COAL COMBUSTION RESIDUAL RULE
GROUNDWATER MONITORING SYSTEM CERTIFICATION

SANDOW 5 GENERATING PLANT
AX LANDFILL
ROCKDALE, TEXAS

OCTOBER 16, 2017

Prepared For:

Luminant Generation Company, LLC
6555 Sierra Drive
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Prepared By:

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Texas Engineering Firm No. 4760

October 16, 2017

PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Pastor, Behling & Wheeler, LLC 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 groundwater monitoring system installed at the referenced facility has been designed and constructed to meet the requirements of Section 257.91 of the CCR Rule.

Patrick J. Behling, P.E.
Principal Engineer
PASTOR, BEHLING & WHEELER, LLC

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) operates the Sandow 5 Generating Plant (Sandow) located approximately 7 miles southwest of Rockdale in Milam County, Texas. Unit No. 5 is an approximately 581-megawatt, lignite-fired electric generation unit that was placed into service in 2009. Coal Combustion Residuals (CCRs) including fly ash and bed ash are generated as part of Unit No. 5 operation. CCR material is currently managed in the AX Landfill (the Site) located approximately 7,500 feet south of Unit No. 5 on former mined land that is part of the Sandow Lignite Mine (Figure 1). Disposal of CCRs in the AX Landfill began in May 2015.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by the EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule was October 19, 2015.

The CCR Rule establishes national minimum criteria for existing and new CCR landfills, existing and new CCR surface impoundments, and lateral expansions to landfills/impoundments. Pastor, Behling & Wheeler, LLC (PBW) was retained by Luminant to evaluate and certify that the groundwater monitoring system at the Site has been designed and constructed to meet the requirements in Section 257.91 of the CCR Rule.

1.1 Sandow 5 Units Subject to Groundwater Monitoring System Requirements

The AX Landfill is the only waste management unit associated with Sandow 5 that meets the definition of a CCR landfill. AX Landfill Cells 1, 2, and 2A are collectively considered an “existing landfill” under 40 CFR 257.53.

This groundwater monitoring system evaluation and certification was prepared for the AX Landfill, which includes Cells 1, 2, and 2A.

1.2 Description of AX Landfill Cells 1, 2, and 2A

The AX Landfill consists of Cells 1, 2, and 2A and covers an area of approximately 169 acres. The AX Landfill is located approximately 7,500 feet south of Sandow 5 on reclaimed mine land that is leased by Luminant from Alcoa (Figure 2). The landfill is used to manage fly ash and bed ash generated from Unit No. 5. Fly ash and bed ash are transported to the landfill in trucks and placed in the landfill as dry material.

AX Landfill Cells 1, 2, and 2A are lined landfill cells. Construction of Cell 1 was completed in July 2013 and construction of Cells 2 and 2A was initiated in May 2015. Cell 2 was completed in October 2015 and Cell 2A was completed in July 2016. Placement of Unit No. 5 CCR began in Cell 1 in May 2015 and Cell 2 in September 2016. As of the date of this report, CCR has not been placed in Cell 2A.

1.3 CCR Unit Groundwater Monitoring System Requirements

Section 257.91 of the CCR Rule indicates that existing CCR landfills and surface impoundments be provided with a groundwater monitoring system that consists of sufficient wells, installed at appropriate location and depths, to yield groundwater samples from the uppermost aquifer that meet the following criteria:

- Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit; and
- Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary to ensure detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

The specific configuration of the groundwater monitoring system must be determined based on site-specific technical information that must include aquifer thickness, groundwater flow rate, groundwater flow direction (including seasonal and temporal fluctuation in groundwater flow), saturated and unsaturated geologic units and fill materials that overly the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the upmost aquifer, including, but not limited to, thickness, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.

At a minimum, the monitoring system must consist of at least one upgradient and three downgradient monitoring wells, and any additional monitoring wells necessary to accurately represent the quality of the background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.

Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space above the sampling depth must be sealed to prevent contamination of samples and the groundwater. There must be documentation in the operating record of the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified engineer must have access to and must review this documentation as part of the groundwater monitoring system certification.

2.0 GROUNDWATER MONITORING SYSTEM EVALUATION

2.1 AX Landfill Groundwater Monitoring System

The CCR groundwater monitoring well system at the AX Landfill consists of nine monitoring wells (AXMW-1, AXMW-2, AX-23, AX-24, AX-25, AX-26, AX-27, AX-28, and AX-29) that are each screened in the uppermost aquifer at the Site. The locations of the CCR monitoring wells are shown on Figure 2. Well construction information and survey data for the CCR wells are summarized in Table 1, CCR monitoring well logs are presented in Appendix A, and photographs of the CCR wells are presented in Appendix B.

2.2 Local Geology and Hydrogeology

The AX Landfill is located in the former Sandow Lignite Mine, which is located in the outcrop area of the Eocene-aged Wilcox Group (Barnes, 1974). The Wilcox Group in the vicinity of the Site is divided into the Hooper Formation, the Simsboro Formation, and the Calvert Bluff Formation (listed from oldest to youngest). The overburden interval and lignite seams mined at the Sandow Lignite Mine are part of the Calvert Bluff Formation.

The AX Landfill is constructed within overburden spoil material that was previously excavated and backfilled during lignite mining operations at the Sandow Lignite Mine. Geologic cross sections were constructed through the landfill area using lithologic data from new and existing CCR wells and other historical soil borings completed in the AX Landfill area. Cross section locations are presented on Figure 3 and the cross sections are presented on Figures 4, 5, and 6.

Lithologic descriptions from soil borings completed in the spoil material indicate that the spoil consists of a highly heterogeneous mixture of sand, silty and clayey sand, and clay. The mine spoil extends from ground surface to depths ranging from approximately 100 feet below ground surface (bgs) on the northwest side of the AX Landfill to more than 160 feet bgs on the southeast side of the AX Landfill. Native material encountered below the spoil zone generally consisted of lignite or native clay.

The uppermost aquifer at the Site occurs under unconfined conditions within the overburden spoil and extends to the base of the spoil where lignite and/or clay confining units are encountered.

2.3 Groundwater Potentiometric Surface Elevations

Eight background groundwater monitoring events were performed using the AX Landfill CCR monitoring well system from October 2015 to December 2016. Static water levels measured during the background monitoring period indicated water elevations ranging from 383.59 feet above mean sea level (amsl) to 458.55 feet amsl, and depths to water ranging from 23.70 feet bgs to 84.11 feet bgs (Table 2). Groundwater potentiometric surface maps based on data collected during the background monitoring period are presented in Appendix C.

Groundwater elevations were generally highest on the west side of the landfill and lowest on the east side of the landfill, with an inferred groundwater flow direction to the east. An average hydraulic gradient of approximately 0.02 ft/ft in the uppermost aquifer was calculated using the groundwater potentiometric surface maps. Based on the potentiometric surface maps, the location of each CCR monitoring well relative to the AX Landfill is as follows:

Upgradient Wells	Downgradient Wells
AXMW-1	AX-24
AXMW-2	AX-25
AX-23	AX-26
AX-29	AX-27
	AX-28

2.4 Uppermost Aquifer Hydraulic Conductivity Testing

PBW performed slug tests at monitoring wells AXMW-1 and AXMW-2 on October 5, 2015 to evaluate groundwater linear flow velocities of the uppermost aquifer at the Site. Slug test data and time-head change plots used to calculate hydraulic conductivities and transmissivities of the uppermost aquifer are provided in Appendix D. A summary of these hydraulic properties is presented in Table 3.

The average hydraulic conductivities for the test wells ranged from 1.85×10^{-4} cm/sec (well AXMW-1) to 2.96×10^{-4} cm/sec (well AXMW-2), with a geometric mean for the test wells of 2.34×10^{-4} cm/sec.

2.5 Conclusions

The CCR groundwater monitoring well system at the AX Landfill complies with Section 257.91 of the CCR Rule. This conclusion is supported by the following as described in detail in previous sections of this report:

- Nine monitoring wells are included in the CCR groundwater monitoring system – four upgradient monitoring wells and five downgradient monitoring wells.
- Each monitoring well is screened in the uppermost aquifer at the Site. Samples collected from upgradient monitoring wells will be representative of the quality of background groundwater that has not been affected by leakage from the landfill and samples collected from downgradient wells will ensure detection of groundwater contamination in the uppermost aquifer from the landfill.
- The monitoring wells are constructed with appropriate well casing to maintain the integrity of the monitoring well borehole and with slotted well screens to enable collection of groundwater samples. In addition, the annular space above the well screen is appropriately sealed to prevent water from entering the well screen from surface sources.
- Appropriate documentation exists in the owner/operator's operating record concerning the design, installation, and development of the monitoring wells.

3.0 REFERENCES

Barnes, Virgil E., 1974. Geologic Atlas of Texas, Austin Sheet. Texas Bureau of Economic Geology.

Tables

TABLE 1
CCR WELL CONSTRUCTION SUMMARY
SANDOW AX LANDFILL

Well ID	Date Installed	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Screen Length (ft)	Total Design Depth (ft bgs)	Casing Diameter (in)
AX-23	10/15/15	335065	3028456	479.78	482.26	65	85	20	85	4
AX-24	10/15/15	336503	3031537	466.48	468.74	61	81	20	81	2
AX-25	10/16/15	335806	3032212	441.11	443.62	65	75	10	75	2
AX-26	10/14/15	334521	3031007	456.34	458.60	55	75	20	75	2
AX-27	10/14/15	333747	3030177	476.82	479.47	78	98	20	98	4
AX-28	10/13/15	332787	3029656	460.75	463.26	25	45	20	45	2
AX-29	10/13/15	333162	3028622	484.96	487.73	45	65	20	65	2
AXMW-1	11/28/12	336064	3029088	471.88	473.65	33	53	20	53	2
AXMW-2	11/28/12	334057	3028201	480.54	482.25	43	63	20	63	2

Notes:
1. Abbreviations: ft - feet; amsl - above mean sea level; bgs - below ground surface; TOC - top of casing; in - inches.

TABLE 2
GROUNDWATER ELEVATION SUMMARY
SANDOW AX LANDFILL

Well ID	TOC Elevation (ft amsl)	Date	Depth to Water (ft btoc)	Water Elevation (ft amsl)
AXMW-1	473.65	11/03/15	25.75	447.90
		12/17/15	25.67	447.98
		02/08/16	25.82	447.83
		04/25/16	25.55	448.10
		06/15/16	25.60	448.05
		08/09/16	26.52	447.13
		10/05/16	25.77	447.88
		12/22/16	26.31	447.34
AXMW-2	482.25	10/29/15	25.86	456.39
		12/17/15	24.75	457.50
		02/08/16	24.51	457.74
		04/26/16	23.72	458.53
		06/15/16	23.70	458.55
		08/10/16	24.35	457.90
		10/06/16	23.98	458.27
		12/22/16	24.26	457.99
AX-23	482.26	10/29/15	32.23	450.03
		12/17/15	31.60	450.66
		02/08/16	31.15	451.11
		04/26/16	30.26	452.00
		06/15/16	30.13	452.13
		08/09/16	30.49	451.77
		10/05/16	30.21	452.05
		12/21/16	30.08	452.18
AX-24	468.74	10/29/15	67.01	401.73
		12/18/15	66.67	402.07
		02/09/16	64.99	403.75
		04/25/16	60.80	407.94
		06/14/16	57.39	411.35
		08/09/16	53.90	414.84
		10/05/16	51.35	417.39
		12/21/16	48.98	419.76
AX-25	443.62	10/29/15	60.03	383.59
		12/18/15	52.99	390.63
		02/09/16	45.84	397.78
		04/25/16	37.94	405.68
		06/14/16	33.62	410.00
		08/10/16	34.78	408.84
		10/05/16	29.18	414.44
		12/21/16	27.44	416.18
AX-26	458.60	11/03/15	63.71	394.89
		12/17/15	58.04	400.56
		02/08/16	54.21	404.39
		04/25/16	51.15	407.45
		06/14/16	46.30	412.30
		08/10/16	51.84	406.76
		10/06/16	47.41	411.19
		12/22/16	45.50	413.10

TABLE 2
GROUNDWATER ELEVATION SUMMARY
SANDOW AX LANDFILL

Well ID	TOC Elevation (ft amsl)	Date	Depth to Water (ft btoc)	Water Elevation (ft amsl)
AX-27	479.47	11/03/15	77.32	402.15
		12/17/15	76.38	403.09
		02/08/16	75.04	404.43
		04/26/16	72.75	406.72
		06/14/16	71.62	407.85
		08/09/16	70.36	409.11
		10/06/16	69.11	410.36
		12/22/16	67.08	412.39
AX-28	463.26	11/03/15	40.38	422.88
		12/18/15	38.87	424.39
		02/08/16	38.71	424.55
		04/25/16	39.25	424.01
		06/15/16	39.18	424.08
		08/09/16	38.99	424.27
		10/05/16	38.69	424.57
		12/21/16	38.39	424.87
AX-29	487.73	10/29/15	59.10	428.63
		12/17/15	58.96	428.77
		02/08/16	58.56	429.17
		04/26/16	57.46	430.27
		06/14/16	57.02	430.71
		08/10/16	56.66	431.07
		10/06/16	56.13	431.60
		12/21/16	55.39	432.34

Notes:
1. Abbreviations: TOC - top of casing; ft - feet; amsl - above mean sea level.

