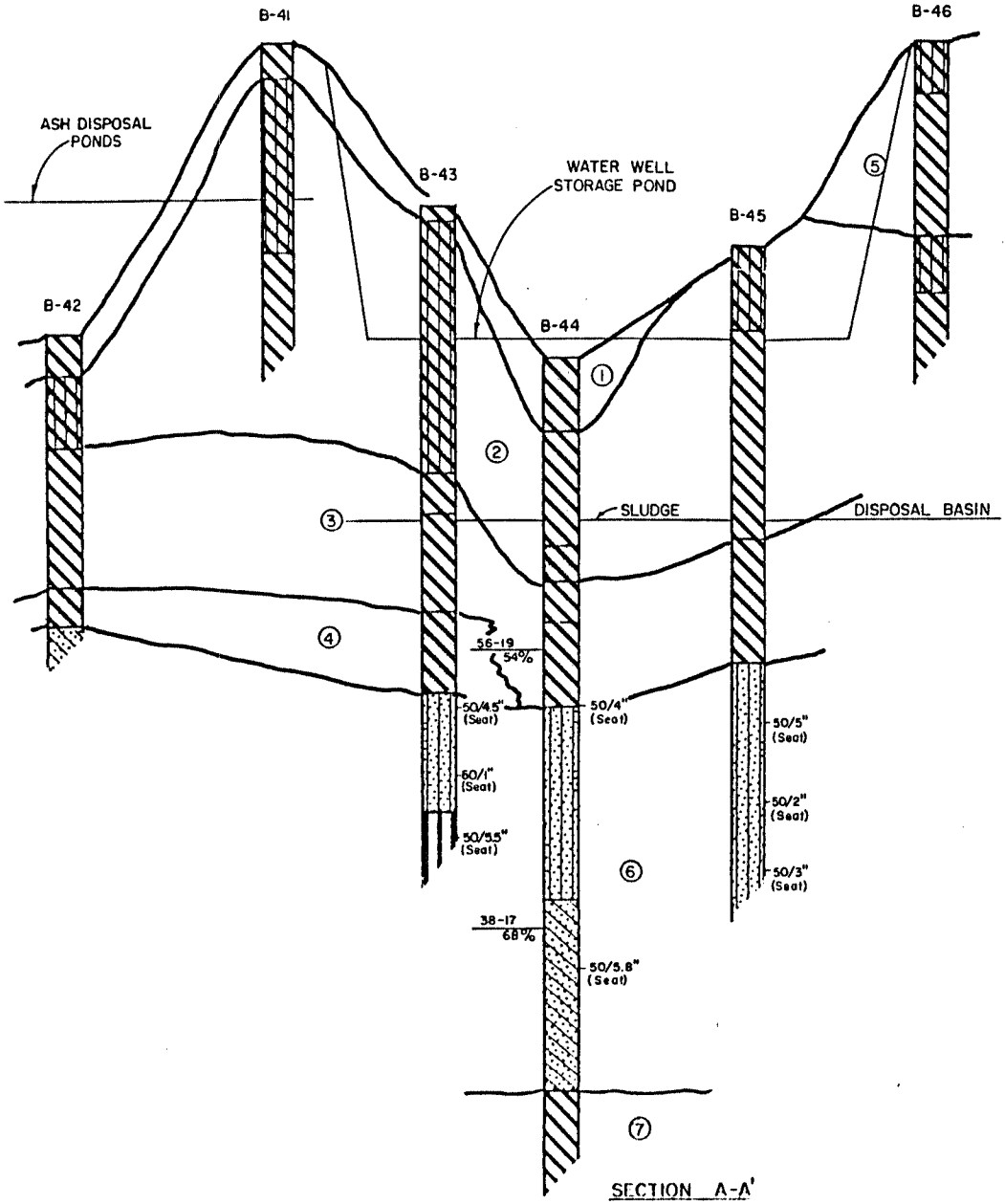
APPENDIX B GEOLOGIC CROSS SECTIONS PREPARED BY NFS



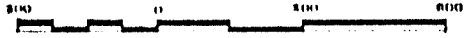
3 CORRECTIONS SEPT 1,1978
2 CORRECTIONS JULY 12,1976
1 CORRECTIONS JUNE 10,1976

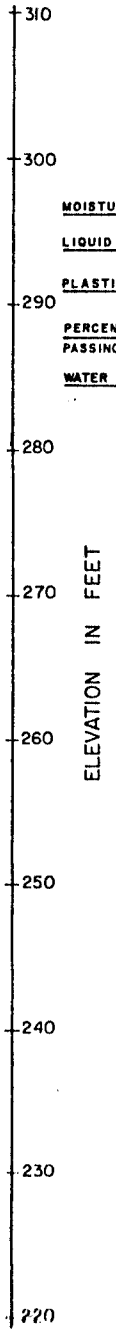
PLAN OF BORINGS

PLATE 1



HORIZONTAL SCALE IN FEET





LABORATORY TEST DATA

MOISTURE CONTENT
LIQUID LIMIT — 30 15 21
PLASTIC LIMIT — 46%
PERCENT BY WEIGHT PASSING NO. 200 SIEVE
WATER LEVEL
BASIC SOIL TYPE SEE PLATE

76
50 (6")
BLOWS/FOOT STANDARD PENETRATION TEST

ANGLE OF INTERNAL FRICTION
ø = 26°: C = 0.40
C = 1.06
COHESION, TONS PER SQ. FT.

$K_v = 1.2 \times 10^{-7}$ PERMEABILITY TESTS (RESULTS IN CM/SEC)
$K_h = 2.0 \times 10^{-7}$ v = vertical h = horizontal

C = COHESION (UNCONFINED COMPRESSION TEST)
ø : C = UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
$ø_c$: C = CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
$ø_{cd}$: C = DIRECT SHEAR TEST

STRATA DESCRIPTIONS

① Stiff to hard, dark gray or dark brown clays.

② Very stiff to hard, light tan, tan, light brown, brown, red, light red, gray or light gray, silty and sandy clays interbedded w/clays and w/occasional fractures and joints, selenite seams, limonite seams, ironstaining and calcareous pockets.

③ Very stiff to hard, tan, light brown, light red, brown, greenish-gray or gray clays w/ occasional slickensides, joints, selenite and limonite filled fractures and sand pockets.

④ Hard tan, brown, greenish-gray or gray sandy and silty w/occasional clay or silty sand s seams, laminations and pockets.

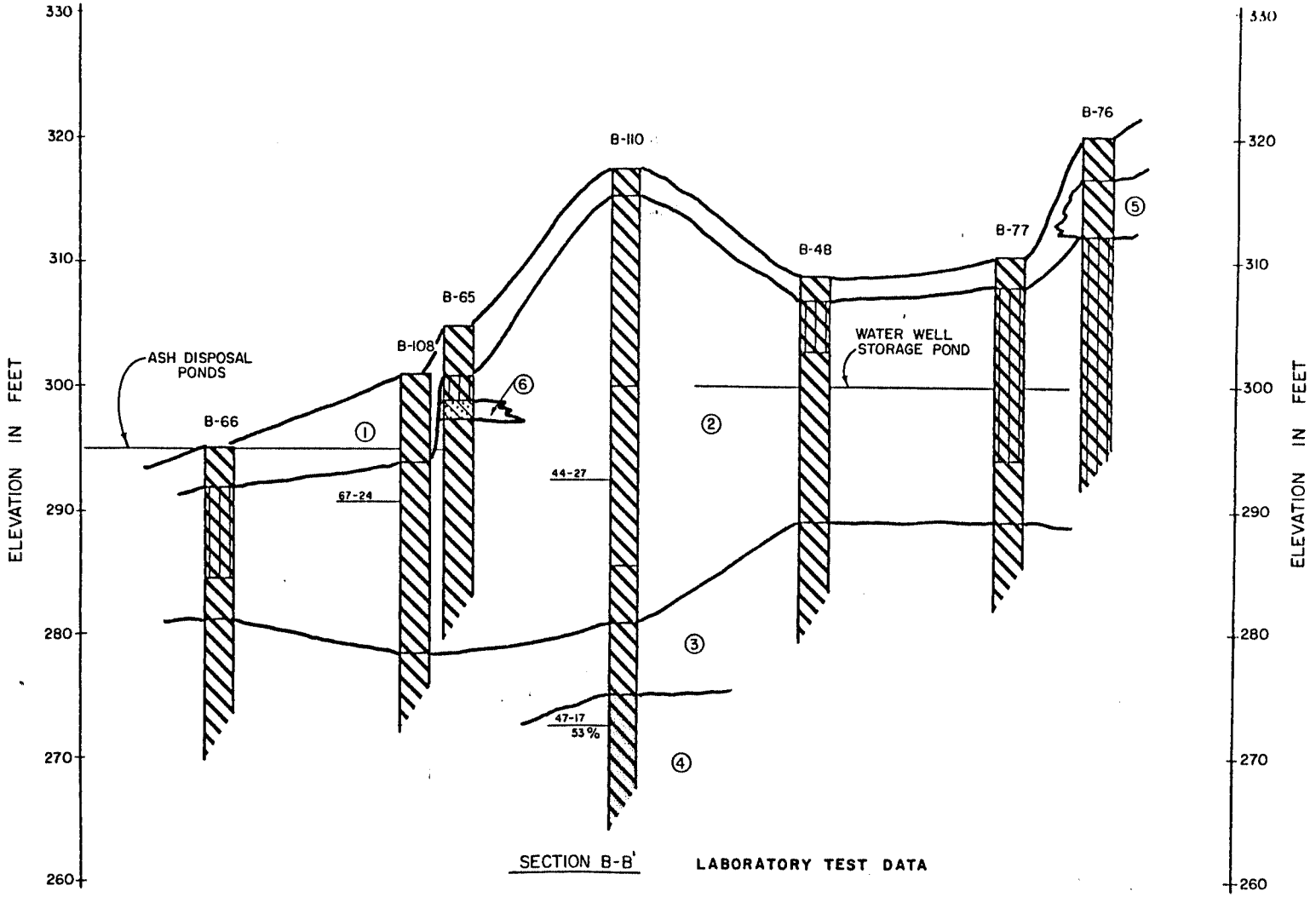
⑤ Very stiff to hard light green clays and silty clays w/occasional selenite and calcareous or silty clay pockets.

⑥ Dense to very dense, light tan, brown, light green, greenish-gray or gray, clayey fine sands, silty fine sands and sandy silts w/occasional clay balls and seams, selenite, ironstaining and carbonaceous material.

⑦ Hard green clays w/white bivalve.

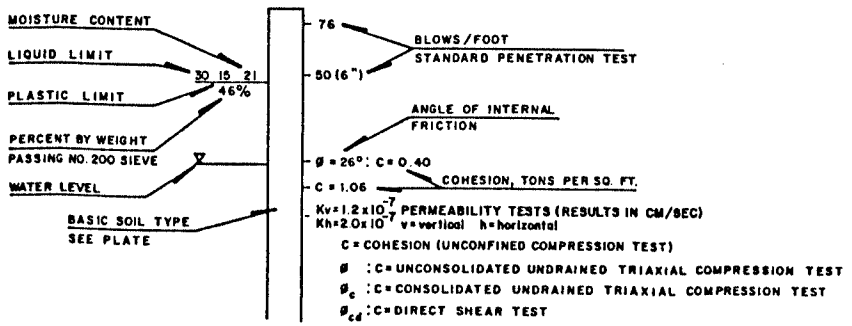
⑧ Dense to very dense tan silty fine sands and sandy silts w/ironstains.

SECTION A-A'
GENERALIZED SOILS PROFILE



SECTION B-B'

LABORATORY TEST DATA



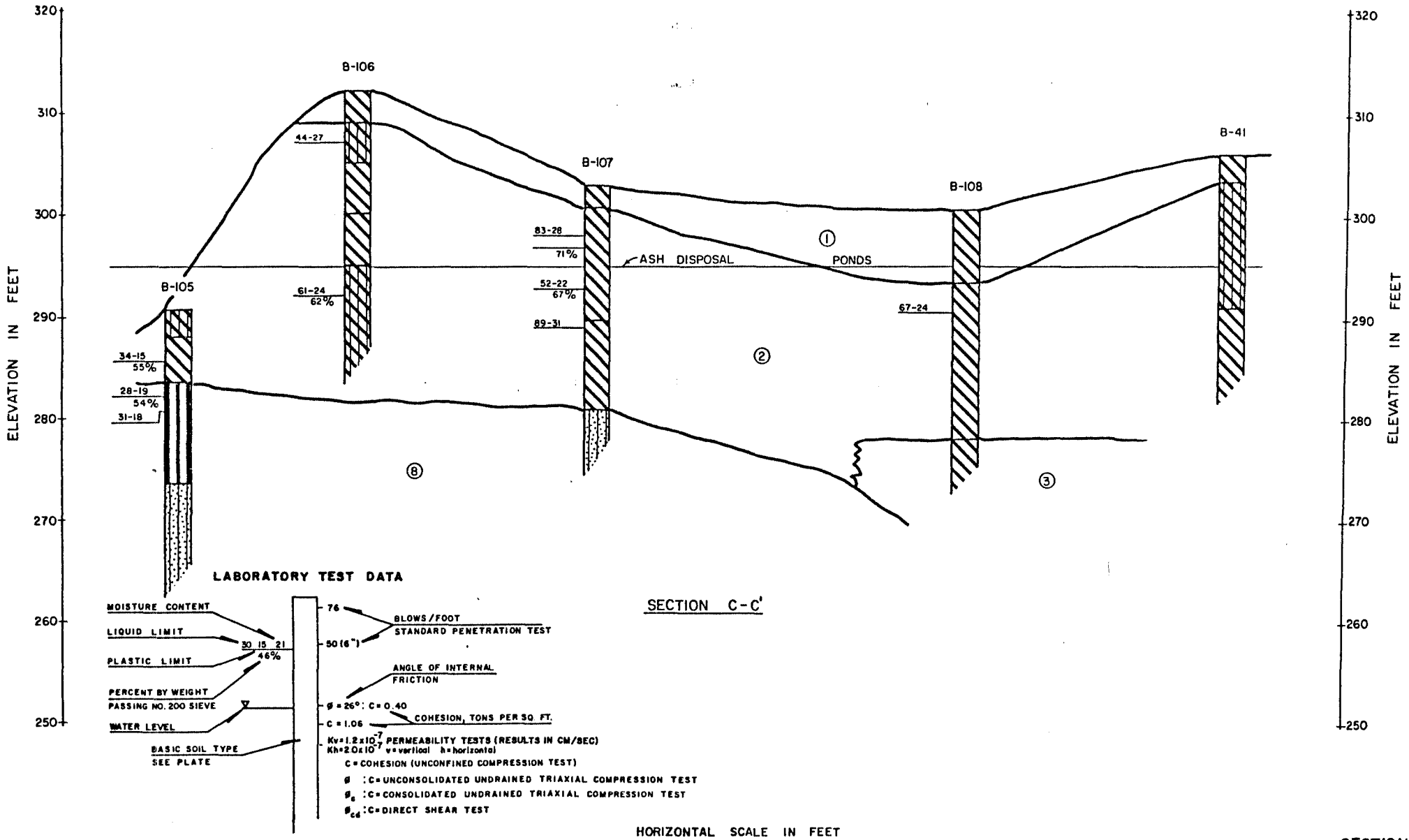
NOTE: For Strata Descriptions see Section A-A'

HORIZONTAL SCALE IN FEET

300 0 300 600

SECTION B-
GENERALIZED SOILS PROFIL

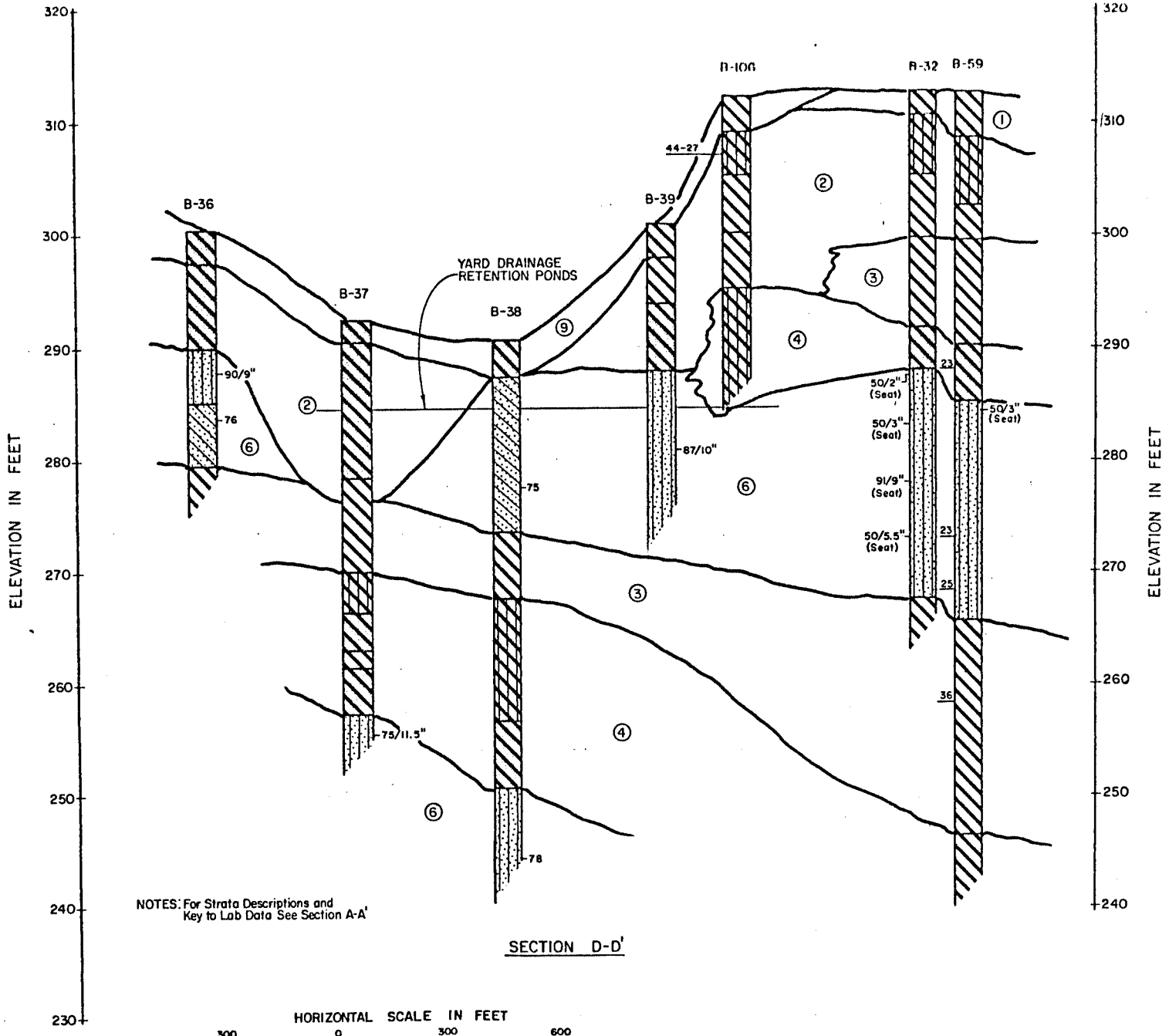
PLATE



NOTE: For Strata Descriptions see Section A-A'

SECTION
GENERALIZED SOILS PROF

PLATE



SECTION D-D'
GENERALIZED SOILS PROFILE

PLATE 5

APPENDIX C GEOLOGIC CROSS SECTIONS PREPARED BY ERM

Legend

- Phase I ERM Wells (July 2015)
- Phase II ERM Wells (November 2015)
- CCR Impoundment/Unit
- Non-CCR Impoundment
- Approximate Plant Boundary

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0 400 800
Feet

FIGURE 2
ERM CHARACTERIZATION WELL LOCATION MAP
Hydrogeologic Characterization
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN:	J. Houghton	DRAWN:	D. Dworkin
CHECKED:	K. Schroeder	DATE:	2/16/2016
SCALE:	AS SHOWN	REVISION:	0

FILE: K:\GIS\SMEC\Christine_TX\MXD\Devin_20160212\Fig2_ERM_WaterWell_Locs.mxd

Environmental Resources Management
ERM

Legend

- Phase I ERM Wells (July 2015)
- Phase II ERM Wells (November 2015)
- Soil Boring (Arias 2012)
- Cross Section Transect
- CCR Impoundment/Unit
- Non-CCR Impoundment
- Approximate Plant Boundary

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Attorney Work Product

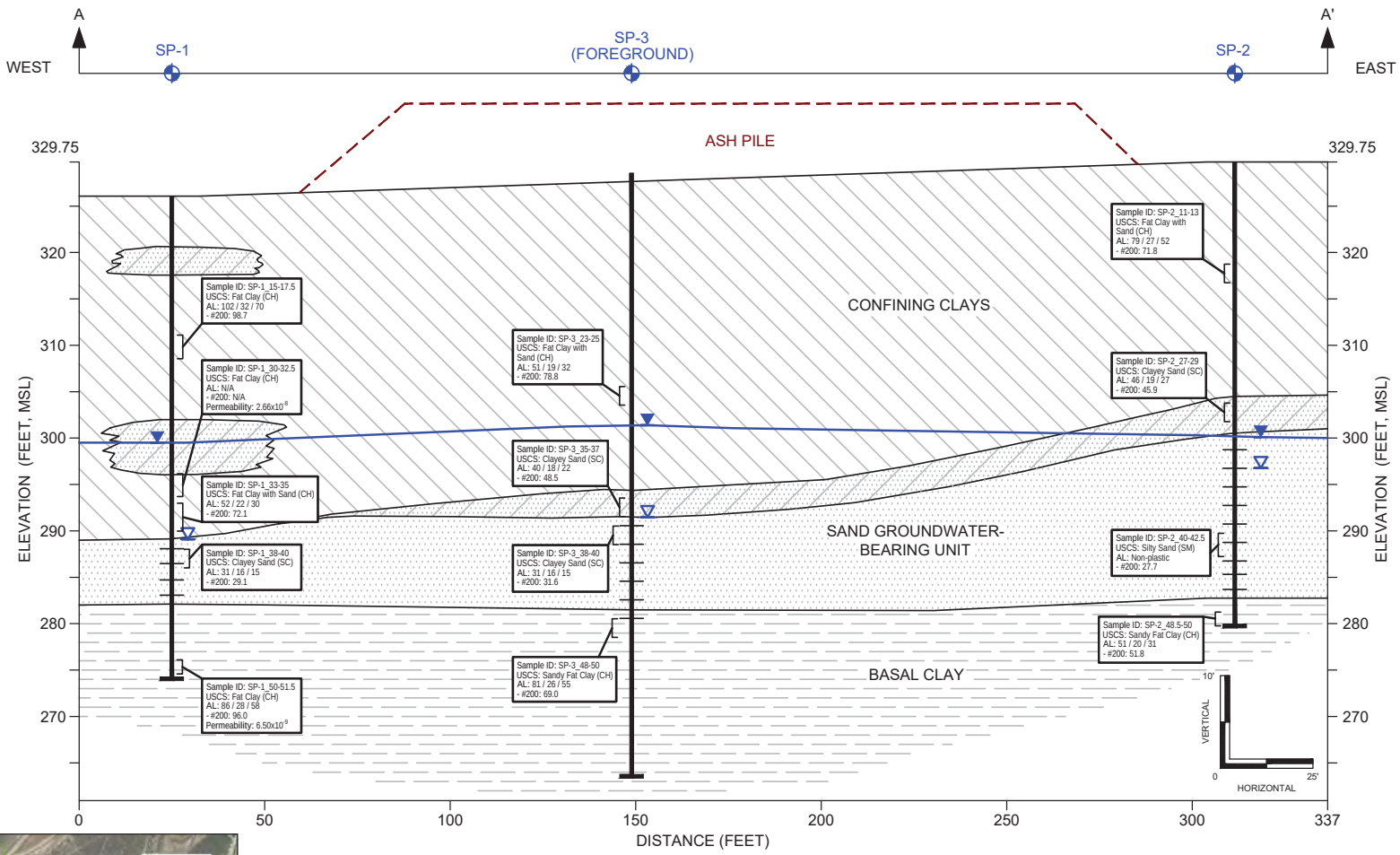
0 400 800 Feet

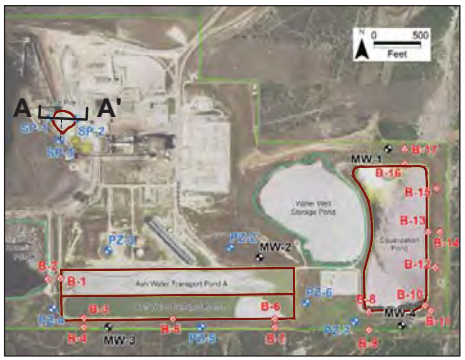
FIGURE 3
STRATIGRAPHIC CROSS SECTION TRANSECT MAP
Hydrogeologic Characterization
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN:	J. Houghton	DRAWN:	D Dworkin
CHECKED:	K. Schroeder	DATE:	2/16/2016
SCALE:	AS SHOWN	REVISION:	0

FILE: K:\GIS\SMEC\Christine_TX\MXD\Devin_20160212\Fig3_Xsec_Locs.mxd

ERM
Environmental Resources Management





LEGEND

- GREY TO BROWN CLAY WITH MINOR SAND AND SILT
- PALE YELLOWISH BROWN AND/OR GREY SILTY CLAY , SANDY CLAY, AND/OR CLAYEY SAND (%-#200>32)
- GREY TO BROWN SAND, SILTY SAND, AND/OR CLAYEY SAND (%-#200<32)
- GREENISH GREY TO BLACK CLAY; MINOR SILT AND SAND CONTENT
- APPROXIMATE GROUND SURFACE ELEVATION
- APPROXIMATE CCR UNIT SURFACE/BASIN
- POTENTIOMETRIC SURFACE (MEASURED DEC. 3, 2015)
- INITIAL GROUNDWATER LEVEL ENCOUNTERED DURING WELL INSTALLATION
- SOIL BORING
- MONITOR WELL
- PHASE II ERM WELLS (INSTALLED NOV. 2015)

SOIL TEST DATA KEY

Sample ID
USCS Soil Classification
Atterburg Limits (%): Liquid Limit / Plastic Limit / Plasticity Index
% Passing #200 Sieve
Permeability (cm/sec) (if applicable)

Notes:
1. Approximate ground-surface elevation interpolated from surveyed elevations of ERM wells.
2. Geologic interpretation of cross-sections based on Phase II ERM wells.

Sources:
1. Aerial: Google Earth Pro.

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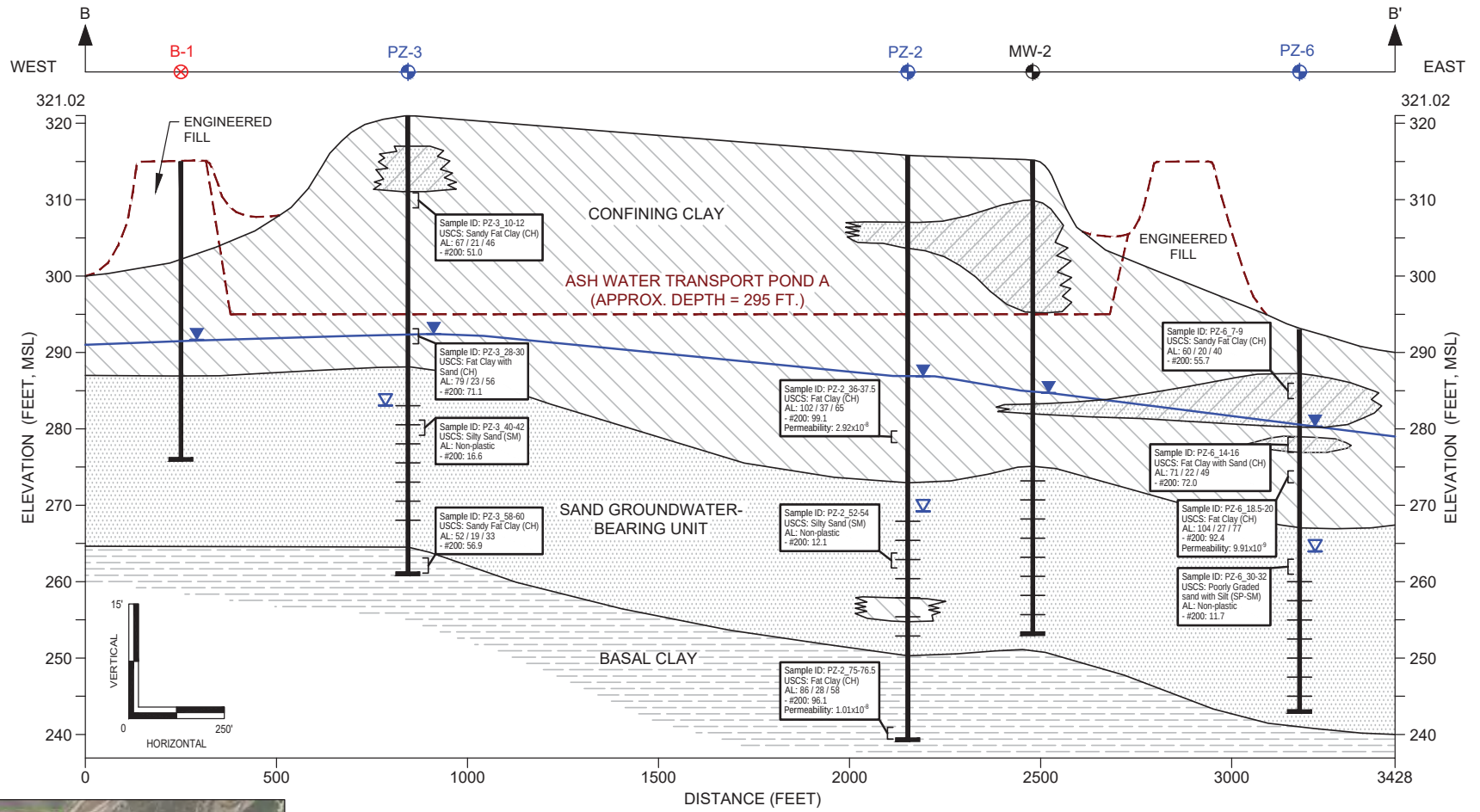
Attorney Work Product

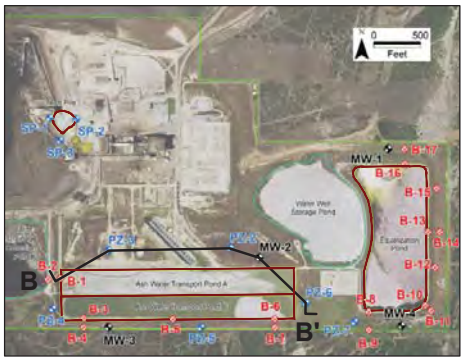
Environmental Resources Management

Figure 4
Stratigraphic Cross Section A-A'
Hydrogeologic Characterization
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN: NH	DRAWN: EFC	CHKD.: KRS
DATE: 2/16/2016	SCALE: AS SHOWN	REV.:

W.O.NO.: H:\DWG\B16\0322807_xsecs6_AA_thru_DD.dwg, 2/16/2016 1:48:59 PM





ERM-Southwest, Inc. TX PE Firm No. 2393

LEGEND

- GREY TO BROWN CLAY WITH MINOR SAND AND SILT
- PALE YELLOWISH BROWN AND/OR GREY SILTY CLAY , SANDY CLAY, AND/OR CLAYEY SAND (%-#200>32)
- GREY TO BROWN SAND, SILTY SAND, AND/OR CLAYEY SAND (%-#200<32)
- GREENISH GREY TO BLACK CLAY; MINOR SILT AND SAND CONTENT
- ENGINEERED FILL
- APPROXIMATE GROUND SURFACE ELEVATION
- APPROXIMATE CCR UNIT SURFACE/BASIN
- POTENTIOMETRIC SURFACE (MEASURED DEC. 3, 2015)
- INITIAL GROUNDWATER LEVEL ENCOUNTERED DURING WELL INSTALLATION
- SOIL BORING
- MONITOR WELL
- ARIAS BORING (INSTALLED SEPT. 2012)
- PHASE I ERM WELLS (INSTALLED JULY 2015)
- PHASE II ERM WELLS (INSTALLED NOV. 2015)

SOIL TEST DATA KEY

Sample ID
USCS Soil Classification
Atterburg Limits (%): Liquid Limit / Plastic Limit / Plasticity Index
% Passing #200 Sieve
Permeability (cm/sec) (if applicable)

Notes:
1. Initial ground water level and potentiometric surface contoured based on Phase I and II ERM wells.
2. Arias Borings were not surveyed and their elevations are approximate. Tippet & Gee drawings may reflect elevation datum different from that used to survey ERM-installed wells.
3. Approximate ground-surface elevation interpolated from surveyed elevations of ERM wells and estimated elevations of Arias borings.
4. Approximate CCR Unit surface and basin interpolated from Arias (2012) and Tippett & Gee, Inc. (1977).
5. Geologic interpretation of cross-sections based on Arias Borings and Phase I/II ERM wells.

Sources:
1. Arias Borings: Geotechnical Engineering Study, Ash Water Transport Pond and Equalization Pond Stability Analyses, Job No. 2012-693, Arias & Associates, Inc. November 19, 2012.
2. Pond Depth/Dimensions: Tippet & Gee, Inc., Sludge Disposal Basin, E9KV Substation, & Temp. Parking Area (Drawing Number C-112), April 5, 1977.
2. Aerial: Google Earth Pro.