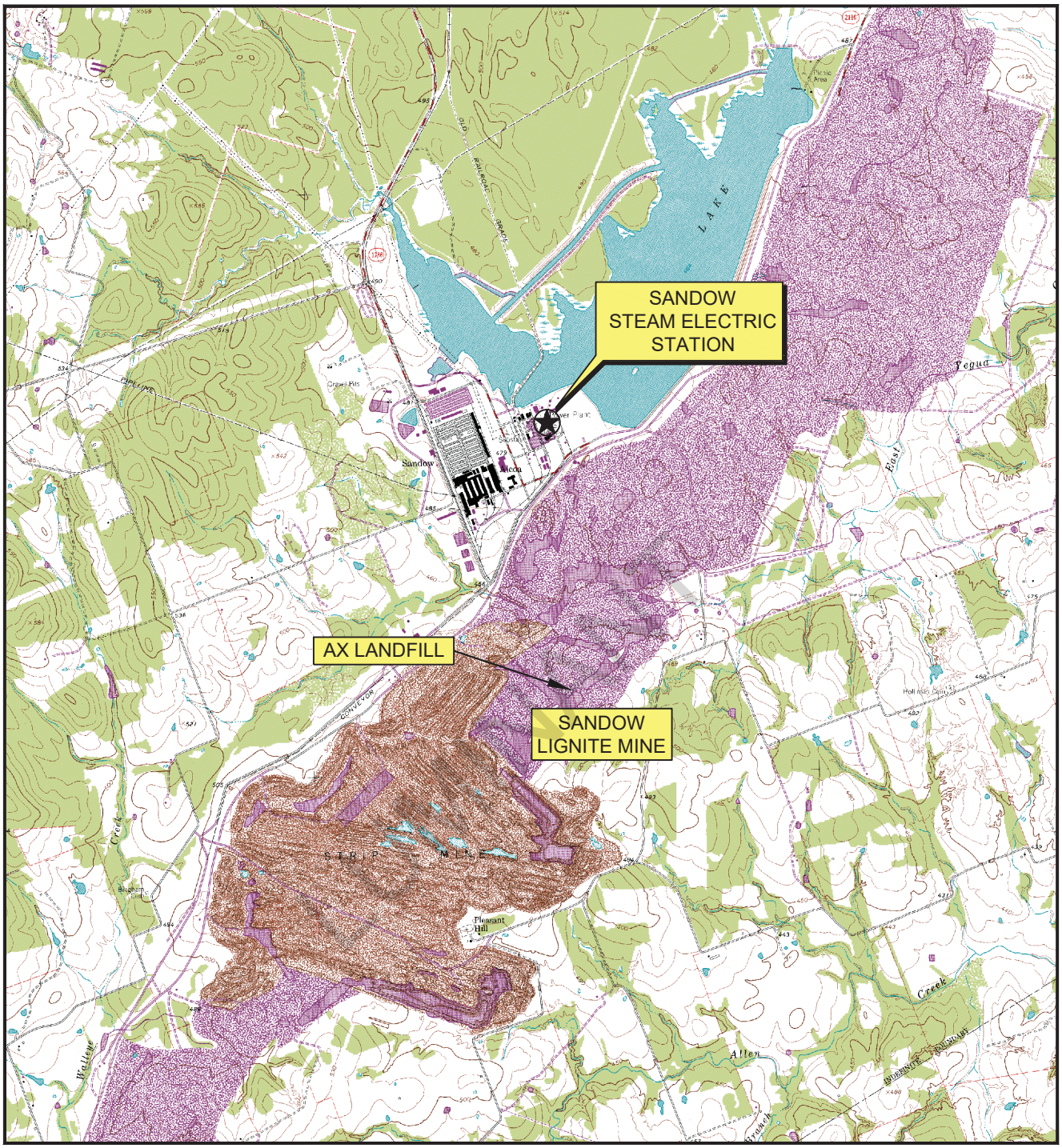
TABLE 3
SUMMARY OF AQUIFER TEST RESULTS
SANDOW AX LANDFILL

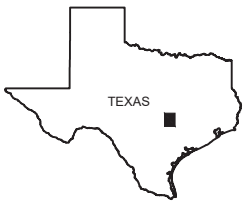
Well ID	Test Type	Aquifer Type	Analysis Method	Approximate Saturated Thickness (feet)	Results	
					T (cm^2/sec)	K (cm/sec)
AXMW-1	Slug-In	Unconfined	Bouwer-Rice	80	3.32E-01	1.36E-04
AXMW-1	Slug-Out	Unconfined	Bouwer-Rice	80	5.70E-01	2.34E-04
				Arithmetic Mean	**4.51E-01**	**1.85E-04**
AXMW-2	Slug-In	Unconfined	Bouwer-Rice	80	7.77E-01	3.19E-04
AXMW-2	Slug-Out	Unconfined	Bouwer-Rice	80	6.64E-01	2.72E-04
				Arithmetic Mean	**7.21E-01**	**2.96E-04**
				GEOMETRIC MEAN FOR ALL WELLS	**5.70E-01**	**2.34E-04**

Notes:

1. Abbreviations: T - transmissivity; K - hydraulic conductivity.

Figures





QUADRANGLE LOCATION

N

Scale in Feet

0 2000 4000

SOURCE:
Base map from www.tnris.gov, Alcoa Lake, TX 7.5 min. USGS quadrangle dated 1963, revised 1988.

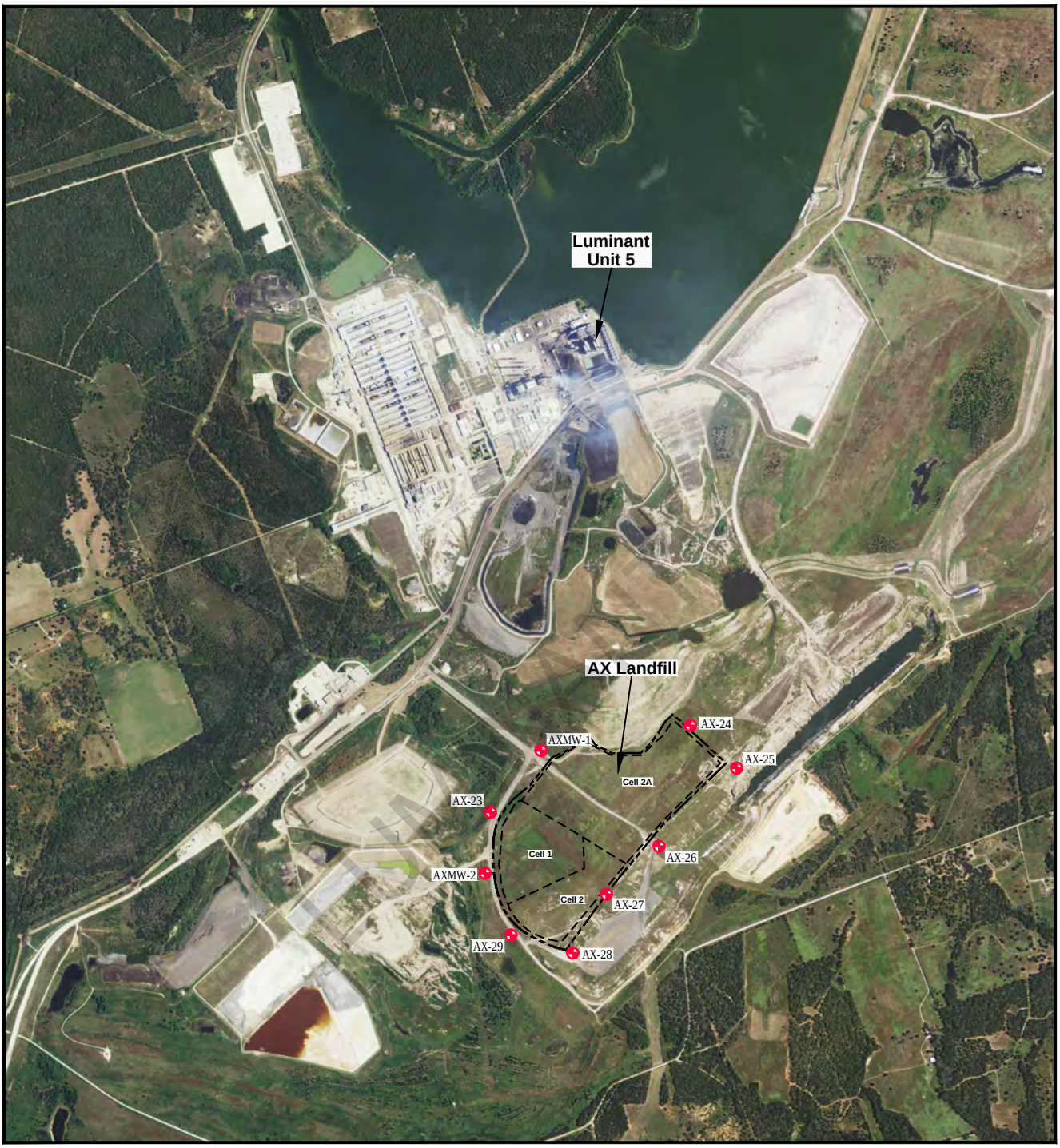
SANDOW STEAM ELECTRIC STATION
ROCKDALE, TEXAS

Figure 1

SITE LOCATION MAP

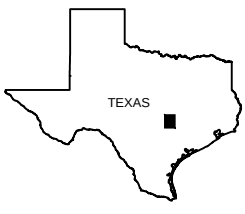
PROJECT: 5164E	BY: AJD	REVISIONS
DATE: MAR., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

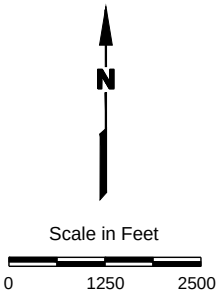


EXPLANATION

CCR Monitoring Well Location



PHOTOGRAPH LOCATION



SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

SANDOW 5 GENERATING PLANT

AX LANDFILL

Figure 2

SITE PLAN

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

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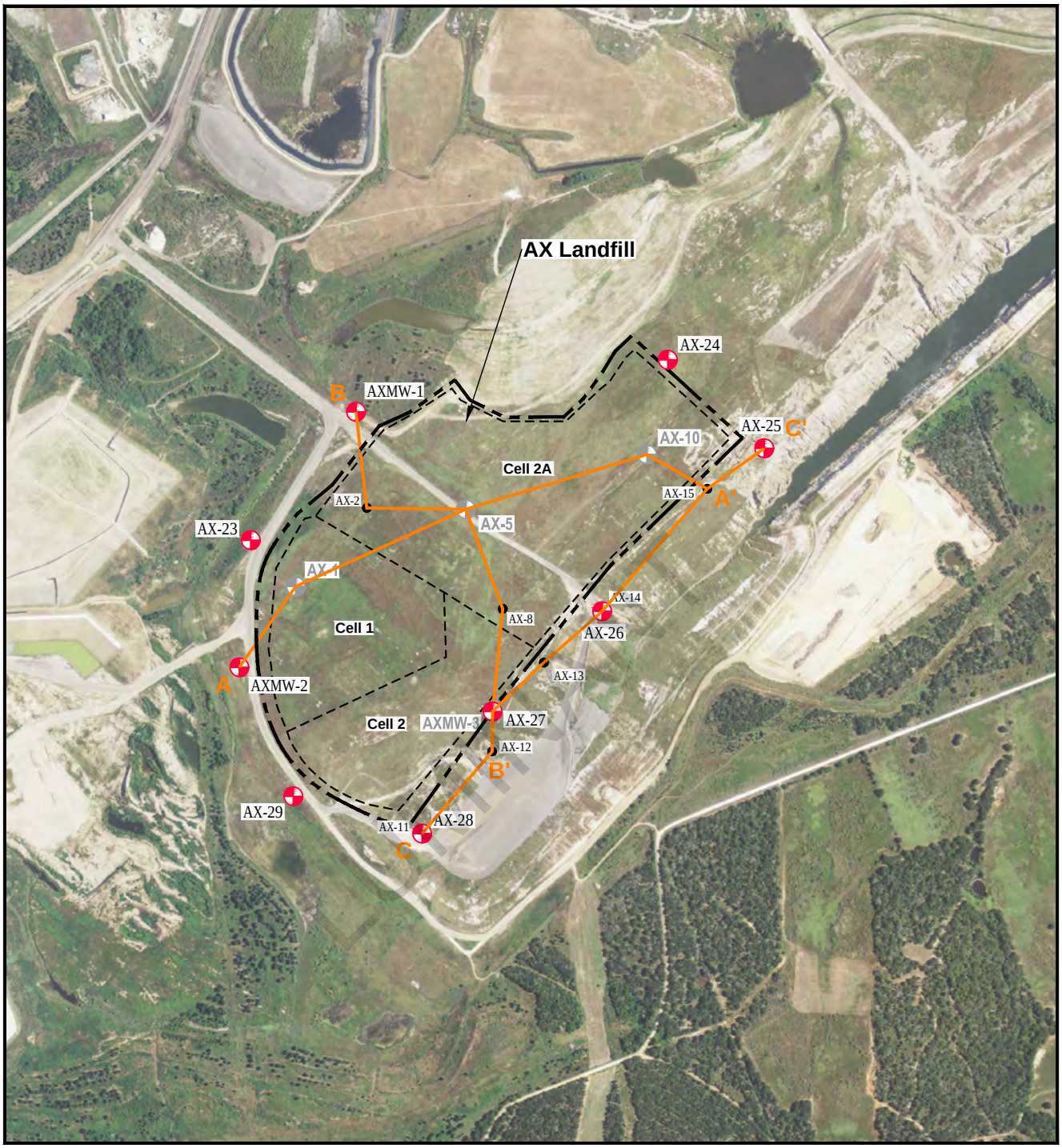

EXPLANATION

- CCR Monitoring Well Location
- Monitoring Well - Plugged
- Soil Boring Location
- A ___ A' Geologic Cross Section Location Lines

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure 3

AX LANDFILL CROSS SECTION LOCATION MAP

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DATE: SEPT., 2017	CHECKED: PJB	

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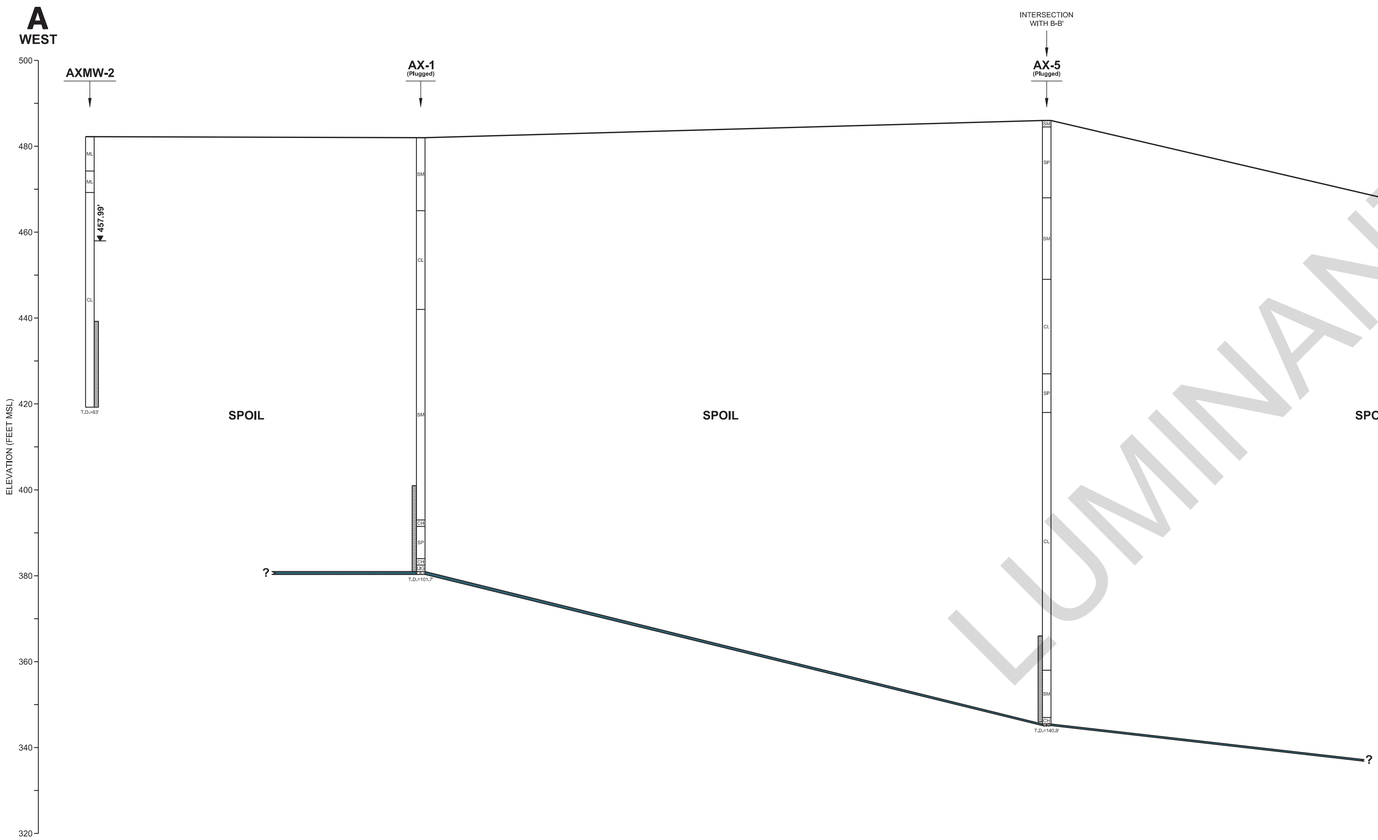
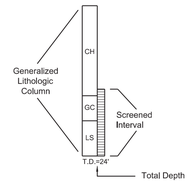


EXPLANATION

- SAND
- CLAY
- LIGNITE

MONITORING WELL CONSTRUCTION



Water Level (Ft MSL)
Measured Dec. 21-22, 2016

Notes:
1.) Ground surface elevation is based primarily on borehole survey data.

SCALE IN FEET

VERTICAL 20

HORIZONTAL 200

10x Vertical Exaggeration

SANDOW STEAM ELECTRIC STATION
ROCKDALE, TEXAS

Figure 4

AX LANDFILL AREA
GEOLOGIC CROSS SECTION A-A'
WEST SIDE OF LANDFILL TO
EAST SIDE OF LANDFILL

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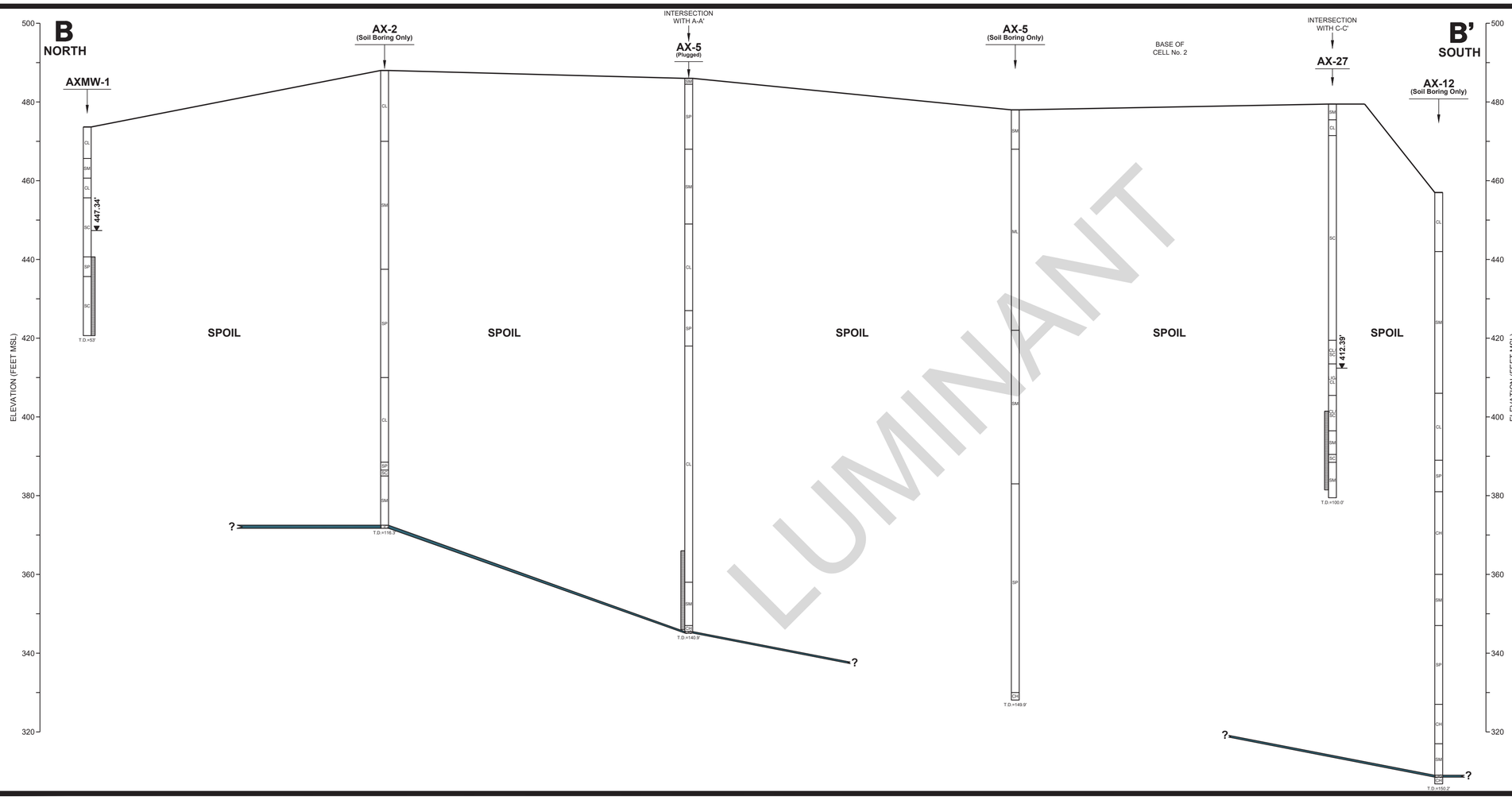
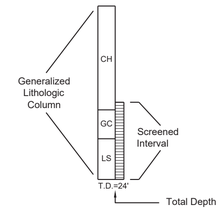


EXPLANATION

- SAND
- CLAY
- LIGNITE

MONITORING WELL CONSTRUCTION



Notes:
1.) Ground surface elevation is based primarily on borehole survey data.