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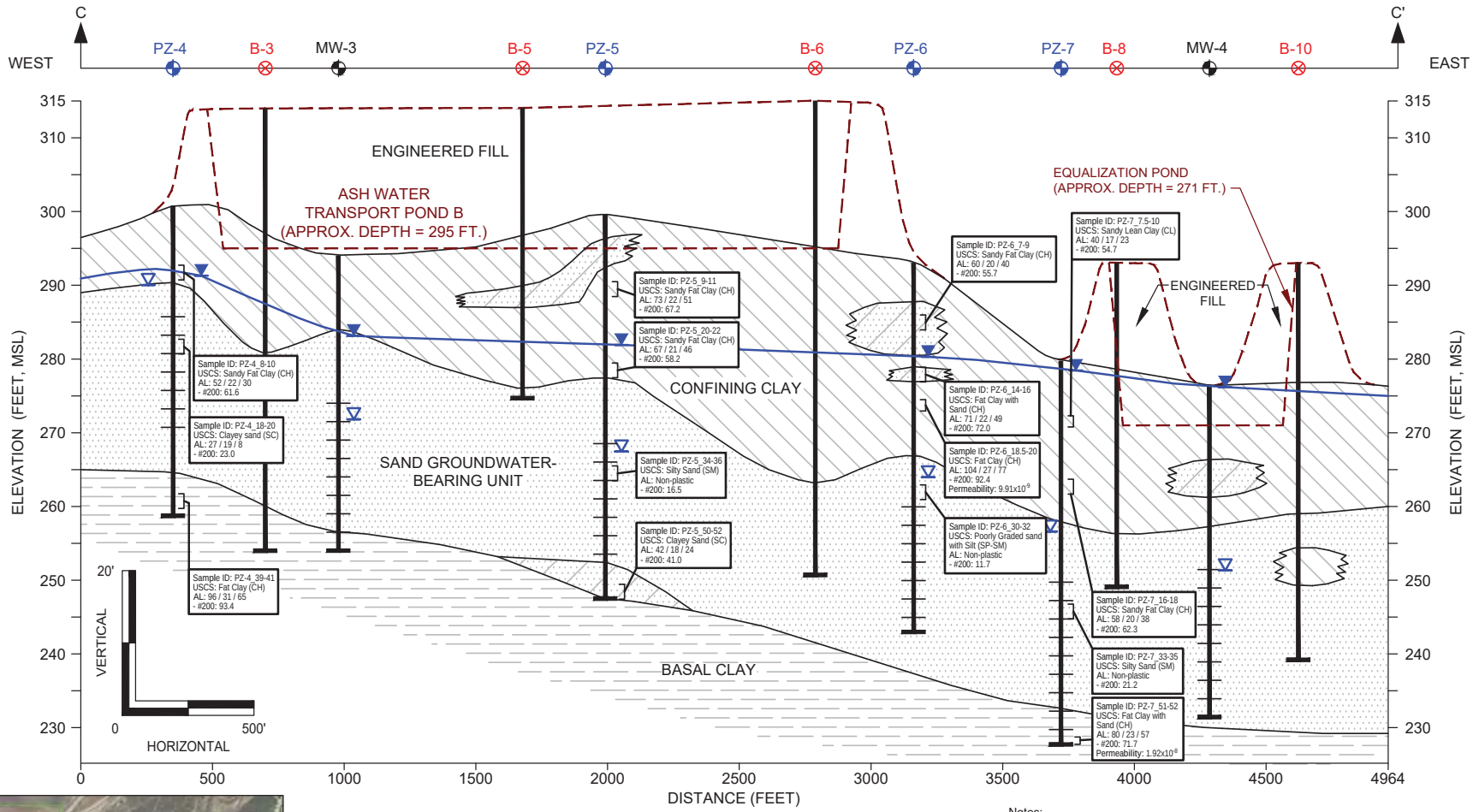
Attorney Work Product

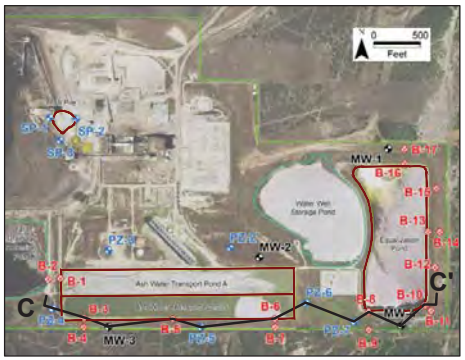
Environmental Resources Management

Figure 5
Stratigraphic Cross Section B-B'
Hydrogeologic Characterization
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN: NH	DRAWN: EFC	CHKD.: KRS
DATE: 2/16/2016	SCALE: AS SHOWN	REV.:

W.O.NO.: H:\DWG\B16\0322807_xsecs6_AA_thru_DD.dwg, 2/16/2016 1:49:00 PM





LEGEND

- GREY TO BROWN CLAY WITH MINOR SAND AND SILT
- PALE YELLOWISH BROWN AND/OR GREY SILTY CLAY , SANDY CLAY, AND/OR CLAYEY SAND (%-#200>32)
- GREY TO BROWN SAND, SILTY SAND, AND/OR CLAYEY SAND (%-#200<32)
- GREENISH GREY TO BLACK CLAY; MINOR SILT AND SAND CONTENT
- ENGINEERED FILL
- APPROXIMATE GROUND SURFACE ELEVATION
- APPROXIMATE CCR UNIT SURFACE/BASIN
- POTENTIOMETRIC SURFACE (MEASURED DEC. 3, 2015)
- INITIAL GROUNDWATER LEVEL ENCOUNTERED DURING WELL INSTALLATION
- SOIL BORING
- MONITOR WELL
- ARIAS BORING (INSTALLED SEPT. 2012)
- PHASE I ERM WELLS (INSTALLED JULY 2015)
- PHASE II ERM WELLS (INSTALLED NOV. 2015)

SOIL TEST DATA KEY

Sample ID
USCS Soil Classification
Atterburg Limits (%): Liquid Limit / Plastic Limit / Plasticity Index
% Passing #200 Sieve
Permeability (cm/sec) (if applicable)

Notes:
1. Initial ground water level and potentiometric surface contoured based on Phase I and II ERM wells.
2. Arias Borings were not surveyed and their elevations are approximate. Tippet & Gee drawings may reflect elevation datum different from that used to survey ERM-installed wells.
3. Approximate ground-surface elevation interpolated from surveyed elevations of ERM wells and estimated elevations of Arias borings.
4. Approximate CCR Unit surface and basin interpolated from Arias (2012) and Tippett & Gee, Inc. (1977).
5. Geologic interpretation of cross-sections based on Arias Borings and Phase I/II ERM wells.

Sources:
1. Arias Borings: Geotechnical Engineering Study, Ash Water Transport Pond and Equalization Pond Stability Analyses, Job No. 2012-693, Arias & Associates, Inc. November 19, 2012.
2. Pond Depth/Dimensions: Tippet & Gee, Inc., Sludge Disposal Basin, E9KV Substation, & Temp. Parking Area (Drawing Number C-112), April 5, 1977.
2. Aerial: Google Earth Pro.

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Attorney Work Product

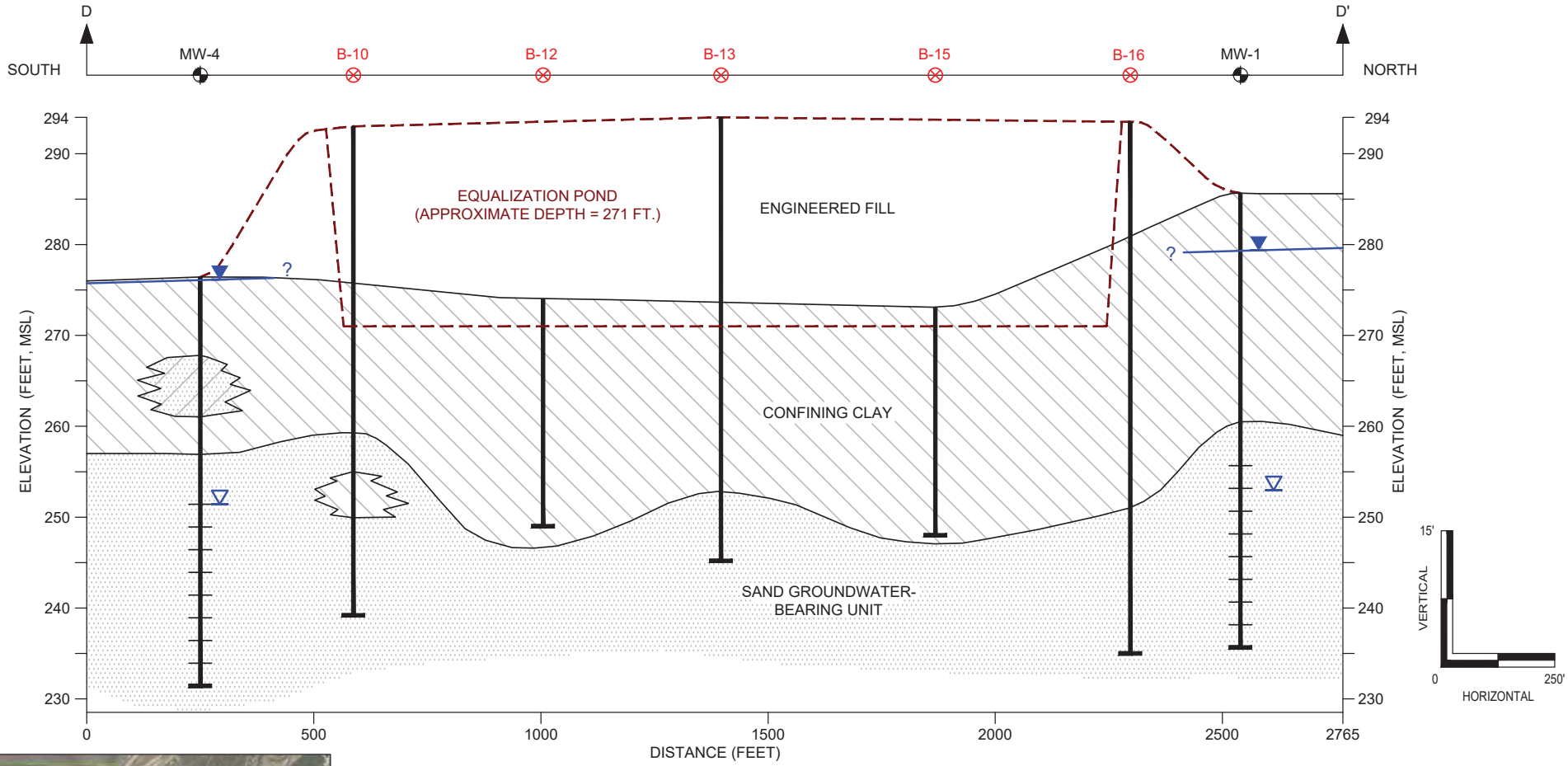
Environmental Resources Management

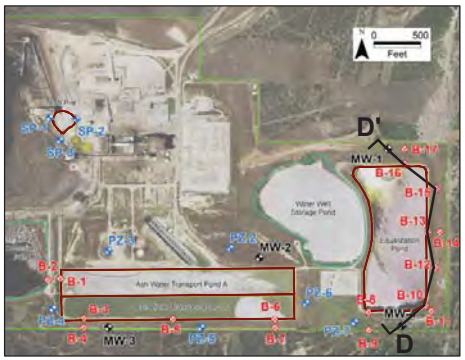
Figure 6
Stratigraphic Cross Section C-C'
Hydrogeologic Characterization
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN: NH	DRAWN: EFC	CHKD.: KRS
DATE: 2/16/2016	SCALE: AS SHOWN	REV.:

W.O.NO.: H:\DWG\B16\0322807_xsecs6_AA_thru_DD.dwg, 2/16/2016 1:49:01 PM

ERM





LEGEND

- GREY TO BROWN CLAY WITH MINOR SAND AND SILT
- PALE YELLOWISH BROWN AND/OR GREY SILTY CLAY , SANDY CLAY, AND/OR CLAYEY SAND (%-#200>32)
- GREY TO BROWN SAND, SILTY SAND, AND/OR CLAYEY SAND (%-#200<32)
- GREENISH GREY TO BLACK CLAY; MINOR SILT AND SAND CONTENT
- ENGINEERED FILL
- APPROXIMATE GROUND SURFACE ELEVATION
- APPROXIMATE CCR UNIT SURFACE/BASIN
- POTENTIOMETRIC SURFACE (MEASURED DEC. 3, 2015)
- INITIAL GROUNDWATER LEVEL ENCOUNTERED DURING WELL INSTALLATION
- SOIL BORING
- MONITOR WELL
- ARIAS BORING (INSTALLED SEPT. 2012)
- PHASE I ERM WELLS (INSTALLED JULY 2015)

SOIL TEST DATA KEY

Sample ID
USCS Soil Classification
Atterburg Limits (%): Liquid Limit / Plastic Limit / Plasticity Index
% Passing #200 Sieve
Permeability (cm/sec) (if applicable)

Notes:
1. Initial ground water level and potentiometric surface contoured based on Phase I and II ERM wells.
2. Arias Borings were not surveyed and their elevations are approximate. Tippet & Gee drawings may reflect elevation datum different from that used to survey ERM-installed wells.
3. Approximate ground-surface elevation interpolated from surveyed elevations of ERM wells and estimated elevations of Arias borings.
4. Approximate CCR Unit surface and basin interpolated from Arias (2012) and Tippett & Gee, Inc. (1977).
5. Geologic interpretation of cross-sections based on Arias Borings and Phase I ERM wells.

Sources:
1. Arias Borings: Geotechnical Engineering Study, Ash Water Transport Pond and Equalization Pond Stability Analyses, Job No. 2012-693, Arias & Associates, Inc. November 19, 2012.
2. Pond Depth/Dimensions: Tippet & Gee, Inc., Sludge Disposal Basin, E9KV Substation, & Temp. Parking Area (Drawing Number C-112), April 5, 1977.
2. Aerial: Google Earth Pro.

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Privileged & Confidential
Attorney Work Product

Environmental Resources Management

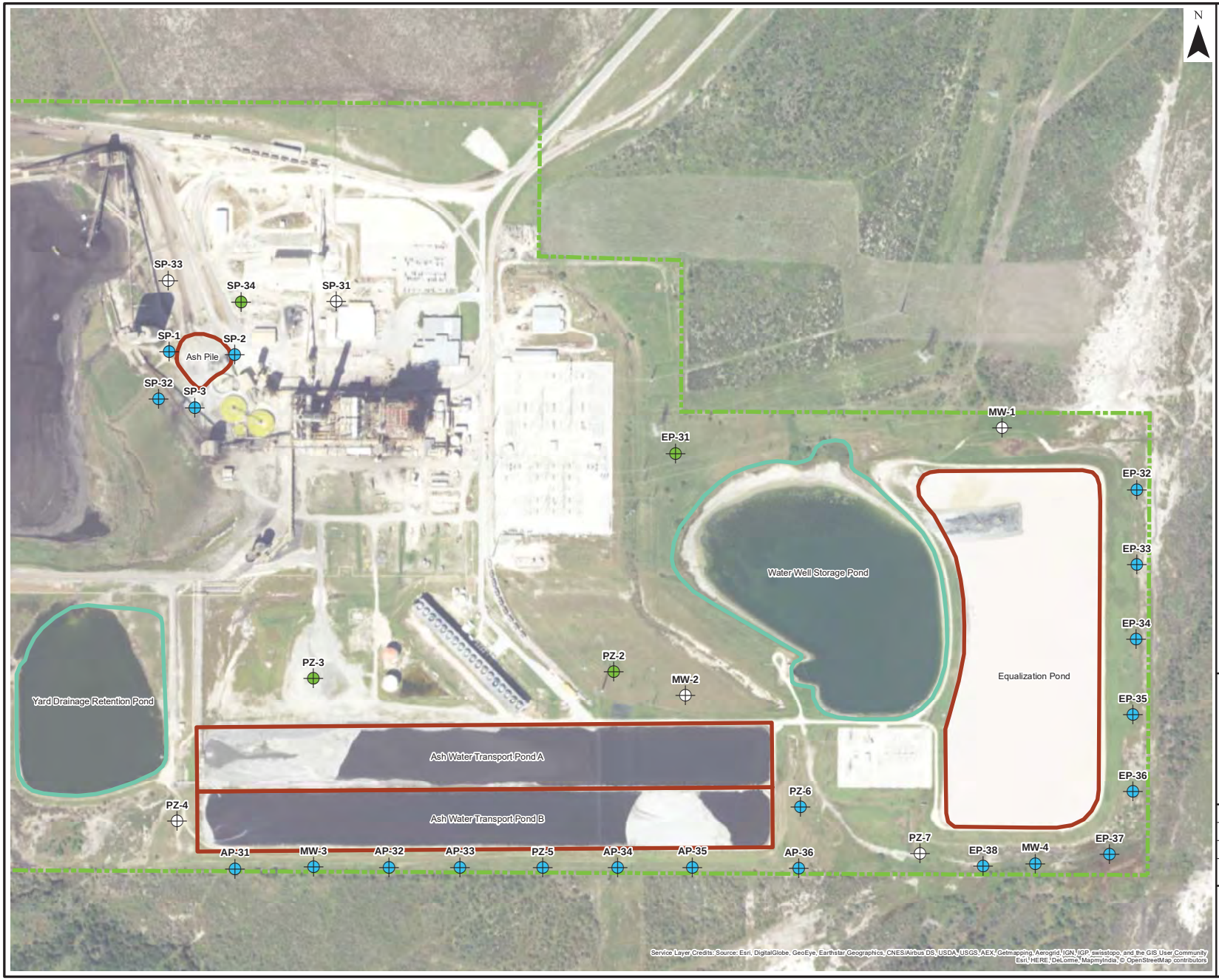
Figure 7
Stratigraphic Cross Section D-D'
Hydrogeologic Characterization
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN: NH	DRAWN: EFC	CHKD.: KRS
DATE: 2/16/2016	SCALE: AS SHOWN	REV.:

W.O.NO.: H:\DWG\B16\0322807_xsecs6_AA_thru_DD.dwg, 2/16/2016 1:49:02 PM

ERM-Southwest, Inc. TX PE Firm No. 2393

APPENDIX D ERM BORING LOGS



Legend

- Background Monitoring Well
- Groundwater Elevation Observation Well
- Point of Compliance Monitor Well
- CCR Impoundment/Unit
- Non-CCR Impoundment
- Approximate Plant Boundary

0 400 800 Feet

FIGURE 1
CCR UNIT
GROUNDWATER MONITORING SYSTEM
San Miguel Electric Cooperative, Inc. Facility
Atascosa County, Texas

DESIGN:	J Seibert	DRAWN:	EFC/SRK
CHECKED:	C Johnson	DATE:	10/16/2017
SCALE:	AS SHOWN	REVISION:	0

FILE: I:\US\AUSDC01\Data\Austin\Projects\0361804 San Miguel Electric Groundwater Sampling-CCR.KP\GIS\MXD\pth3\Fig1_CCRunit.mxd

Environmental Resources Management
ERM

Environmental Resources Management

MW-1
DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-1 Date Drilled 7-30-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 50.0 ' Boring Diam. 8 "

N. Coord. 13440389.33' E. Coord. 2138976.52' Surface Elevation 285.22' Ft MSL Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

Top of Casing Elevation 289.16' Stickup 3.94'

Depth to Water: 1. Ft. btoc 8.72 (8/5/15) 2.Ft. btoc 8.94 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Sample Type	Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
285.66	0				0-50	0-5	NO RECOVERY: No recovery due to hydrovac from 0-5 ft.
285							
	5					5-14	SILTY CLAY: Gley 1/3/5GY, very dark greenish gray, damp, semi-plastic, sticky, PP = 1.0 TSF. At 6.3 ft. 7.5YR/3/4, dark brown, laminae present, non-plastic, crumbly, occasional lenticular pockets of fine grained sand.
280							
	10						At 10 ft. Alternating 7.5YR/3/3, dark brown and 10YR/5/2, grayish brown; dry to damp.
275						14-20	SILTY CLAY: 10YR/4/4, dark yellowish brown, dry to damp, crumbly, non-plastic, PP = 0-0.5 TSF, gradational contact with unit below, thin calcareous lenses throughout.
	15						
270							
	20					20-24	CLAY: 2.5Y/5/3, light olive brown, damp, semi-plastic, sticky.
265							
							At 23 ft. 2.5Y/5/3, light olive brown mottled with Gley 1/4/10GY, dark greenish gray.
	25					24-25	NO RECOVERY: No recovery.
260						25-30	SILTY SAND: Gley 1/3/5GY, very dark greenish gray, dry to damp, very fine grained, moderately sorted, angular to rounded, uncemented to weakly cemented, small lenticular black fragments occasionally, no bedding present, silt content decreases with depth.
	30						

ERM Environmental Resources Management

MW-1 DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-1 Date Drilled 7-30-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 50.0 ' Boring Diam. 8 "

N. Coord. 13440389.33' E. Coord. 2138976.52' Surface Elevation 285.22' Ft MSL Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

Top of Casing Elevation 289.16' Stickup 3.94'

Depth to Water: 1. Ft. btoc 8.72 (8/5/15) 2.Ft. btoc 8.94 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Sample Type	Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
255	30					30-40	SAND: 5Y/4/2, olive gray, damp to moist, very fine grained, well sorted, rounded, uncemented, thinly bedded from 31.7-31.9 ft.
250	35						
245	40					40-50	SAND: Gley 1/3/10GY, very dark greenish gray, damp, same as above.
240	45						
235	50						T.D. = 50.0 '
230	55						
	60						

ERM Environmental Resources Management

MW-2 DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-2 Date Drilled 7-28-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 62.0 ' Boring Diam. 8 "

N. Coord. 13439223.51' E. Coord. 2137596.56' Surface Elevation 314.73" Ft MSL Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 42.00 ' Sump Length 0 '

Top of Casing Elevation 317.68' Stickup 2.95'

Depth to Water: 1. Ft. btoc 30.88 (8/5/15) 2.Ft. btoc 32.01 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Sample Type	Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
315.19	0				0-62	0-5	NO RECOVERY: No recovery due to hydrovac from 0-5 ft.
310	5					5-8.25	CLAYEY SAND: 5YR/4/1, dark gray, damp; sand is fine grained, angular; clay is semi-plastic, PP = 0 TSF.
						8.25-10.1	SILTY SAND: 10YR/7/3, very pale brown, damp, PP = 1.25 TSF. At 8.3 ft. Poorly sorted, angular, weakly cemented.
305	10					10.1-10.5	At 10 ft. fine to medium grained, poorly sorted, angular, uncemented to weakly cemented, friable, possible calcite seams.
						10.5-15	CLAYEY SAND: 10YR/7/4, very pale brown, damp, sticky, fine grained, semi-plastic.
							SILTY SAND: 10YR/7/4, very pale brown, damp.
300	15					15-18	SILTY SAND: 10YR/7/1, light gray with bands of 10YR/5/6, yellowish brown; dry to damp, fine to medium grained, moderately sorted, angular, uncemented to weakly cemented, black seams occasionally. At 16.6-16.8 ft. moist.
						18-18.5	
						18.5-20	CLAY: 10YR/7/1, light gray with bands of 10YR/5/6, yellowish brown; dry to damp, thinly laminated.
295	20					20-32	SILTY SAND: 10YR/7/1, light gray with bands of 10YR/5/6, yellowish brown; dry to damp.
							SILTY CLAY: 7.5YR/5/2, brown, dry, hard, non-plastic, thinly laminated, breaks along laminae, has yellow seams.
290	25						At 27.2 ft. 2.5YR/3/3, dark reddish brown.
							At 27.4 ft. 7.5YR/5/2, brown.
285	30					32-33.1	SILTY SAND: 7.5Yr/5/4, brown, moist, very fine grained, subangular to rounded, uncemented.
						33.1-40	SILTY CLAY: 7.5YR/5/2, brown, dry, semi- to non-plastic, thinly laminated, thin (0.01 ft) calcareous seams approx. every 0.4 ft. from 31-55 ft., sticky from 35-36.7 ft.
	35						

ERM Environmental Resources Management

MW-2
DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-2 Date Drilled 7-28-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 62.0 ' Boring Diam. 8 "

N. Coord. 13439223.51' E. Coord. 2137596.56' Surface Elevation 314.73" Ft MSL Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 42.00 ' Sump Length 0 '

Top of Casing Elevation 317.68' Stickup 2.95'

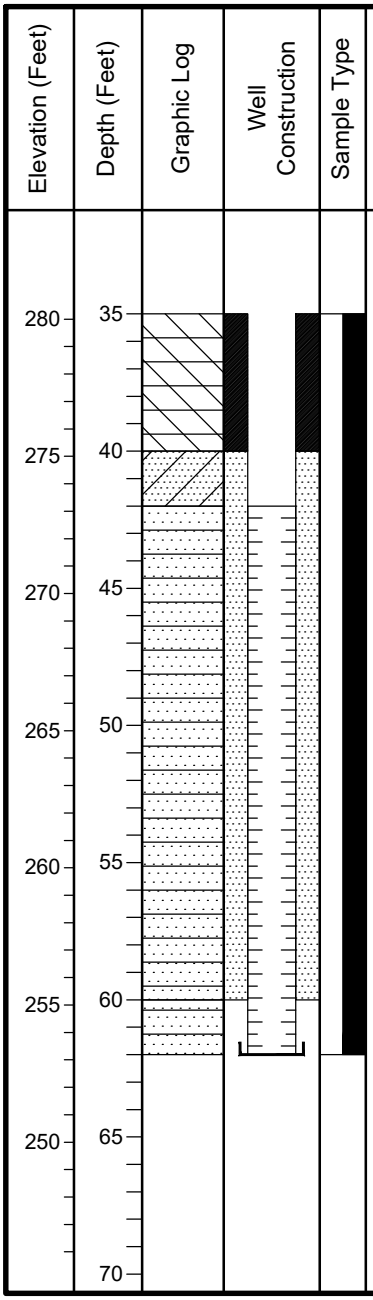
Depth to Water: 1. Ft. btoc 30.88 (8/5/15) 2.Ft. btoc 32.01 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B



Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
		At 35 ft. 2.5Y/5/3, light olive brown, dry to damp.
	40-42	CLAYEY SAND: 5Y/4/1, dark gray mottled with 5Y/6/2, light olive gray, dry, fine grained, well sorted, hard, subrounded to subangular, weakly cemented.
	42-60	SILTY SAND: 5Y/3/1, very dark gray, dry, very fine to fine grained, angular to rounded, well sorted, uncemented to weakly cemented, thinly bedded, friable, no bedding from 45-47 ft.
		At 45 ft. Gley 1/4/10Y, dark greenish gray, damp.
		At 47 ft. moist.
		At 50 ft. Gley 1/4/10Y, dark greenish gray, very fine to fine grained, angular to rounded, well sorted, uncemented to weakly cemented, thinly bedded, friable.
		At 51 ft. damp.
	60-62	SILTY SAND: Gley 1/4/10Y, dark greenish gray, damp, same as above.
		T.D. = 62.0 '

Environmental Resources Management

MW-3
DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-3 Date Drilled 7-30-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 40.0 ' Boring Diam. 8 "

N. Coord. 13438476.28' E. Coord. 2135977.76' Surface Elevation 293.74' Ft MSL Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Sump Length 0 '

Top of Casing Elevation 295.90' Stickup 2.16 '

Depth to Water: 1. Ft. btoc 12.01 (8/5/15) 2.Ft. btoc 12.53 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Sample Type	Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
294.01	0				0-40	0-5	NO RECOVERY: No recovery due to hydrovac from 0-5 ft.
290	5					5-7	CLAY: 10YR/6/3, pale brown, dry to damp, semi- to non-plastic, crumbly.
						7-10	At 6.8 ft. thin lenticular calcareous lenses. NO RECOVERY: No recovery.
285	10					10-15	SILTY SAND: 10YR/5/3, brown mottled with Gley 1/7/N, light gray, damp, very fine grained, well sorted, uncemented.
280	15					15-30	SILTY SAND: 5Y/5/3, olive, moist, very fine grained, uncemented, subangular to rounded.
275	20						At 20 ft. damp, moderately to well sorted, thinly bedded.
							At 22 ft. 5Y/5/4, olive, wet to saturated.
270	25						At 25 ft. 5Y/5/3, olive, wet. At 25.8 ft. damp.
265	30						

Environmental Resources Management

MW-3
DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-3 Date Drilled 7-30-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 40.0 ' Boring Diam. 8 "

N. Coord. 13438476.28' E. Coord. 2135977.76' Surface Elevation 293.74' Ft MSL Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Sump Length 0 '

Top of Casing Elevation 295.90' Stickup 2.16 '

Depth to Water: 1. Ft. btoc 12.01 (8/5/15) 2.Ft. btoc 12.53 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Sample Type	Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
260	30					30-35	SILTY SAND: 5Y5/3, olive, damp, very fine grained, uncemented, moderately to well sorted, thinly bedded.
							At 33.2 ft. Gley 1/3/5GY, very dark greenish gray.
	35					35-35.4	SILTY SAND: Gley 1/3/5GY, very dark greenish gray, damp, very fine grained, uncemented, moderately to well sorted, thinly bedded.
						35.4-35.8	CLAY: Gley 1/3/5GY, very dark greenish gray, dry, non-plastic, PP = 1.5 TSF, crumbly.
255						35.8-37.6	SILTY SAND: Gley 1/3/5GY, very dark greenish gray, damp, same as above.
	40					37.6-40	CLAY: Gley 1/3/5GY, very dark greenish gray, dry, same as above. T.D. = 40.0 '
250	45						
245	50						
240	55						
235	60						

ERM Environmental Resources Management

MW-4 DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-4 Date Drilled 7-31-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 45.0 ' Boring Diam. 8 "

N. Coord. 13438491.17' E. Coord. 2139120.57' Surface Elevation 275.83 ' Feet Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 25.00 ' Sump Length 0 '

Top of Casing Elevation 278.58' Stickup 2.75'

Depth to Water: 1. Ft. btoc 2.29 (8/5/15) 2.Ft. btoc 2.83 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Sample Type	Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
276.43	0				0-45	0-5	NO RECOVERY: No recovery due to hydrovac from 0-5 ft.
275							
	5					5-8.6	SILTY CLAY: 10YR/5/1, gray, damp to moist, semi-plastic, sticky, PP = 0-1.0 TSF.
270							
						8.6-10	NO RECOVERY: No recovery.
	10					10-13.25	CLAYEY SAND: 10YR/5/1, gray, damp, very fine grained, well sorted, subrounded, uncemented, sticky.
265							
						13.25-15.25	SILTY SAND: 10YR/5/1, gray mottled with 2.5Y/6/3, light yellowish brown, dry to damp, very fine grained, moderately sorted, uncemented, no bedding, calcareous lenses throughout.
	15					15.25-19.25	CLAY: 2.5Y/6/3, light yellowish brown, damp, semi- to non-plastic, PP = 1.0-2.0 TSF, has lenticular calcareous pockets throughout, no laminae, has orange discoloration seams.
260							
						19.25-45	SILTY SAND: 10YR/5/1, gray mottled with 2.5Y/6/3, light yellowish brown, damp, same as above.
	20						At 22 ft. Gley 1/3/10Y, very dark greenish gray.
255							At 23 ft. lenticular "clay-type" fragments.
							At 24 ft. black "clay-type" seam.
	25						At 25 ft. Gley 1/4/N, dark gray, wet to saturated, very fine grained, well sorted, subrounded, uncemented.
250							
	30						At 28.4 ft. moist.

ERM Environmental Resources Management

MW-4
DRILLING LOG

Proj. No. 0309575 Boring/Well ID MW-4 Date Drilled 7-31-15

Project Phase I - SMECI Well Installation Owner San Miguel Electric Coop.

Location Atascosa County, Tx Boring T.D. 45.0 ' Boring Diam. 8 "

N. Coord. 13438491.17' E. Coord. 2139120.57' Surface Elevation 275.83 ' Feet Datum

Screen: Type Sch 40 PVC Diam. 2.00 " Length 20.00 ' Slot Size 0.10 "

Casing: Type Sch 40 PVC Diam. 2.00 " Length 25.00 ' Sump Length 0 '

Top of Casing Elevation 278.58' Stickup 2.75'

Depth to Water: 1. Ft. btoc 2.29 (8/5/15) 2.Ft. btoc 2.83 (9/3/15)

Drilling Company Tolunay-Wong Engineers Driller Keith Barge

Drilling Method Hollow Stem Auger Log By Mike Kristoff

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Sample Type	Sample Interval (Feet)	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
245	30						At 30.2 ft. wet to saturated.
240	35						At 34.2 ft. Gley 1/4/10GY, dark greenish gray, moist, becomes thinly bedded.
235	40						At 40 ft. moist.
							At 42 ft. dry to damp.
230	45						T.D. = 45.0 '
225	50						
220	55						
	60						

ERM Environmental Resources Management

PZ-2
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-2 Date Drilled 2015-11-14

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 76.50 ' Boring Diam. 6.00 "

N. Coord. 13439326.33' E. Coord. 2137285.33' Surface Elevation 315.86 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 2.00 '

Top of Casing Elevation 318.92 ' Stickup 3.06'

Depth to Water: 1. Ft. btoc 31.16 (2015-11-21) 2.Ft. btoc 31.47 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Jesse Houghton

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
315.80	0					0-2	CLAYEY SILT: Brown (10 YR 5/3) with some yellow (10 YR 8/6) and strong brown (2.5 YR 5/8) coloration; damp; soft; friable.
							At 1.75' bgs: Color change to very dark brown (10 YR 2/2); dry; some calcareous nodules present.
315				>4.5		2-4	CLAY: Very dark brown (10 YR 2/2); dry; hard; low plasticity; some silt content and calcareous nodules present.
							At 2.5' bgs: Color change to dark greenish brown (10 YR 4/2) with very dark brown (10 YR 2/2) mottling; damp; friable.
						4-5	At 3' bgs: Color change to pale brown (10 YR 6/3); some gravel (2-5 mm) and root content present.
	5			1.75			SILT: Very pale brown (10 YR 7/4); dry; medium dense; slight clay content.
310						5-8.75	At 4.5' bgs: Gravel present (up to 30 mm); Color change at 4.9' bgs to brownish yellow (10 YR 7/8) with black (10 YR 2/1) coloring.
				0.5			SILTY CLAY: Reddish black (2.5 YR 2.5/1); damp; medium stiff; firm; high plasticity; moderate toughness; clay content increases with depth; occasional thin calcareous stringers.
						8.75-11	CLAYEY SANDY SILT: Pale brown (10 YR 6/3); soft; damp; medium plasticity; low toughness; occasional sub-angular chalky pebbles and iron oxide staining.
	10						
305				1.5		11-15.75	CLAYEY SILT: Dark greyish brown (10 YR 4/2); soft; moist; medium to high plasticity; low toughness; occasional iron oxide staining; trace small calcareous concretions; possible gypsum or anhydrite (<5mm) present.
	15			4.0			
300						15.75-20.5	CLAY: Reddish brown (5 YR 4/4) and yellowish red (5 YR 4/6); damp; stiff to hard; high plasticity; moderate toughness; some silt content; abundant iron oxide staining; some small, white calcareous concretions; gypsum or anhydrite (<2 mm); planar fractures.
				4.0			
	20						

ERM Environmental Resources Management

PZ-2 DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-2 Date Drilled 2015-11-14

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 76.50 ' Boring Diam. 6.00 "

N. Coord. 13439326.33' E. Coord. 2137285.33' Surface Elevation 315.86 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 2.00 '

Top of Casing Elevation 318.92 ' Stickup 3.06'

Depth to Water: 1. Ft. btoc 31.16 (2015-11-21) 2.Ft. btoc 31.47 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Jesse Houghton

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
295	20			2.75 1.0 2.75		20.5-23.3	CLAY: Dark red (2.5 YR 3/6); damp; very stiff; medium to high plasticity; medium to high toughness; some silt and trace very fine sand content; abundant iron staining; occasional yellow (2.5 Y 7/8) chalky parting planes. At 22.8' bgs: Color change to dark reddish brown (2.5 YR 2.5/4); damp; medium stiff; very high plasticity.
290	25			3.0		23.3-26.3	SILTY SANDY CLAY: Reddish brown (5 YR 4/4); stiff; damp; medium plasticity; medium to high toughness; abundant iron staining; occasional yellow parting planar fractures.
285	30			2.5 3.0		26.3-33	SANDY SILTY CLAY: Very dark greyish brown (10 YR 3/2) to yellowish red (5 YR 4/6); dry; soft; low to medium plasticity; moderate toughness; pulverized/blocky texture (possibly due to drilling technique); abundant iron oxide staining. At 27' bgs: Very fine sand increases with depth to 28' bgs; trace small gypsum crystals. At 28.5' bgs: Higher degree of consolidation with slight laminations.
280	35			3.5 >4.5	**PZ-2**_36-37.5 **USCS:** Fat Clay (CH) **AL:** 102 / 37 / 65 **- #200:** 99.1 **k:** 2.92×10^{-8}	33-37.5	At 32' bgs: Reddish brown (5 YR 3/4), stiff clay lens with white calcareous concretions at top of interval. Reddish brown (5 YR 5/4), very stiff silty clay lens with white gypsum filled fissures at bottom of interval. CLAY: Brown (7.5 YR 5/3); dry; hard; medium to high plasticity; high toughness; well consolidated; homogeneous with silty clay throughout; occasional iron oxide staining; common calcite or gypsum/anhydrite crystals forming primarily in horizontal parting planes. At 36' bgs: Cohesive sample (shelby tube) collected from 36'-37.5' bgs.
	40			0.25		37.5-41.4	CLAY: Yellowish brown (10 YR 5/4); damp; hard; high plasticity; high toughness; silty clay throughout, trace very fine grained sand; common iron oxide staining.

ERM Environmental Resources Management

PZ-2 DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-2 Date Drilled 2015-11-14

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 76.50 ' Boring Diam. 6.00 "

N. Coord. 13439326.33' E. Coord. 2137285.33' Surface Elevation 315.86 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 2.00 '

Top of Casing Elevation 318.92 ' Stickup 3.06'

Depth to Water: 1. Ft. btoc 31.16 (2015-11-21) 2.Ft. btoc 31.47 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Jesse Houghton

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
275	40			0.25		41.4-43	SANDY CLAY: Very dark grey (2.5 Y 3/1); dry; hard; slight plasticity; sand content increases with depth, grades rapidly with following interval.
				1.5		43-46	CLAYEY SILTY SAND: Very dark grey (2.5 Y 3/1); damp; fine grained; sub-rounded; well sorted; loose to medium dense; slight plasticity. Top of Transmissive Sand Unit.
270	45						At 45.75' bgs: Abundant black massive (possibly organic) material occurring in small broken blocks (0.25 to 1" diameter).
						46-46.6	
				<0.25		46.6-58	CLAY: Dark yellowish brown (10 YR 4/6); damp; stiff to very stiff; very high plasticity; medium toughness; silty clay throughout; homogeneous. SILTY SAND: Dark greenish grey (Gley-1 3/1 to Gley-2 4/1); moist, fine to very fine grained; sub-rounded; well sorted; uncemented; loose; slight plasticity to non-plastic; homogeneous.
265	50			<0.25			At 51' bgs: Wet.
				>4.5	**PZ-2**_52-54 **USCS:** Silty Sand (SM) **AL:** Non-plastic **- #200:** 12.1		At 52' bgs: Non-cohesive grab sample collected from 52'-54' bgs.
				0.5			
260	55						
						58-61	SANDY SILTY CLAY: Dark greenish grey (Gley-1 4/1); dry to damp; low plasticity; hard; homogeneous.
	60			>4.5			

ERM Environmental Resources Management

PZ-2
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-2 Date Drilled 2015-11-14

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 76.50 ' Boring Diam. 6.00 "

N. Coord. 13439326.33' E. Coord. 2137285.33' Surface Elevation 315.86 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 2.00 '

Top of Casing Elevation 318.92 ' Stickup 3.06'

Depth to Water: 1. Ft. btoc 31.16 (2015-11-21) 2.Ft. btoc 31.47 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Jesse Houghton

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
255	60					61-65.5	CLAYEY SAND: Dark greenish grey (Gley-2 4/1) and greenish grey (Gley-2 5/1); damp to moist; very fine to fine grained; sub-rounded; poorly sorted; loose to medium dense; slight plasticity; homogeneous.
250	65			>4.5		65.5-68.5	SILTY SANDY CLAY: Dark greenish grey (Gley-2 3/1); damp; hard; medium plasticity; sand content is very fine to fine grained and well sorted; clay content and plasticity increase with depth. Top of Basal Clay Unit.
						68.5-76.5	SILTY CLAY: Dark greenish grey (Gley-1 3/1); very stiff to hard; high toughness; massive/structure less.
245	70						At 71' bgs: Pelecypod or gastropod fossils (brecciated) to 75' bgs.
240	75				**PZ-2**_75-76.5 **USCS:** Fat Clay (CH) **AL:** 86 / 28 / 58 - **#200:** 96.1 **Permeability:** 1.01x10-8		At 75' bgs: Cohesive sample (split spoon) collected from 75'-76.5' bgs.
	80						T.D. = 76.50 '

ERM Environmental Resources Management

PZ-3
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-3 Date Drilled 2015-11-18

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 60.00 ' Boring Diam. 6.00 "

N. Coord. 13439296.00' E. Coord. 2135976.24' Surface Elevation 320.89' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 323.19 ' Stickup 2.30 '

Depth to Water: 1. Ft. btoc 30.68 (2015-11-21) 2.Ft. btoc 31.00 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
321.02	0			0.5		0-3.5	NO RECOVERY: Soil hydroexcavated.
320						3.5-5	CLAYEY SAND: Light yellowish brown (10 YR 6/4) with some strong brown (7.5 YR 5/8) coloration; moist; fine grained; sub-angular; well sorted.
	5					5-7.5	SANDY SILTY CLAY: Pale brown (10 YR 6/3); damp to moist; soft; low plasticity; trace iron oxide staining; yellowish brown (10 YR 5/4) clayey sand lens from 5 - 5.5' bgs. At 6.5' bgs: 3" Silty clay layer, dense.
315				<0.25		7.5-10	CLAYEY SAND: Very pale brown (10 YR 7/3); damp; very fine to fine grained; sub-angular; poorly sorted; loose; slight plasticity; silt content throughout; some silty clay pieces within, hard, friable; Yellow (2.5 Y 8/6) silt stringers present.
	10			0.5	**PZ-3**_10-12 **USCS:** Sandy Fat Clay (CH) **AL:** 67 / 21 / 46 - **#200:** 51.0	10-23.5	SILTY CLAY: Pale brown (10 YR 6/3); damp; soft; slight to low plasticity; some very fine grained sand content; iron oxide staining; trace gypsum crystals. Non-cohesive grab sample collected from 10'-12' bgs. At 11' bgs: Yellow silt stringers present. At 12' bgs: Decreasing silt content.
310							At 13' bgs: Soft, moist, reddish brown (2.5 YR 5/3) layer. At 13.5' bgs: Increasing sand content. At 14' bgs: Slight iron oxide staining.
	15			0.75			
305				3.5			At 16' bgs: Dense; no iron oxide staining.
				<0.25			At 17' bgs: Increasing sand content; friable.
				1.0-3.0			At 18' bgs: Medium dense; slight iron oxide staining and yellow silt stringers present. At 18.5' bgs: Decreasing sand content; 6" Soft, reddish brown, silty clay layer.
	20			3.0-3.25			

ERM Environmental Resources Management

PZ-3 DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-3 Date Drilled 2015-11-18

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 60.00 ' Boring Diam. 6.00 "

N. Coord. 13439296.00' E. Coord. 2135976.24' Surface Elevation 320.89' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 323.19 ' Stickup 2.30 '

Depth to Water: 1. Ft. btoc 30.68 (2015-11-21) 2.Ft. btoc 31.00 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
300	20			4			At 20' bgs: Dense; decreasing silt content; dark reddish brown (2.5 YR 3/4) mottling from 20.5' - 21' bgs.
				2.5		23.5-33	CLAY: Brown (10 YR 5/3); damp; medium stiff; low to high plasticity with depth; slight to trace silt content with depth; slight iron oxide staining and yellow silt stringers present.
295	25			2.75			At 26' bgs: No iron oxide staining.
					PZ-3_28-30 **USCS:** Fat Clay with Sand (CH) **AL:** 79 / 23 / 56 **- #200:** 71.1		At 27' bgs: Iron oxide staining; thin gypsum seams (2-3 mm) present; At 27.5' bgs: Color change to pale brown (10 YR 6/3); high plasticity. At 28' bgs: Medium dense; medium plasticity; slight very fine grained sand content (increases with depth); abundant gypsum seams to 29' bgs: Non-cohesive grab sample collected from 28'-30' bgs.
290	30			4			31.5' bgs: Color change to brown (10 YR 5/3); dense; trace iron oxide staining and gypsum.
				<0.25-2.0		33-36.5	CLAYEY SILTY SAND: Brown (10 YR 5/3); damp; very fine grained; sub-angular; poorly sorted (sorting increases with depth); medium dense to loose; slight plasticity; intermixed dense pieces of very fine grained sandy clay; slight gypsum seams and yellow silt stringers present. Top of Transmissive Sand Unit. At 34' bgs: Reddish brown to 35' bgs; no gypsum. At 35' bgs: Decreasing silt and clay content; color change to dark reddish brown (5 YR 3/4) at 35.75' bgs.
285	35			<0.25		36.5-45.5	SAND: Light olive brown (2.5 Y 5/3); moist; very fine to fine grained; sub-angular to sub-rounded; well sorted; loose; non-plastic; slight clay content (decreases with depth); iron oxide staining. At 37.5' bgs: Color change to pale olive (5 Y 6/3); very moist; no iron oxide staining. At 38' bgs: Wet; slight yellow silt stringers present.
	40						

ERM Environmental Resources Management

PZ-3 DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-3 Date Drilled 2015-11-18

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 60.00 ' Boring Diam. 6.00 "

N. Coord. 13439296.00' E. Coord. 2135976.24' Surface Elevation 320.89' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 323.19 ' Stickup 2.30 '

Depth to Water: 1. Ft. btoc 30.68 (2015-11-21) 2.Ft. btoc 31.00 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
280	40				**PZ-3**_40-42 **USCS:** Silty Sand (SM) **AL:** Non-plastic **- #200:** 16.6		At 40' bgs: Non-cohesive grab sample collected from 40'-42' bgs. At 44' bgs: Iron oxide staining; no silt stringers.
						45.5-48	SILTY SAND: Pale olive (5 Y 6/7); very moist to wet; very fine grained; loose; slight plasticity; intermixed silty sand and sandy silt content; trace clay content; iron oxide staining and trace yellow silt stringers present. At 47.5' bgs: Increasing clay content with depth.
275	45					48-55	SAND: Pale olive (5 Y 6/7); very moist to wet; very fine to fine grained; sub-rounded; well sorted; loose to medium dense; non-plastic; slight yellow silt stringers present; 2" layer of very dark brown (7.5 YR 2.5/2) clayey silt at 48' bgs. At 48.5' bgs: Reddish brown silt lamina present to 49.5' bgs. At 51' bgs: 1" layer of reddish brown silt. At 52' bgs: Loose; some silt content (increases with depth). At 54' bgs: Increasing yellow silt stringer content.
	50			1.25			
270				0.5		55-56	CLAYEY SAND: Pale olive (5 Y 4/4) intermixed with reddish brown (5 YR 4/3); moist; very fine grained; medium dense; slight plasticity; some silt content; abundant yellow silt stringers; At 54.75' bgs: Increasing silt and clay content; gypsum crystals (2 mm) present.
	55			1.75		56-56.5	CLAYEY SILT: Olive (5 Y 5/3); damp; medium density; slight to low plasticity; some reddish brown silty clay content; abundant yellow silt stringers and grey (5 Y 7/1), very fine grained sand stringers present.
265				2.5-3.0		56.5-58	CLAY: Dark reddish brown (5 YR 3/1); damp to dry; very stiff; medium plasticity; slight fine grained sand and silt content; abundant yellow silt stringers to 57.5' bgs. Top of Basal Clay Unit. At 57' bgs: Olive mottling; light gray very fine grained sand to silt lamina to 57.5' bgs; At 58' bgs: 3" Layer of very dark greenish grey (Gley-1 5 GY 3/1) clayey sand.
				>4.5		58-60	CLAY: Very dark greenish grey (Gley-1 5 GY 7/1); damp to dry; very dense; medium plasticity; some silt and slight very fine grained sand content; abundant light grey silt to very fine grained sand stringers. Non-cohesive grab sample collected from 58'-60' bgs. At 59' bgs: Gypsum seams present. T.D. = 60.00 '
	60				**PZ-3**_58-60 **USCS:** Sandy Fat Clay (CH) **AL:** 52 / 19 / 33 **- #200:** 56.9		

ERM Environmental Resources Management

PZ-4
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-4 Date Drilled 2015-11-14

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 42.00 ' Boring Diam. 6.00 "

N. Coord. 3438674.49' E. Coord. 2135383.07' Surface Elevation 300.63 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Sump Length 2.00 '

Top of Casing Elevation 303.21' Stickup 2.58'

Depth to Water: 1. Ft. btoc 13.80 (2015-11-21) 2.Ft. btoc 12.50 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Jesse Houghton

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
300.73	0			0.5		0-3.5	CLAY: Brown (7.5 YR 5/2); moist; very soft; medium to high plasticity;
300							At 1.5' bgs: Calcareous nodules present (5 - 30 mm).
				1.75		3.5-4.5	SILTY CLAY: Light brown (7.5 YR 6/3) with black (7.5 YR 2.5/1) and strong brown (7.5 YR 5/8) mottling; moist; medium stiff; slightly plastic.
				0.25		4.5-7.8	At 4.5' bgs: Soft; low plasticity; silt content decreases.
	5			0.5			SILTY CLAY: Dark greyish brown (2.5 Y 4/2) with some mottling; damp; soft; high plasticity; organic material present; occasional small dark concretions and iron oxide staining.
295							
				1.5	**PZ-4**_8-10 **USCS:** Sandy Fat Clay (CH) **AL:** 52 / 22 / 30 **- #200:** 61.6	7.8-8.3	CLAY: Reddish black (2.5 YR 2.5/1); damp; medium stiffness; high plasticity; some silt and very fine sand (sub-angular, poorly sorted) content; trace small chert pebbles (sub-angular); trace organic matter and iron oxide staining. Non-cohesive grab sample collected from 8'-10' bgs.
						8.3-9	
						9-10.3	
	10						
290						10.3-11.2	CLAY: Very dark grey (10 YR 3/1); highly mottled with iron oxide staining and very dark brown (10 YR 2/2) clay; damp; medium stiff to stiff; high plasticity; some silt content. Top of Transmissive Sand Unit.
				1.5		11.2-20	CLAY: Very dark grey (7.5 YR 3/1); damp; medium stiff to stiff; high plasticity; 10 YR 2/2; slightly silt and minor sand (very fine grained, poorly sorted, firm) content; trace iron oxide staining.
							CLAYEY SAND: Light olive brown (2.5 Y 5/3); moist to wet; very fine grained; sub-angular to sub-rounded; poorly sorted; very soft; very high plasticity; some sandy clay content. Top of Transmissive Sand Unit.
				2.0			SAND: Greyish brown (2.5 Y 5/2); damp; very well sorted; sub-rounded to round; loose to medium dense; slight plasticity; minor fine content; abundant iron oxide staining to 12.7' bgs.
	15						At 16.6' bgs: Moderately cemented sandy, sub-angular cobbles with black and reddish staining; abundant iron oxide staining to 17.3' bgs.
285				<0.25			
					PZ-4_18-20 **USCS:** Clayey Sand (SC) **AL:** 27 / 19 / 8 **- #200:** 23.0		At 18' bgs: Non-cohesive grab sample collected from 18'-20' bgs.
	20						

ERM Environmental Resources Management

PZ-4
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-4 Date Drilled 2015-11-14

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 42.00 ' Boring Diam. 6.00 "

N. Coord. 3438674.49' E. Coord. 2135383.07' Surface Elevation 300.63 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Sump Length 2.00 '

Top of Casing Elevation 303.21' Stickup 2.58'

Depth to Water: 1. Ft. btoc 13.80 (2015-11-21) 2.Ft. btoc 12.50 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Jesse Houghton

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
280	20			0.75		20-30	CLAYEY SAND: Olive (5 Y 4/4) with some yellow (5 Y 7/6) mottling; moist; very fine to fine grained; sub-rounded to rounded; weakly cemented; loose to medium dense; low to slight plasticity; iron oxide staining.
275	25			0.5			
270	30			4.0		30-31.6	SANDY CLAY: Pinkish grey (7.5 YR 6/2); damp; hard; high plasticity; sand content is very fine to fine grained, poorly sorted, moderately cemented; occasional iron oxide staining.
				4.0		31.6-34.5	SILTY CLAY: Light yellowish brown (2.5 Y 6/4) with occasional mottling; damp; firm to hard; high plasticity;
							At 33' bgs: Very fine sand content to 34' bgs.
265	35					34.5-36	CLAY: Brown (7.5 YR 4/3) with occasional mottling; dry to damp; hard; high plasticity; sandy in some places.
						36-42	CLAY: Dark greenish grey (Gley-1 3/1); dry; very hard; blocky structure; slight silt and very fine sand content. Top of Basal Clay Unit.
				4.5			
				>4.5			At 39' bgs: Non-cohesive grab sample collected from 39'-41' bgs.
	40						

ERM Environmental Resources Management

PZ-4
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-4 Date Drilled 2015-11-14

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 42.00 ' Boring Diam. 6.00 "

N. Coord. 3438674.49' E. Coord. 2135383.07' Surface Elevation 300.63 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Sump Length 2.00 '

Top of Casing Elevation 303.21' Stickup 2.58'

Depth to Water: 1. Ft. btoc 13.80 (2015-11-21) 2.Ft. btoc 12.50 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Jesse Houghton

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
260	40				**PZ-4**_39-41 **USCS:** Fat Clay (CH) **AL:** 96 / 31 / 65 **- #200:** 93.4		T.D. = 42.00 '
255	45						
250	50						
245	55						
	60						

ERM Environmental Resources Management

PZ-5
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-5 Date Drilled 2015-11-16

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13438473.93' E. Coord. 2136974.86' Surface Elevation 299.29' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 2.00 '

Top of Casing Elevation 302.77 ' Stickup 3.47 '

Depth to Water: 1. Ft. btoc 20.00 (2015-11-21) 2.Ft. btoc 20.15 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
299.52	0			0.75		0-3	SILTY CLAY: Black (10 YR 2/1); moist; soft to medium stiff; low to medium plasticity; calcareous material.
						3-5	SAND: Pale brown (10 YR 6/3) with some strong brown (7.5 YR 5/8) coloration; damp; medium to fine grained; sub-angular to sub-rounded; poorly sorted; medium dense; non-plastic: some silt content.
295	5			<0.25		5-11	CLAYEY SILTY SAND: Light yellowish brown (10 YR 6/4); dry; very fine grained; sub-angular; well sorted; loose; non-plastic to slightly plastic; partially cemented sand pieces throughout; 2" layer of yellow silt (5 Y 8/6) at 5' bgs.
							At 8' bgs: Color changes to brown (7.5 YR 5/4); increasing clay and silt content; some iron oxide staining; some dense silty clay pieces.
290	10				**PZ-5**_9-11 **USCS:** Sandy Fat Clay (CH) **AL:** 73 / 22 / 51 **- #200:** 67.2		At 9' bgs: Non-cohesive grab sample collected from 9'-11' bgs.
				3.5		11-13.5	SILTY CLAY: Brown (7.5 YR 5/4); damp; medium stiff; low plasticity (increases with depth); some very fine grained sand content; iron oxide staining.
							At 13' bgs: Color change to light brown (7.5 YR 6/3).
				2.75		13.5-22	CLAY: Brown (7.5 YR 5/4); damp; dense to very dense; low to medium plasticity; some silt content; iron oxide staining; trace gypsum seams present.
285	15						At 15' bgs: Medium plasticity; increasing silt content; trace sand content.
				4.0			At 16' bgs: Some gypsum seams present; slight very fine grained sand content.
							At 18' bgs: Damp to moist.
280	20						

ERM Environmental Resources Management

PZ-5 DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-5 Date Drilled 2015-11-16

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13438473.93' E. Coord. 2136974.86' Surface Elevation 299.29' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 2.00 '

Top of Casing Elevation 302.77 ' Stickup 3.47 '

Depth to Water: 1. Ft. btoc 20.00 (2015-11-21) 2.Ft. btoc 20.15 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	20				**PZ-5**_20-22 **USCS:** Sandy Fat Clay (CH) **AL:** 67 / 21 / 46 **- #200:** 58.2		At 20' bgs: Very dense to hard; some very fine grained sand content. Non-cohesive grab sample collected from 20'-22' bgs.
				0.5		22-25	CLAYEY SAND: Light yellowish brown (2.5 Y 6/3); moist; loose; slightly plastic; some silt content; iron oxide staining. Top of Transmissive Sand Unit.
275							At 24' bgs: Intermixed reddish brown (2.5 YR 4/3) coloration; yellow silt stringers present.
	25			2.5		25-26	SAND: Brown (7.5 YR 5/4) with reddish brown (2.5 YR 4/3); damp to moist; very fine grained; sub-angular; well sorted; medium dense; non-plastic; slight clay content.
				1.25		26-26.5	
				<0.25		26.5-46.5	SANDY SILTY CLAY: Dark reddish brown (5 YR 3/2); moist; loose to medium stiff; low plasticity; sand content is very fine grained.
							SAND: Dark reddish brown (5 YR 3/2); moist; loose; non-plastic; very fine grained; sub-angular; well sorted; little silt and trace clay content.
270	30						At 27' bgs: Color change to olive grey (5 Y 5/2); very moist with increasing moisture at depth; no clay content.
							At 32' bgs: Wet; trace to slight yellow silt stringers present.
							At 34' bgs: Non-cohesive grab sample collected from 34'-36' bgs.
265	35				**PZ-5**_34-36 **USCS:** Silty Sand (SM) **AL:** Non-plastic **- #200:** 16.5		
							At 37' bgs: Abundant iron oxide staining.
							At 38' bgs: Slight iron oxide staining.
260	40						

ERM Environmental Resources Management

PZ-5
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-5 Date Drilled 2015-11-16

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13438473.93' E. Coord. 2136974.86' Surface Elevation 299.29' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 2.00 '

Top of Casing Elevation 302.77 ' Stickup 3.47 '

Depth to Water: 1. Ft. btoc 20.00 (2015-11-21) 2.Ft. btoc 20.15 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
255	40			0.75			At 40' bgs: Abundant iron oxide staining.
	45			<0.25			At 42' bgs: Slight clay content and iron oxide staining.
				3.25			At 45.75' bgs: Color change to dark greenish grey (Gley-1 5GY 5/1); increasing silt content.
				3.0		46.5-47.5	SILTY SAND: Dark greenish grey (Gley-1 5GY 5/1); moist; medium dense to dense; non-plastic to slight plasticity; slight clay content (increases with depth).
250	50			2.0		47.5-52	SILTY CLAY: Dark reddish grey (2.5 YR 3/1) with dark greenish grey (Gley 1 5GY 5/1) mottling; damp; medium stiff to stiff; medium to high plasticity; some dark greenish grey, very fine grained sand to silt stringers. Top of Basal Clay Unit.
				>4.5	**PZ-5**_50-52 **USCS:** Clayey Sand (SC) **AL:** 42 / 18 / 24 **- #200:** 41.0		At 48.5' bgs: Dark greenish grey sandy clay lens to 49.5' bgs.
							At 50' bgs: Very stiff. Non-cohesive grab sample collected from 50'-52' bgs.
245	55						At 51' bgs: Light grey (Gley-1 N 7), very fine grained sand stringers.
240	60						T.D. = 52.00 '

ERM Environmental Resources Management

PZ-6
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-6 Date Drilled 2015-11-20

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 13438736.08' E. Coord. 2138097.96' Surface Elevation 292.79 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 33.00 ' Sump Length 2.00 '

Top of Casing Elevation 297.42' Stickup 4.63'

Depth to Water: 1. Ft. btoc 15.84 (2015-11-21) 2.Ft. btoc 15.83 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
292.98	0			0.75		0-2.5	CLAY: Black (10 YR 2/1); moist; soft; low to medium plasticity.
				0.5		2.5-4.5	SILTY CLAY: Dark greyish brown (10 YR 4/2); moist; soft; slight plasticity. At 3.5' bgs: Strong brown (7.5 YR 5/8) coloration; silt content increases with depth; calcareous material present.
290						4.5-5	CLAYEY SILT: Yellowish brown (10 YR 5/4) with brownish yellow (10 YR 6/8); moist; soft; some brown (10 YR 5/3), dry, blocky, stiff clay pieces and slight gravel (5-10 mm) present.
	5			0.25		5-13	CLAYEY SAND: Light yellowish brown (2.5 Y 6/3); damp to moist; very fine grained; loose, slight plasticity; some silt content; slight iron oxide staining and yellow (2.5 Y 8/6) silt stringers present. At 7' bgs: Medium dense to dense; intermixed reddish brown (5 YR 5/3) lamina; increasing silt content; abundant iron oxide staining. Non-cohesive grab sample collected from 7'-9' bgs.
				2.0-3.75 <0.25	**PZ-6**_7-9 **USCS:** Sandy Fat Clay (CH) **AL:** 60 / 20 / 40 **- #200:** 55.7		
285							At 9.5' bgs: Loose; friable; decreasing clay content.
	10						At 12' bgs: Medium dense; clay content increases; decreasing very fine grained sand content.
280				0.75		13-14	SILTY CLAY: Brown (10 YR 5/3); damp; soft; slight to low plasticity; some very fine grained sand content; iron oxide staining; slight yellow silt stringers present.
				4.25	**PZ-6**_14-16 **USCS:** Fat Clay with Sand (CH) **AL:** 71 / 22/49 **- #200:** 72.0	14-16	CLAYEY SAND: Brown (10 YR 5/3); damp; very dense; slight plasticity; iron oxide staining; some silt content. Non-cohesive grab sample collected from 14'-16' bgs.
	15					16-16.5	CLAYEY SILT: Brown (10 YR 5/3); damp; medium dense; low plasticity; slight sand content; iron oxide staining.
				3.5 1.0		16.5-18.25	SILTY CLAY: Light yellowish brown (10 YR 6/4); damp; loose to medium stiff, low plasticity; iron oxide staining throughout; gypsum seam (5 mm) at 16.75' bgs.
275							At 17' bgs: Thin gypsum seams present; trace very fine grained sand.
				2.5-3.5	**PZ-6**_18.5-20 **USCS:** Fat Clay (CH) **AL:** 104 / 27 / 77 **- #200:** 92.4 **k:** 9.91×10^{-9}	18.25-21.5	CLAY: Pale brown (10 YR 6/3); damp; stiff; high to very high plasticity (fat); iron oxide staining and gypsum seams present. Cohesive sample (split spoon) collected from 18.5'-20' bgs.
	20						

ERM Environmental Resources Management

PZ-6
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-6 Date Drilled 2015-11-20

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 13438736.08' E. Coord. 2138097.96' Surface Elevation 292.79 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 33.00 ' Sump Length 2.00 '

Top of Casing Elevation 297.42' Stickup 4.63'

Depth to Water: 1. Ft. btoc 15.84 (2015-11-21) 2.Ft. btoc 15.83 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	20						At 19' bgs: Mottled with brown (10 YR 4/7). At 20' bgs: No mottling; trace silt content (increases with depth).
				3.25-3.5		21.5-26	SILTY CLAY: Yellowish brown (10 YR 5/4); damp; stiff to very stiff; high to medium plasticity (decreases with depth); silt content increases with depth; iron oxide staining; gypsum seams present.
270							
	25						At 24' bgs: Trace very fine grained sand content (increases with depth); trace gypsum seams.
				3.75		26-27.5	CLAYEY SAND: Dark greenish grey (Gley-1 5 GY 4/1); damp to moist; very fine grained; stiff; slight plasticity; some silt content; clay content decreases with depth; Light grey (Gley-1 7/1) silt stringers present. Top of Transmissive Sand Unit.
				<0.25		27.5-43.5	SAND: Dark greenish grey (Gley-1 5 GY 4/1); moist to very moist; very fine grained to fine grained; sub-rounded; well sorted; loose; non-plastic; trace clay and silt content.
265							At 29' bgs: Intermixed with dark brown (2.5 YR 3/2) to 29.5' bgs; wet.
	30				**PZ-6**_30-32 **USCS:** Poorly Graded Sand with Silt (SP-SM) **AL:** Non-plastic **- #200:** 11.7		At 30' bgs: Color changes to dark greenish grey (Gley-1 10 GY 4/1). Non-cohesive grab sample collected from 30'-32' bgs.
260							At 32.5' bgs: Trace black silty stringers to 33.25' bgs.
	35						
255							At 36' bgs: Very wet to saturated.
	40						

ERM Environmental Resources Management

PZ-6
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-6 Date Drilled 2015-11-20

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 13438736.08' E. Coord. 2138097.96' Surface Elevation 292.79 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 33.00 ' Sump Length 2.00 '

Top of Casing Elevation 297.42' Stickup 4.63'

Depth to Water: 1. Ft. btoc 15.84 (2015-11-21) 2.Ft. btoc 15.83 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
250	40			0.5			At 41.5' bgs: Very fine grained, slight silt content.
				1.5		43.5-46	At 43' bgs: Decreasing moisture content (wet). SILTY SAND: Dark greenish grey (Gley-1 5 GY 4/1); very moist; very fine grained; medium dense; non-plastic; trace clay content. At 44' bgs: Intermixed clayey silt lenses.
	45			2.0 <0.25		46-50	SAND: Dark greenish gray (Gley-1 5 GY 4/1); moist to wet; very fine to fine grained; sub-angular; well sorted; medium dense; non-plastic. At 46.5' bgs: Loose.
245				2.0 <0.25			At 48' bgs: Medium dense to 48.5' bgs. At 49' bgs: Increasing silt content; slight clay content.
	50						T.D. = 50.00 '
240							
	55						
235							
	60						

ERM Environmental Resources Management

PZ-7 DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-7 Date Drilled 2015-11-19

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13438533.37' E. Coord. 2138619.06' Surface Elevation 279.54' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 27.00 ' Sump Length 2.00 '

Top of Casing Elevation 281.99' Stickup 2.45'