SCALE IN FEET

VERTICAL 20

HORIZONTAL 200

10x Vertical Exaggeration

SANDOW STEAM ELECTRIC STATION
ROCKDALE, TEXAS

Figure 5

AX LANDFILL AREA
GEOLOGIC CROSS SECTION B-B'
NORTH SIDE OF LANDFILL TO
SOUTH SIDE OF LANDFILL

PROJECT: 5123E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

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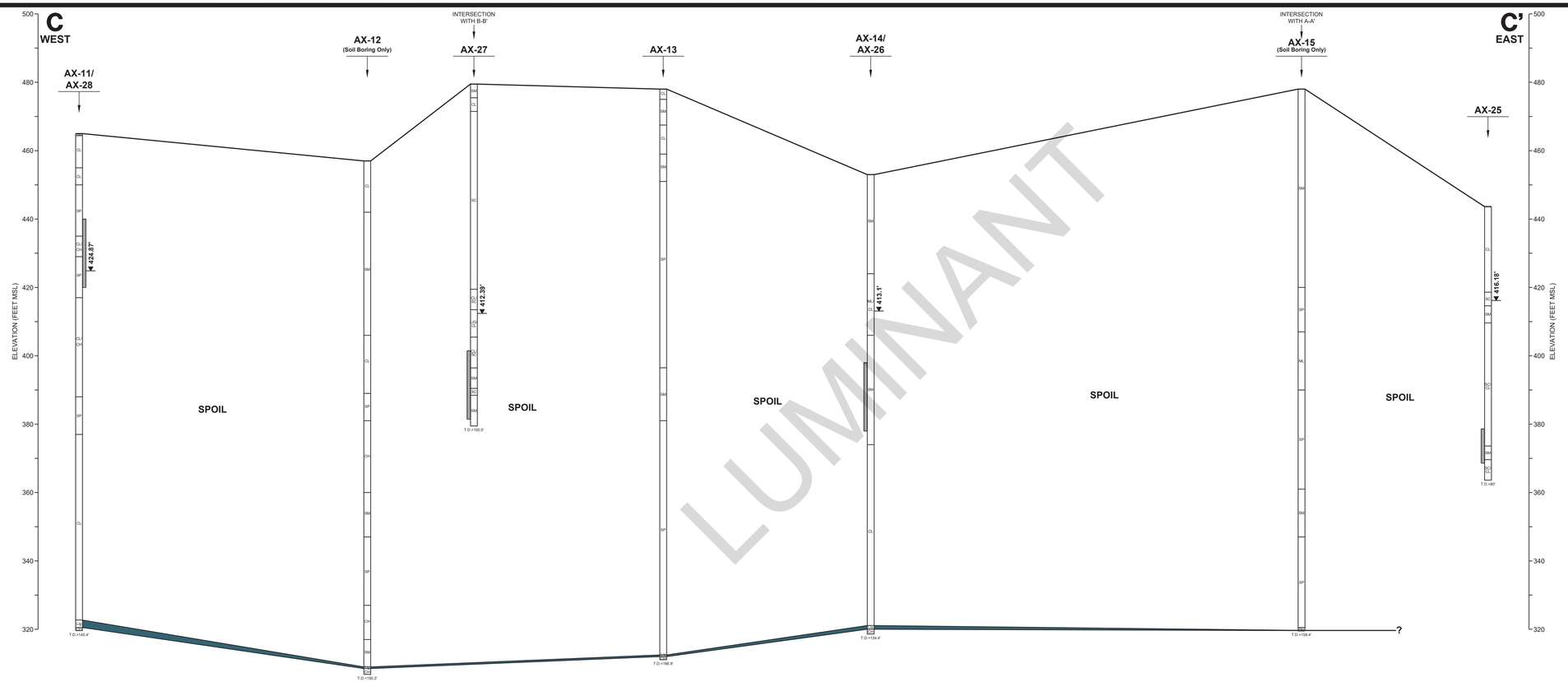
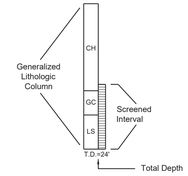


EXPLANATION

- SAND
- CLAY
- LIGNITE

MONITORING WELL CONSTRUCTION



Notes:
1.) Ground surface elevation is based primarily on borehole survey data.

SCALE IN FEET

VERTICAL 20

HORIZONTAL 200

10x Vertical Exaggeration

SANDOW STEAM ELECTRIC STATION
ROCKDALE, TEXAS

Figure 6

AX LANDFILL AREA
GEOLOGIC CROSS SECTION C-C'
WEST SIDE OF LANDFILL TO
EAST SIDE OF LANDFILL

PROJECT: 5123E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

Appendix A

CCR Monitoring Well Logs

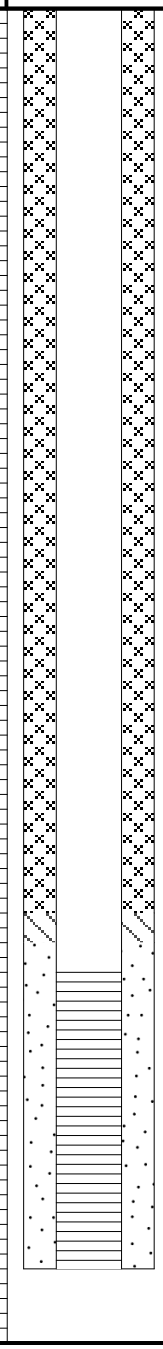
Luminant

Log of Boring: AX-23

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 5164E

Completion Date:	10/15/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	8.5
Driller:	Timmy Beach	Total Depth (ft):	90
Driller's License:	5814M	TOC Elevation (ft. AMSL):	482.26
Logged By:	Michelle Hulewicz	Northing:	335064.705
Sampling Method:	4"x10' Core barrel	Easting:	3028456.298

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0				
5		4.0/10.0		
10				
15		9.2/10.0		
20				
25		10.0/10.0		(0 - 59) Silty, sandy CLAY spoil, dark gray and brown, dry to moist, moisture content increases with depth, none to weak cementation, soft to hard, none to medium plasticity, abundant roots (0'-2'), more cohesive with depth, higher sand content (11'-15'), color change to brown with orange and rust colored mottling (11'-15'), lower sand content and light gray and dark gray clay laminations (15'-17', 23'-27', 36'-39'), orange sand lenses in dark gray clay (17'-23' and 30'-36'), higher sand content (27'-36'), dark gray with light gray and orange mottling (39'-47' and 53'-56'), lower clay content with depth (56'-59')
30			CL	
35		9.0/10.0		
40				
45		10.0/10.0		
50				
55		8.0/10.0		
60			SM	(59 - 60) Silty SAND spoil, light gray, very moist, moderate cementation, unconsolidated, gradual contact
65		9.7/10.0		
70				
75		9.0/10.0	SC/CL	(60 - 90) Sandy CLAY/ clayey SAND spoil, dark gray, orange and light gray mottling throughout, very moist, weak to moderate cementation, soft to very firm, low to medium plasticity, light gray sand lenses, 1' thick orange and dark gray clay layer at 66', sand layers with higher moisture content (6" thick at 72', 1' thick at 89', 1' thick at 85', and 2" thick light gray sand lense at 89'), lignite layer at 90'
80				
85		8.7/10.0		
90				

PBW

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Notes:
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Well Materials
(2.48-65) Casing, 4" Sch 40 FJT PVC
(65-85) Screen, 4" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-61') Grout
(61'-63') Bentonite pellets
(63'-85') 20/40 sand

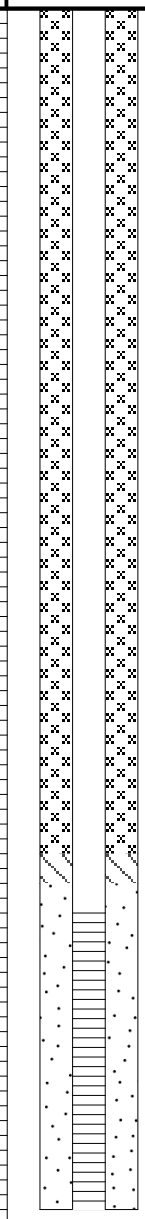
Luminant

Log of Boring: AX-24

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 5164E

Completion Date:	10/15/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.25
Driller:	Timmy Beach	Total Depth (ft):	90
Driller's License:	5814M	TOC Elevation (ft. AMSL):	468.74
Logged By:	Michelle Hulewicz	Northing:	336503.03
Sampling Method:	4"x10' Core barrel	Easting:	3031536.564

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0		3.0/10.0	SM	(0 - 17) Silty SAND spoil, light gray, dry, soft, unconsolidated, tan/brown with some orange 5'-10'), gradual increase in clay content with depth
5				
10				
15		2.8/10.0		
20		8.0/10.0	SC/CL	(17 - 80) Sandy CLAY/ clayey SAND spoil, dark gray, dry to moist (moisture increases with depth), weak cementation, soft with firm clay layers, clay layer at 19' (dark brown, dark gray, and light gray laminations), higher clay content (20'-27'), 2" tan sand lens at 25', higher sand content (27'-30'), interbedded light gray/tan sand and dark gray clay layers (sand at 32'-33', 33.5'-34.5', 35'-40', 41'-42', 44'-45', and 48'-50), dark gray silty clay layer (53'-58'), dark gray with brown/tan (60'-62'), silty clay layer with tan sand lenses (62'-68'), rusty colored and orange mottling (64'-65'), 1' thick tan and very moist sand layer at 74', higher clay content (74'-76'), light gray sand layer at 77', 1' thick dark gray/ brown clay layer at 78'
25				
30				
35		6.0/10.0		
40				
45		6.0/10.0		
50				
55		10.0/10.0		
60				
65		10.0/10.0		
70				
75		9.0/10.0		
80				
85		10.0/10.0	SM	(80 - 90) Silty SAND spoil, dark gray/ brown, wet (80'-84') and very moist (84'-90'), color change to light gray at 84', small lignite pieces (less than 0.5" diameter) at 84'.
90				

PBW

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Notes:
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Well Materials
(2.26-61) Casing, 2" Sch 40 FJT PVC
(61-81) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-57') Grout
(57'-59') Bentonite pellets
(59'-81') 20/40 sand

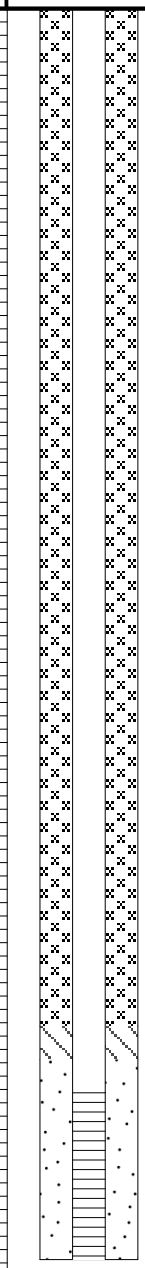
Luminant

Log of Boring: AX-25

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 5164E

Completion Date:	10/16/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.25
Driller:	Timmy Beach	Total Depth (ft):	80
Driller's License:	5814M	TOC Elevation (ft. AMSL):	443.62
Logged By:	Michelle Hulewicz	Northing:	335806.391
Sampling Method:	4"x10' Core barrel	Easting:	3032212.339

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0		4.0/10.0	CL	(0 - 25) Silty CLAY spoil, brown and dark gray with some orange and light gray, dry, weak cementation, soft to firm, unconsolidated (13'-17'), some lignite pieces at 9' and 12', becomes more sandy (very fine grained) with depth, clay and lignite mixed 21'-22', piece of wood (4" thick) at 24'
4				
8				
12		4.0/10.0		
16				
20				
24		9.7/10.0		
28			SC	(25 - 29) Clayey SAND spoil, light gray and tan, dry, soft, none to weak cementation
32			SM	(29 - 34) Silty SAND spoil with clay lenses, slightly moist, soft, unconsolidated
36		3.0/10.0	SC/CL	(34 - 70) Clayey SAND/ sandy CLAY spoil, light gray with orange mottling (34'-40'), slightly moist, moisture content increases with depth, none to weak cementation, unconsolidated, none to low plasticity, piece of wood at 39', interbedded sandy clay and clayey sand, gray and tan with orange, dark gray and brown mixed in (40'-50'), hard 2" thick gray clay layer at 47', ~1" thick clay lenses (medium plasticity, dark gray, light gray, and dark brown) throughout 50'-60', color transition to dark gray/brown at 60', higher sand content and higher moisture content (63'-64'), trace amounts of lignite at 63', higher clay content (very firm, dark gray, medium plasticity) (64'-68'), dark brown and orange (67'-68')
40				
44		7.2/10.0		
48				
52		4.0/10.0		
56				
60				
64		10.0/10.0		
68				
72		9.5/10.0	SM	(70 - 74) Silty SAND spoil with clay lenses, light and dark gray, wet, weak cementation, unconsolidated, none to low plasticity
76			SC/CL	(74 - 80) Clayey SAND/ sandy CLAY spoil, dark gray and brown, moist, weak to moderate cementation, soft to firm, none to low plasticity, higher clay content with depth, 2" thick orange layer with lignite pieces at 79'
80				

PBW

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Notes:
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Well Materials
(2.51-65) Casing, 2" Sch 40 FJT PVC
(65-75) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-61') Grout
(61'-63') Bentonite pellets
(63'-75') 20/40 sand

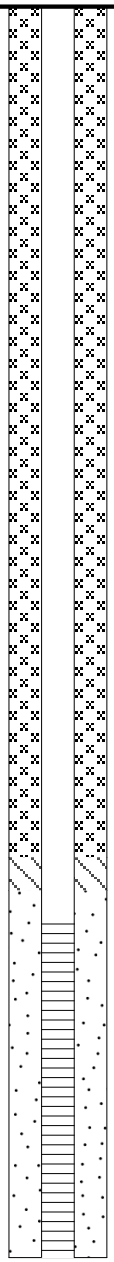
Luminant

Log of Boring: AX-26

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 5164E

Completion Date:	10/14/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.25
Driller:	Timmy Beach	Total Depth (ft):	80
Driller's License:	5814M	TOC Elevation (ft. AMSL):	458.6
Logged By:	Michelle Hulewicz	Northing:	334521.489
Sampling Method:	4"x10' Core barrel	Easting:	3031007.111