Depth to Water: 1. Ft. btoc 3.98 (2015-11-21) 2.Ft. btoc 3.86 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
279.72	0			<0.25		0-4	CLAY: Dark grey (10 YR 4/1); very moist; soft; low plasticity; sticky texture. At 1' bgs: Slight yellowish brown silty clay content. At 2.5' bgs: Black (10 YR 2/1); increasing silt content with depth. At 3.5' bgs: Medium stiffness and plasticity.
275	5			0.5		4-5 5-18	SILTY CLAY: Black (10 YR 2/1); very moist; soft; slight plasticity; friable. At 4.75; bgs: Saturated; very soft; low to medium plasticity; very sticky. CLAY: Very dark greyish brown (10 YR 3/2); moist to wet; high plasticity; soft to medium stiff; slight silt content (increases with depth); sticky texture. At 7.5' bgs: Yellow (2.5 Y 8/6) silt stringers present. Non-cohesive grab sampled collected from 7.5'-10' bgs.
				0.75	**PZ-7**_7.5-10 **USCS:** Sandy Lean Clay (CL) **AL:** 40 / 17 / 23 **- #200:** 54.7		
270	10			1.25-1.5			At 10' bgs: Color change to dark greyish brown (10 YR 4/3) with light yellowish brown (2.5 Y 6/3) heavy mottling. At 11' bgs: Trace greenish grey (Gley-1 5 G 6/1) coloration; medium plasticity; increase in density; silty clay layer present. At 13' bgs: Color change to dark grey (10 YR 4/1) with greenish grey mottling; moist; root content present. At 13.5' bgs: White (5Y 3/1) silt stringers present. At 14' bgs: Color change to light olive brown (2.5 Y 5/3) with very dark brown (10 YR 2/2) mottling; slight iron oxide staining; some white silt stringers present. At 15' bgs: Color change to light yellowish brown (2.5 Y 6/4); moist; medium plasticity; slight iron oxide staining; At 15.5' bgs: Gypsum seams present to 16' bgs. At 16' bgs: Moist to damp; stiff; silt content increases with depth; iron oxide staining; yellow silt stringers present; trace gypsum seams.
				1.0			
265	15			2.5-3.25	**PZ-7**_16-18 **USCS:** Sandy Fat Clay (CH) **AL:** 58 / 20 / 38 **- #200:** 62.3		Non-cohesive grab sample collected from 16'-18' bgs
				<0.25		18-19	SILTY CLAY: Light yellowish brown (2.5 Y 6/4) with very dark brown (10 YR 2/2) mottling; moist; soft; slight to low plasticity; some very fine grained sand content; iron oxide staining; trace gypsum crystals.
				0.25		19-21	SANDY CLAY: Light yellowish brown (2.5 Y 6/4); moist; soft; slight plasticity; intermixed with clayey sand; sand content is very fine grained, sub-angular, well sorted; some silt content (decreases with depth).
260	20						

ERM Environmental Resources Management

PZ-7
DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-7 Date Drilled 2015-11-19

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13438533.37' E. Coord. 2138619.06' Surface Elevation 279.54' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 27.00 ' Sump Length 2.00 '

Top of Casing Elevation 281.99' Stickup 2.45'

Depth to Water: 1. Ft. btoc 3.98 (2015-11-21) 2.Ft. btoc 3.86 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	20					21-29	NO RECOVERY: No recovery. 21'-22' bgs logged from Shelby tube: Silt; very dark greenish grey (Gley-1 10 Y 3/1); very moist; loose; non-plastic; slight very fine grained sand and clay content. Approximate Top of Transmissive Sand Unit.
255	25						
				<0.25		29-45	SAND: Dark greenish grey (Gley-1 10 GY 4/1); saturated; very fine to fine grained; sub-angular; well sorted; loose; non-plastic.
250	30						
					PZ-7_33-35 **USCS:** Silty Sand (SM) **AL:** Non-plastic **- #200:** 21.2		At 33' bgs: Non-cohesive grab sample collected from 33'-35' bgs.
245	35						
				0.5-2.0			At 36.5' bgs: 3" clayey sand to sandy clay lens.
							At 39' bgs: Trace to slight clay content.
240	40			<0.25-0.5			

ERM Environmental Resources Management

PZ-7 DRILLING LOG

Proj. No. 0322807 Boring/Well ID PZ-7 Date Drilled 2015-11-19

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13438533.37' E. Coord. 2138619.06' Surface Elevation 279.54' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 27.00 ' Sump Length 2.00 '

Top of Casing Elevation 281.99' Stickup 2.45'

Depth to Water: 1. Ft. btoc 3.98 (2015-11-21) 2.Ft. btoc 3.86 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	40			1.5			At 40' bgs: Color change to very dark greenish grey (Gley-1 10 GY 3/1).
				<0.25			At 42.5' bgs: Medium dense; some clay content.
				3.5			
				<0.25			At 43.5' bgs: Dense, clayey sand lens to 44.5 ft.
235	45			3.25		45-46	CLAYEY SAND: Greenish black (Gley-1 10 GY 2.5/1); very moist; very fine grained; dense; slight plasticity; gradual transition to very fine grained sandy clay; slight silt content (increases with depth); light grey (Gley-1 N 7/1) silt stringers present.
				4.25		46-47	
				>4.5		47-48.5	SILTY CLAY: Greenish black (Gley-1 10 GY 2.5/1); moist; very stiff; low plasticity; slight to some very fine grained sand content; light grey silt stringers present. Top of Basal Clay Unit.
				>4.5		48.5-52	CLAY: Greenish black (Gley-1 10 GY 2.5/1); damp to moist; very stiff; high plasticity; little silt and trace very fine grained sand content; light grey silt stringers present.
230	50				**PZ-7**_51-52 **USCS:** Fat Clay with Sand (CH) **AL:** 80 / 23 / 57 **- #200:** 71.7 **k:** 1.92×10^{-8}		CLAY: Greenish black (Gley-1 10 GY 2.5/1); damp; very stiff; very high plasticity (fat); slight silt content.
							At 51' bgs: Cohesive sample (split spoon) collected from 51'-52' bgs.
225	55						T.D. = 52.00 '
220	60						

ERM Environmental Resources Management

SP-1
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-1 Date Drilled 2015-11-12

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13440721.47' E. Coord. 2135348.03' Surface Elevation 326.31' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

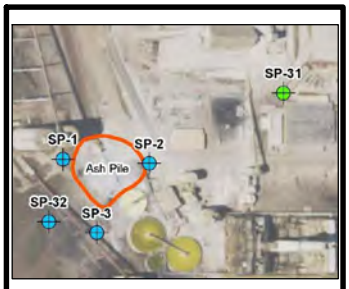
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 325.97 ' Stickup -0.34'

Depth to Water: 1. Ft. btoc 25.82 (2015-11-21) 2.Ft. btoc 26.18 (2015-12-03)

Drilling Company Cascade Drilling, LLC. Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
326.07	0					0-1.5	COAL: Dark brown (7.5 YR 3/2); dry; cemented.
				3.0		1.5-3	CLAY: Black (7.5 YR 2.5/1); damp; very stiff; medium plasticity; aggregate/caliche material present.
						3-5	CLAYEY SILT TO SILTY CLAY: Pale brown (10 YR 6/3); damp; compact; friable.
325	5			2.0-4.0		5-8.5	CLAYEY SAND: Brown (10 YR 5/3) with yellow (10 YR 7/3) coloration; damp to moist; very fine grained; medium dense to dense; slightly plastic; slight silt content; iron oxide staining.
320				3.0		8.5-15	SILTY CLAY: Brown (7.5 Y 5/3); damp to moist; medium stiff; low plasticity; some sand content; abundant iron oxide staining from 9.5' - 10' bgs.
	10			4.25			At 10.5' bgs: Reddish brown (5 YR 4/3) and light grey (5 YR 7/1) mottling; very dense; slight iron oxide staining.
315				4.5			At 12.5' bgs: Damp to dry.
							At 14' bgs: Color change to pale brown (10 YR 6/3).
	15			2.5	**SP-1**_15-17.5 **USCS:** Fat Clay (CH) **AL:** 102 / 32 / 70 **- #200:** 98.7	15-20	CLAY: Brown (7.5 Y 5/3); damp; medium stiff; medium plasticity; some silt content. Non-cohesive grab sample collected from 15'-17.5' bgs.
310							At 17' bgs: Iron oxide staining. At 17.5' bgs: Damp to dry; friable.
	20						

ERM Environmental Resources Management

SP-1
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-1 Date Drilled 2015-11-12

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13440721.47' E. Coord. 2135348.03' Surface Elevation 326.31' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

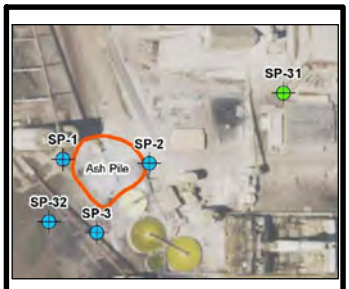
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 325.97 ' Stickup -0.34'

Depth to Water: 1. Ft. btoc 25.82 (2015-11-21) 2.Ft. btoc 26.18 (2015-12-03)

Drilling Company Cascade Drilling, LLC. Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
305	20			>4.5		20-24	SILTY SANDY CLAY: Brown (7.5 Y 5/3); dry to damp; very stiff; low plasticity; sand content is very fine grained, sub-angular, and well sorted; iron oxide staining and gypsum seams present; increasing clay content with depth.
							At 22.5' bgs: Very fine grained sandy clay; damp to moist; low to medium plasticity; increasing sand content with depth.
				1.5		24-30	CLAYEY SILTY SAND: Pale brown (10 YR 6/3); damp; very fine grained, sub-angular, well sorted; medium dense to loose; slight to low plasticity; iron oxide staining; slight gypsum crystal content.
	25			3.0			At 25' bgs: Color change to light yellowish brown (2.5 Y 6/4); increase sand content; dense to soft with depth.
300				<0.25			
				>4.5			At 27.5' bgs: Moist; very dense; low plasticity; reddish brown lamina (5 YR 4/3) and gypsum seams present.
	30			3.0-4.5	**SP-1**_30-32.5 **USCS:** Fat Clay (CH) **k:** 2.66×10^{-8}	30-37	SILTY CLAY: Pale brown (10 YR 6/3) with reddish brown mottling (5 YR 4/3); damp; stiff to very stiff; low plasticity; some very fine grained sand content; iron oxide staining and gypsum seams present.
295				>4.5	**SP-1**_33-35 **USCS:** Fat Clay with Sand (CH) **AL:** 52 / 22 / 30 **- #200:** 72.1		At 33' bgs: Color change to brown (7.5 YR 4/3); very stiff to medium stiff with depth; low to medium plasticity; decreased sand and silt content; yellow (5 Y 8/6) silt lenses present. Cohesive sample (shelby tube) collected from 33'-35' bgs.
	35						At 36' bgs: Color change to dark yellowish brown (10 YR 4/4); moist; increased silt content; slight silt lens content; no iron oxide staining or gypsum seams.
290				3.0			
				<0.25		37-38	CLAYEY SAND: Brown (7.5 YR 4/3); moist to very moist; soft; slight to non-plastic; some silt content; sand content is very fine grained, sub-angular, and well sorted. Top of Transmissive Sand Unit.
					SP-1_38-40 **USCS:** Clayey Sand (SC) **AL:** 31 / 16 / 15 **- #200:** 29.1	38-42	SAND: Light olive brown (2.5 YR 5/3); moist with increasing moisture with depth; very fine grained; sub-angular, well sorted; loose; non-plastic; some clay and silt content.
	40						

ERM Environmental Resources Management

SP-1
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-1 Date Drilled 2015-11-12

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 52.00 ' Boring Diam. 6.00 "

N. Coord. 13440721.47' E. Coord. 2135348.03' Surface Elevation 326.31' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

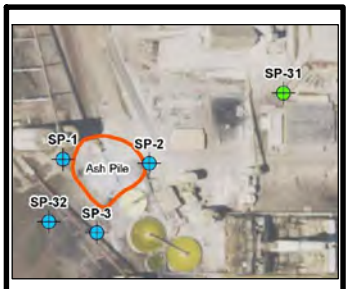
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 325.97 ' Stickup -0.34'

Depth to Water: 1. Ft. btoc 25.82 (2015-11-21) 2.Ft. btoc 26.18 (2015-12-03)

Drilling Company Cascade Drilling, LLC. Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
285	40			1.5 2.0			At 39.5' bgs: Decreasing clay content. At 40' bgs: Increasing clay content.
						42-44	CLAYEY SAND: Light olive brown (2.5 YR 5/3); moist; very fine grained; sub-angular; well sorted; loose to medium dense; slight to low plasticity; some silt content. At 42.5' bgs: Increased clay and silt content.
				2.5-3.0		44-45	SILTY CLAY: Dark reddish brown (5 YR 3/2); damp; stiff; medium to high plasticity; decreasing silt content with depth; light grey (5 YR 7/1) silt stringers; yellow silt stringers from 44.75' - 45' bgs.
	45			2.75 4.0		45-50	SILTY SANDY CLAY: Very dark greenish gray (Gley 1 - 5 GY 3/1); damp; stiff; medium plasticity; gypsum seams present (up to 2-3 mm thick); 3" light grey (Gley 1 - 10Y 7/1) sandy clay lens at top of 45' bgs. At 46' bgs: Trace sand; slight silt content. At 48' bgs: Damp to dry; decreased sand and silt content with depth.
280							
275	50			>4.5	**SP-1**_50-51.5 **USCS:** Fat Clay (CH) **AL:** 86 / 28 / 58 **- #200:** 96.0 **k:** 6.50×10^{-9}	50-52	CLAY: Very dark greenish gray (Gley 1 - 5 GY 3/1); damp; stiff; high plasticity.Cohesive sample (split spoon) collected from 50'-51.5' bgs. Top of Basal Clay Unit. T.D. = 52.00 '
270	55						
	60						

ERM Environmental Resources Management

SP-2
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-2 Date Drilled 2015-11-13

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 13440707.13' E. Coord. 2135634.20' Surface Elevation 330.20' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

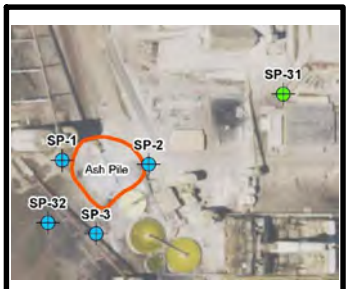
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 2.00 '

Top of Casing Elevation 329.80 ' Stickup -0.4'

Depth to Water: 1. Ft. btoc 27.78 (2015-11-21) 2.Ft. btoc 28.06 (2015-12-03)

Drilling Company Cascade Drilling, LLC. Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
329.75	0					0-3	CALICHE: Road base material (hard caliche/gravel).
				2.25		3-4.5	SILTY CLAY: Brown (10 YR 5/3); damp; medium stiff; low plasticity; slight sand content; top 3" very fine grained sand with some clay; yellow (10 YR 8/8) silt stringers present; large aggregate (road base >110 mm). At 3.5' bgs: Iron oxide staining. At 4' bgs: Fly ash (possibly slough material).
325	5			0.5 2.5		4.5-5 5-16.5	CLAYEY SAND: Yellowish brown (10 YR 5/4); damp; loose; non-plastic to slightly plastic; some silty clay nodules present; iron oxide staining. SILTY SANDY CLAY: Brown (10 YR 5/3); damp to moist with increasing moisture with depth; medium stiff; low to medium plasticity; some sand content; trace iron oxide staining; yellow silt stringers present. At 7.5' bgs: 3" Yellowish red (2.5 YR 3/6) interval; wet; very stiff; trace sand; some light grey silt stringers.
				>4.5			
320	10			<0.25 2.5 3.25	**SP-2**_11-13 **USCS:** Fat Clay with Sand (CH) **AL:** 79 / 27 / 52 **- #200:** 71.8		At 10' bgs: Loose; some sandy clay content. At 10.5' bgs: Color alternates with dark red (10 R 3/6); damp; medium stiff; low plasticity; slight iron oxide staining; yellow silt stringers present. At 11' bgs: Non-cohesive grab sample collected from 11'-13' bgs.
				>4.5			At 13' bgs: Damp to dry; very stiff; decreasing sand content.
315	15						At 15' bgs: Color change to reddish brown (5 YR 4/3).
				2.25		16.5-25	CLAY: Yellowish brown (10 YR 5/4); damp; medium stiff; medium plasticity; friable; trace sand and slight silt content; abundant gypsum seams (2-3 mm). At 18' bgs: Iron oxide staining and slight yellow silt stringers to 20' bgs.
310	20			2.75			

ERM Environmental Resources Management

SP-2
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-2 Date Drilled 2015-11-13

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 13440707.13' E. Coord. 2135634.20' Surface Elevation 330.20' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

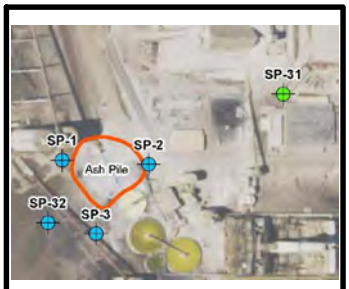
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 2.00 '

Top of Casing Elevation 329.80 ' Stickup -0.4'

Depth to Water: 1. Ft. btoc 27.78 (2015-11-21) 2.Ft. btoc 28.06 (2015-12-03)

Drilling Company Cascade Drilling, LLC. Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	20			3.0			At 20.5' bgs: Medium to high plasticity; no sand content. At 21' bgs: Iron oxide staining.
				2.75			At 23' bgs: Color change to pale brown (10 YR 6/3) to brown (10 YR 5/3); no iron oxide staining; abundant light grey (5 Y 7/1) and yellow silt stringers present.
305	25			>4.5		25-29	SILTY SANDY CLAY: Yellowish brown (10 YR 5/4) to brown (10 YR 5/3); damp; very stiff; low plasticity; slight yellow silt stringers present.
					SP-2_27-29 **USCS:** Clayey Sand (SC) **AL:** 46 / 19 / 27 **- #200:** 45.9		At 27' bgs: Iron oxide staining and gypsum seams present. Non-cohesive grab sample collected from 27'-29' bgs. At 28' bgs: Increased sand content.
				>4.5-3.0		29-31.5	CLAYEY SAND: Yellowish brown (10 YR 5/4) intermixed with reddish brown (5 YR 4/3); damp to moist; very dense to medium dense with depth; slightly plastic; abundant yellow silt lenses; trace gypsum crystals. Top of Transmissive Sand Unit.
300	30			<0.25		31.5-45	SAND: Light olive brown (2.5 Y 5/3); very moist to wet; very fine grained; sub-angular; well sorted; loose; non-plastic. At 32' bgs: 2" orange and black medium cemented sand; trace clay content to 34' bgs. At 33' bgs: Wet.
295	35						At 35' bgs: 6" clayey sand to sandy clay lense; iron oxide staining.
							At 37' bgs: Slight silt content. At 37.5' bgs: 2-3" Alternating strong brown (7.5 YR 5/8) to very dark brown (7.5 YR 2.5/2); gypsum seams and aggregate (10-50 mm) present. At 38' bgs: Trace clay content. At 39.5' bgs: 3" layer of alternating strong brown very fine grained sand to very dark brown silt; Some clay content.
290	40						

ERM Environmental Resources Management

SP-2
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-2 Date Drilled 2015-11-13

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 13440707.13' E. Coord. 2135634.20' Surface Elevation 330.20' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

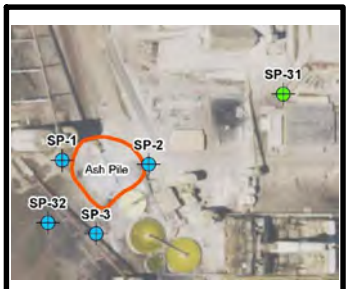
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 2.00 '

Top of Casing Elevation 329.80 ' Stickup -0.4'

Depth to Water: 1. Ft. btoc 27.78 (2015-11-21) 2.Ft. btoc 28.06 (2015-12-03)

Drilling Company Cascade Drilling, LLC. Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	40			0.25-0.75	**SP-2**_40-42.5 **USCS:** Silty Sand (SM) **AL:** Non-plastic **- #200:** 27.7		At 40' bgs: Non-cohesive grab sample collected from 40'- 42.5' bgs.
				<0.25-0.50			At 42.5' bgs: Color change to olive brown (2.5 Y 4/3).
285	45			1.5 0.5		45-47	CLAYEY SAND: Pale olive (5 Y 6/4); moist; loose to medium dense; slightly plastic; trace iron oxide staining.
				2.75		47-48.5	At 47' bgs: Increased clay content, abundant iron oxide staining, yellow silt stringers present.
280	50			4.0	**SP-2**_48.5-50 **USCS:** Sandy Fat Clay (CH) **AL:** 51 / 20 / 31 **- #200:** 51.8	48.5-50	CLAY: Brown (7.5 YR 5/2); damp to moist; stiff; medium to high plasticity; slight silt content; abundant iron oxide staining. At 47.5' bgs: 1" thick pink (7.5 yr 7/4) silt lens with gypsum seams; pale olive very fine grained sand to silt stringers. SILTY CLAY: Greenish black (Gley-1 5 GY 2.5/1); damp; very stiff; medium plasticity; slight light grey (Gley-1 N 7/1), very fine grained sand stringers. Non-cohesive grab sample collected from 48.5'-50' bgs. Top of Basal Clay Unit. T.D. = 50.00 '
275	55						
270	60						

ERM Environmental Resources Management

SP-3
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-3 Date Drilled 2015-11-11

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440478.09' E. Coord. 2135459.99' Surface Elevation 328.60 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

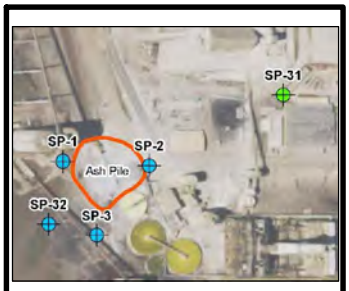
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 328.34 ' Stickup -0.26'

Depth to Water: 1. Ft. btoc 28.11 (2015-11-21) 2.Ft. btoc 28.18 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
328.55	0			0.75		0-0.5	OTHER: Fly ash fill; dark bluish grey (Gley-2 10B 3/1); dry; loose; some clay content with increasing clay content with depth.
				>4.5		0.5-1 1-3.5	CLAY: Very dark greyish brown (2.5 Y 3/2); damp; soft; slight to low plasticity. SILTY CLAY: Brown (7.5 YR 3/2); dry; hard; compact; some gravel present.
325						3.5-5	SILTY SANDY CLAY: Light yellowish brown (2.5 Y 10/3) with olive yellow (2.5 Y 6/8); dry; medium stiff; friable; sand content is very fine grained.
	5			<0.25		5-12.5	CLAYEY SILT: Dark greyish brown (10 YR 4/2); damp to moist; soft to medium dense with depth; slight to low plasticity; yellow (10 YR 7/6) silt laminations present; some gravel present (up to 40 mm) from 5'-10' bgs.
320							
	10			2.5			At 10' bgs: Silt laminations become brown (10 YR 5/3) to 12.5' bgs.
				>4.5		12.5-33.5	SILTY CLAY: Brown (10 YR 5/3); moist; stiff; low plasticity; iron oxide staining; yellowish brown (10 YR 5/3) silt laminations present.
315							
	15						At 15' bgs: Very stiff; medium plasticity.
310							
	20						

ERM Environmental Resources Management

SP-3 DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-3 Date Drilled 2015-11-11

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440478.09' E. Coord. 2135459.99' Surface Elevation 328.60 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

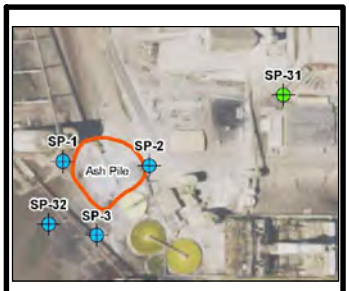
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 328.34 ' Stickup -0.26'

Depth to Water: 1. Ft. btoc 28.11 (2015-11-21) 2.Ft. btoc 28.18 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	20						At 20' bgs: Color change to light brown (7.5 YR 6/3); damp to dry; low to medium plasticity; decreasing silt content with depth; gypsum seams present.
				3.0	**SP-3**_23-25 **USCS:** Fat Clay with Sand (CH) **AL:** 51 / 19 / 32 **- #200:** 78.8		At 22.5' bgs: Increasing silt content, no gypsum.
305	25			>4.5			At 25' bgs: Color change to brown (10 YR 5/3); damp to moist; medium plasticity; no iron oxide staining; gypsum seams present to 26' bgs.
							At 27.5' bgs: Increasing silt content, gypsum seams present to 28.5' bgs.
300	30						At 29.5' bgs: Yellow silt laminations present to 30' bgs. At 30' bgs: Iron oxide staining; gypsum seams present at top of 31' bgs.
						33.5-35	SANDY CLAY: Pale brown (10 YR 6/3); moist; stiff to loose with depth; low plasticity; sand content is very fine grained, sub-angular, and well sorted. At 34' bgs: Iron oxide staining present.
295				<0.25		35-36	CLAYEY SILTY SAND: Pale brown (10 YR 6/3); moist; loose; low plasticity; sand content is very fine grained; iron oxide staining. Non-cohesive grab sample collected from 35'-37' bgs.
	35				**SP-3**_35-37 **USCS:** Clayey Sand (SC) **AL:** 40 / 18 / 22 **- #200:** 48.5	36-37	
				3.3		37-41	SILTY CLAY: Pale brown (10 YR 6/3); moist; medium stiff; slight plasticity; some sand content; slight iron oxide staining. SAND: Pale brown (10 YR 6/3); very moist to wet; very fine grained; sub-angular; well sorted; slight clay content; slight iron oxide staining.
				<0.25			At 38' bgs: Color change to pale olive (5 Y 6/4). Non-cohesive grab sample collected from 38'-40' bgs. Top of Transmissive Sand Unit.
290					**SP-3**_38-40 **USCS:** Clayey Sand (SC) **AL:** 31 / 16 / 15 **- #200:** 31.6		
	40						

ERM Environmental Resources Management

SP-3 DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-3 Date Drilled 2015-11-11

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440478.09' E. Coord. 2135459.99' Surface Elevation 328.60 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

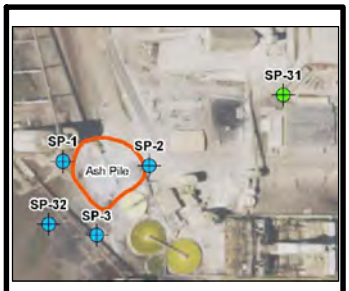
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 328.34 ' Stickup -0.26'

Depth to Water: 1. Ft. btoc 28.11 (2015-11-21) 2.Ft. btoc 28.18 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	40					41-47	At 40.5' bgs: Increased clay content. CLAYEY SILTY SAND: Light yellowish brown (2.5 Y 6/4); wet to very moist; very fine grained; sub-angular; well sorted; medium density; slight to low plasticity.
285				2.25			
	45						At 45' bgs: Gypsum lens present. At 45.5' bgs: 4" Dark reddish grey (5 YR 4/2) silty clay lens, stiff, medium plasticity.
				3.25			At 46' bgs: Color change to light olive brown (2.5 Y 5/3).
				4.0		47-48.5	CLAY: Dark reddish grey (5 YR 4/2); moist to damp; stiff; medium plasticity; some silt content; grey (5 YR 5/1) silt stringers present.
				>4.5	**SP-3**_48-50 **USCS:** Sandy Fat Clay (CH) **AL:** 81 / 26 / 55 **- #200:** 69.0		At 47.5' bgs: Gypsum seams present.
280						48.5-50	At 48' bgs: Non-cohesive grab sample collected from 48'-50' bgs. CLAY: Greenish black (Gley-1 10 Y 2.5/1); damp; very stiff; medium plasticity; blocky with some silt content; thin gypsum seams to 50' bgs.
	50					50-61.5	Top of Basal Clay Unit. SILTY CLAY: Very dark greenish grey (Gley-1 5 GY 3/1); damp; very stiff; medium plasticity; trace very fine grained sand; trace gypsum crystals.
				4.0-4.5			At 52' bgs: Damp to dry; no gypsum crystals.
275				>4.5			At 54' bgs: Damp.
	55						At 56' bgs: Very moist; stiff; slight sand content that increases with depth.
				2.5			At 57' bgs: Very fine grained sandy clay lens to 58' bgs.
				3.0			
				1.5-2.0			At 58' bgs: Moist to damp; medium stiff to stiff.
270							
	60			>4.5			

ERM Environmental Resources Management

SP-3
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-3 Date Drilled 2015-11-11

Project Phase II - Hydrogeologic Characterization Owner San Miguel Electric Cooperative, Inc.

Location Christine, Texas Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440478.09' E. Coord. 2135459.99' Surface Elevation 328.60 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

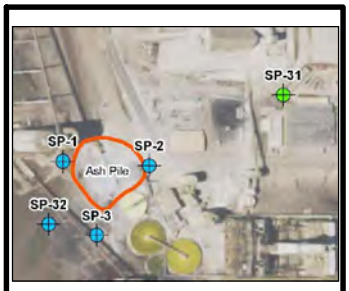
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 38.00 ' Sump Length 2.00 '

Top of Casing Elevation 328.34 ' Stickup -0.26'

Depth to Water: 1. Ft. btoc 28.11 (2015-11-21) 2.Ft. btoc 28.18 (2015-12-03)

Drilling Company Cascade Drilling, LLC Driller Gerald Cain

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204; ELEVATIONS IN NAVD88, COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Field Description/Soil Classification (Color, Texture, Structure)
	60			>4.5			At 60' bgs: Damp; very stiff.
						61.5-65	CLAY: Very dark greenish grey (Gley-1 5 GY 3/1); damp; very stiff; medium to high plasticity; some silt to very fine grained sand content; grey silt stringers present.
265	65						T.D. = 65.00 '
260	70						
255	75						
250	80						

ERM Environmental Resources Management

AP-31 DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-31 Date Drilled 2016-04-30

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 24.00 ' Boring Diam. 6.00 "

N. Coord. 13438468.61' E. Coord. 2135635.13' Surface Elevation 290.59 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 9.00 ' Sump Length 0 '

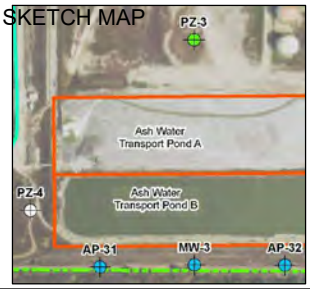
Top of Casing Elevation 292.80 ' Stickup 2.22 '

Depth to Water: 1. Ft. btoc 6.94 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
290.59	0			> 4.5	AP-31_0-1.5 USCS: Sandy Lean Clay (CL) AL: 47 / 18 / 29 -200 Sieve: 51.1	0-3	SILTY CLAY: Black (Gley-1 2.5/N); dry to damp; very stiff; high plasticity; occasional white calcareous concretions; minor organics (roots). Non-cohesive grab sample collected from 0'-1.5' bgs. At 1.5' bgs: Tan silty sand stringers present (occurrence increases with depth). Non-cohesive grab sample collected from 1.5'-3' bgs. At 2' bgs: Moist.
290				2.5			
				0.25	AP-31_1.5-3 USCS: Sandy Lean Clay (CL) AL: 37 / 17 / 20 -200 Sieve: 57.7		
				<0.25		3-8	SAND: Brownish yellow (10 YR 6/6); very moist to wet; very fine grained; sub-round; well sorted; loose; non-plastic; occasional iron oxide staining. Top of Transmissive Sand Unit. At 5' bgs: Poor recovery from 5'-8' bgs (soil saturated). Color change to light yellowish brown (2.5 Y 6/3); moderately sorted; minor silt content.
	5						
285						8-9.5	CLAYEY SILTY SAND: Light yellowish brown (2.5 Y 6/3); wet; very fine grained; loose to medium dense; slight to low plasticity; occasional yellow and dark reddish brown silt stringers; occasional iron oxide staining (occurrence decreases with depth).
				10		9.5-10	SILTY SAND: Light yellowish brown (2.5 Y 6/3); wet; very fine grained; sub-round; loose; non-plastic; trace clay; friable; abundant iron oxide staining.
				<0.25			
	10			<0.25		10-14	SAND: Light yellowish brown (2.5 Y 6/4); saturated; fine grained; sub-round; well sorted; loose; non-plastic; iron oxide staining. At 12' bgs: Color change to pale olive (5 Y 6/3). At 12.6' bgs: Clayey silty sand lens to 12.8' bgs; iron oxide stained lamina (1-10 mm); occasional yellow silt stringers. At 13.5' bgs: Very fine grained; minor silt content.
280							
				0.75			
				<0.25			
				<0.25		14-24	SILTY SAND: Light olive grey (5 Y 6/2); wet; very fine grained; sub-round; loose; slight plasticity; abundant iron oxide staining; occasional yellow silt stringers (2 mm) to 14.25' bgs. At 15' bgs: Occasional iron oxide stained lamina. At 16.5' bgs: Sandy clay lens (20 mm); iron oxide staining; yellow silt stringers. At 17' bgs: Medium dense; increased silt content. At 17.5' bgs: Intermixed pinkish brown, high plasticity clay lens; iron oxide stained lamina. At 18' bgs: Minor clay content; abundant iron oxide staining; occasional yellow silt stringers. At 18.5' bgs: Dense. At 19' bgs: Color change to light yellowish brown (2.5 Y 6/4); trace clay (occurrence decreases with depth).
	15			0.25-0.5			
275							
				1.25			
				3.0			
	20						

ERM Environmental Resources Management

AP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-31 Date Drilled 2016-04-30

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 24.00 ' Boring Diam. 6.00 "

N. Coord. 13438468.61' E. Coord. 2135635.13' Surface Elevation 290.59 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 9.00 ' Sump Length 0 '

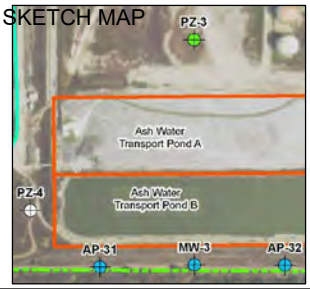
Top of Casing Elevation 292.80 ' Stickup 2.22 '

Depth to Water: 1. Ft. btoc 6.94 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
270	20			>0.25			At 21' bgs: Loose. At 22' bgs: Minor clay content to 22.5' bgs; occasional iron oxide staining. At 23' bgs: No recovery. T.D. = 24.00 '
265	25						
260	30						
255	35						
	40						

ERM Environmental Resources Management

AP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-32 Date Drilled 2016-04-29

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 35.00 ' Boring Diam. 6.00 "

N. Coord. 13438474.96' E. Coord. 2136306.27' Surface Elevation 295.84 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 19.50 ' Sump Length 0 '

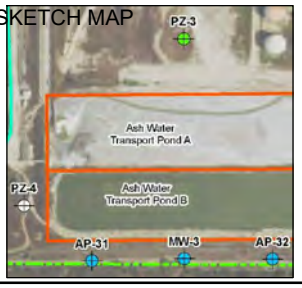
Top of Casing Elevation 297.94 ' Stickup 2.10 '