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0		5.0/10.0	CL	(0 - 10) Silty CLAY spoil, dark brown, dry, weak cementation, soft, none to low plasticity, orange, dark gray, and light gray clay lenses, more compact with depth, higher plasticity with depth
4				
8				
12		6.0/10.0	SC	(10 - 12) Clayey SAND spoil, gray and tan, slightly moist, none to weak cementation, unconsolidated
16			CL	(12 - 20) Silty CLAY spoil, dark brown, slightly moist, weak cementation, firm, lower sand content (17'-20'), color change to dark gray with light gray lamination, friable
20		6.0/10.0	SC/CL	(20 - 65) Sandy CLAY/clayey SAND spoil, light gray and brown with dark gray clay lenses, moist, weak cementation, soft with firm clay lenses, none to medium plasticity, ~1' thick dark gray, firm, and friable clay layer, purple and orange clay lenses (25'-30'), higher sand content (30'-32'), higher clay content (32'-35'), light gray and dark gray laminations (35'-38'), orange and gray clay lenses (38'-40'), dark gray (40'-43') transitions to light gray (43'-45'), dark purple, light gray, and brown clay lenses (45'-47'), higher sand content (45'-50'), higher dark gray clay content (50'-51'), higher sand content (light gray/tan) (51'-53'), higher clay content with dark and light laminations (53'-54'), higher sand content (light gray) (54'-55'), dark gray with orange mottling (55'-65'), 2" thick sand layer at 65'
24				
28				
32		9.0/10.0		
36				
40				
44		9.2/10.0		
48				
52		7.0/10.0		
56				
60				
64		6.0/10.0		
68				
72		7.0/10.0	CL	(65 - 80) Silty CLAY spoil with some sand, dark gray, moist, weak to moderate cementation, firm, low to medium plasticity, very wet (70'-74'), slightly moist (74'-80')
76				
80				

PBW

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Notes:
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Well Materials
(2.26-55) Casing, 2" Sch 40 FJT PVC
(55-75) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-51') Grout
(51'-53') Bentonite pellets
(53'-75') 20/40 sand

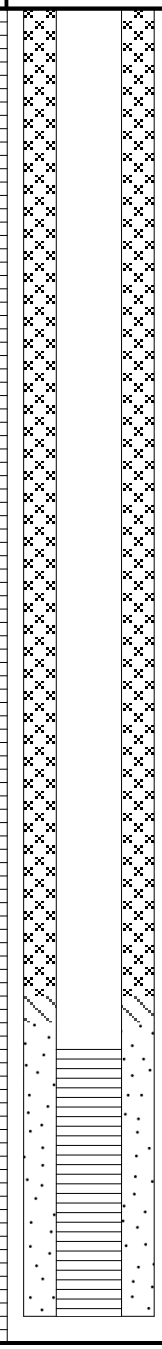
Luminant

Log of Boring: AX-27

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 5164E

Completion Date:	10/14/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	8.5
Driller:	Timmy Beach	Total Depth (ft):	100
Driller's License:	5814M	TOC Elevation (ft. AMSL):	479.47
Logged By:	Michelle Hulewicz	Northing:	333747.276
Sampling Method:	4"x10' Core barrel	Easting:	3030177.105

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0			SM	(0 - 4) Silty SAND spoil with clay, dark brown, dry, none to weak cementation, unconsolidated to consolidated, organic smell, more cohesive with depth
5		5.7/10.0	CL	(4 - 8) Sandy, silty CLAY spoil, dark brown, dry, weak to moderate cementation, firm, low plasticity, 2" thick organic layer at 5', metallic nodule at 7'
10				
15		5.0/10.0		
20				
25		5.3/10.0		
30				(8 - 60) Clayey SAND spoil, gray, slightly moist, weak cementation, unconsolidated, none to low plasticity, lower clay content (13'-16' and 23'-27'), tan clayey sand (12'-13'), dark gray clay lenses present (16'-19' and 23'-27'), 3" diameter rock at 31', orange/brown, light gray, and dark gray clay lenses throughout 30'-50', 4" thick lignite layer at 49', 6" thick lignite layer at 56', pieces of lignite present in clayey sand (56'-60'), 2" thick dark gray clay layer at 59'
35		1.9/10.0	SC	
40				
45		9.4/10.0		
50				
55		7.8/10.0		
60				
65		8.7/10.0	CL/SC	(60 - 66) Sandy CLAY/ clayey SAND spoil, dark gray, higher clay content (60'-63' and 64'-66'), some orange and light gray mottling (60'-66'), moist, weak cementation, soft with firm clay pockets
70			Lig/CL	(66 - 74) Interbedded light gray CLAY and LIGNITE spoil, dry, weak cementation, firm to very hard, none to low plasticity
75		7.5/10.0		
80			CL/SC	(74 - 83) Sandy CLAY/ clayey SAND spoil, dark gray and tan, moist, weak cementation, firm, softer and higher sand content with depth, higher clay content (80'-83')
85		8.4/10.0	SM	(83 - 89) Silty SAND spoil, light gray and tan, wet, weak cementation, unconsolidated, 1" thick dark gray clay lense at 87'
90			SC	(89 - 91) Clayey SAND spoil, orange and dark gray, moist, weak to moderate, unconsolidated to consolidated, none to low plasticity
95		10.0/10.0	SM	(91 - 100) Silty SAND spoil, light gray, wet, weak cementation, unconsolidated to consolidated, dark gray and tan clay lenses present (95'-98'), rock fragment present at 96', higher clay content with depth, rusty colored clay lense at 99'
100				

PBW

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Notes:
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Well Materials
(2.65-78) Casing, 4" Sch 40 FJT PVC
(78-98) Screen, 4" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-74') Grout
(74'-76') Bentonite pellets
(76'-98') 20/40 sand

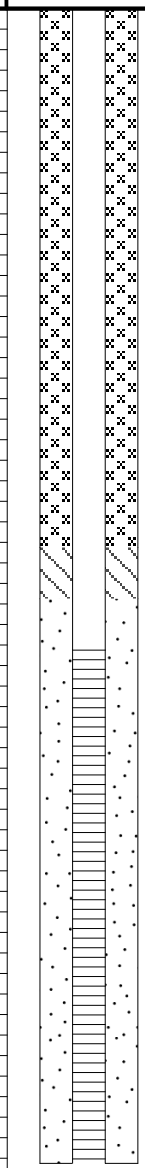
Luminant

Log of Boring: AX-28

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 5164E

Completion Date:	10/13/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.25
Driller:	Timmy Beach	Total Depth (ft):	50
Driller's License:	5814M	TOC Elevation (ft. AMSL):	463.26
Logged By:	Michelle Hulewicz	Northing:	332787.311
Sampling Method:	4"x10' Core barrel	Easting:	3029655.555

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0		7.0/10.0	CL	(0 - 10) Sandy CLAY spoil, dark brown, dry to moist, weak cementation, soft to firm, none to low plasicity, organics present (roots, twigs), lower sand content with depth
4				
8				
12		4.8/10.0		
16				
20		6.5/10.0	SM/SC	(10 - 43) Silty SAND spoil with some clay, light gray to tan, moist, weak cementation, unconsolidated, none to low plasticity, rust colored staining (~6" thick) at 15', interbedded dark gray, hard clay layers with some purple and rust coloring, 6" clay layer at 20' and 8" clay layer at 35', higher clay content with depth, color change to dark brown/ dark gray at 30', becomes wet (39'-43')
24				
28				
32		5.0/10.0		
36				
40				
44		10.0/10.0	CL	(43 - 50) Sandy CLAY spoil, dark gray, slightly moist, moderate cementation, firm to hard, none to low plasticity, rust colored and black nodules present
48				
52				

PBW

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Notes:
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Well Materials
(2.51-25) Casing, 2" Sch 40 FJT PVC
(25-45) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-21') Grout
(21'-23') Bentonite pellets
(23'-45') 20/40 sand

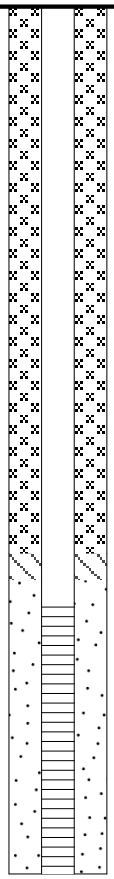
Luminant

Log of Boring: AX-29

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 5164E

Completion Date:	10/13/2015	Drilling Method:	Sonic
Drilling Company:	Walker-Hill Environmental	Borehole Diameter (in.):	6.25
Driller:	Timmy Beach	Total Depth (ft):	100
Driller's License:	5814M	TOC Elevation (ft. AMSL):	487.73
Logged By:	Michelle Hulewicz	Northing:	333161.803
Sampling Method:	4"x10' Core barrel	Easting:	3028621.836

Depth (ft)	Well Materials	Recovery (ft/ft)	USCS	Lithologic Description
0		7.0/10.0	CL	(0 - 16.5) Silty CLAY with sand, dry, weak cementation, soft to firm, gray and brown with orange mottling, none to low plasticity, 3" layer of sand at 4' and 8" sand layer at 12', higher sand content with depth
15		8.5/10.0		
20				(16.5 - 31) Silty CLAY, dark gray and brown with some purple mottling, moist, weak to moderate cementation, soft to firm, medium plasticity, plasticity decreases with depth, organic smell, roots present, becomes less cohesive with depth, 2" sand lense at 21', higher sand content with depth, pieces of wood at 29'
25		6.5/10.0		
30		9.8/10.0	SM	(31 - 60) Silty SAND, fine grained, light gray/tan with some orange mottling at 33', slightly moist, weak cementation, unconsolidated, organics present throughout, interbedded clay (gray) and sand (brown) with orange and rust colored staining (35'-38'), clay layers have medium plasticity, higher clay content (45'-50'), purple brown clay lense at 58'
45		6.0/10.0		
50		5.6/10.0		
60		10.0/10.0	SC	(60 - 69) Slightly clayey SAND, dark gray with light gray and tan mottling, fine to medium grained, very moist, weak cementation, soft, low plasticity, 4" thick laminated dark and light gray clay layer (firm) at 65'
65				
70			Lig	(69 - 72) LIGNITE, sharp contact, slightly moist, weak cementation, soft
75		10.0/10.0	CL	(72 - 100) Silty CLAY, interbedded dark and light gray, friable, slightly moist, moderate cementation, hard, none to low plasticity, higher moisture content and sand content (very fine grained) with depth, gradual transition to sandy clay (77'-90'), lower sand content (90'-100')
80				
85		10.0/10.0		
90				
95		10.0/10.0		
100				

PBW

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Notes:
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Well Materials
(2.77-45) Casing, 2" Sch 40 FJT PVC
(45-65) Screen, 2" Sch 40 FJT PVC, 0.010" slot

Annular Materials
(0'-41') Grout
(41'-43') Bentonite pellets
(43'-65') 20/40 sand

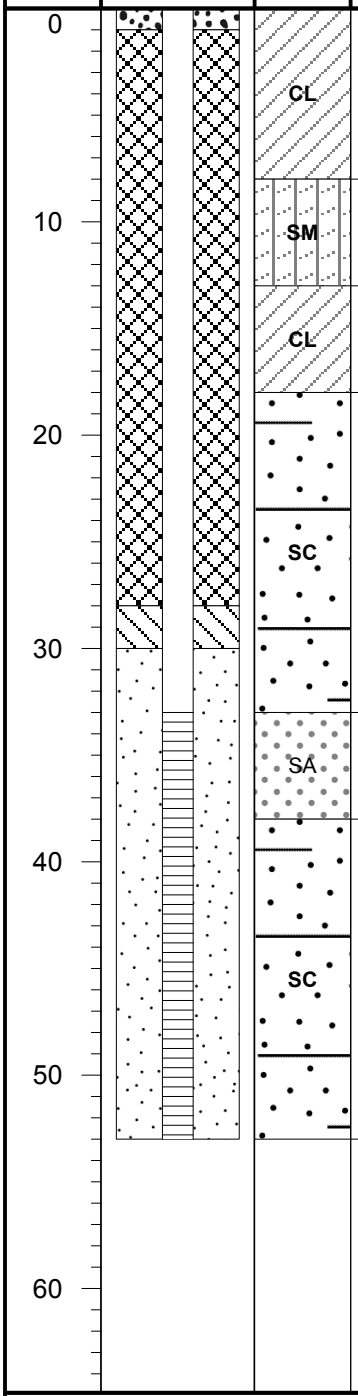
Luminant

Log of Boring: AXMW-1

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 1815

Completion Date:	11/28/2012	Drilling Method:	Hollow Stem Auge
Drilling Company:	EnviroCore, Inc.	Borehole Diameter (in.):	8
Driller:	Craig Schena	Total Depth (ft):	53
Driller's License:	4694	Northing:	336064.36
Field Supervisor:	Carolyn E Sexton	Easting:	3029087.23
Sampling Method:	Cuttings	TOC Elev. (ft AMSL):	473.65



(0.0 - 8) SILTY CLAY, CL, very dark gray, with sand.