Depth to Water: 1. Ft. btoc 14.27 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
295.84	0					0-8	SILTY CLAY: Black (Gley-1 N 2.5); damp to dry; medium stiff; medium to high plasticity; some white calcareous concretions; minor organics (roots).
295							
	5			4.5			At 5' bgs: Color change to very dark greyish brown (10 YR 3/2); very stiff; high plasticity; abundant white calcareous concretions.
290				4.0			At 6' bgs: Stiff; friable.
				2.5			At 7' bgs: Mottled with light yellowish brown; medium stiff to stiff.
				2.25		8-10.5	SILTY SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp; very fine grained; medium stiff; medium to high plasticity; sand content increases with depth; occasional iron oxide staining.
	10						
				2.75	AP-32_11-13 USCS: Sandy Fat Clay (CH) AL: 61 / 21 / 40 -200 Sieve: 51.9	10.5-15	SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp; medium stiff to stiff; high plasticity (fat); sand content very fine grained; minor silt content. At 11' bgs: Non-cohesive grab sample collected from 11'-13' bgs. At 12' bgs: Iron oxide staining to 12.25' bgs. At 13.5' bgs: 1" iron oxide stained layer. At 14' bgs: Light grey silt stringers to 14.5' bgs. At 14.5' bgs: Occasional gypsum crystals.
285							
	15			<0.25		15-16	SILTY SAND: Yellowish brown (10 YR 5/4); moist; very fine grained; sub-round; loose with some intermixed hard compacted pieces; non-plastic to slightly plastic; trace clay content; iron oxide staining; minor yellow silt stringers. Top of Transmissive Sand Unit. At 15.4' bgs: 1" dark reddish brown, very moist layer.
280				<0.25		16-25	SAND: Pale brown (10 YR 6/3); very moist to wet; very fine grained; sub-round; well sorted; loose with some hard compacted pieces; non-plastic; trace silt content; abundant iron oxide staining. At 17' bgs: Wet; occasional iron oxide staining. At 18' bgs: Color change to light olive brown (2.5 Y 5/4); decreasing silt content. At 19' bgs: Fine to very fine grained.
	20						

ERM Environmental Resources Management

AP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-32 Date Drilled 2016-04-29

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 35.00 ' Boring Diam. 6.00 "

N. Coord. 13438474.96' E. Coord. 2136306.27' Surface Elevation 295.84 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 19.50 ' Sump Length 0 '

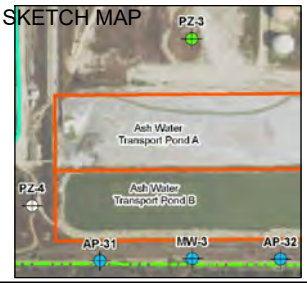
Top of Casing Elevation 297.94 ' Stickup 2.10 '

Depth to Water: 1. Ft. btoc 14.27 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
275	20						At 22' bgs: Abundant iron oxide staining.
							At 23' bgs: Trace iron oxide staining;
							At 24' bgs: Minor silt content; abundant iron oxide staining.
270	25			<0.25		25-35	SILTY SAND to SANDY SILT: Light olive brown (2.5 Y 5/4); very moist; very fine grained; sub-round; loose; slight plasticity; trace clay.
				0.75			At 26' bgs: Density increases with depth; abundant iron oxide staining.
							At 27' bgs: Occasional iron oxide staining.
265	30						At 28.75' bgs: Trace yellow silt stringers; dark reddish brown silt lamina (5-8 mm).
							At 29.5' bgs: Abundant iron oxide staining to 30.5' bgs.
							At 30.5' bgs: Occasional yellow and dark reddish brown silt stringers.
							At 31' bgs: Medium dense; minor clay content (slight to low plasticity); abundant iron oxide staining.
				<0.25			At 33' bgs: Loose, trace clay content.
260	35						At 34' bgs: Occasional iron oxide staining.
							T.D. = 35.00 '
	40						

ERM Environmental Resources Management

AP-33
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-33 Date Drilled 2016-04-29

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 42.00 ' Boring Diam. 6.00 "

N. Coord. 13438474.79' E. Coord. 2136615.43' Surface Elevation 301.62 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 27.00 ' Sump Length 0 '

Top of Casing Elevation 304.67 ' Stickup 3.05 '

Depth to Water: 1. Ft. btoc 20.47 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
301.62	0			2.75		0-1	SILTY CLAY: Black (Gley-1 N 2.5); damp; medium dense; medium to high plasticity; calcareous white stringers; minor organics (roots).
				<0.25		1-10	CLAYEY SAND: Light yellowish brown (2.5 Y 6/3); damp; very fine grained; loose; slight to low plasticity; minor silt content; iron oxide staining; white silt stringers (abundant to 2' bgs); trace gypsum crystals.
300							
				1.5			At 4' bgs: Increasing density and clay content; abundant iron oxide staining.
	5						
				2.0			At 6' bgs: Color change to pale brown (10 YR 6/3); medium dense; decreasing clay content; minor iron oxide staining; occasional white silt stringers; trace gypsum crystals.
295				<0.25			At 7' bgs: Slight plasticity; friable; abundant yellow silt stringers.
							At 8.5' bgs: Hard compacted pieces present.
							At 9.75' bgs: Abundant iron oxide staining.
	10			2.0		10-12	CLAYEY SILT to SILTY CLAY: Brown (7.5 YR 5/4); damp; medium dense; low plasticity; some very fined grained sand content; occasional iron oxide staining.
290							At 11.25' bgs: Light yellowish brown silty clay lens (30 mm).
				1.75		12-16	CLAY: Pale brown (10 YR 6/3); damp to moist; medium stiff; very high plasticity (fat); some silt content; occasional iron oxide stained lamina (1-2 mm); trace gypsum inclusions.
				2.5			At 13' bgs: medium stiff to stiff; decreasing silt content; blocky; trace yellow silt stringers; trace gypsum seams.
	15						
				2.25		16-20	SILTY SANDY CLAY: Pale brown (10 YR 6/3); damp; medium stiff; high plasticity (fat); sand content very fine grained; iron oxide staining; occasional gypsum stringers (up to 3 mm). Clayey very fine grained sand lens from 16'-16.25' bgs.
285							
							At 19' bgs: Decreasing plasticity; yellow silt lens present (40 mm).
	20			2.0			

ERM Environmental Resources Management

AP-33 DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-33 Date Drilled 2016-04-29

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 42.00 ' Boring Diam. 6.00 "

N. Coord. 13438474.79' E. Coord. 2136615.43' Surface Elevation 301.62 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 27.00 ' Sump Length 0 '

Top of Casing Elevation 304.67 ' Stickup 3.05 '

Depth to Water: 1. Ft. btoc 20.47 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
280	20			>4.5		20-22	SANDY CLAY: Brown (7.5 YR 5/4); damp; medium stiff to stiff; medium plasticity; sand content very fine grained; occasional iron oxide staining and yellow silt stringers. At 20.5' bgs: Hard.
				1.25		22-24	CLAYEY SAND: Brown (7.5 YR 5/4); damp; very fine grained; loose to medium dense; slight plasticity; trace iron oxide staining; occasional yellow silt stringers; reddish brown silt clay lamina to 22.5' bgs. Top of Transmissive Sand Unit.
				<0.25		24-35.5	At 23' bgs: Decreasing clay content. SAND: Light yellowish brown (2.5 Y 6/4) intermixed with dark reddish brown (to 24.25' bgs); moist; very fine grained; sub-round; well sorted; loose; non-plastic to slightly plastic; minor silt and trace clay content; occasion iron oxide staining.
275	25						At 26' bgs: Increase occurrence of iron oxide staining; occasional yellow silt stringers. At 26.5' bgs: Non-plastic; no silt or clay content. At 27' bgs: Very moist. At 28' bgs: Color change to light olive brown (2.5 Y 5/3). Non-cohesive grab sample collected from 28'-30' bgs. At 29' bgs: Wet; abundant iron oxide staining.
				0.75	AP-33_28-30 USCS: Silty Sand (SM) AL: Non-plastic -200 Sieve: 21.1		
	30			<0.25			At 31' bgs: Very moist; medium dense; slight plasticity; slight silt and clay content to 31.5' bgs; occasional yellow silt lamina; trace dark reddish brown silt lamina.
270				2.0			At 31.5' bgs: No silt or clay content; no iron oxide staining.
				<0.25			
	35			<0.25			
265						35.5-42	SILTY SAND: Olive (5 Y 5/4); very moist; very fine grained; sub-round; loose; slight plasticity; minor clay content (decreases with depth); abundant iron oxide staining (to 36' bgs); occasional yellow and dark reddish brown silt stringers. At 36' bgs: Color change to pale olive (5 Y 6/4). At 37' bgs: Trace iron oxide staining. At 38' bgs: Occasional iron oxide staining. At 39.5' bgs: Abundant yellow and dark reddish brown silt stringers to 39.75' bgs.
	40						

ERM Environmental Resources Management

AP-33
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-33 Date Drilled 2016-04-29

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 42.00 ' Boring Diam. 6.00 "

N. Coord. 13438474.79' E. Coord. 2136615.43' Surface Elevation 301.62 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 27.00 ' Sump Length 0 '

Top of Casing Elevation 304.67 ' Stickup 3.05 '

Depth to Water: 1. Ft. btoc 20.47 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
260	40						At 40' bgs: Decreasing silt content; no clay content; trace iron oxide staining; occasional yellow silt stringers.
							T.D. = 42.00 '
255	45						
250	50						
245	55						
	60						

ERM Environmental Resources Management

AP-34 DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-34 Date Drilled 2016-04-28

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 40.00 ' Boring Diam. 6.00 "

N. Coord. 13438471.69' E. Coord. 2137302.1' Surface Elevation 293.91 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 24.00 ' Sump Length 0 '

Top of Casing Elevation 296.32 ' Stickup 2.41 '

Depth to Water: 1. Ft. btoc 13.61 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
293.91	0			2.5		0-3.5	SILTY CLAY: Black (Gley-1 2.5 N); wet; medium stiff to stiff; medium to high plasticity; calcareous white stringers; minor organics (roots).
290	5			0.5		3.5-12	CLAYEY SAND: Pale brown (2.5 Y 7/3); moist; very fine grained; loose; slight to low plasticity; minor silt content; occasional iron oxide staining and yellow silt stringers; trace gypsum crystals. At 6' bgs: Color change to light yellowish brown (10 YR 6/4); damp. At 7.5' bgs: Dark red silt clay layer (1"); abundant iron oxide staining. At 8' bgs: Color change to pale brown (10 YR 6/3); occasional iron oxide staining (occurrence decreases with depth).
285	10			0.5		12-12.75	At 10.5' bgs: Increasing clay content; abundant iron oxide staining. At 11' bgs: Occasional yellow silt stringers. SILTY SANDY CLAY: Pale brown (2.5 Y 6/3); damp; soft with increasing density at depth; low to medium plasticity; decreasing sand and silt content at depth; iron oxide staining; yellow silt stringers.
				3.0-3.25		12.75-16.5	CLAY: Light yellowish brown (10 YR 6/4); damp; stiff; high to very high plasticity (fat); some silt content; iron oxide staining. At 13' bgs: Trace silt content. Cohesive sample (California modified split spoon) collected from 13'-14.5' bgs. At 14' bgs: Abundant iron oxide staining. At 14.5' bgs: Gypsum seams (1-2 mm).
280	15				AP-34_13-14.5 USCS: Fat Clay (CH) AL: 96 / 26 / 70 -200 Sieve: 99.0 Permeability: 5.51×10^{-9}		
				2.5 0.5		16.5-18.5	SANDY CLAY: Light yellowish brown (10 YR 6/4); damp; medium stiff to stiff; medium to high plasticity; sand content very fine grained; increasing sand content at depth; occasional iron oxide staining. At 17' bgs: Loose.
275	20			<0.25		18.5-24	CLAYEY SAND: Light yellowish brown (2.5 Y 6/4); damp; very fine grained; loose; slight to low plasticity; occasional iron oxide staining; occasional gypsum seams (1-2 mm) and minor gypsum crystals. Top of Transmissive Sand Unit.

ERM Environmental Resources Management

AP-34 DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-34 Date Drilled 2016-04-28

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 40.00 ' Boring Diam. 6.00 "

N. Coord. 13438471.69' E. Coord. 2137302.1' Surface Elevation 293.91 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 24.00 ' Sump Length 0 '

Top of Casing Elevation 296.32 ' Stickup 2.41 '

Depth to Water: 1. Ft. btoc 13.61 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20			2.0			At 20' bgs: Abundant iron oxide staining. At 21' bgs: Medium dense. At 21.5' bgs: Yellow silt lens (2"). *22.5' bgs: Minor iron oxide staining; abundant yellow silt stringers. At 23' bgs: Loose; decreasing clay content.
270				<0.25		24-32	SAND: Yellowish brown (10 YR 5/4); dry to damp; very fine grained; sub-round; well sorted; loose; non-plastic; trace silt and clay content; occasional yellow silt stringers. At 25.25' bgs: Dark brown to black silt lamina (1-4 mm). At 26' bgs: Color change to light olive brown (2.5 Y 5/3); no silt or clay content; minor yellow silt stringers (occurrence decreases with depth). At 26.5' bgs: Wet.
	25						At 28' bgs: Occasional yellow silt stringers to 29' bgs.
265							
	30						At 30' bgs: Abundant yellow silt stringers to 31' bgs.
							At 31' bgs: Color change to pale olive (5 Y 6/3); occasional yellow silt stringers.
				<0.25		32-38.6	SILTY SAND: Pale olive (5 Y 6/3); very moist to wet; very fine grained; sub-round; loose; non-plastic to slightly plastic; trace clay content; occasional yellow silt stringers.
260							
	35						At 36.75' bgs: Very fine grained sand lens to 37.25' bgs; abundant iron oxide staining. At 37.25' bgs: Trace yellow silt stringers. At 38' bgs: Increased clay content to 38.5' bgs. At 38.5' bgs: Iron oxide stained silt lens (30 mm).
				1 <0.25		38.6-40	SILTY SAND: Dark greenish grey (Gley-1 5GY 4/1); moist; very fine grained; sub-round; medium dense to loose; low plasticity to non-plastic; intermixed greyish brown silty clay to 39' bgs. *39' bgs: Dark brown to black silt lamina (1-3 mm) to 39.25' bgs. *39.25' bgs: Trace clay content. T.D. = 40.00 '
255							
	40						

ERM Environmental Resources Management

AP-35
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-35 Date Drilled 2016-04-28

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 43.00 ' Boring Diam. 6.00 "

N. Coord. 13438475.13' E. Coord. 2137627.82' Surface Elevation 293.85 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 28.00 ' Sump Length 0 '

Top of Casing Elevation 298.36 ' Stickup 4.51 '

Depth to Water: 1. Ft. btoc 14.67 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
293.85	0			2.25		0-3	SILTY CLAY: Black (Gley-1 N 2.5); dry to damp; stiff; medium plasticity; calcareous white stringers; minor organics (roots).
				0.75		3-7	CLAYEY SAND: Light yellowish brown (2.5 Y 6/3); damp; fine grained; loose; slight plasticity; minor silt content; minor hard compacted tan silty clay pieces; trace gypsum crystals. At 5' bgs: Occasional iron oxide staining, yellow silt stringers, and gypsum crystals. At 6' bgs: Reddish brown clayey silt lens (2"). At 6.25' bgs: Color change to brown (10 YR 5/3); increasing clay content.
290	5			3.5		7-8	CLAYEY SAND to SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp to moist; very fine to fine grained; dense; low plasticity. At 7.5' bgs: Dark red silty clay layer (1"). At 7.75' bgs: Iron oxide staining; occasional yellow silt stringers.
				3.0		8-14	CLAYEY SAND: Light brownish grey (10 YR 6/2); dry; very fine grained; dense; slight plasticity; trace silt content; iron oxide staining; occasional yellow silt stringers; trace gypsum crystal inclusions. At 8.75' bgs: Dark red silty clay lens (2"). At 10.75' bgs: Abundant iron oxide staining. At 11.5' bgs: Color change to brown (10 YR 5/3); medium dense to loose.
285	10			1.75			
280	15			2.75-3.5	AP-35_15-17 USCS: Fat Clay (CH) AL: 100 / 27 / 73 -200 Sieve: 97.5	14-18	CLAY: Light yellowish brown (2.5 Y 6/3); damp; medium stiff; very high plasticity (fat); abundant iron oxide staining; trace yellow silt stringers; trace gypsum seams. At 14.5' bgs: Trace silt content to 15' bgs. At 15' bgs: Non-cohesive grab sample collected from 15'-17' bgs. At 17' bgs: Increasing silt content.
275	20			3.0-3.5		18-22	SILTY SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp; stiff; high to very high plasticity (fat); sand content very fine grained; occasional iron oxide staining; trace gypsum seams.

ERM Environmental Resources Management

AP-35
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-35 Date Drilled 2016-04-28

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 43.00 ' Boring Diam. 6.00 "

N. Coord. 13438475.13' E. Coord. 2137627.82' Surface Elevation 293.85 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 28.00 ' Sump Length 0 '

Top of Casing Elevation 298.36 ' Stickup 4.51 '

Depth to Water: 1. Ft. btoc 14.67 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20						At 20' bgs: Pale brown clayey sand lens to 20.5' bgs.
				2.0			At 21' bgs: Trace iron oxide staining to 21.75' bgs.
							At 21.5' bgs: Minor gypsum crystals.
						22-26.25	At 21.75' bgs: Increasing sand content.
270				3.0			CLAYEY SAND: Light yellowish brown (2.5 Y 6/4); damp to moist; fine grained; sub-angular; medium dense to dense; slight to low plasticity; minor silt content; abundant iron oxide staining. Top of Transmissive Sand Unit.
	25						At 23.5' bgs: Color change to dark greenish grey (Gley-1 5GY 4/1); damp; dense; abundant light grey silt stringers; occasional gypsum seams.
				<0.25			At 25.25' bgs: Black, hard organic lens (10 mm).
				<0.25		26.25-43	At 25.5' bgs: Moist; loose; minor clay content (decreases with depth).
							SAND: Dark greenish grey (Gley-1 5GY 4/1); moist; fine grained; sub-round; well sorted; loose; slight plasticity to non-plastic; trace clay content (decreases with depth).
265							At 28' bgs: Wet; no clay content.
	30						
260							
	35						
							At 37' bgs: Saturated.
							At 38' bgs: Medium dense to dense; silty clay to clay laminae (1 mm) to 41' bgs.
255							At 39' bgs: Very moist.
	40						

ERM Environmental Resources Management

AP-35
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-35 Date Drilled 2016-04-28

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 43.00 ' Boring Diam. 6.00 "

N. Coord. 13438475.13' E. Coord. 2137627.82' Surface Elevation 293.85 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 28.00 ' Sump Length 0 '

Top of Casing Elevation 298.36 ' Stickup 4.51 '

Depth to Water: 1. Ft. btoc 14.67 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
250	40						At 41' bgs: Dark greyish brown clay striations.
245	45						T.D. = 43.00 '
240	50						
235	55						
	60						

ERM Environmental Resources Management

AP-36
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-36 Date Drilled 2016-04-27

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 41.00 ' Boring Diam. 6.00 "

N. Coord. 13438468.90' E. Coord. 2138091.77' Surface Elevation 284.05 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 25.50 ' Sump Length 0 '

Top of Casing Elevation 288.75 ' Stickup 4.70 '

Depth to Water: 1. Ft. btoc 6.75 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
284.05	0					0-4.5	CLAY: Black (Gley-1 N 2.5); damp; stiff; high plasticity; white calcareous nodules; minor organics (roots).
280	5			0.5 0.5 3.5 <0.25 3.0		4.5-6 6-7 7-7.5 7.5-10	CLAYEY SANDY SILT: Light grey (10 YR 7/2) heavily mottled with brown and dark red; wet; medium dense to dense; low plasticity; sand content very fine grained; iron oxide staining. At 5.5' bgs: Intermixed silty sandy clay content. CLAYEY SAND: Brown (10 YR 5/3) with dark red; damp; fine grained; sub-round; medium dense; slight plasticity; minor silt content; iron oxide staining; minor yellow silt stringers; trace gypsum crystals near 7' bgs. SILTY CLAY: Weak red (10 R 5/3); dry; stiff to very stiff; low plasticity; some very fine grained sand content; grey silt laminae throughout.
275	10			3.75	AP-36_12-14 USCS: Fat Clay (CH) AL: 94 / 26 / 68 -200 Sieve: 92.4	10-14.5	CLAYEY SAND: Brown (10 YR 5/3) with dark red; damp; very fine grained; sub-round; loose; slight plasticity; minor silt content; iron oxide staining. At 8' bgs: Medium dense to dense; increasing silt content; trace yellow silt stringers (to 9' bgs); trace gypsum crystals. At 9.75' bgs: Increasing clay content. At 9.9' bgs: Abundant gypsum crystals (up to 4 mm). CLAY: Pale brown (10 YR 6/3); damp; very stiff; high to very high plasticity (fat); trace very fine grained sand and silt content; occasional iron oxide staining; trace yellow silt stringers; occasional gypsum seams. At 12' bgs: Non-cohesive grab sample collected from 12'-14' bgs. At 14.25' bgs: Large gypsum crystal nodule (40-50 mm).
270	15			3.75		14.5-19	SANDY CLAY: Pale brown (10 YR 6/3); damp; very stiff; high to very high plasticity (fat); sand content very fine grained; occasional iron oxide staining; trace yellow silt stringers. At 17' bgs: Abundant iron oxide staining and gypsum crystals to 18' bgs. At 18' bgs: Increasing density.
265	20			>4.5 4.0		19-21	SANDY CLAY to CLAYEY SAND: Brown (10 YR 5/3); damp; stiff; low to slight plasticity; sand content fine grained; decreased sand content at depth; occasional gypsum crystals. Dark greenish grey lens at 19' bgs (1").

ERM Environmental Resources Management

AP-36
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-36 Date Drilled 2016-04-27

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 41.00 ' Boring Diam. 6.00 "

N. Coord. 13438468.90' E. Coord. 2138091.77' Surface Elevation 284.05 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 25.50 ' Sump Length 0 '

Top of Casing Elevation 288.75 ' Stickup 4.70 '

Depth to Water: 1. Ft. btoc 6.75 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20			1.5		21-22	At 20' bgs: Abundant iron oxide staining. CLAYEY SAND: Very dark greenish grey (Gley-1 10GY 3/1); damp; very fine grained; sub-round; medium dense; slight plasticity; occasional light grey silt stringers; trace black organic inclusions. Top of Transmissive Sand Unit.
				<0.25		22-41	SAND: Very dark greenish grey (Gley-1 10GY 3/1); moist; very fine grained; sub-round; well sorted; very loose; non-plastic; trace silt content.
260							At 24' bgs: Color change to yellowish brown (10 YR 5/6); very moist; abundant iron oxide staining.
	25			<0.25			At 25' bgs: Color change to greyish brown (2.5 Y 5/2); saturated.
							At 26' bgs: Occasional iron oxide staining.
							At 28' bgs: Iron oxide stained lens (20 mm).
255							
	30						At 30.5' bgs: Color change to dark greenish grey (Gley-1 5GY 4/1).
							At 31' bgs: Minor yellowish orange silt stringers to 33' bgs.
250							
	35			>4.5			At 36' bgs: Very dense clayey sand lens to 37' bgs.
				<0.25			
245				>4.5			At 39' bgs: Very dense clayey sand lens to 40' bgs.
	40			<0.25			

ERM Environmental Resources Management

AP-36
DRILLING LOG

Proj. No. 0346369 Boring/Well ID AP-36 Date Drilled 2016-04-27

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 41.00 ' Boring Diam. 6.00 "

N. Coord. 13438468.90' E. Coord. 2138091.77' Surface Elevation 284.05 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 25.50 ' Sump Length 0 '

Top of Casing Elevation 288.75 ' Stickup 4.70 '

Depth to Water: 1. Ft. btoc 6.75 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	40						T.D. = 41.00 '
240	45						
235	50						
230	55						
225	60						

ERM Environmental Resources Management

EP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-31 Date Drilled 2016-05-04

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440278.04' E. Coord. 2137553.92' Surface Elevation 313.23 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 0 '

Top of Casing Elevation 316.70 ' Stickup 3.47 '

Depth to Water: 1. Ft. btoc 24.81 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
313.23	0					0-5	SILTY CLAY: Black (Gley-1 N 2.5); minor organics (roots).
310	5			0.5		5-8.5	CLAYEY SANDY SILT: Light yellowish brown (2.5 Y 5/3); dry to damp; loose; slight plasticity; abundant hard compacted pieces of brown silty clay; minor iron oxide staining; occasional gypsum crystals and trace gypsum seams.
305	10			1.5		8.5-11	CLAYEY SILT: Brown (7.5 YR 5/4); dry to damp; medium dense; slight to low plasticity; trace sand content; occasional yellow silt stringers. At 9' bgs: Color change to reddish brown (5 YR 4/4); occasional iron oxide staining. At 10' bgs: No iron oxide staining or yellow silt stringers; occasional light grey silt stringers and gypsum crystals.
300	15			<0.25		11-15.5	INTERBEDDED CLAYEY SILT AND SAND: Reddish brown (5 YR 5/3) clayey silt with light brown (7.5 YR 6/3) sand; damp; clayey silt content is very dense, low plasticity, and fractures along planar surfaces; sand content is very fine grained, loose, and non-plastic; increased clay content at depth; abundant iron oxide staining; occasional yellow silt stringers. At 13' bgs: Clayey silt partially compacted. At 14' bgs: Sand color changes to white (White 7.5 YR 6/3).
295	20			<0.25		15.5-32	CLAYEY SANDY SILT: Reddish brown (5 YR 5/3); damp; loose; low to slight plasticity; intermixed with hard silty clay; abundant iron oxide staining. At 15.75' bgs: Decreased hard silty clay content to 16.25' bgs. At 16' bgs: Minor iron oxide staining. At 17' bgs: Decreased hard silty clay content. At 17.75' bgs: Abundant iron oxide staining to 18.25' bgs. At 18' bgs: Occasional tan silty sand stringers. At 19' bgs: Abundant iron oxide staining.

ERM Environmental Resources Management

EP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-31 Date Drilled 2016-05-04

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440278.04' E. Coord. 2137553.92' Surface Elevation 313.23 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 0 '

Top of Casing Elevation 316.70 ' Stickup 3.47 '

Depth to Water: 1. Ft. btoc 24.81 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20						At 21' bgs: Minor to trace iron oxide staining; occasional yellow silt stringers.
290							At 23' bgs: Trace hard silty clay content; occasional tan clayey sand stringers. At 24' bgs: Moist; increasing clay content.
	25						At 25' bgs: Color change to brown (7.5 YR 5/3); minor hard silty clay content; abundant sand lenses (to 26' bgs); minor iron oxide staining; occasional yellow silt stringers. At 26.5' bgs: Reddish brown clayey silt lens; occasional iron oxide staining; minor yellow silt stringers. At 27' bgs: Damp; trace iron oxide staining and yellow silt stringers. At 28' bgs: Non-cohesive grab sample collected from 28'-30' bgs. At 29' bgs: Occasional hard silty clay content and iron oxide staining. At 30' bgs: Very dense, reddish brown fat clay lens to 30.25' bgs, from 30.75'-31' bgs, and from 31.5'-31.75' bgs. Minor iron oxide staining to 32' bgs.
285							
	30			>4.5		32-38	CLAY: Reddish brown (5 YR 4/3); damp; very stiff; very high plasticity (fat); trace silt content (decreases with depth); occasional iron oxide staining and tan silt stringers.
280							
	35						At 35' bgs: Color change to brown (10 YR 5/3). At 36' bgs: Non-cohesive grab sample collected from 36'-38' bgs.
					EP-31_36-38 USCS: Fat Clay (CH) AL: 109 / 28 / 81 -200 Sieve: 99.7		
275				<0.25		38-41	At 37' bgs: Gypsum seam (20 mm). At 37.5' bgs: very dark greenish grey layer (2"). CLAY: Dark greenish grey (Gley-1 10GY 4/1); moist; soft; medium plasticity; occasional hard compacted clay pieces.
	40						

ERM Environmental Resources Management

EP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-31 Date Drilled 2016-05-04

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440278.04' E. Coord. 2137553.92' Surface Elevation 313.23 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 0 '

Top of Casing Elevation 316.70 ' Stickup 3.47 '

Depth to Water: 1. Ft. btoc 24.81 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	40			0.25-0.5			At 40.5' bgs: light yellowish brown layer (1"); silt stringers. SILTY SANDY CLAY: Dark greenish grey (Gley-1 10GY 4/1); moist; soft; low plasticity; sand content very fine grained; occasional hard compacted clay pieces; occasional light grey silt stringers.
				<0.25		42.5-50	CLAYEY SAND: Dark greenish grey (Gley-1 10GY 4/1); damp to moist; very fine grained; loose; slight to low plasticity; minor to trace silt; occasional hard compacted pieces; minor light grey silt stringers. Top of Transmissive Sand Unit.
270							
	45						At 45.5' bgs: Increasing clay content. At 45.75' bgs: Color change to brown (7.5 YR 4/4); decreasing clay content. At 47' bgs: Decreasing clay content.
							At 48' bgs: Occasional sand lenses to 50' bgs. At 48.25' bgs: Dark reddish brown layer to 48.5' bgs. At 49' bgs: Occasional yellow silt lamina.
265							
	50			<0.25		50-57	SAND: Olive grey (5 Y 5/2); wet; fine grained; sub-round; well sorted; loose; non-plastic.
							At 52' bgs: Saturated.
260							
	55						At 55' bgs: Very fine grained.
							At 56.25' bgs: Color change to dark greenish grey (Gley-1 10GY 4/1).
				0.25			
				1.0-1.25		57-59	SILTY SAND: Dark greenish grey (Gley-1 10GY 4/1); very moist; very fine grained; sub-round; loose to medium dense; non-plastic to slightly plastic.
255							At 58.75' bgs: Trace clay.
				2.0		59-60.75	SANDY CLAY: Dark greenish grey (Gley-1 10GY 4/1); very moist; medium stiff; low to medium plasticity; sand content very fine grained; trace silt content.
	60						

ERM Environmental Resources Management

EP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-31 Date Drilled 2016-05-04

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 65.00 ' Boring Diam. 6.00 "

N. Coord. 13440278.04' E. Coord. 2137553.92' Surface Elevation 313.23 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 48.00 ' Sump Length 0 '

Top of Casing Elevation 316.70 ' Stickup 3.47 '

Depth to Water: 1. Ft. btoc 24.81 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
250	60			0.25 0.5 1.25		60.75-63	SILTY SAND: Dark greenish grey (Gley-1 10GY 4/1); very moist; very fine grained; sub-round; loose; slight plasticity. At 61.5' bgs: Medium dense. At 62' bgs: Dense, high plasticity sandy clay layer laminated with grey silt to 62.75' bgs.
				<0.25		63-65	SAND: Dark greenish grey (Gley-1 10GY 4/1); very moist; fine grained; sub-round; well sorted; loose; non-plastic. At 64.5' bgs: Medium dense.
	65			2.5			T.D. = 65.00 '
245							
	70						
240							
	75						
235							
	80						

ERM Environmental Resources Management

EP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-32 Date Drilled 2016-05-04

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 52.50 ' Boring Diam. 6.00 "

N. Coord. 13440120.60' E. Coord. 2139563.40' Surface Elevation 273.26 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 26.00 ' Sump Length 0 '

Top of Casing Elevation 277.44 ' Stickup 4.18 '

Depth to Water: 1. Ft. btoc 1.57 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
273.26	0					0-5	SILTY CLAY: Very dark greyish brown (10 YR 3/2); stiff; high plasticity; occasional white calcareous concretions; minor organics (roots).
270	5			1.5-2.0		5-17	SILTY CLAY: Very dark grey (10 YR 3/1); damp to moist; medium stiff; very high plasticity (fat); trace white calcareous concretions to 7' bgs; trace organics (roots) -to 7.5' bgs. At 7' bgs: Trace to minor light yellowish brown mottling. At 7.5' bgs: Trace gypsum nodules. At 8' bgs: Color change to dark greyish brown (10 YR 4/2) with trace mottling; occasional black nodules. At 9' bgs: Color change to greyish brown (10 YR 5/2).
265	10			1.25 1.0			
260	15			2.0 2.5 1.25 1.75 2.25 2.75	EP-32_14-16 USCS: Fat Clay with Sand (CH) AL: 62 / 21 / 41 -200 Sieve: 71.4 Permeability: 8.48×10^{-9}	17-20	At 13.75' bgs: Increased yellowish brown mottling; occasional gypsum nodules. At 14' bgs: Cohesive sample (Shelby tube) collected from 14'-16' bgs. At 14.5' bgs: Color change to light yellowish brown (2.5 Y 6/3) with abundant greyish brown mottling; occasional gypsum crystal lenses. At 15.5' bgs: Trace very fine grained sand content. At 16' bgs: Occasional dark brown mottling; abundant gypsum crystal nodules. At 16.5' bgs: Increasing sand content. SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp; medium stiff to stiff; very high plasticity (fat); sand content very fine grained; trace iron oxide staining; occasional black nodules; abundant gypsum crystals.
255	20						

ERM Environmental Resources Management

EP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-32 Date Drilled 2016-05-04

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 52.50 ' Boring Diam. 6.00 "

N. Coord. 13440120.60' E. Coord. 2139563.40' Surface Elevation 273.26 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 26.00 ' Sump Length 0 '

Top of Casing Elevation 277.44 ' Stickup 4.18 '

Depth to Water: 1. Ft. btoc 1.57 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
250	20			1.5		20-20.75	SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp to moist; medium stiff; medium to high plasticity; sand content very fine grained, occurrence increases with depth; occasional iron oxide staining; minor black nodules; abundant gypsum crystals.
				2.0		20.75-21.25	
				2.0		21.25-24	CLAYEY SAND: Light brownish grey (2.5 Y 6/2); moist; very fine grained; sub-round; medium dense; low to slight plasticity; trace silt; abundant iron oxide staining; minor black nodules; trace gypsum crystals. Top of Transmissive Sand Unit.
				2.5-3.0			At 21' bgs: Color change to greenish grey (Gley-1 10GY 6/1); occasional black nodules.
				1.5-1.75		24-32	SILTY SAND: Very dark greenish grey (Gley-1 10GY 6/1); very moist; very fine grained; sub-round; medium dense; slight plasticity; trace clay; minor light grey silt stringers; trace black nodules; occasional black staining.
				0.75			At 22' bgs: Dense; abundant black nodules and staining.
	25			<0.25	EP-32_25-26 USCS: Silty Sand (SM) AL: Non-Plastic -200 Sieve: 14.5		At 22.75' bgs: Decreasing silt content.
245							At 23' bgs: Medium dense; no black nodules and staining.
							At 23.5' bgs: Wet.
	30						SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine to fine grained; sub-round; well sorted; loose; non-plastic; trace silt to 24.25' bgs.
							At 25' bgs: Non-cohesive grab sampled collected from 25'-26' bgs.
							At 27' bgs: Sand content fine grained.
						32-34	At 31.5' bgs: Minor silt content; black silt laminae to 31.6' bgs.
240							SILTY SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine grained; sub-round; loose; non-plastic to slightly plastic.
							At 32.5' bgs: Trace clay content to 32.75' bgs.
	35					34-36.25	At 33.5' bgs: Stiff, high plasticity sandy clay layer (1"); thin light grey silt laminae.
							CLAYEY SAND to SANDY CLAY: Very dark greenish grey (Gley-1 10GY 3/1); moist; very fine grained; sub-round; dense; low plasticity; minor silt content.
						36.25-42	At 34.5' bgs: Occasional light grey to grey silt laminae (<1 mm).
							At 35' bgs: Dense.
							At 35.5' bgs: Abundant light grey silt laminae.
235							SAND: Very dark greenish grey (Gley-1 10GY 3/1); very moist to wet; fine grained; sub-round; well sorted; medium dense; slight plasticity; intermixed with dense, medium to high plasticity, brown silty clay; minor light grey silt stringers to 36.4' bgs.
	40						At 38' bgs: Light grey silt stringers to 38.25' bgs.