(8 - 13) SILTY SAND, SM, yellowish brown, with pebbles, and hematite.

(13 - 18) SANDY CLAY, CL, very dark grayish brown, poorly sorted.

(18 - 33) CLAYEY SAND, SC, dark yellowish brown, some lignite fragments.

(33 - 38) SAND, light olive brown, medium grained, sub-rounded, moderately sorted.

(38 - 53) CLAYEY SAND, SC, yellowish brown, medium grained, sub-angular, poorly sorted.

PBW
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Notes: All material is mine spoil

Annular Materials
(0.0 - 1.0) Concrete
(1.0 - 28.0) BenSeal
(28.0 - 30.0) Bentonite Chips
(30.0 - 53.0) Filter Pack (16/30)

Well Materials
(+3.0 - 33.0) Casing, 2" Sch 40 FJT PVC
(33.0 - 53.0) Screen, 2" Sch 40 FJT PVC,
0.01 slot

Luminant

Log of Boring: AXMW-2

Sandow 5 Generating Plant
Rockdale, TX

PBW Project No. 1815

Completion Date:	11/28/2012	Drilling Method:	Hollow Stem Auge
Drilling Company:	EnviroCore, Inc.	Borehole Diameter (in.):	8
Driller:	Craig Schena	Total Depth (ft):	63
Driller's License:	4694	Northing:	334057.17
Field Supervisor:	Carolyn E Sexton	Easting:	3028199.98
Sampling Method:	Cuttings	TOC Elev. (ft AMSL):	482.25

Depth (ft)	Well Materials	USCS	Lithologic Description
0		ML	(0.0 - 8) SANDY SILT, ML, dark grayish brown.
10			(8 - 13) CLAYEY SILT with sand, ML, dark grayish brown.
20		CL	(13 - 63) SILTY CLAY, CL, dark gray, moist, some sand and lignite fragments.
30			
40			
50			
60			

Notes: All material is mine spoil.

Annular Materials
(0.0 - 1.0) Concrete
(1.0 - 38.0) BenSeal
(38.0 - 40.0) Bentonite Chips
(40.0 - 63.0) Filter Pack (16/30)

Well Materials
(+3.0 - 43.0) Casing, 2" Sch 40 FJT PVC
(43.0 - 63.0) Screen, 2" Sch 40 FJT PVC, 0.01 slot

PBW
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Appendix B

Photographs of CCR Monitoring Wells

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Sandow AX Landfill

Photograph 1: AX-23

Photograph 2: AX-24

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Sandow AX Landfill

Photograph 3: AX-25

Photograph 4: AX-26

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Sandow AX Landfill

Photograph 5: AX-27

Photograph 6: AX-28

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Sandow AX Landfill

Photograph 7: AX-29

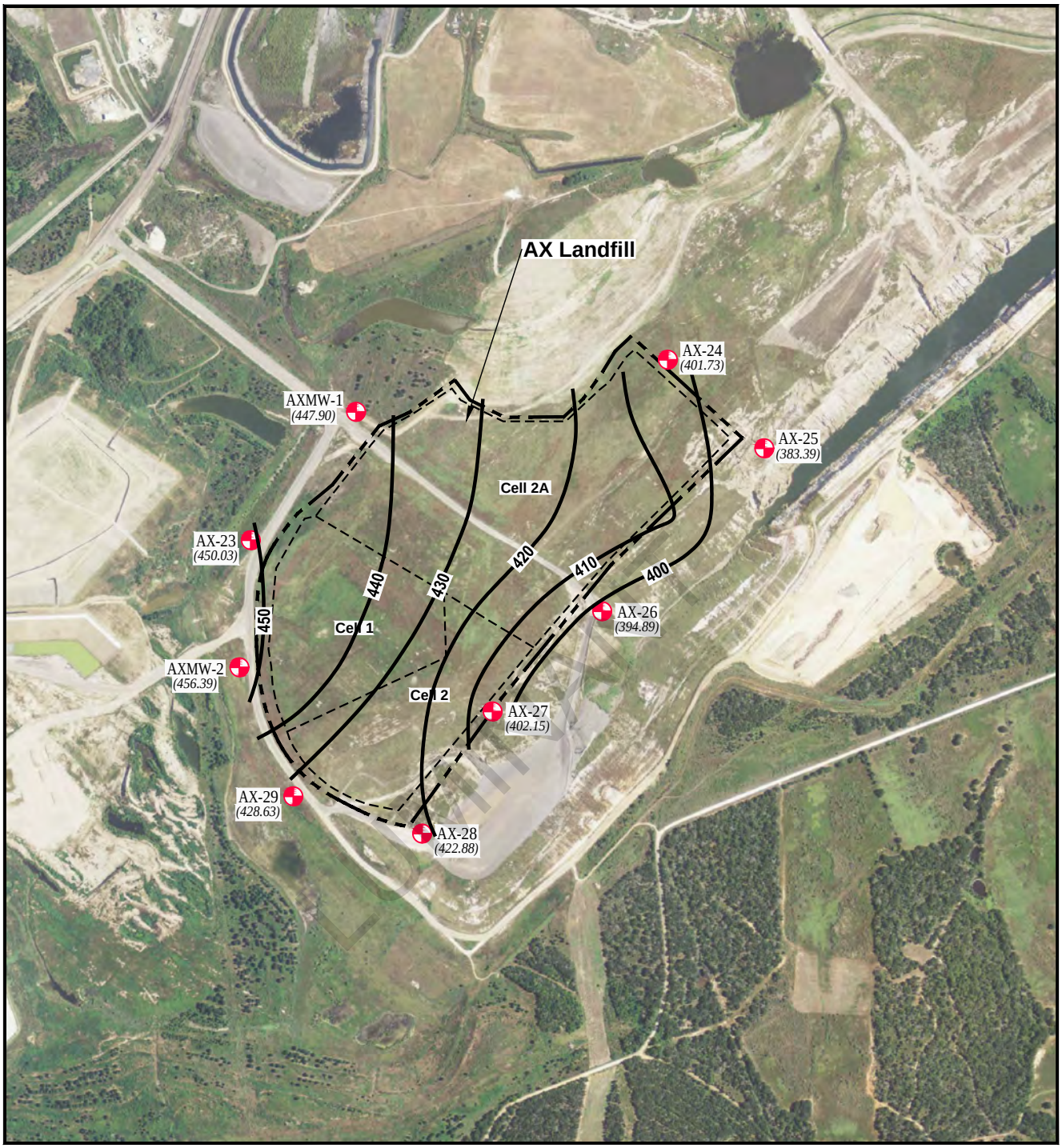
Photograph 8: AXMW-1

Appendix B – Photographs of CCR Groundwater Monitoring Wells
Sandow AX Landfill

Photograph 9: AXMW-2

Appendix C

Groundwater Potentiometric Surface Maps



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

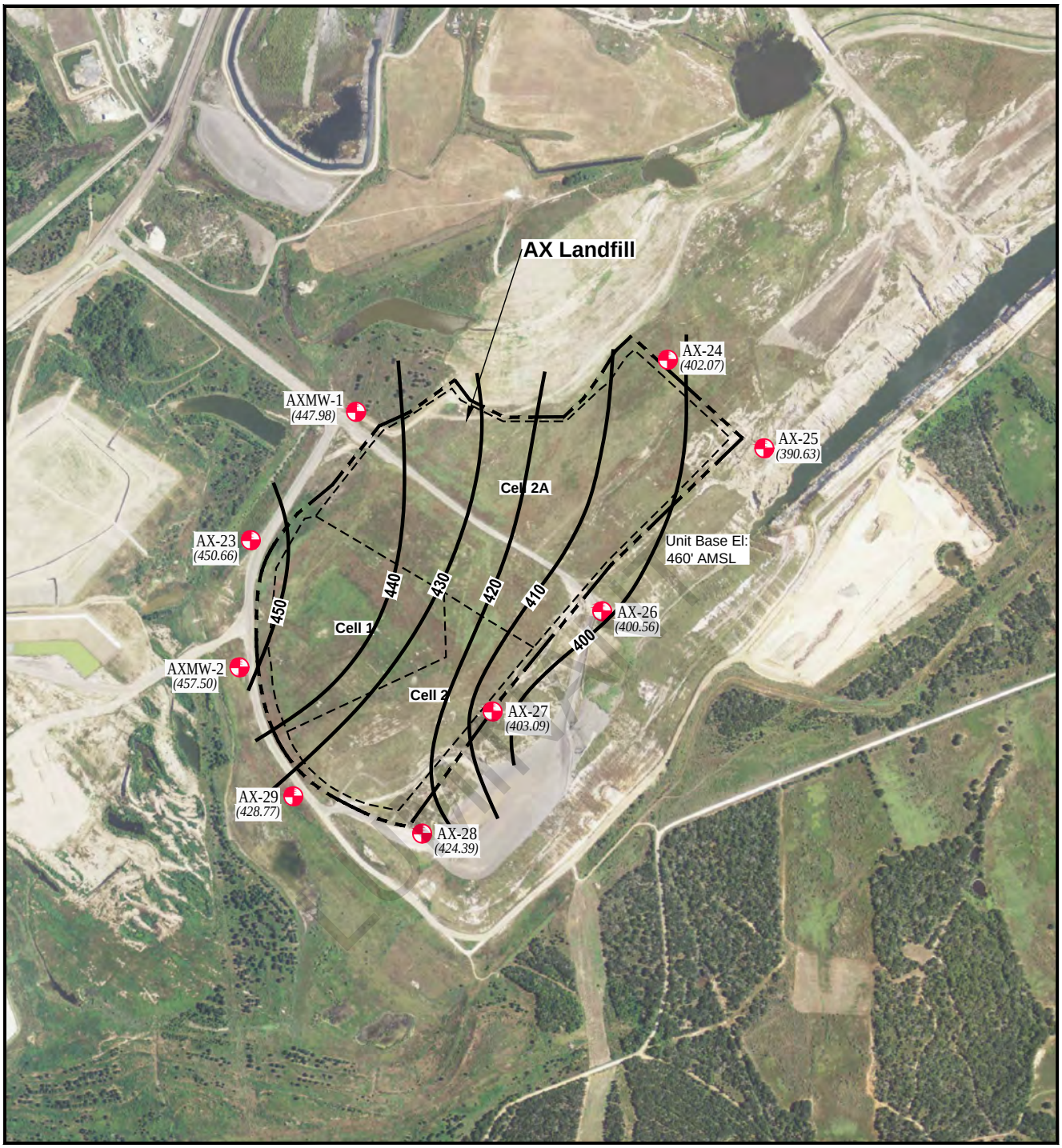
SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-1

AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP OCTOBER 29 - NOVEMBER 3, 2015