ERM Environmental Resources Management

EP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-32 Date Drilled 2016-05-04

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 52.50 ' Boring Diam. 6.00 "

N. Coord. 13440120.60' E. Coord. 2139563.40' Surface Elevation 273.26 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 26.00 ' Sump Length 0 '

Top of Casing Elevation 277.44 ' Stickup 4.18 '

Depth to Water: 1. Ft. btoc 1.57 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
230	40			2.0-2.5		42-43.5	At 39' bgs: Trace black nodules and staining. At 39.5' bgs: Dense. At 40' bgs: Medium dense. At 41.5' bgs: Increasing clay content. At 41.75' bgs: Occasional gypsum crystal nodules. CLAYEY SAND: Very dark greenish grey (Gley-1 5GY 3/1); moist; very fine grained; sub-round; medium dense, low plasticity; intermixed with dense, medium to high plasticity, brown silty clay; abundant light grey to grey silt stringers; occasional tan silt stringers; trace black nodules.
				1.5-2.0		43.5-46	At 43' bgs: Very dense. SANDY SILTY CLAY: Very dark greenish grey (Gley-1 5GY 3/1); damp; very stiff; medium plasticity (increases with depth); sand content very fine grained; abundant grey silt to very fine grained silt stringers; trace black nodules.
	45			> 4.5 >4.5 4.0 3.5 4.5		46-52.5	At 45' bgs: Dense. CLAY: Greenish black (Gley-1 5GY 2.5/1); damp; very stiff; very high plasticity (fat); thin grey silty to very fine grained sand laminae to 47' bgs. Top of Basal Clay Unit. At 47.5' bgs: Abundant tan silt stringers. At 50' bgs: Occasional tan silt stringers. At 51' bgs: Cohesive sample (California modified split spoon) collected from 51'-52.5' bgs.
225				> 4.5 4.5	EP-32_51-52.5 USCS: Fat Clay (CH) AL: 100 / 27 / 73 -200 Sieve: 94.4 Permeability: 6.76×10^{-9}		
	50						T.D. = 52.50 '
220							
	55						
215							
	60						

ERM Environmental Resources Management

EP-33
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-33 Date Drilled 2016-05-03

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 41.00 ' Boring Diam. 6.00 "

N. Coord. 13439793.23' E. Coord. 2139563.41' Surface Elevation 273.66 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 26.00 ' Sump Length 0 '

Top of Casing Elevation 278.00 ' Stickup 4.34 '

Depth to Water: 1. Ft. btoc 0.90 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
273.66	0					0-6	SILTY CLAY: Very dark greyish brown (10 YR 3/2); damp; stiff; high plasticity; minor white calcareous concretions and organics (roots).
270	5			0.5-0.75		6-9	At 5' bgs: Color change to dark greyish brown (10 YR 4/2) with minor black mottling; moist to very moist; soft; medium plasticity; occasional white calcareous concretions. No Recovery
265	10			2.0		9-16	SILTY CLAY: Dark greyish brown (10 YR 4/2) with minor light yellowish brown mottling; moist; medium stiff; very high plasticity (fat); minor white calcareous concretions. At 11' bgs: Occasional gypsum seams.
260	15			2.0	EP-33_16-18 USCS: Sandy Lean Clay (CL) AL: 42 / 18 / 24 -200 Sieve: 60.0	16-19.5	At 13' bgs: Increasing yellowish brown mottling; trace grey mottling. At 14.5' bgs: Abundant mottling. At 15' bgs: Gradual color change to light olive brown (2.5 Y 5/3). At 15.5' bgs: Trace very fine grained sand content; increasing silt content; occasional white silt stringers. SANDY CLAY: Light olive brown (2.5 Y 5/3) with trace greenish grey mottling; damp; medium stiff; very high plasticity (fat); sand content very fine grained; minor iron oxide staining (to 18' bgs). Occasional black nodules and abundant gypsum seams at 16.25' bgs. Non-cohesive grab sample collected from 16'-18' bgs. At 19' bgs: Increasing sand content; occasional iron oxide staining.
255	20			3.0-3.5		19.5-21	SANDY CLAY: Pale olive (5 Y 6/3); damp to moist; stiff; medium to low plasticity; sand content very fine grained and occurrence increases with depth; occasional iron oxide staining; minor gypsum inclusions.

ERM Environmental Resources Management

EP-33
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-33 Date Drilled 2016-05-03

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 41.00 ' Boring Diam. 6.00 "

N. Coord. 13439793.23' E. Coord. 2139563.41' Surface Elevation 273.66 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 26.00 ' Sump Length 0 '

Top of Casing Elevation 278.00 ' Stickup 4.34 '

Depth to Water: 1. Ft. btoc 0.90 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20			<0.25		21-23.5	CLAYEY SAND: Pale olive (5 Y 6/3); damp to moist; very fine grained; sub-round; loose to medium dense; slight plasticity; trace silt content; increased clay content from 21.25'-21.75' bgs. Top of Transmissive Sand Unit.
				2.25			At 21.5' bgs: Abundant iron oxide staining.
				>4.5			At 22.25' bgs: Color change to dark greenish grey (Gley-1 5GY 4/1), very dense.
250				1.5-2.0		23.5-25	SILTY SAND: Dark greenish grey (Gley-1 5GY 4/1); very moist; very fine grained; sub-round; medium dense; slight plasticity; dark brown and black staining to 24' bgs.
	25			<0.25		25-32	At 24' bgs: Wet.
							SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine grained; sub-round; well sorted; loose; non-plastic.
245							At 26' bgs: Saturated;
	30						At 28' bgs: Wet.
							At 31.5' bgs: Minor silt content.
				<0.25		32-33.5	SILTY SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine grained; sub-round; loose; non-plastic to slightly plastic.
240				2.0		33.5-38	CLAYEY SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine grained; sub-round; medium dense; low plasticity.
	35			4.25			At 34.75' bgs: Light grey silt lamina. Very dense, high plasticity silt clay lens from 34.8'-35' bgs.
				2.0			At 36.75' bgs: very fine grained, sub-round, well sorted sand lens to 37' bgs.
				1.5			
235				2.0		38-41	SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine grained; well sorted; medium dense; slight plasticity; intermixed with dark brownish grey silty clay.
	40						

ERM Environmental Resources Management

EP-33
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-33 Date Drilled 2016-05-03

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 41.00 ' Boring Diam. 6.00 "

N. Coord. 13439793.23' E. Coord. 2139563.41' Surface Elevation 273.66 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 26.00 ' Sump Length 0 '

Top of Casing Elevation 278.00 ' Stickup 4.34 '

Depth to Water: 1. Ft. btoc 0.90 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
230	40						T.D. = 41.00 '
225	45						
220	50						
215	55						
	60						

ERM Environmental Resources Management

EP-34 DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-34 Date Drilled 2016-05-03

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 53.50 ' Boring Diam. 6.00 "

N. Coord. 13439467.18' E. Coord. 2139561.39' Surface Elevation 274.62 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 0 '

Top of Casing Elevation 278.71 ' Stickup 4.09 '

Depth to Water: 1. Ft. btoc 0.99 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
274.62	0					0-12	SILTY CLAY: Black (7.5 YR 2.5/1); stiff; high plasticity; minor white calcareous concretions; minor organics (roots).
270	5			1.0			At 5' bgs: Very moist (decreasing moisture with depth); soft to medium stiff; medium to high plasticity; occasional white calcareous concretions.
				2.0			At 9' bgs: No organic content.
265	10						At 11' bgs: Decreasing silt content; high plasticity.
				2.0		12-13	SANDY SILTY CLAY: Brown (10 YR 5/3); damp; medium stiff; high to very high plasticity (fat); sand content very fine grained; occasional white calcareous nodules and gypsum stringers.
				1.0		13-16	CLAYEY SAND: Light yellowish brown (2.5 Y 6/3); damp; very fine grained; sub-round; loose; slight plasticity; minor silt content; occasional white silt stringers. Sandy clay lens (3") at 13' bgs.
260	15			0.5			At 15.5' bgs: Sandy clay lens (3").
				1.5		16-17	SANDY CLAY to SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp to moist; soft to medium stiff; low plasticity; sand content fine grained; occasional iron oxide staining; occasional white silt stringers; minor gypsum crystal nodules.
				2.25		17-22.5	At 16.8' bgs: Medium to coarse grained, sub-round, well sorted, wet clayey sand lens.
				2.5	EP-34_18-20 USCS: Fat Clay with Sand (CH) AL: 91 / 25 / 66 -200 Sieve: 71.4		SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp; medium stiff; very high plasticity (fat); minor silt content; abundant iron oxide staining; minor organic black staining; abundant gypsum crystal nodules.
				3.0			
255	20						

ERM Environmental Resources Management

EP-34
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-34 Date Drilled 2016-05-03

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 53.50 ' Boring Diam. 6.00 "

N. Coord. 13439467.18' E. Coord. 2139561.39' Surface Elevation 274.62 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 0 '

Top of Casing Elevation 278.71 ' Stickup 4.09 '

Depth to Water: 1. Ft. btoc 0.99 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20			3.25	EP-34_20-22 USCS: Sandy Fat Clay (CH) AL: 60 / 20 / 40 -200 Sieve: 51.7 Permeability: 1.30×10^{-8}		At 18' bgs: Non-cohesive grab sample collected from 18'-20' bgs. At 19.25' bgs: Gypsum seam (3 mm). At 20' bgs: Cohesive sample (Shelby tube) collected from 20'-22' bgs. At 19.75' bgs: Medium grained, sub-angular, well sorted sand lens (1"). At 21' bgs: Stiff.
				<0.25		22.5-24	
				3.5	EP-34_23-24 USCS: Clayey Sand (SC) AL: 36 / 17 / 19 -200 Sieve: 37.5	24-27	SANDY CLAY: Light olive brown (2.5 Y 5/4); moist; soft to medium stiff with depth; medium plasticity; sand content very fine grained; iron oxide staining; occasional yellow silt stringers. At 23' bgs: Non-cohesive grab sample collected from 23'-24' bgs. At 23.5' bgs: Occasional grey mottling; stiff; increasing sand content; abundant iron oxide staining; abundant silt sand stringers.
250	25			>4.5	EP-34_24-25 USCS: Clayey Sand (SC) AL: 38 / 18 / 20 -200 Sieve: 36.3		
				4.0			CLAYEY SAND: Very dark greenish grey (Gley-1 10GY 3/1); damp; very fine grained; sub-round; very dense; slight plasticity; trace silt content. Dense, medium plasticity sandy clay lens (3"); occasional light grey silt stringers. Top of Transmissive Sand Unit. Non-cohesive grab sample collected from 24'-25' bgs. At 24.5' bgs: Occasional black organic nodules. At 26.5' bgs: Dark brown to black staining (1"); decreasing clay content.
				1.25-1.5	EP-34_27-29 USCS: Silty Sand (SM) AL: Non-plastic -200 Sieve: 13.9	27-34.5	
245	30						SAND: Very dark greenish grey (Gley-1 10GY 3/1); wet; fine grained; sub-round; well sorted; medium dense to loose; non-plastic. Non-cohesive grab sample collected from 27'-29' bgs. At 32.5' bgs: Minor silt content.
240	35			1.0		34.5-37	SILTY SAND: Very dark greenish grey (Gley-1 10GY 3/1); wet; very fine grained; sub-round; loose to medium dense; slight plasticity; minor to trace clay content.
				1.5			
				4.0-4.5		37-39	CLAYEY SILTY SAND: Very dark greenish grey (Gley-1 10GY 3/1); very moist; very fine grained; sub-round; dense; low plasticity; increasing clay content at depth.
				0.75		39-39.5	SAND: Very dark greenish grey (Gley-1 10GY 3/1); very moist; fine-grained; sub-round; well sorted; loose; non-plastic.
235	40			2.5		39.5-47	(For description see next page)

ERM Environmental Resources Management

EP-34
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-34 Date Drilled 2016-05-03

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 53.50 ' Boring Diam. 6.00 "

N. Coord. 13439467.18' E. Coord. 2139561.39' Surface Elevation 274.62 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 31.00 ' Sump Length 0 '

Top of Casing Elevation 278.71 ' Stickup 4.09 '

Depth to Water: 1. Ft. btoc 0.99 (2015-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	40					39.5-47	CLAYEY SAND to SANDY CLAY: Very dark greenish grey (Gley-1 10GY 3/1); very moist; very fine grained; sub-round; trace silt content; intermixed with dense, medium plasticity, dark brown silty clay.
				4.25			At 43' bgs: Very dense; increasing clay content.
230	45			3.25			At 46' bgs: Hard, high plasticity (fat), silty clay lens (2").
				>4.5			At 46.5' bgs: Dense.
						47-49	SILTY SANDY CLAY: Greenish black (Gley-1 10Y 2.5/1); damp to dry; very stiff; high plasticity; sand content very fine grained; abundant light grey silt stringers; occasional black nodules (<1 mm); rare mollusk shells.
				>4.5		49-53.5	CLAY: Greenish black (Gley-1 10Y 2.5/1); damp; very stiff; very high plasticity (fat); some silt content; occasional light grey silt to very fine grained sand stringers. Top of Basal Clay Unit.
225	50				EP-34_50-52 USCS: Fat Clay with Sand (CH) AL: 67 / 21 / 46 -200 Sieve: 76.8		At 50' bgs: Non-cohesive grab sample collected from 50'-52' bgs.
					EP-34_52-53.5 USCS: Sandy Fat Clay (CH) AL: 71 / 22 / 49 -200 Sieve: 58.3 Permeability: 7.18×10^{-9}		At 52' bgs: Cohesive sample (California modified split spoon) collected from 52'-53.5' bgs.
220	55						T.D. = 53.50 '
215	60						

ERM Environmental Resources Management

EP-35 DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-35 Date Drilled 2016-05-02

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 45.00 ' Boring Diam. 6.00 "

N. Coord. 13439140.06' E. Coord. 2139546.31' Surface Elevation 275.71 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 29.00 ' Sump Length 0 '

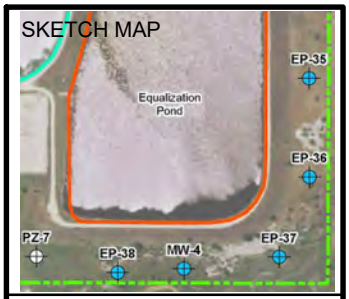
Top of Casing Elevation 279.86 ' Stickup 4.15 '

Depth to Water: 1. Ft. btoc 2.24 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
275.71	0					0-5	SILTY CLAY: Black (2.5 Y 2.5/1); stiff; high plasticity; occasional iron oxide staining; white calcareous nodules; minor organics (roots).
275							
	5			0.5		5-6.75	SILTY SANDY CLAY: Very dark grey (10 YR 3/1); moist to damp; soft; low plasticity; sand content very fine grained; trace iron oxide staining. At 6' bgs: Medium stiff.
270				2.0			
				<0.25		6.75-8.5	CLAYEY SANDY SILT: Very dark grey (10 YR 3/1); moist; loose; slight plasticity; sand content very fine grained.
				1.0			At 8.25' bgs: Increasing clay content with depth; occasional very fine grained, brown sand stringers.
				2.5-3.0		8.5-11	SANDY CLAY: Very dark greyish brown (10 YR 3/2) with light brown mottling (occurrence increases with depth); damp; medium stiff; medium to plasticity; sand content very fine grained; occasional very fine grained, light brown sand stringers.
	10			3.25			At 10' bgs: Dark greyish brown (10 YR 4/2); stiff; very high plasticity; abundant white silt stringers.
265				3.5		11-15	SILTY CLAY: Light yellowish brown (2.5 Y 6/3); damp; stiff; very high plasticity (fat); minor fine grained sand content; occasional white silt to very fine grained sand stringers; trace white calcareous nodules; occasional gypsum crystals.
							At 13' bgs: Abundant gypsum stringers (to 14' bgs); trace grey mottling, iron oxide staining, and black organic nodules (to 15' bgs).
	15			4.0			At 14' bgs: Increasing sand content, trace silt and gypsum stringers.
260				3.5		15-22.5	SANDY CLAY: Light olive brown (2.5 Y 5/3) with minor grey mottling (to 19' bgs); damp; stiff to very stiff; very high plasticity (fat); sand content very fine grained; trace silt; gypsum nodules throughout.
							At 17' bgs: Minor iron oxide staining to 18' bgs.
							At 18' bgs: Minor to occasional iron oxide staining.
	20						At 19' bgs: Increasing sand content; abundant iron oxide staining, white silt stringers, and gypsum nodules.

ERM Environmental Resources Management

EP-35 DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-35 Date Drilled 2016-05-02

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 45.00 ' Boring Diam. 6.00 "

N. Coord. 13439140.06' E. Coord. 2139546.31' Surface Elevation 275.71 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 29.00 ' Sump Length 0 '

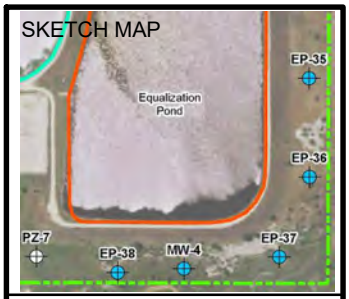
Top of Casing Elevation 279.86 ' Stickup 4.15 '

Depth to Water: 1. Ft. btoc 2.24 (2015-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20						At 20.5' bgs: Abundant very fine grained, light brown sand stringers to 21' bgs. At 21.5' bgs: Abundant very fine grained, light brown sand stringers to 22.5' bgs.
255						22.5-24	At 22.4' bgs: Greenish grey mottling; gypsum seam (10 mm). SANDY CLAY: Light olive brown (2.5 Y 5/3); damp; medium stiff; medium plasticity; sand content very fine grained; minor silt content (occurrence decreases with depth); iron oxide staining; occasional gypsum crystals to 23' bgs.
	25					24-25	At 23' bgs: Dense; increasing sand content.
250						25-33	At 23.5' bgs: Medium to low plasticity. CLAYEY SAND: Dark greenish grey (Gley-1 10Y 4/1); damp; very fine grained; sub-round; very dense; low to slight plasticity; abundant light grey silt stringers; occasional intermixed dark grey sandy clay lenses. Top of Transmissive Sand Unit. NO RECOVERY: Soil falls out of casing (saturated).
	30						
245				<0.25		33-37.5	SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine to fine grained; sub-round; well sorted; loose; non-plastic.
	35			1.5			At 35.5' bgs: Medium dense; trace silt content (increases with depth).
240				0.75		37.5-40	SILTY SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine grained; sub-round; loose; non-plastic to slightly plastic; increasing silt content at depth.
				<0.25			At 38.75' bgs: Intermixed medium dense, high plasticity (fat), dark brown clay lenses.
				2-3			
	40			1.5			

ERM Environmental Resources Management

EP-35
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-35 Date Drilled 2016-05-02

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 45.00 ' Boring Diam. 6.00 "

N. Coord. 13439140.06' E. Coord. 2139546.31' Surface Elevation 275.71 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 29.00 ' Sump Length 0 '

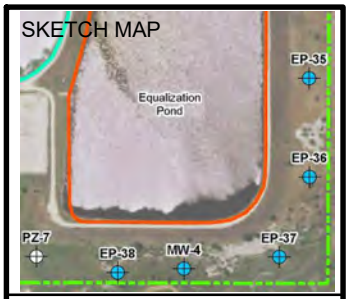
Top of Casing Elevation 279.86 ' Stickup 4.15 '

Depth to Water: 1. Ft. btoc 2.24 (2015-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
235	40			1.5		40-41	SAND: Dark greenish grey (Gley-1 10GY 4/1); wet; very fine grained; sub-round; well sorted; medium dense; slightly plastic; intermixed with low to medium plasticity, brown silty clay.
				1.5		41-45	CLAYEY SAND: Dark greenish grey (Gley-1 10GY 4/1); very moist; very fine grained; sub-round; loose to medium dense; slight to low plasticity; intermixed with medium plasticity, brown silt clay; trace silt content.
				3.0			At 43' bgs: Dense.
				1.0			At 44' bgs: Loose to medium dense.
230	45						T.D. = 45.00 '
225	50						
220	55						
	60						

ERM Environmental Resources Management

EP-36
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-36 Date Drilled 2016-05-02

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 47.00 ' Boring Diam. 6.00 "

N. Coord. 13438803.92' E. Coord. 2139546.80' Surface Elevation 275.58 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

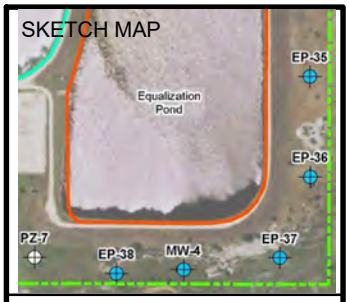
Top of Casing Elevation 278.50 ' Stickup 2.92 '

Depth to Water: 1. Ft. btoc 2.98 (2015-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
275.58	0			>4.5		0-10	SILTY CLAY: Black (10 YR 2/1); very stiff; high plasticity; white calcareous concretions; minor organics (roots).
275							
	5			0.5			At 5' bgs: Color change to very dark grey (10 YR 3/1); moist; soft to medium stiff (increasing stiffness at depth).
270				1.5			
				2.0			At 8' bgs: Abundant light brown mottling; medium dense; minor very fine grained sand content; increasing silt content; trace white calcareous concretions.
	10			0.5-1.0		10-17	SILTY SANDY CLAY: Light yellowish brown (2.5 Y 6/3) with some brown mottling; moist; soft; high plasticity; sand content very fine grained; occasional white calcareous nodules to 10.5' bgs.
265							At 11' bgs: Damp to moist; medium stiff; occasional white silt to very fine grained sand stringers.
				1.5-2.0			
	15						At 14.5' bgs: Clayey sand lens (0.25").
260				3.75			At 16' bgs: Minor greyish green mottling; stiff; increasing plasticity with depth; trace iron oxide staining and gypsum crystals.
				2.5		17-21	CLAY: Light yellowish brown (2.5 Y 6/3) with greenish grey mottling; damp; medium stiff; very high plasticity (fat); minor to trace silt (decreases with depth); iron oxide staining; white silt to very fine grained sand stringers; occasional gypsum crystals.
				3.0			At 17.8' bgs: Black organic laminae to 18' bgs.
	20						At 18' bgs: Minor iron oxide staining to 20' bgs.

ERM Environmental Resources Management

EP-36 DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-36 Date Drilled 2016-05-02

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 47.00 ' Boring Diam. 6.00 "

N. Coord. 13438803.92' E. Coord. 2139546.80' Surface Elevation 275.58 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

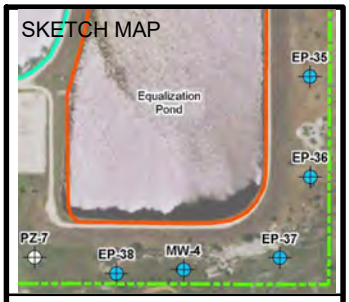
Top of Casing Elevation 278.50 ' Stickup 2.92 '

Depth to Water: 1. Ft. btoc 2.98 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
255	20			3.5	EP-36_22-23.5 USCS: Sandy Fat Clay (CH) AL: 64 / 21 / 43 -200 Sieve: 1.07x10^{-8}	21-25	At 18.5' bgs: Abundant silt stringers to 18.75' bgs. At 19' bgs: Medium stiff to stiff. At 19.5' bgs: Color change to light olive brown (2.5 Y 5/3); abundant white medium to coarse grained sand stringers; some gypsum crystals. SILTY SANDY CLAY: Light olive brown (2.5 Y 5/3); damp; stiff; very high plasticity (fat); sand content very fine grained; iron oxide staining (to 21.75' bgs); abundant white silt and medium grained sand stringer; minor gypsum crystals.
				1.5			
250	25			4.0		25-27	At 22' bgs: Iron oxide staining; minor white silt and medium grained sand stringers; trace yellow silt stringers. Cohesive sample (California modified split spoon) collected from 22'-23.5' bgs. At 24' bgs: Medium dense, increasing sand content.
				4.0		27-29	SANDY CLAY to CLAYEY SAND: Very dark greenish grey (Gley-1 10Y 3/1); damp; very stiff; medium to low plasticity; sand content very fine grained, sub-round; decreasing clay content with depth; occasional light grey silt stringers. Top of Transmissive Sand Unit.
				>4.5			
245	30			0.75	EP-36_29.5-30 USCS: Silty Sand (SM) AL: Non-plastic -200 Sieve: 16.8	29-29.5	CLAYEY SAND: Very dark greenish grey (Gley-1 10Y 3/1); damp to moist; very fine to fine grained; sub-round; very dense; low to slight plasticity; trace silt; decreasing silt content with depth; occasional light grey silt stringers.
				0.25		29.5-37	At 28' bgs: Very dense; occasional dark brown to black organic silt lenses. SILTY SAND: Very dark greenish grey (Gley-1 10Y 3/1); wet; very fine grained; sub-round; loose; slight plasticity; trace clay content (occurrence decreases with depth); occasional dark brown to black silt stringers. SAND: Dark greenish grey (Gley-1 5GY 4/1); wet; fine grained; sub-round to sub-angular; well sorted; loose; non-plastic. Non-cohesive grab sample collected from 29.5'-30' bgs.
240	35			<0.25		37-43	SILTY SAND: Dark greenish grey (Gley-1 5GY 4/1); saturated; very fine grained; sub-round; loose; slight plasticity; trace clay content; minor clayey sand lenses.
	40						

ERM Environmental Resources Management

EP-36
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-36 Date Drilled 2016-05-02

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 47.00 ' Boring Diam. 6.00 "

N. Coord. 13438803.92' E. Coord. 2139546.80' Surface Elevation 275.58 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

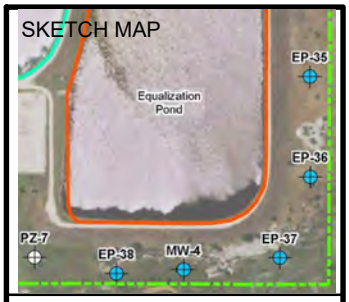
Top of Casing Elevation 278.50 ' Stickup 2.92 '

Depth to Water: 1. Ft. btoc 2.98 (2015-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
235	40			1.5-1.75		43-47	CLAYEY SAND: Dark greenish grey (Gley-1 5GY 4/1); very moist; very fine grained; sub-round; medium dense; low plasticity; occasional dark greenish grey silty clay lenses.
230	45						At 45' bgs: Silty clay lenses change color to brown.
225	50						T.D. = 47.00 '
220	55						
	60						

ERM Environmental Resources Management

EP-37 DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-37 Date Drilled 2016-04-26

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 56.00 ' Boring Diam. 6.00 "

N. Coord. 13438531.26' E. Coord. 2139444.56' Surface Elevation 275.02 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

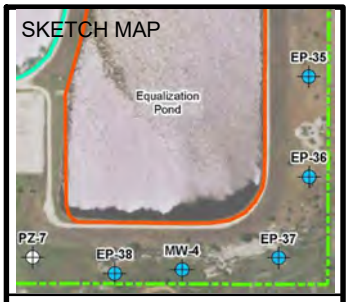
Top of Casing Elevation 277.80 ' Stickup 2.78 '

Depth to Water: 1. Ft. btoc 2.31 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Jesse Houghton

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
275.02	0			1.0		0-6.5	CLAY to SILTY CLAY: Dark reddish grey (2.5 YR 3/1) to very dark grey (2.5 Y 3/1); wet; stiff; high plasticity; wet from 0-6' bgs; damp to moist from 6.0-6-5' bgs.
270	5			0.75		6.5-7.5	SILTY CLAY to CLAY: Dark greyish brown (2.5 Y 4/2); damp to moist; stiff; high plasticity; minor sand stringers; white calcareous lenses (<1 mm).
				1.0		7.5-8	CLAYEY SAND to SANDY CLAY: Olive grey (5 Y 5/2); moist; very fine grained; loose to medium dense; high plasticity.
				2.5		8-14.5	CLAY: Olive brown (2.5 Y 4/3) with minor green and black mottling; dry; very stiff; high plasticity; minor thin very fine grained sand lenses; black lenses (possibly organic); common white calcareous nodules (<1 mm) and crystals.
265	10						
260	15			0.75		14.5-16	CLAYEY SILTY SAND: Light olive brown (2.5 Y 5/3); damp; loose; slight plasticity.
				2.5		16-21.8	CLAY: Brown (7.5 YR 4/3) with green and orange mottling; dry to damp; very stiff; very high plasticity; occasional fine to very fine grained calcareous concretions and crystals.
	20			4.5			At 18' bgs: Non-cohesive grab sample collected from 18'-20' bgs. At 18.5' bgs: Very fine grained, orange sand and calcite crystals present along parting planes or fissures to 21.8' bgs; orange and white mottling increase with depth.

ERM Environmental Resources Management

EP-37
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-37 Date Drilled 2016-04-26

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 56.00 ' Boring Diam. 6.00 "

N. Coord. 13438531.26' E. Coord. 2139444.56' Surface Elevation 275.02 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

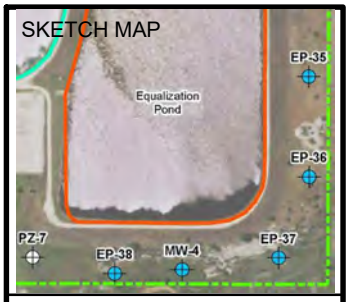
Top of Casing Elevation 277.80 ' Stickup 2.78 '

Depth to Water: 1. Ft. btoc 2.31 (2015-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Jesse Houghton

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
255	20			4.5	EP-37_18-20 USCS: Fat Clay with Sand (CH) AL: 73 / 22/ 51 -200 Sieve: 84.3		At 19.7' bgs: Silty clay lens to 20.2' bgs.
				4.5		21.8-23	CLAY: Yellowish brown (10 YR 5/4) with orange and cream mottling; dry; very stiff; medium to high plasticity; interbedded with wavy lenses of silty clay and sandy clay.
				3.5		23-25	At 22.3' bgs: Black band (1"); soft peaty clay. CLAYEY SAND: Very dark greenish grey (Gley-1 10Y 3/1) with orange mottling (to 24' bgs); dry; dense; slight plasticity; heterogeneous. Top of Transmissive Sand Unit.
250	25			3.5		25-27.2	SILTY CLAY with SAND: Very dark greenish grey (Gley-1 10Y 3/1); damp; medium stiff; sand content fine to very fine grained. At 26.8' bgs: Dark brown mottling.
						27.2-39.5	SAND: Greenish grey (Gley-2 10BG 5/1); moist; fine to very fine grained; sub-round; well sorted; loose; non-plastic; homogeneous.
245	30				EP-37_30-32 USCS: Silty Sand (SM) AL: Non-plastic -200 Sieve: 23.1		At 30' bgs: Non-cohesive grab sample collected from 30'-32' bgs.
240	35						
	40			1.5		39.5-50	CLAYEY SAND: Greenish grey (Gley-2 10BG 5/1); damp to moist; fine to very fine grained; sub-round; well sorted; loose to medium dense; slight plasticity; homogeneous and featureless; rare grey clay mottling. At 39.5' bgs: Laminated, black silty clay lens (2").

ERM Environmental Resources Management

EP-37
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-37 Date Drilled 2016-04-26

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 56.00 ' Boring Diam. 6.00 "

N. Coord. 13438531.26' E. Coord. 2139444.56' Surface Elevation 275.02 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

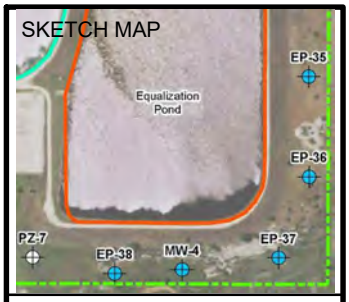
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 30.00 ' Sump Length 0 '

Top of Casing Elevation 277.80 ' Stickup 2.78 '

Depth to Water: 1. Ft. btoc 2.31 (2015-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Jesse Houghton

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
235	40						
230	45						
225	50			>4.5		50-53	At 48.8' bgs: Dense, grey clay lens to 49.0' bgs. SANDY SILTY CLAY: Dark bluish grey (Gley-2 5B 4/1); dry to damp; stiff; medium to high plasticity; sand content very fine grained; occasional very small (<1 mm) black nodules and white silt lenses; rare mollusk shells.
				>4.5		53-56	CLAY: Very dark greenish grey (Gley-1 10Y 3/1); dry; very stiff; very high plasticity; blocky; homogeneous and featureless. Top of Basal Clay Unit.
220	55				EP-37_55-56 USCS: Sandy Fat Clay (CH) AL: 96 / 26 / 70 -200 Sieve: 69.3 Permeability: 9.73×10^{-9}		At 55' bgs: Cohesive sample (California modified split spoon) collected from 55'-56' bgs. T.D. = 56.00 '
	60						

Environmental Resources Management

EP-38
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-38 Date Drilled 2016-04-27

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 40.00 ' Boring Diam. 6.00 "

N. Coord. 13438478.49' E. Coord. 2138894.74' Surface Elevation 276.97 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 25.00 ' Sump Length 0 '

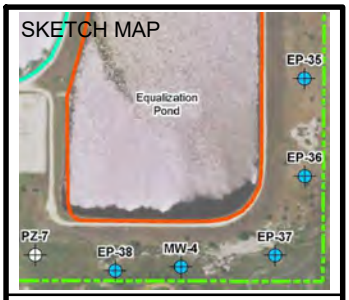
Top of Casing Elevation 279.35 ' Stickup 2.38 '

Depth to Water: 1. Ft. btoc 1.36 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Jesse Houghton

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
276.97	0					0-6.5	SILTY CLAY: Very dark grey (10 YR 3/1); damp to moist; medium stiff; high to very high plasticity; minor very fine grained sand content; homogeneous and featureless; rare organics (peat, roots).
275							
	5			0.75			
				0.5		6.5-8	CLAYEY SAND to SANDY CLAY: Very dark grey (10 YR 3/1); damp to moist; very fine grained; loose; rare organics.
270				3.5		8-10	SILTY SANDY CLAY: Very dark grey (10 YR 3/1) with pale brown and occasional green mottling; moist; very stiff; high plasticity.
	10			1.75		10-12.5	CLAY: Brown (10 YR 5/3) with abundant dark grey, green, and tan deformed mottling (wavy); dry; very stiff; very high plasticity; minor silt and very fine grained sand content; abundant calcite and gypsum lenses and occasional lenticular vugs. At 11' bgs: Clayey, very fine grained sand lens (1").
265				3.5	EP-38_13-15 USCS: Fat Clay (CH) AL: 96 / 26 / 70 -200 Sieve: 93.2	12.5-14.5	CLAY: Yellowish brown (10 YR 5/4) with dark grey and orange mottling; dry; very dense; very high plasticity; iron oxide staining; abundant calcite and gypsum crystal lenses. At 13' bgs: Non-cohesive grab sample collected from 13'-15' bgs.
	15			2.5		14.5-18	CLAY: Yellowish brown (10 YR 5/6); dry to damp; dense; very high plasticity; minor silt and very fine grained sand content; common iron oxide staining; occasional small calcite and gypsum lenses.
260				>4.5		18-20	CLAYEY SAND to SANDY CLAY: Yellowish brown (10 YR 5/4) with occasional grey mottling; damp to moist; very fine grained; dense; high plasticity; common iron oxide staining. At 18.4' bgs: Pink massive gypsum concretion (1").
	20			2.0			

ERM Environmental Resources Management

EP-38
DRILLING LOG

Proj. No. 0346369 Boring/Well ID EP-38 Date Drilled 2016-04-27

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 40.00 ' Boring Diam. 6.00 "

N. Coord. 13438478.49' E. Coord. 2138894.74' Surface Elevation 276.97 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 15.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 25.00 ' Sump Length 0 '

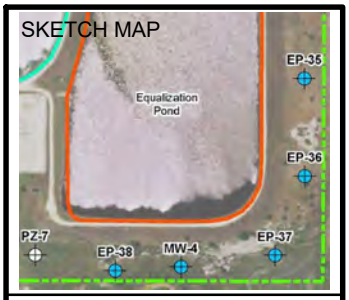
Top of Casing Elevation 279.35 ' Stickup 2.38 '

Depth to Water: 1. Ft. btoc 1.36 (2016-05-24) 2. Ft. btoc ( )

Drilling Company Cascade Drilling, LLC Driller Jesse Houghton

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	20			2.0		20-22	SANDY CLAY: Very dark grey (Gley-1 N 3); moist; medium stiff; high plasticity; sand content very fine grained. At 20.2' bgs: Increasing sand content with depth; iron oxide stained calcareous concretion (2").
255				2.5		22-23.5	CLAYEY SAND: Dark greenish grey (Gley-1 10Y 4/1); wet; fine to very fine grained; sub-round; medium dense; medium to high plasticity; occasional organic lenses. Top of Transmissive Sand Unit.
				2.5		23.5-26	SAND: Dark greenish grey (Gley-1 10Y 4/1) with occasional grey mottling; wet; fine to very fine grained; sub-round; loose; non-plastic; some clay content (slightly mottled appearance) from 23.5'-24.5' bgs; occasional black organic seams (>1").
	25						
				2.5		26-40	CLAYEY SAND: Dark greenish grey (Gley-2 5BG 4/1); wet to moist; fine to very fine grained; sub-round; loose to medium dense; slight plasticity; loosely stratified with dark grey clay; generally homogeneous and featureless.
250							
	30						
245							At 32' bgs: Saturated.
	35						
240							
	40						T.D. = 40.00 '

ERM Environmental Resources Management

SP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID SP-31 Date Drilled 2016-05-05

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 62.00 ' Boring Diam. 6.00 "

N. Coord. 13440939.92' E. Coord. 2136076.16' Surface Elevation 331.89 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 46.50 ' Sump Length 0 '

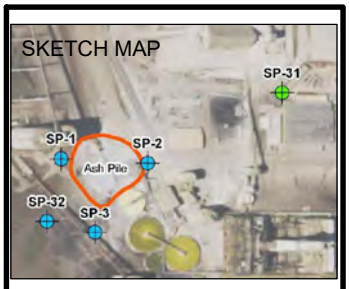
Top of Casing Elevation 335.01 ' Stickup 3.12 '

Depth to Water: 1. Ft. btoc 35.45 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
331.89	0					0-5	NO RECOVERY: Previously excavated for sub-surface clearance activities.
330							
	5			<0.25		5-10	CLAYEY SANDY SILT: Very pale brown (10 YR 7/3); dry to damp; loose; slight plasticity; intermixed with hard, brown silty clay (partially compacted pieces); sand content very fine grained; occasional iron oxide staining (to 6' bgs); abundant yellow silt stringers; occasional gypsum crystals.
325							At 8' bgs: Color change to light reddish brown (5 YR 6/4); silty clay content changes color to reddish brown with some very dark red; occasional iron oxide staining.
	10			>4.5		10-16	At 9' bgs: Loose, light grey clayey silt lens to 9.25' bgs. SILTY CLAY to CLAY: Reddish brown (5 YR 5/3); dry; very stiff; high plasticity; friable; fractures along planar surfaces; occasional iron oxide staining; abundant tan silt to very fine grained sand stringers.
320							At 12' bgs: Decreasing silt to very fine grained sand stringers.
							At 12.75' bgs: Stiff, high plasticity (fat) clay lens to 13.5' bgs.
	15			0.5			At 15' bgs: Color change to dark red (2.5 YR 3/6); soft; medium to low plasticity; increasing silt content with depth; occasional yellow silt laminae.
315						16-20	CLAYEY SILTY SAND to CLAYEY SANDY SILT: Reddish brown (2.5 YR 4/4); damp; very fine grained; loose; low plasticity; minor iron oxide staining; occasional light grey very fine grained sand stringers; abundant yellow silt stringers.
							At 17' bgs: Reddish brown intermixed with pale brown (10 YR 7/3).
							At 18' bgs: Abundant hard silt clay lenses (compact).
							At 18.3' bgs: Gypsum seam (3 mm);
							At 19.25' bgs; Gypsum seam (20 mm); abundant iron oxide staining to 19.5' bgs.
	20			<0.25			

ERM Environmental Resources Management

SP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID SP-31 Date Drilled 2016-05-05

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 62.00 ' Boring Diam. 6.00 "

N. Coord. 13440939.92' E. Coord. 2136076.16' Surface Elevation 331.89 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

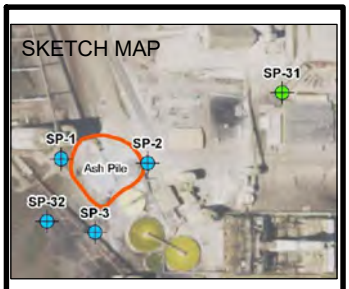
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 46.50 ' Sump Length 0 '

Top of Casing Elevation 335.01 ' Stickup 3.12 '

Depth to Water: 1. Ft. btoc 35.45 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
310	20			<0.25		20-25.5	SILTY CLAY to CLAY: Dark reddish brown (5 YR 3/3); damp; loose; high plasticity; hard, compact pieces present; soil fractures along planar surfaces. At 20.75' bgs: Minor iron oxide staining and yellow silt stringers, trace gypsum crystals. At 21' bgs: Trace iron oxide staining. At 23' bgs: Damp to dry; minor fine grained sand content; increasing silt content. At 24' bgs; Gypsum crystal seam (5 mm). At 24.5' bgs: Occasional yellow silt stringers and gypsum inclusions. At 25' bgs: Increasing plasticity.
	25			0.5 3.5 4.0		25.5-33	CLAY: Brown (7.5 YR 5/2); damp; stiff to very stiff; very high plasticity (fat); trace silt; minor iron oxide staining and yellow silt stringers. At 27' bgs: Abundant gypsum crystals to 27.5' bgs. At 27.5' bgs: Occasional yellow silt stringers. At 28' bgs: Non-cohesive grab sample collected from 28'-30' bgs.
305				3.0			At 29' bgs: Gypsum seam (5 mm). At 29.25' bgs: Color change to dark greenish grey (Gley-1 5GY 4/1); blocky fracturing.
				>4.5	SP-31_28-30 USCS: Fat Clay with Sand (CH) AL: 97 / 26 / 71 -200 Sieve: 75.3		
	30			2.5			At 30.5' bgs: Color change to brown (7.5 YR 4/2); damp to dry; occasional iron oxide staining and yellow silt stringers to 31' bgs.
300				>4.5			At 32' bgs: Color change to dark greenish grey (Gley-1 5GY 4/1) to 32.5' bgs; dry; minor silt content (increases with depth). At 32.8' bgs: Occasional yellow silt stringers to 33' bgs.
				3.0 >4.5		33-35	SANDY CLAY: Brown (7.5 YR 5/2); dry; very stiff; very high plasticity (fat); sand content very fine grained; minor silt content; soil fractures in planar surfaces; abundant yellow silt stringer to 34' bgs.
	35			1.0-<0.25		35-40	At 34' bgs: Color change to dark greenish grey (Gley-1 5 GY 4/1) to 34.5' bgs. At 34.5' bgs: Minor gypsum seams; occasional yellow silt stringers.
295							SANDY SILTY CLAY to CLAYEY SILTY SAND: Brown (10 YR 5/3); very moist to wet; soft; low to slight plasticity; sand content very fine grained. At 37.5' bgs: Brown intermixed with reddish brown; decreasing clay content with depth; occasional yellow silt stringers.
	40			<0.25			

ERM Environmental Resources Management

SP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID SP-31 Date Drilled 2016-05-05

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 62.00 ' Boring Diam. 6.00 "

N. Coord. 13440939.92' E. Coord. 2136076.16' Surface Elevation 331.89 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

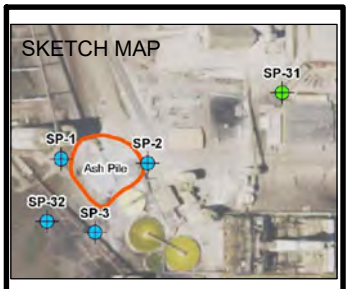
Casing: Type Sch. 40 PVC Diam. 2.00 " Length 46.50 ' Sump Length 0 '

Top of Casing Elevation 335.01 ' Stickup 3.12 '

Depth to Water: 1. Ft. btoc 35.45 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	40			<0.25		40-41	SAND: Greyish brown (2.5 Y 5/2); saturated; very fine grained; sub-round; well sorted; loose; non-plastic.
				>4.5		41-41.5	At 40.5' bgs: Trace silt and clay content.
				<0.25		41.5-46	At 40.75' bgs: Color change to light grey (2.5 Y 7/2).
290							SANDSTONE: Very dark greenish grey (Gley-1 10 Y 3/1); dry; hard; very fine grained.
							SAND: Pale olive (5 Y 6/3); wet; very fine grained; sub-round; well sorted; loose; non-plastic. Top of Transmissive Sand Unit.
	45						At 45' bgs: Occasional yellow silt stringers.
				<0.25		46-47.25	SILTY SAND: Pale olive (5 Y 6/3); very moist to wet; very fine grained; loose; slight plasticity; occasional yellow silt stringers.
285				1.0			At 47' bgs: Minor clay content.
				<0.25		47.25-57.5	CLAYEY SILTY SAND: Pale olive (5 Y 6/3); very moist; very fine grained; sub-round; loose; slight to low plasticity; occasional iron oxide staining and yellow silt stringers.
				0.5			
	50			2.0			At 49.75' bgs: Increasing clay content; abundant iron oxide staining and yellow silt stringers to 50.25' bgs.
280				1.0			At 50.5' bgs: Color change to olive (5 Y 5/3); medium dense; no iron oxide staining or yellow silt stringers.
				1.5			At 51.5' bgs: Dark reddish brown silty clay lens with clayey silty sand laminae.
				2.0			At 52' bgs: Color change to dark greyish brown (2.5 Y 4/2); loose.
	55			2.5			At 53.5' bgs: Medium stiff, medium plasticity, dark brown silty clay content (intermixed).
							At 54' bgs: Medium dense; trace to minor silt content.
275							At 56.5' bgs: Increasing clay content.
				>4.5		57.5-62	CLAY: Dark reddish grey (10 R 4/1); damp to dry; very stiff; very high plasticity (fat); trace silt content (occurrence decreases with depth); top 2" of section dark reddish brown with gypsum crystal inclusions. Top of Basal Clay Unit.
	60						

ERM Environmental Resources Management

SP-31
DRILLING LOG

Proj. No. 0346369 Boring/Well ID SP-31 Date Drilled 2016-05-05

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 62.00 ' Boring Diam. 6.00 "

N. Coord. 13440939.92' E. Coord. 2136076.16' Surface Elevation 331.89 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 46.50 ' Sump Length 0 '

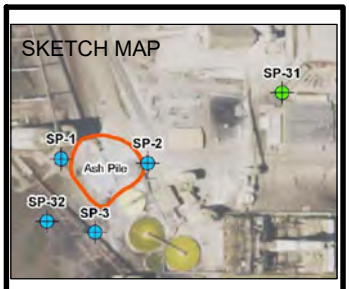
Top of Casing Elevation 335.01 ' Stickup 3.12 '

Depth to Water: 1. Ft. btoc 35.45 (2015-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP



NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
270	60						At 60' bgs: Abundant dark greenish grey very fine grained sand lenses and light grey silt lenses. At 61' bgs: Color change to very dark grey (10 YR 3/1). T.D. = 62.00 '
265	65						
260	70						
255	75						
	80						

ERM Environmental Resources Management

SP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID SP-32 Date Drilled 2016-05-05

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 2135302.00 ' E. Coord. 13440520.00 ' Surface Elevation 325.21 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 37.00 ' Sump Length 0 '

Top of Casing Elevation 327.89 ' Stickup 2.68 '

Depth to Water: 1. Ft. btoc 27.42 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
325.21	0					0-5	NO RECOVERY: Previously excavated for sub-surface clearance.
320	5			0.25		5-8.5	CLAYEY SILTY SAND: Light brownish grey (10 YR 6/2); dry; very fine grained; loose; low to slight plasticity; some hard, compact silt clay pieces; occasional iron oxide staining and tan silt stringers.
				2.0		8.5-13	CLAY: Reddish brown (5 YR 4/4); damp; medium stiff; medium plasticity; trace silt content; friable, fractured minor to trace iron oxide staining; occasional tan very fine grained sand stringers.
315	10						At 10.5' bgs: High plasticity; increasing silt content.
							At 12' bgs: Dry.
				1.5-2.0		13-20	CLAY: Pale brown (10 YR 6/3); damp; medium stiff; very high plasticity (fat); trace silt content; friable; blocky; fractures along planar surfaces; occasional iron oxide staining; minor yellow silt stringers.
310	15			2.50			
				2.0			At 16' bgs: No yellow silt stringers.
				1.0	SP-32_18-20 USCS: Fat Clay (CH) AL: 101 / 27 / 74 -200 Sieve: 99.7 Permeability: 7.23×10^{-9}		At 18' bgs: Soil no longer blocky and does not fracture. Cohesive sample (Shelby tube) collected from 18'-20' bgs. At 18.5' bgs: Abundant iron oxide staining to 18.75' bgs.
	20			2.5			

ERM Environmental Resources Management

SP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID SP-32 Date Drilled 2016-05-05

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 2135302.00 ' E. Coord. 13440520.00 ' Surface Elevation 325.21 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 37.00 ' Sump Length 0 '

Top of Casing Elevation 327.89 ' Stickup 2.68 '

Depth to Water: 1. Ft. btoc 27.42 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
305	20			2.5		20-24	SILTY SANDY CLAY: Light yellowish brown (2.5 Y 6/3); damp; medium stiff; very high plasticity (fat); sand content very fine grained; trace yellow silt stringers. At 20.75' bgs: Abundant iron oxide staining to 21' bgs. At 22' bgs: Increasing sand and silt content; occasional iron oxide staining and gypsum crystals. At 23' bgs: Soft; occasional yellow silt stringers. At 23.5' bgs: Decreasing plasticity.
				2.0			
				<0.25			
				<0.25		24-27	SANDY CLAY: Pale brown (10 YR 6/3); damp; soft; low plasticity; sand content very fine grained; decreasing sand content at depth; trace iron oxide staining; occasional grey very fine grained sand stringers; abundant yellow silt stringers. At 26' bgs: Medium dense; medium plasticity (increases with depth).
300	25			2.0			
				4.0		27-30	SANDY CLAY: Pale brown (10 YR 6/3); damp; stiff to very stiff; high to very high plasticity (fat); sand content very fine grained; occasional yellow silt stringers; minor dark reddish brown silt stringers. At 27' bgs: Gypsum seam (2 mm). At 29' bgs: Occasional gypsum crystal inclusions.
295	30			3.0-3.5		30-37.5	SANDY SILTY CLAY: Brown (7.5 YR 4/1), heavily mottled with light brown; damp; stiff; very high plasticity (fat); sand content very fine grained; abundant light grey very fine grained sand stringers and yellow silt stringers. At 31.5' bgs: No mottling; occasional iron oxide staining.
290	35						At 36.5' bgs: Abundant yellow silt stringers to 37.5' bgs.
				2.5		37.5-38	CLAYEY SAND: Brown (10 YR 5/3); very moist; very fine grained; sub-round; loose; slight plasticity; occasional medium to high plasticity, silty clay lamina. Top of Transmissive Sand Unit.
				1.0		38-39	
				<0.25			SAND: Light brownish grey (2.5 Y 6/2); wet; very fine to fine grained; sub-round, well sorted; loose; non-plastic.
				<0.25		39-42	
	40			0.25			(See next page for description)

ERM Environmental Resources Management

SP-32
DRILLING LOG

Proj. No. 0346369 Boring/Well ID SP-32 Date Drilled 2016-05-05

Project Phase III - Hydrogeologic Characterization & Groundwater Monitoring System Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 50.00 ' Boring Diam. 6.00 "

N. Coord. 2135302.00 ' E. Coord. 13440520.00 ' Surface Elevation 325.21 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 37.00 ' Sump Length 0 '

Top of Casing Elevation 327.89 ' Stickup 2.68 '

Depth to Water: 1. Ft. btoc 27.42 (2016-05-24) 2. Ft. btoc _____ (_____)

Drilling Company Cascade Drilling, LLC Driller Brigham Bradford

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
285	40			0.25	SP-32_40-42 USCS: Clayey Sand (SC) AL: 34 / 16 / 18 -200 Sieve: 40.4	39-42	CLAYEY SILTY SAND: Light yellowish brown (2.5 Y 6/3); moist to wet; very fine grained; loose; slight to low plasticity. Non-cohesive grab sampled collected from 40'-42' bgs. At 41' bgs: Medium dense.
				>4.5		42-47.5	SILTY CLAY: Brown (7.5 YR 4/4); damp to dry; very stiff; very high plasticity (fat); abundant light brown very fine grained sand; occasional yellow silt stringers. At 43' bgs: Abundant gypsum crystal inclusions to 43.5' bgs.
280	45						At 46.5' bgs: Occasional light brown sand lenses; some gypsum crystal inclusions to 47.5' bgs.
				>4.5	SP-32_48-50 USCS: Fat Clay with Sand (CH) AL: 79 / 23 / 56 -200 Sieve: 75.2	47.5-50	CLAY: Very dark greenish grey (Gley-1 10Y 3/1); damp to dry; very stiff; very high plasticity (fat); occasional grey to dark grey silt stringers; occasional thin lamina of gypsum crystals. Top of Basal Clay Unit. At 48' bgs: Non-cohesive grab sample collected from 48'-50' bgs.
275	50						T.D. = 50.00 '
270	55						
	60						

Environmental Resources Management

SP-33
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-33 Date Drilled 2016-10-18

Project Additional Ash Pile Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 39.00 ' Boring Diam. 6.00 "

N. Coord. 13441030.47 ' E. Coord. 2135343.93 ' Surface Elevation 327.36 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 24.00 ' Sump Length 0 '

Top of Casing Elevation 329.96 ' Stickup 2.60 '

Depth to Water: 1. Ft. btoc 22.55 (2016-10-26) 2. Ft. btoc 0.00 ( )

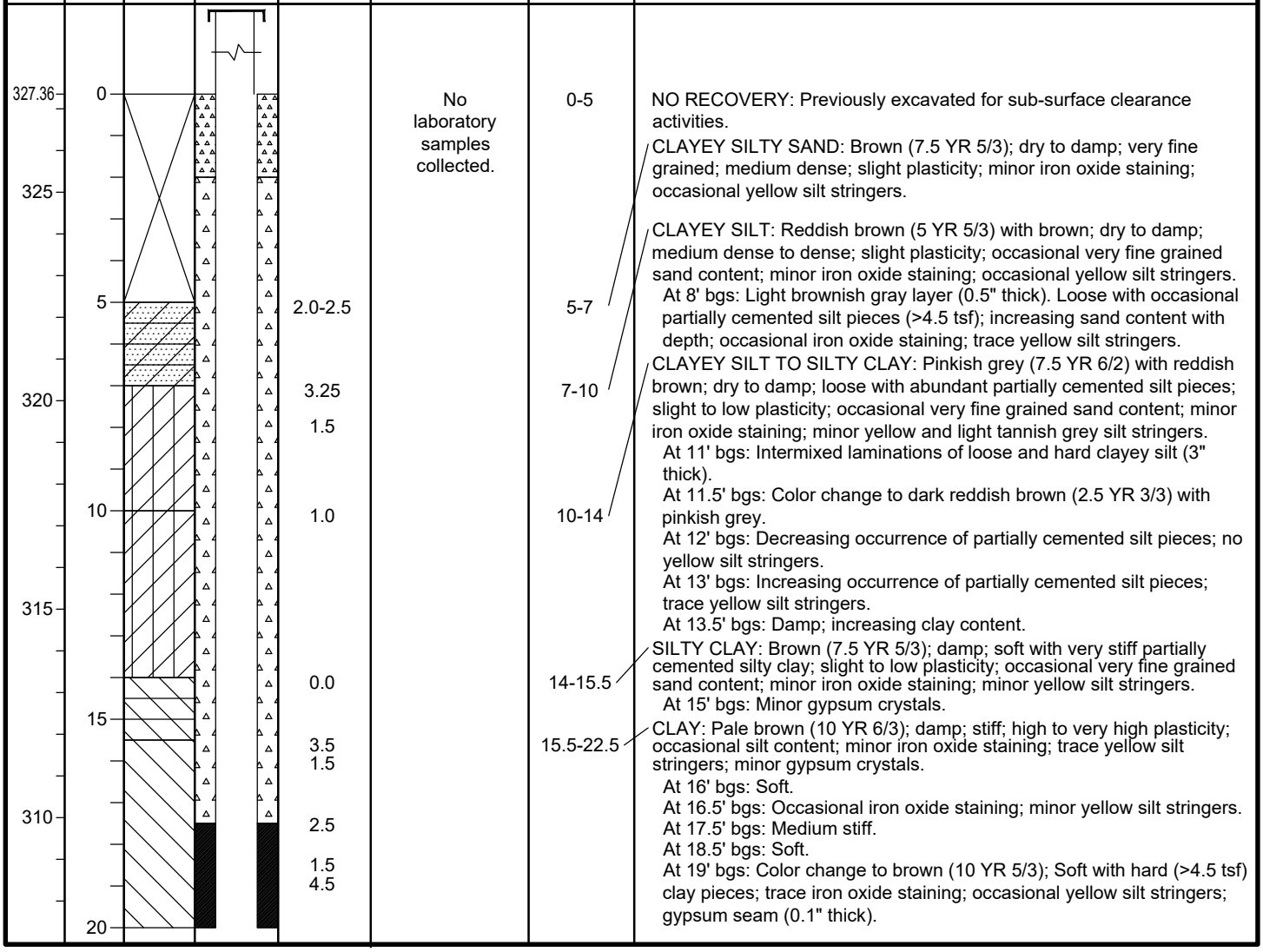
Drilling Company Cascade Drilling, LLC Driller Jagaedy Maples

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B



Environmental Resources Management

SP-34
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-34 Date Drilled 2016-10-19

Project Additional Ash Pile Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 55.00 ' Boring Diam. 2.00 "

N. Coord. 13440938.26 ' E. Coord. 2135661.23 ' Surface Elevation 332.00 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 39.00 ' Sump Length 0 '

Top of Casing Elevation 334.62 ' Stickup 2.62 '

Depth to Water: 1. Ft. btoc 31.00 (2016-10-24) 2. Ft. btoc 0.00 ( )

Drilling Company Cascade Drilling, LLC Driller Jagaedy Maples

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
332.00	0				No laboratory samples collected.	0-5	NO RECOVERY: Previously excavated for sub-surface clearance activities.
330							CLAYEY SILTY SAND: Very pale brown (10 YR 7/3) with light brown (7.5 YR 6/3); damp; very fine grained; loose; slight plasticity; friable; occasional iron oxide staining; trace gypsum crystals. At 7.5' bgs: Partly cemented silty to sandy clay pieces (>4.5 tsf). At 8' bgs: Increasing clay content with depth.
	5			0.5-1.5		5-8.5	SILTY SANDY CLAY: Brown (7.5 YR 4/3); damp; medium stiff to stiff; medium plasticity; friable; minor iron oxide staining; abundant light brown, very fine grained sand to silt stringers; trace yellow silt stringers. At 10' bgs: Partially cemented silty clay pieces; trace iron oxide staining; occasional yellow silt stringers. At 10.5' bgs: Dark reddish brown color band (0.5' thick); moist; soft. At 11' bgs: Damp, medium stiff; low plasticity; increasing sand content with depth; abundant yellow silt stringers.
325				1.0-1.5 3.0		8.5-12.5	
	10			0.5 3.0-3.5			SANDY CLAY: Brown (7.5 YR 4/3); damp; very stiff; medium plasticity; sand content very fine grained; occasional silt content; occasional iron oxide staining; occasional light brown and yellow silt stringers. At 14' bgs: Dark reddish brown silty clay lens (<0.1" thick). At 14.5' bgs: Dark reddish brown silty clay lens (<0.1" thick). At 14.75' bgs: Dark reddish brown mottling. At 15' bgs: Soft; low plasticity; increasing sand and silt content with depth; minor partially cemented sandy clay pieces; abundant iron oxide staining; abundant yellow silt stringers.
320				>4.5		12.5-16	
	15			0.5 2.0-2.5		16-21.5	SILTY CLAY: Brown (7.5 YR 4/3) with occasional dark reddish brown and minor light brown mottling; damp; medium stiff; low to medium plasticity; minor iron oxide staining; abundant tan, silt to very fine grained sand stringers. At 16.5' bgs: Minor yellow silt stringers to 17' bgs. At 16.75' bgs: Black vertical and horizontal laminated silt stringers to 17' bgs. At 17' bgs: Soil core breaks along planar surfaces to 18' bgs. At 17.5' bgs: Decreasing sand content with depth; minor dark reddish brown silt stringers. At 18' bgs: Color change to reddish brown (2.5 YR 4/4); medium stiff to stiff; medium plasticity; trace very fine grained sand content; trace iron oxide staining; occasional yellow silt stringers. At 19.5' bgs: Minor gypsum crystals.
315				4.0->4.5 2.5-3.5			
	20						

Environmental Resources Management

SP-34
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-34 Date Drilled 2016-10-19

Project Additional Ash Pile Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 55.00 ' Boring Diam. 2.00 "

N. Coord. 13440938.26 ' E. Coord. 2135661.23 ' Surface Elevation 332.00 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 39.00 ' Sump Length 0 '

Top of Casing Elevation 334.62 ' Stickup 2.62 '

Depth to Water: 1. Ft. btoc 31.00 (2016-10-24) 2. Ft. btoc 0.00 ( )

Drilling Company Cascade Drilling, LLC Driller Jagaedy Maples

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
							At 20' bgs: Minor very fine grained sand content; friable; minor iron oxide staining; minor yellow silt stringers.
	20			2.0			CLAY: Brown (7.5 YR 4/3); damp; very stiff; very high plasticity (fat); trace silt content to 22' bgs; occasional yellow silt stringers.
							At 21.5' bgs: Abundant iron oxide staining; occasional gypsum crystals.
							At 22.25' bgs: Diagonally laminated gypsum seam (0.2" thick) to 22.5' bgs.
310				>4.5		21.5-26.5	At 22.5' bgs: No iron oxide staining or gypsum crystals.
							At 22.75' bgs: Gypsum crystals (0.2" thick).
							At 23.5' bgs: Color change to light brownish grey (10 YR 6/2).
							At 23.5' bgs: Friable.
	25			3.0-4.5			CLAYEY SILTY SAND TO SANDY SILTY CLAY: Light yellow brown (2.5 Y 6/3); damp; sand content very fine grained; loose; low to slight plasticity; minor iron oxide staining; trace reddish brown silt stringers; minor gypsum crystal seams (<0.1" thick).
							At 27.5' bgs: Trace to minor yellow silt stringers; occasional partially cemented silty clay pieces to 29.5' bgs.
305				0.5-1.0		26.5-29.5	CLAYEY SAND: Yellowish brown (10 YR 5/4); damp; very fine grained; loose; slight plasticity; occasional silt content; occasional partially cemented sandy to silty clay pieces (>4.5 tsf); abundant tan silt stringers; minor brown clay stringers.
							At 30' bgs: Decreasing clay content with depth.
							At 31' bgs: Minor reddish brown silt stringers; occasional gypsum seams (0.1"-0.2" thick) with loose crystals.
							At 31.5' bgs: Increasing clay content with depth.
	30			0.0		29.5-32	SILTY CLAY: Yellowish brown (10 YR 5/4); moist; loose to medium stiff; low to medium plasticity; occasional very fine grained sand content; minor light brown silt stringers; abundant gypsum crystal inclusions.
300				1.5		32-32.5	SILTY CLAY: Dark reddish brown (5 YR 3/3); damp; very stiff; medium to high plasticity; trace very fine grained sand content; abundant iron oxide staining; minor light brown and trace yellow silt stringers.
				>4.5		32.5-37	At 33' bgs: Trace gypsum inclusions (0.2"-0.4" thick).
							At 34.25' bgs: Black (Gley-1 N 2.5), high plasticity layer to 34.75' bgs; no iron oxide staining; occasional bluish grey silt stringers; trace gypsum crystals.
							At 35' bgs: Black, medium plasticity layer to 35.75' bgs; occasional bluish grey silt stringers.
	35						At 35.75' bgs: Color change to dusky red (2.5 YR 3/2); gypsum seams (0.2" thick).
							At 36.25' bgs: Color change to Brown (7.5 YR 4/3); moist; medium stiff to stiff; minor very fine grained sand content; abundant iron oxide staining; occasional gypsum crystals.
				3.25			
295				0.0		37-38.5	CLAYEY SILTY SAND: Light olive brown (2.5 Y 4/3); moist to very moist; very fine grained; sub-angular; loose; slight plasticity; decreasing clay content with depth; occasional iron oxide staining. Top of Transmissive Sand Unit.
							At 37.5' bgs: Occasional tan silt to very fine grained sand stringers.
						38.5-42.5	At 38' bgs: Occasional thin, dark reddish brown silt lenses.
	40						SILTY SAND: Olive (5 Y 5/3); wet; very fine grained; sub-angular; loose; slight plasticity to non-plastic; trace clay content (decreases with depth); trace iron oxide staining; trace yellow silt stringers.

Environmental Resources Management

SP-34
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-34 Date Drilled 2016-10-19

Project Additional Ash Pile Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 55.00 ' Boring Diam. 2.00 "

N. Coord. 13440938.26 ' E. Coord. 2135661.23 ' Surface Elevation 332.00 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 10.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 39.00 ' Sump Length 0 '

Top of Casing Elevation 334.62 ' Stickup 2.62 '

Depth to Water: 1. Ft. btoc 31.00 (2016-10-24) 2. Ft. btoc 0.00 ( )

Drilling Company Cascade Drilling, LLC Driller Jagaedy Maples

Drilling Method Sonic Drilling Log By Nick Houtchens

SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B

Elevation (Feet)	Depth (Feet)	Graphic Log	Well Construction	Penetrometer (TSF)	Lab Sample Data	Description Interval (Feet)	Description/Soil Classification (Color, Texture, Structure)
	40						At 40' bgs: No yellow silt stringers.
				1.0-1.5			At 41' bgs: Medium dense.
290							At 42' bgs: Minor clay content.
				0.0		42.5-45.5	SAND: Olive (5 Y 5/3); wet; very fine grained; sub-round; well sorted; loose; non-plastic; trace silt content; minor iron oxide staining.
							At 43.5' bgs: Trace iron oxide staining to 45.5' bgs.
	45						At 44.5' bgs: Increasing silt content with depth.
				0.0-0.5		45.5-47.75	SILTY SAND: Olive (5 Y 5/3); wet, very fine grained; loose; slight plasticity; trace clay content; minor iron oxide staining.
285							At 46.5' bgs: Occasional reddish brown silt stringers.
				1.5-1.75		47.75-49.5	CLAYEY SILTY SAND: Light olive brown (2.5 Y 5/3); wet; very fine grained; medium dense; low plasticity; increasing clay content with depth; abundant iron oxide staining; trace reddish brown silt stringers.
				3.25-3.5		49.5-50	SANDY CLAY: Light olive brown (2.5 Y 5/3) with minor dark red brown mottling; moist to damp; stiff; medium plasticity; sand content very fine grained; occasional silt content; abundant iron oxide staining; abundant light brown silt to very fine grained sand stringers; minor yellow silt stringers; minor gypsum crystals.
	50			4.5		50-51.5	
280				>4.5		51.5-55	SILTY CLAY: Greenish black (Gley-1 5GY 2.5/1); damp; stiff; high plasticity; intermixed with dark greenish grey (Gley-1 10GY 4/1) silty sand. Top of Basal Clay Unit.
							At 50.5' bgs: Very stiff; occasional grey silt stringers.
							At 51' bgs: Occasional thin gypsum seams (0.1" thick).
	55						CLAY: Greenish black (Gley-1 5GY 2.5/1); damp; very stiff; very high plasticity (fat); trace silt content; abundant light grey to grey silt stringers; trace gypsum seams (<0.1" thick).
275							T.D. = 55.00 '
	60						

Environmental Resources Management

SP-33
DRILLING LOG

Proj. No. 0322807 Boring/Well ID SP-33 Date Drilled 2016-10-18

Project Additional Ash Pile Installation Owner San Miguel Electric Cooperative, Inc.

Location Christine, TX Boring T.D. 39.00 ' Boring Diam. 6.00 "

N. Coord. 13441030.47 ' E. Coord. 2135343.93 ' Surface Elevation 327.36 ' Ft. MSL Datum

Screen: Type Sch. 40 PVC Diam. 2.00 " Length 5.00 ' Slot Size 0.01 "

Casing: Type Sch. 40 PVC Diam. 2.00 " Length 24.00 ' Sump Length 0 '

Top of Casing Elevation 329.96 ' Stickup 2.60 '

Depth to Water: 1. Ft. btoc 22.55 (2016-10-26) 2. Ft. btoc 0.00 ( )

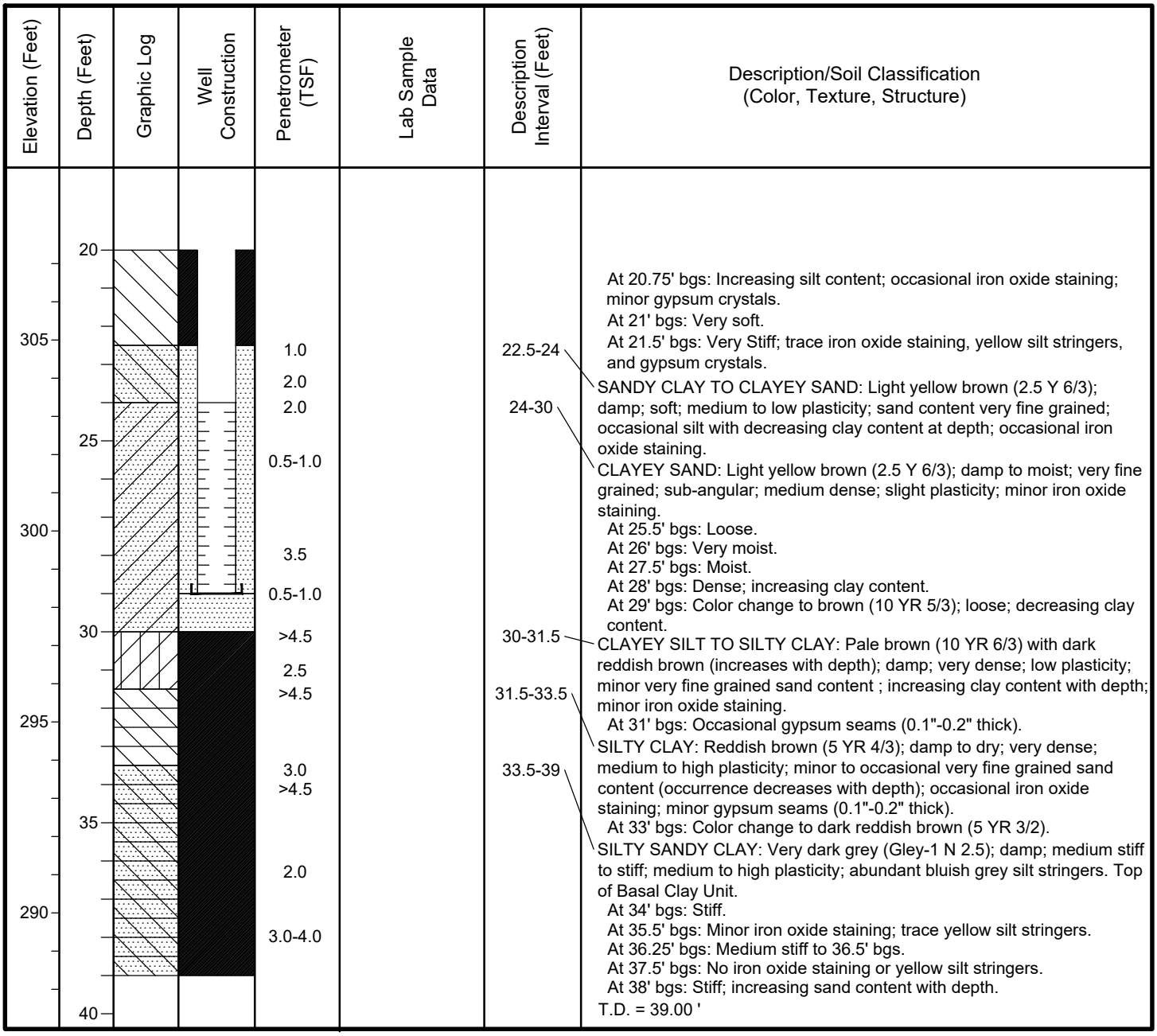
Drilling Company Cascade Drilling, LLC Driller Jagaedy Maples

Drilling Method Sonic Drilling Log By Nick Houtchens

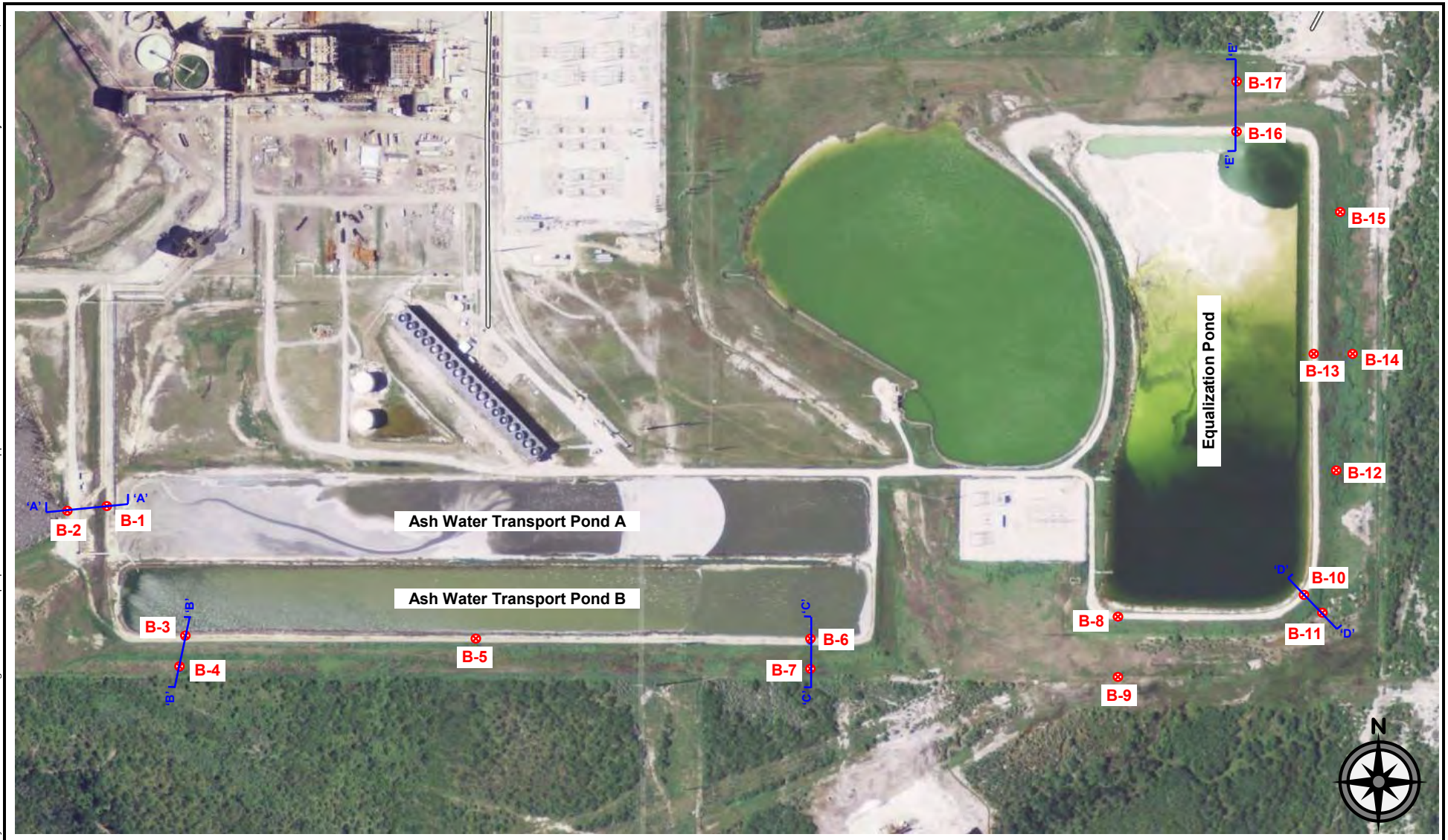
SKETCH MAP

NOTES

COORDINATES IN TEXAS SOUTH CENTRAL STATE PLANE 4204 ORTHO HGT NAVD88 COMPUTED USING GEOID12B



APPENDIX E ARIAS BORING LOGS



ARIAS & ASSOCIATES, INC.
Geotechnical • Environmental • Testing
TBPE Registration No. F-32

142 Chula Vista
San Antonio, Texas 78232
Office: (210) 308-5884 Fax: (210) 308-5886

BORING LOCATION PLAN

Ash Transport Water Pond and Equalization Pond
Stability Analyses at San Miguel Lignite Mine
Atascosa County, Texas

Date: October 22, 2012	Job No.: 2012-695
Drawn By: TAS	Checked By: GRA
Approved By: DB	Scale: N.T.S.

Appendix C

Boring Log No. B-1

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/24/12
Elevation: 315 ft (Estimated)
Coordinates: N: 13438995.96 E: 2135464.98
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Silty GRAVEL (GM) with sand, dense, gray and brown		SS	29	24	47	23		28	
FILL: LEAN CLAY (CL) with sand, stiff to very stiff, gray and brown, trace of gypsum, mottled		SS	30					14	
	5	SS	33	28	67	39		23	
FAT CLAY (CH), very stiff to hard, gray to dark brown, with considerable gypsum seams		SS	33					25	
- light brown an dgray below 8 ft.		T	33	35	57	22	1.75		
	10								
- seepage along gypsum seam at 10 ft.		T	31	37	56	19	1.5		
	15	T							
	20	SS	38					32	
LEAN CLAY (CL), hard, gray and brown, with thin gypsum seams									
- considerable iron oxide material below 24 ft.	25	SS	20	20	42	22		82	
SILTY Fine SAND (SM), very dense, gray and brown		SS						**50/1"	
	30								
	35	SS	24					**50/6"	33
		SS	23					**50/6"	
Borehole terminated at 39 feet									

Groundwater Data:
First encountered during drilling: 9.5-ft depth
After 60 hours: 9.6-ft depth (26.3-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 39 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-2

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 303 ft (Estimated)
Coordinates: N: 13438985.27 E: 2135331.45
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)		SN	WC	PL	LL	PI	PP	N	-200
FILL: Silty GRAVEL (GM) with sand, medium dense, light gray and brown			SS	26					74	
LIGNITE Material, hard, dark brown and black										
FILL: GRAVELLY FAT CLAY (CH) with sand, very stiff, gray and brown			SS	24	21	53	32		28	
FAT CLAY (CH), very stiff to hard, gray and brown, with gypsum and silt seams	5		SS	33					36	
			SS	31	25	63	38		21	
			T	25	21	54	33	2.25		
- sandy with oxide staining below 10 ft.	10		T	24				5.0		
SILTY Fine SAND (SM), very dense, gray and brown		▼								
	15		SS	23					86/12"	32
		▽								
	20		SS	26					72	32
			SS	24					50/5"	31

Borehole terminated at 24.4 feet

Groundwater Data:
First encountered during drilling: 17-ft depth
After 48 hours: 13.4-ft depth (17.8-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 24.4 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-3

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/24/12
Elevation: 314 ft (Estimated)
Coordinates: N: 13438572.89 E: 2135716.20
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)		SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH), very stiff, gray and brown, mottled, trace sand, trace gravel			SS	30					19	
			SS	34	26	64	38		16	
	5		SS	29					22	
FILL: LEAN CLAY (CL), very stiff to hard, gray and brown, mottled, trace fine sand			SS	25	22	49	27		21	
	10		SS	21					28	
			T	26	18	46	28	4.0		
	15		T	30				2.75		
FILL: FAT CLAY (CH), very stiff, dark gray and brown, mottled			T	28	21	62	41	2.75		
	20									
	25		T	28	23	66	43	3.0		
FAT CLAY (CH), very stiff, gray and brown, with gypsum										
	30		T	38				3.0		
SILTY Fine SAND (SM), very dense, gray and brown, with yellow stains			SS	23					**50/5"	24
	35									
	40		SS	27					**50/5"	
SANDY SILT (ML), very dense, gray and brown										
- iron oxide lenses below 43 ft.	45		SS	22					50/5"	51
			SS	27					50/4"	
	50									
SANDY FAT CLAY (CH), dense to very dense, dark gray, with gypsum seams	55		SS	25	19	50	32		75	
			SS	26	22	77	55		44	
	60									
Borehole terminated at 60 feet										

Groundwater Data:
First encountered during drilling: 33-ft depth
After 60 hours: 34.3-ft depth (47-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 60 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Boring Log No. B-4

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 289 ft (Estimated)
Coordinates: N: 13438471.89 E: 2135716.65
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	N	-200
SANDY LEAN CLAY (CL), very stiff to hard, gray and dark brown		SS	9				32	
		SS	7	16	45	29	22	
SILTY SAND (SM), loose to medium dense, light gray and brown	5	SS	7				8	
		SS	14				15	20
- very dense below 9 ft.	10	SS	22	24	25	1	51	
		SS	24				**50/6"	
	15	SS	31				**50/6"	17
	20	SS	33				81	
	25	SS	25				**50/6"	31
	30	SS	27				50/4"	
SANDY FAT CLAY (CH), hard, gray	35	SS	29	19	54	35	51	
Borehole terminated at 35 feet								

Groundwater Data:
First encountered during drilling: 12-ft depth
After 48 hours: 11.3-ft depth (18-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 35 ft

Nomenclature Used on Boring Log

Split Spoon (SS)

Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
N = SPT Blow Count

** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-5

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 314 ft (Estimated)
Coordinates: N: 13438062.07 E: 2136671.33
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)		SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH) with sand, stiff to hard, gray and brown, mottled, trace gypsum			SS	29	29	87	58		23	
			SS	32					26	
	5		T	36	28	72	44	2.5		
			T	21				4.0		
			T	27	28	60	32	4.0		
	10		T	28				5.5		
- trace of fine gravel from 12 ft. to 13 ft. - dark gray and brown below 13 ft.										
	15		T	32	29	61	32	1.25		
FAT CLAY (CH), gray and brown, with iron oxide staining adn gypsum			T	28				5.75		
	20									
- brown below 23 ft.										
SILTY SAND (SM), very dense, gray and brown, with yellow stains	25		SS	31					65	52
FAT CLAY (CH), hard, gray and brown, with gypsum seams										
	30		SS	37	36	102	66		43	
	35	▽	SS	32					52	
SILTY Fine SAND (SM), very dense, gray and brown			SS	22					50/4"	29
Borehole terminated at 39.3 feet										

Groundwater Data:
First encountered during drilling: 37.5-ft depth (23.2-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 39.3 ft

Nomenclature Used on Boring Log

Split Spoon (SS) | Thin-walled tube (T) | ▽ Water encountered during drilling

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-6

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/24/12
Elevation: 315 ft (Estimated)
Coordinates: N: 13438561.88 E: 2137764.40
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH), very stiff, gray and brown, with mottling, sand seams, some dark brown layers		SS	18					29	
		SS	24	29	83	54		21	
	5	SS	34					21	
		SS	29	28	81	53		21	
	10	SS	24					22	
		SS	30					19	
	15	T	29	28	84	56	2.75		
	20	T	32				2.75		
	25	T	27				2.25		
FAT CLAY (CH), hard, dark gray									
	30	T							
- gray and brown below 30 ft.									
- sand seams 33 ft. to 38 ft.	35	T	26	26	70	44	4.0		
- gypsum seams below 38 ft.	40	SS	41					33	
	45	SS		29	97	68		51	
- lignite seam at 49 ft.	50	SS						50/5"	
SILTY SAND (SM), very dense, gray to dark gray	55	SS						**50/2"	
	60	SS						**50/3"	17
SANDY SILT (ML), very dense, gray to dark gray		SS						50/3"	50
Borehole terminated at 64.3 feet									

Groundwater Data:
First encountered during drilling: 51.5-ft depth
After 60 hours: 32.8-ft depth (49.6-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 64.3 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-7

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 289 ft (Estimated)
Coordinates: N: 13438470.98 E: 2137764.82
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH) with sand, stiff to very stiff, dark gray and brown, with mottling and organics		SS	20					18	
		SS	17					14	
SANDY FAT CLAY (CH), hard, light gray and brown, with sand layers	5	SS	25	28	70	42		50	
- less sand below 7 ft.		SS	23					56	
	10	SS	32	19	90	71		57	
- with gypsum below 10 ft.		SS	33					58	
	15	SS	40	35	109	74		22	
FAT CLAY (CH), very stiff, gray, with gypsum seams		T							
	20								
CLAYEY SAND (SC), hard, gray and brown		T	20				5.0		
	25								
		SS						**50/3"	
SILTY SAND (SM), very dense, gray	30								
		SS	27					**50/3"	13

Borehole terminated at 33.8 feet

Groundwater Data:
First encountered during drilling: 23-ft depth
After 48 hours: 13.3-ft depth (21.9-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 33.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-8

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 293 ft (Estimated)
Coordinates: N: 13438637.13 E: 2138770.33
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: FAT CLAY (CH), stiff to very stiff, light gray to dark brown, some mottling		SS	21	28	65	37		26	
		SS	32					14	
	5	SS	27	25	69	44		18	
		SS	30					14	
	10	SS	30	25	74	49		13	
		SS	35					15	
	15	T	38	27	74	47	2.75		
▼	20	T	36				2.75		
FAT CLAY (CH), very stiff to hard, brown to dark brown	25	T	26	19	58	39	2.25		
- with sand from 28 ft. to 33 ft.	30	T	19				4.75		
▽ - brown and gray below 33 ft.	35	T	34	23	65	42	2.5		
CLAYEY Fine SAND (SC), very dense, light gray to brown	40	T	22				5.0		
SILTY SAND (SM), very dense, dark gray		SS	27					**50/5"	15
Borehole terminated at 43.9 feet									

Groundwater Data:
First encountered during drilling: 32.5-ft depth
After 120 hours: 18.6-ft depth (26.3-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 43.9 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
▽ Water encountered during drilling
▼ Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-9

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/25/12
Elevation: 276 ft (Estimated)
Coordinates: N: 13438445.24 E: 2138771.20
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAYEY SAND (SC), dense, dark brown, with white calcite		SS	13					17	
FAT CLAY (CH), stiff, black, trace organics		SS	27	21	65	44		14	
	5	SS	21					14	
SANDY LEAN CLAY (CL), very stiff, dark gray, trace organics		SS	24	13	39	26		16	
	10	SS	20					19	56
		SS	20					25	
FAT CLAY (CH), stiff to hard, light gray and brown, with gypsum	15	T	40	32	109	77	1.5		
- sandy below 19 ft.	20	T	27				4.25		

Borehole terminated at 20 feet

Groundwater Data:
During drilling: Not encountered
After 48 hours: 6.7-ft depth (8.3-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 20 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-10

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 293 ft (Estimated)
Coordinates: N: 13438710.59 E: 2139375.54
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Poorly-graded GRAVEL with Sand (GP), dense, light gray and brown		SS	29					25	
FILL: FAT CLAY (CH), stiff to very stiff, light gray and brown, with mottling		SS	36	29	67	38		18	
- gray and brown from 4 ft. to 13 ft.	5	SS	33					23	
		SS	26					24	
	10	SS	30	32	86	54		17	
		SS	33					19	
- gray to dark brown below 13 ft.	15	T	36	25	84	59	1.75		
	20	T	33				1.5		
LEAN CLAY (CL), stiff, gray	25	T							
	30	T	25	18	49	31	1.5		
		T	20				1.75		
Fine SAND (SP), dense, gray to brown	35								
FAT CLAY (CH), hard, gray to brown, with gypsum	40	SS	25	24	72	48		43	
CLAYEY Fine SAND (SC), very dense, gray	45	SS	20					50/5"	
SILTY Fine SAND (SM), very dense, gray	50	SS	24					**50/4"	
		SS	28					**50/3"	14
Borehole terminated at 53.8 feet									

Groundwater Data:
First encountered during drilling: 18.4-ft depth
After 120 hours: 18.1-ft depth (25.2-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 53.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-11

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 273 ft (Estimated)
Coordinates: N: 13438650.27 E: 2139438.15
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FAT CLAY (CH), stiff, dark brown - trace organics to 4 ft.		SS	25	21	65	44		9	
		SS	27					10	
- gray and brown below 5 ft.	5	T	33	22	57	35	1.75		
		T	32				1.75		
		T	30				1.75		
	10	T	25	21	56	35	1.75		
	15	T	25	32	77	45	1.5		
CLAYEY Fine SAND (SC), medium dense to very dense, light gray and brown									
	20	SS	22					32	
	25	SS	28	20	45	25		22	
SILTY SAND (SM), very dense, gray									
		SS	25					**50/6"	19
Borehole terminated at 29 feet									

Groundwater Data:
During drilling: Not encountered
After 120 hours: 1.8-ft depth (1.9-ft open borehole depth)
Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 29 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-12

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/21/12
Elevation: 274 ft (Estimated)
Coordinates: N: 13439115.06 E: 2139480.55
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N
FILL: FAT CLAY (CH), hard, dark brown, trace organics		SS	31					27
		T	18	17	50	33	9.0	
	5	T	17				7.75	
LEAN CLAY with Sand (CL), stiff to hard, dark brown		T	20	17	29	12	3.0	
		T	20				2.0	
	10	T	20				1.25	
	15	SS	19	19	39	20		29
- less sand, light gray and brown below 15 ft.								
	20	SS	21	17	42	25		36
- some gypsum seams below 23 ft.								
	25	SS	26					31
Borehole terminated at 25 feet								

Groundwater Data:
First encountered during drilling: 14-ft depth
After 120 hours: 6-ft depth (9.8-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 25 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count

2012-695.GPJ 10/22/12 (BORING LOG SA12-01,ARIASSA12-01.GDT,LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-13

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/19/12
Elevation: 294 ft (Estimated)
Coordinates: N: 13439498.52 E: 2139407.56
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Poorly-graded SAND (SP) with gravel, medium dense, light gray and brown		SS	23					20	
FILL: FAT CLAY (CH) with sand, very stiff, gray and brown, mottled		SS	34					24	
	5	SS	36	30	71	41		21	
- less sand, dark gray and brown below 6 ft.		SS	25					17	
	10	SS	32	24	66	42		17	
		SS	33					20	
	15	SS	37	25	81	56		24	
	20	T	32	21	68	47	1.5		
- very stiff to hard below 23 ft.		T	26				3.5		
	25								
FAT CLAY (CH), very stiff to hard, dark gray and brown	30	T	27	24	75	51	4.25		
		T	22				2.25		
	35								
- gray and brown below 35 ft.		T	28	20	57	37	4.0		
	40								
- considerable gypsum below 40 ft.									
Poorly-graded Fine SAND (SP), very dense, light gray and brown, with lignite seam and sandy silt seams		SS	26					50/4"	
	45								
SANDY LEAN CLAY (CL), hard, light gray and brown									
		SS	30					**50/4"	56
Borehole terminated at 48.8 feet									

Groundwater Data:
First encountered during drilling: 44-ft depth
After 144 hours: 23.7-ft depth (28.8-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 48.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-14

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/26/12
Elevation: 273 ft (Estimated)
Coordinates: N: 13439499.09 E: 2139532.23
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)		SN	WC	PL	LL	PI	PP	N	-200
FAT CLAY (CH), medium stiff to very stiff, dark brown - trace organics to 4 ft.			SS	18					16	
			SS	19					12	
	5		T	26	16	50	34	1.0		
- gray with some calcite below 6 ft.			T	27				2.25		
- brown below 8 ft.			T	16	19	62	43	1.75		
	10		T	28				1.25		
SANDY LEAN CLAY (CL), stiff, light gray and brown	15		T	25	16	35	19	1.5		
CLAYEY SAND (SC), medium dense, light gray and brown	20		SS	19					46	43
SANDY LEAN CLAY (CL), hard, dark gray and brown										
- thin lignite lense at 24 ft.	25		SS	21	15	45	30		64	

Borehole terminated at 25 feet

Groundwater Data:
First encountered during drilling: 6-ft depth
After 24 hours: 7-ft depth (11.2-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 25 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

N = SPT Blow Count
-200 = % Passing #200 Sieve

Boring Log No. B-15

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/26/12
Elevation: 273 ft (Estimated)
Coordinates: N: 13439963.51 E: 2139494.49
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N
FAT CLAY (CH), medium stiff to very stiff, dark brown - trace organics to 2 ft.		SS	16					24
		SS	29					13
	5	T	26	19	58	39	1.5	
- gray and brown below 6 ft.		T	29				1.25	
		T	29	19	61	42	2.0	
	10							
- sandy from 10 ft. to 12 ft.		T	31				1.0	
	15	T	31	19	54	35	1.0	
SANDY FAT CLAY (CH), very stiff, light gray and brown								
	20	SS	21					18
	25	SS	21	18	52	34		30
Borehole terminated at 25 feet								

Groundwater Data:
First encountered during drilling: 19-ft depth
After 24 hours: 4.8-ft depth (21.3-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 25 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-16

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/19/12
Elevation: 294 ft (Estimated)
Coordinates: N: 13440224.56 E: 2139154.93
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FILL: Poorly-graded Fine or Coarse SAND (SP) with gravel, medium dense, light gray and brown, some clay pockets		SS	30					19	
FILL: FAT CLAY (CH), very stiff, dark gray, gray and brown mottling, with sandy clay pockets		SS	28					21	
	5	SS	30					20	
		SS	29	23	69	46		23	
	10	SS	35					21	
		SS	37	27	76	49		21	
	15	SS	33					22	
	20	SS	27					21	
FAT CLAY (CH), medium stiff to very stiff, light gray and brown	25	T	37	24	69	45	1.0		
	30	T	36				3.0		
- gypsum seams below 33 ft.	35	T	34	26	118	92	3.25		
	40	T	35				3.5		
SILTY Fine SAND (SM), very dense, gray and brown	45	SS	32					**50/6"	19
	50	SS	30					**50/4"	
	55	SS	29					**50/6"	21
		SS	28					**50/6"	
Borehole terminated at 59 feet									

Groundwater Data:
First encountered during drilling: 42.5-ft depth
After 144 hours: 20.8-ft depth (24.8-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 59 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

Boring Log No. B-17

Project: **Ash Water Transport Pond & Equalization Pond Stability Analyses at San Miguel Lignite Mine Christine, Texas**

Location: See Boring Location Plan

Sampling Date: 9/26/12
Elevation: 273 ft (Estimated)
Coordinates: N: 13440386.15 E: 2139154.19
Backfill: Cement-bentonite grout

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
FAT CLAY (CH), medium stiff to very stiff, gray and brown - trace organics to 4 ft.		SS	17					21	
		SS	19					16	
	5	SS	40	27	82	55		13	
		T	38				1.0		
		T	34				1.5		
	10	T	33	25	74	49	2.25		
- some gypsum below 13 ft.	15	T	31				3.25		
		T	22				2.75		
	20								
SANDY LEAN CLAY (CL), medium stiff, gray and brown		T	25	24	36	12	0.75		
	25								
SILTY SAND (SM), very dense, gray and brown		SS	26					**50/4"	19
Borehole terminated at 28.8 feet									

Groundwater Data:
First encountered during drilling: 24-ft depth
After 24 hours: 5.2-ft depth (23-ft open borehole depth)

Field Drilling Data:
Coordinates: Survey
Logged By: J. Kniffen
Driller: Eagle Drilling, Inc.
Equipment: Truck-mounted drill rig

Single flight auger: 0 - 28.8 ft

Nomenclature Used on Boring Log

Split Spoon (SS)
Thin-walled tube (T)
Water encountered during drilling
Delayed water reading

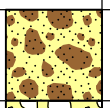
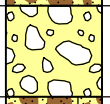
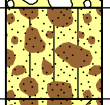
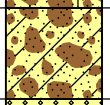
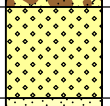
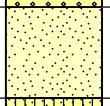
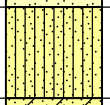
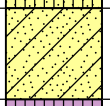
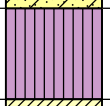
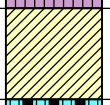
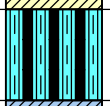
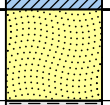
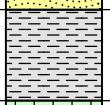
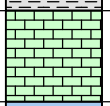
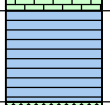
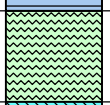
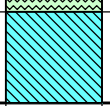
WC = Water Content (%)
PL = Plastic Limit
LL = Liquid Limit
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
N = SPT Blow Count
** = Blow Counts During Seating Penetration
-200 = % Passing #200 Sieve

2012-695.GPJ 10/22/12 (BORING LOG SA12-01.ARIASSA12-01.GDT.LIBRARY2012.GLB)

Arias & Associates, Inc.

Job No.: 2012-695

KEY TO CLASSIFICATION SYMBOLS USED ON BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS		DESCRIPTIONS
COARSE-GRAINED SOILS (More Than Half of Material LARGER Than No. 200 Sieve size)	GRAVELS (More Than Half of Coarse Fraction is LARGER Than No. 4 Sieve Size)	Clean Gravels (Little or no Fines)	GW		Well-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
			GP		Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or no Fines
		Gravels With Fines (Appreciable Amount of Fines)	GM		Silty Gravels, Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS (More Than Half of Coarse Fraction is SMALLER Than No. 4 Sieve Size)	Clean Sands (Little or no Fines)	SW		Well-Graded Sands, Gravelly Sands, Little or no Fines
			SP		Poorly-Graded Sands, Gravelly Sands, Little or no Fines
		Sands With Fines (Appreciable Amount of Fines)	SM		Silty Sands, Sand-Silt Mixtures
			SC		Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS (More Than Half of Material is SMALLER Than No. 200 Sieve Size)	SILTS & CLAYS	Liquid Limit Less Than 50	ML		Inorganic Silts & Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
	SILTS & CLAYS	Liquid Limit Greater Than 50	MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils, Elastic Silts
			CH		Inorganic Clays of High Plasticity, Fat Clays
FORMATIONAL MATERIALS	SANDSTONE				Massive Sandstones, Sandstones with Gravel Clasts
	MARLSTONE				Indurated Argillaceous Limestones
	LIMESTONE				Massive or Weakly Bedded Limestones
	CLAYSTONE				Mudstone or Massive Claystones
	CHALK				Massive or Poorly Bedded Chalk Deposits
	MARINE CLAYS				Cretaceous Clay Deposits
	GROUNDWATER			▼	Indicates Final Observed Groundwater Level
				▽	Indicates Initial Observed Groundwater Location

Arias & Associates, Inc.