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

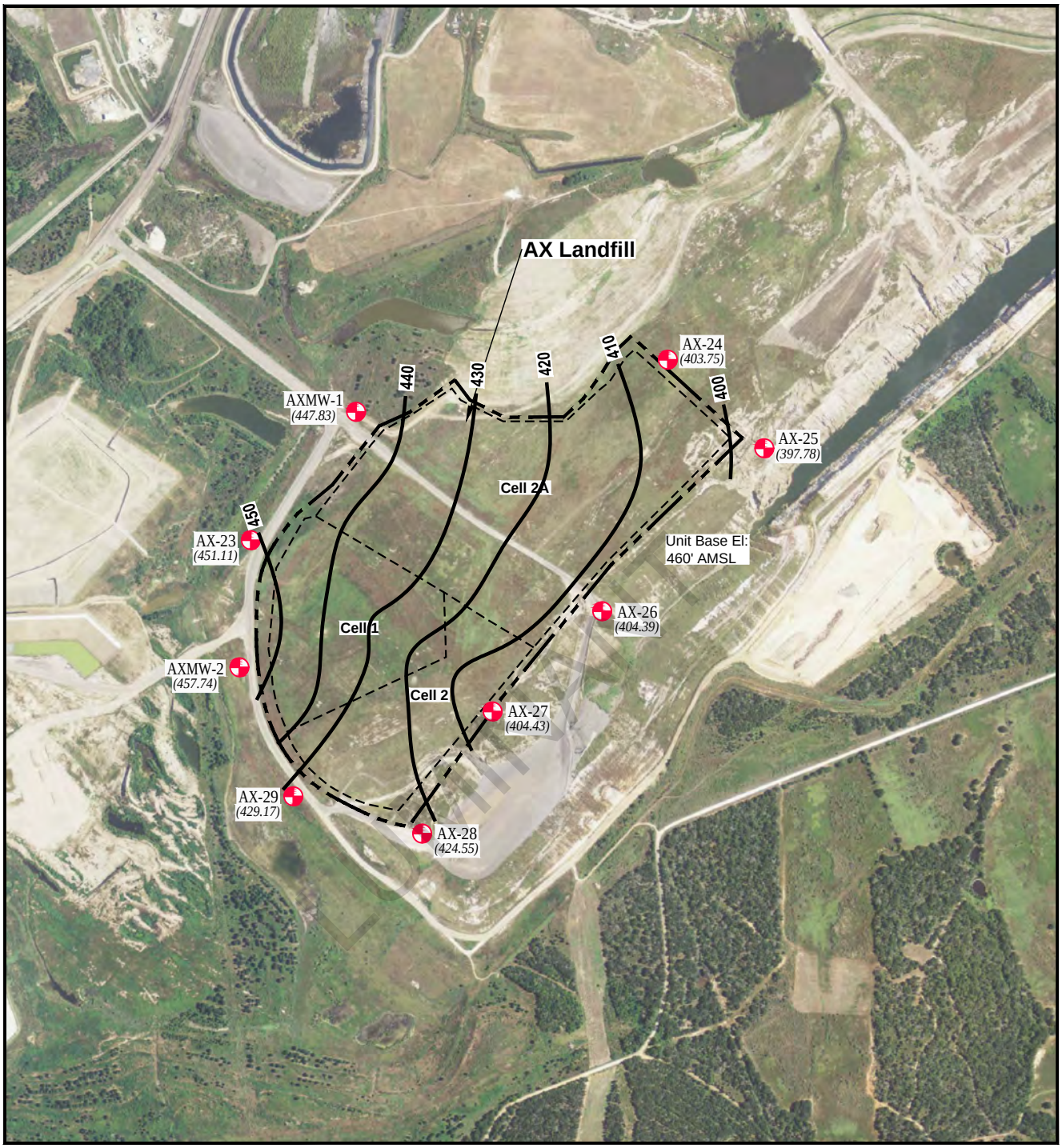
SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-2

AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP DECEMBER 17-18, 2015

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

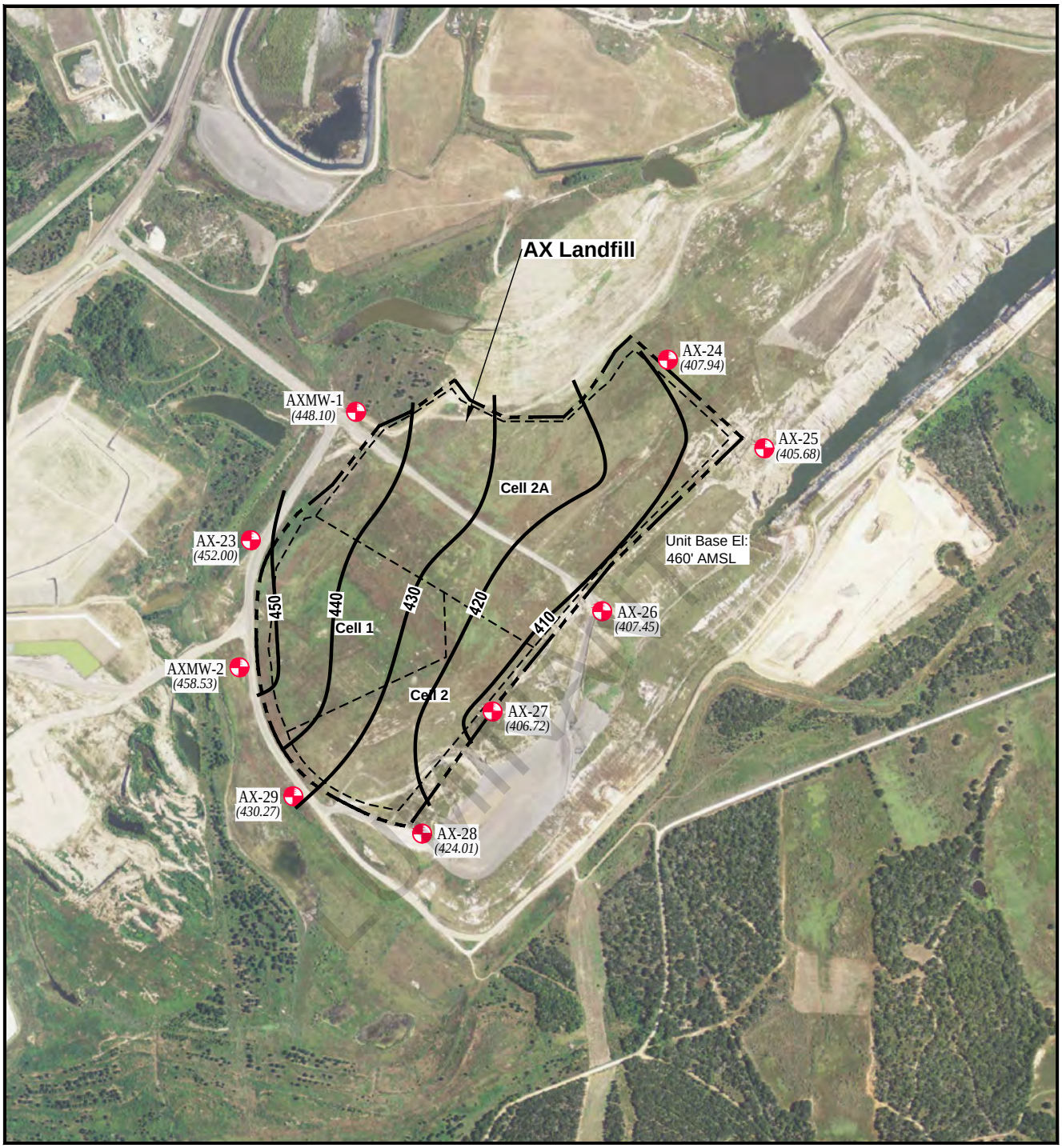
SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-3

AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP FEBRUARY 8-9, 2016

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

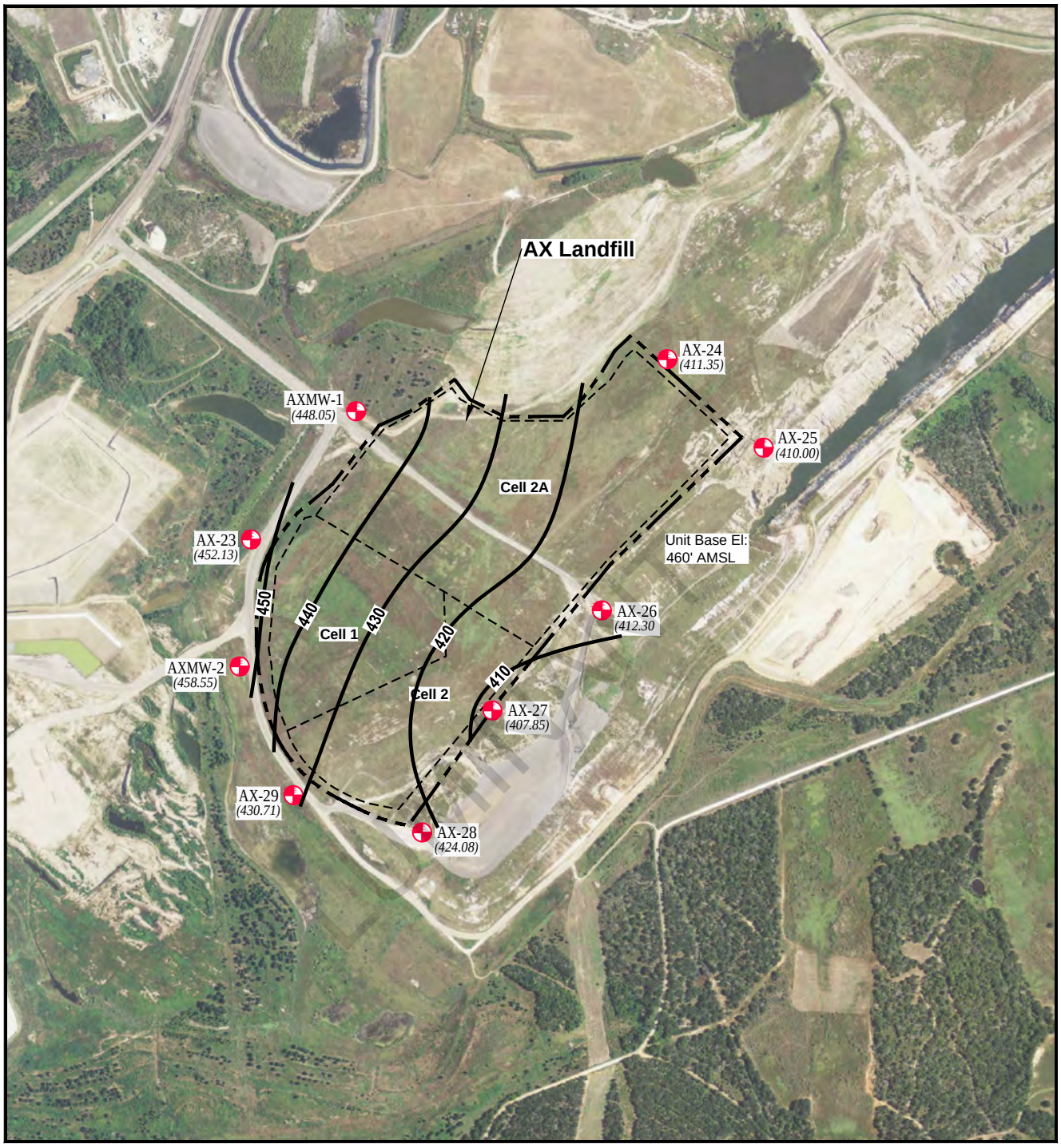
SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-4

AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP APRIL 25-26, 2016

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

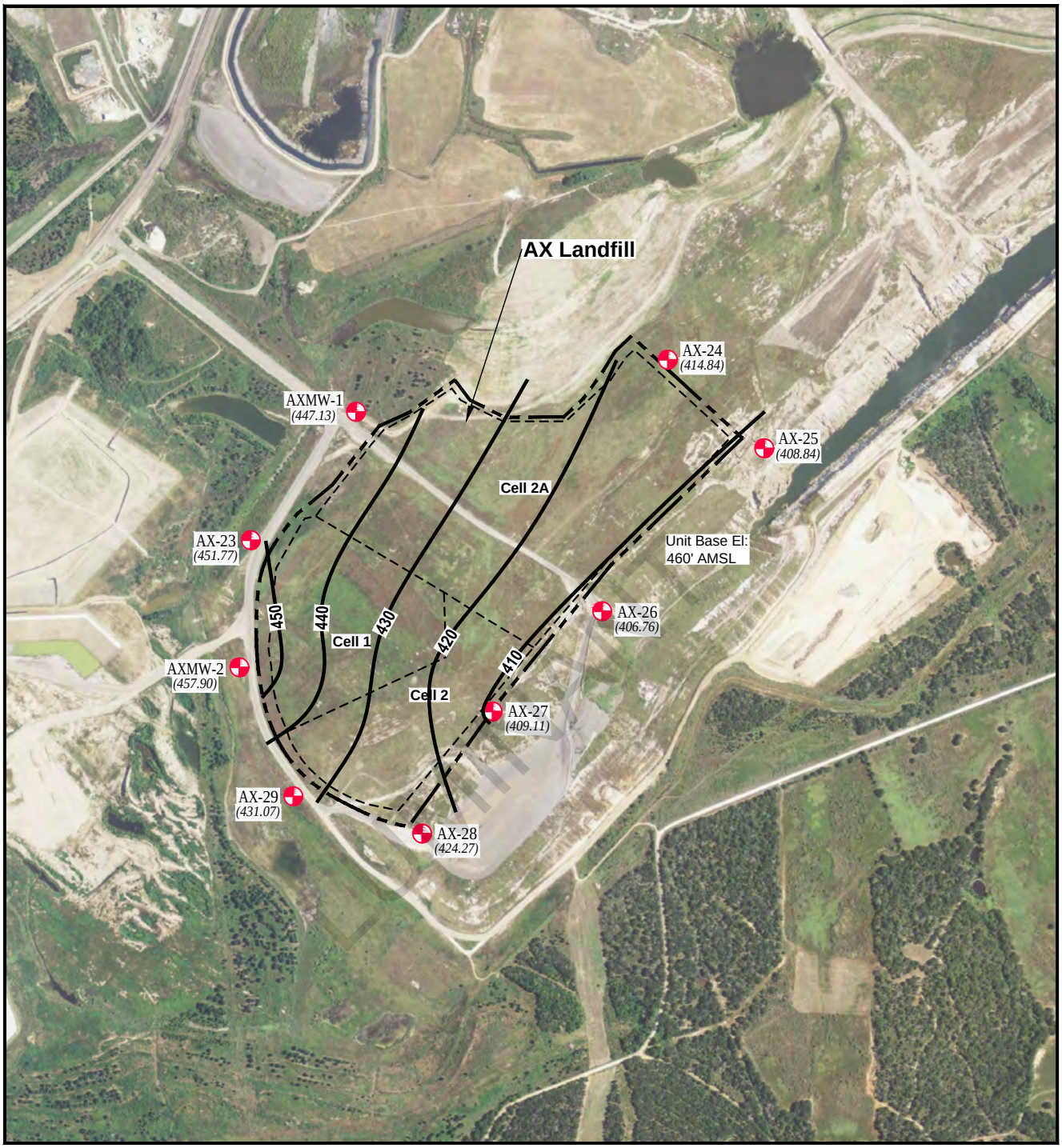
SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-5

AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP JUNE 14-15, 2016

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

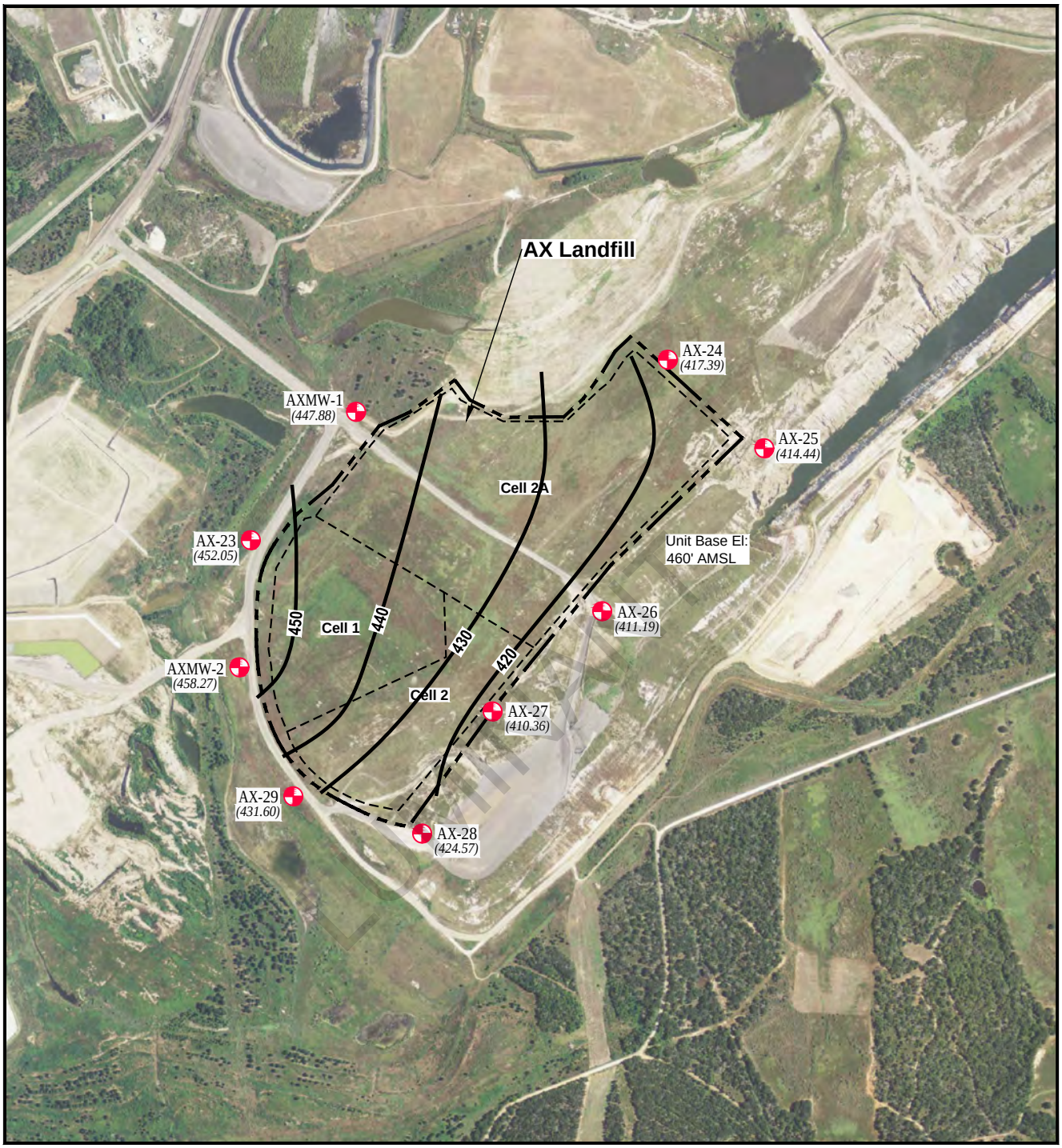
SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-6

AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP AUGUST 9-10, 2016

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

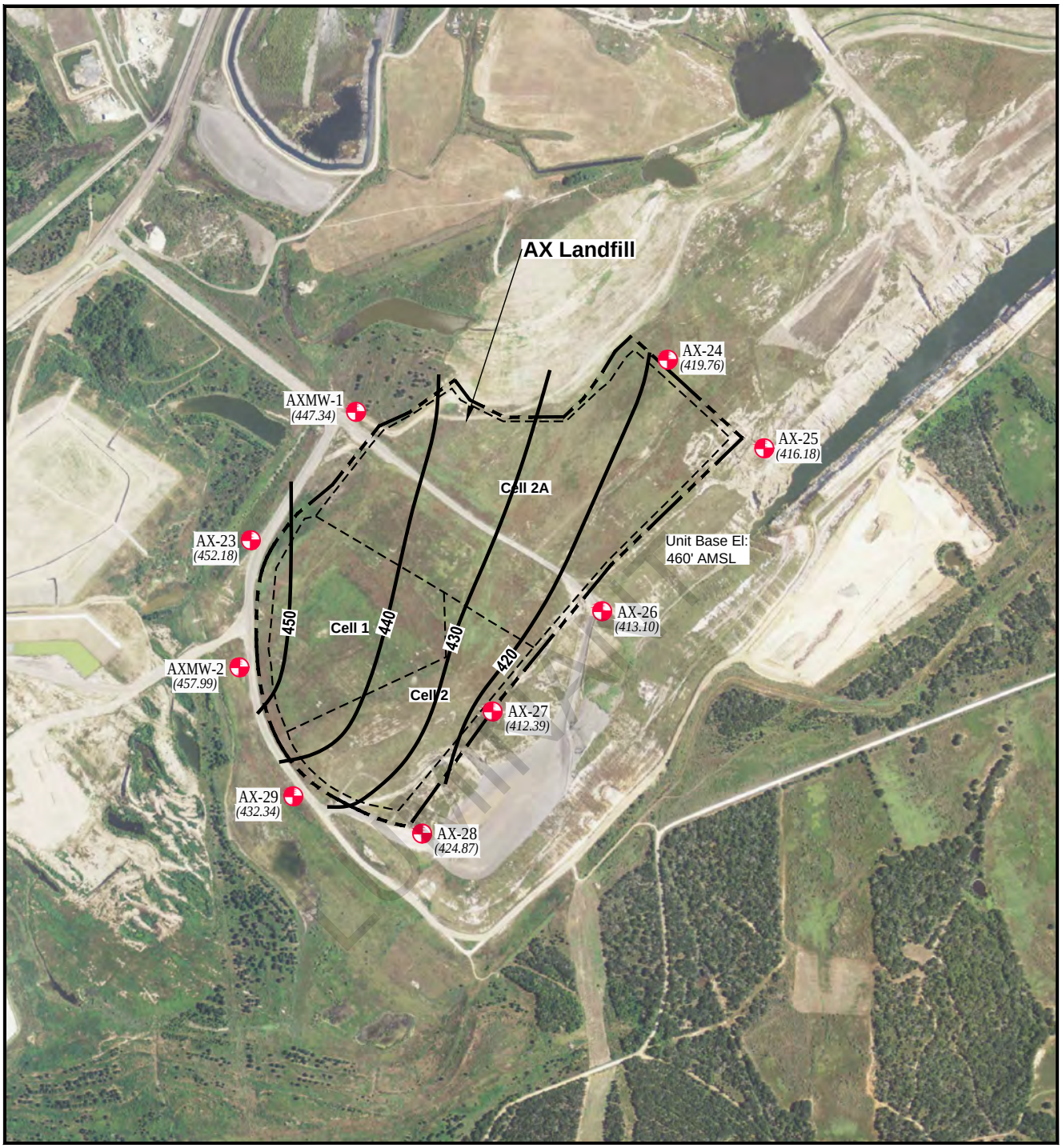
SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-7

AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP OCTOBER 5-6, 2016

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS



EXPLANATION

- CCR Monitoring Well
- (414.49) Groundwater Potentiometric Surface (ft. MSL)
- 400 Groundwater Potentiometric Surface Contour (C.I. = 10 ft.)

N

Scale in Feet

0 600 1200

SOURCE:
Imagery from www.tnris.gov, Alcoa Lake, aerial photographs, 2012.

SANDOW 5 GENERATING PLANT
AX LANDFILL

Figure C-8

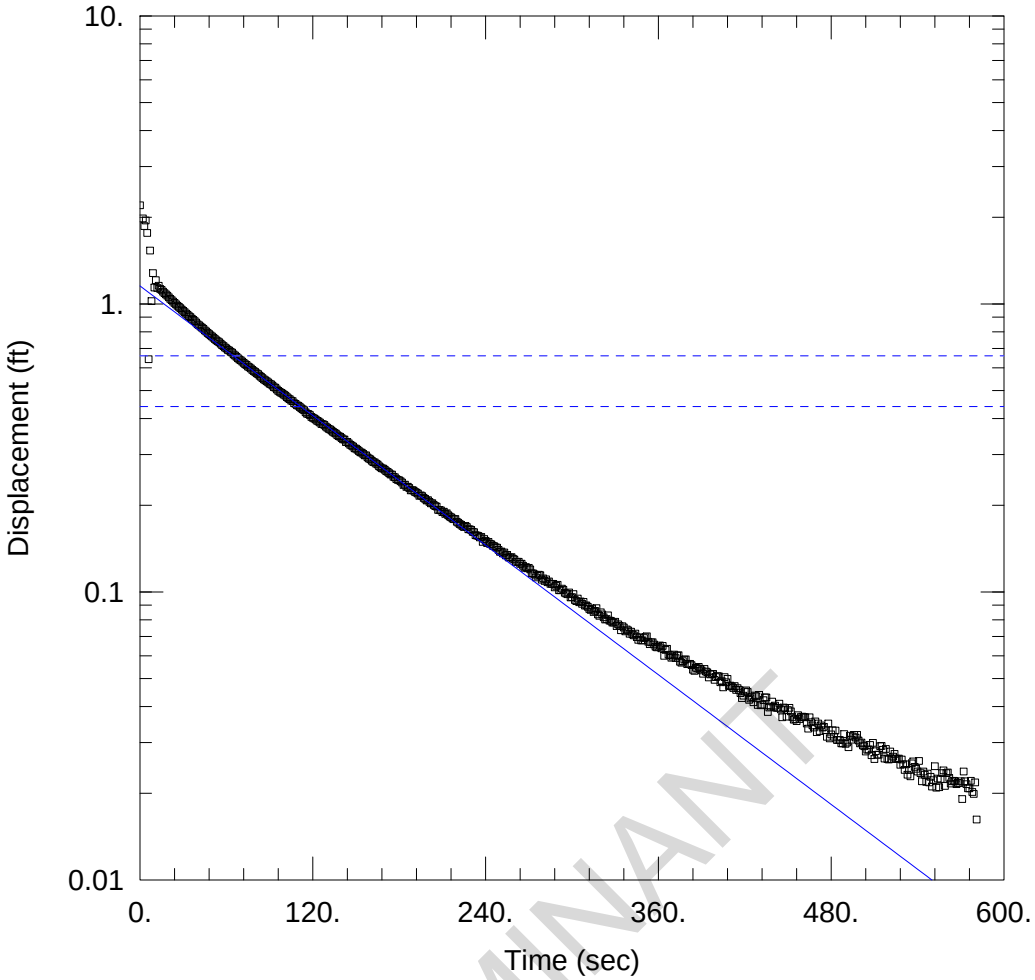
AX LANDFILL GROUNDWATER POTENTIOMETRIC SURFACE MAP DECEMBER 21-22, 2016

PROJECT: 5164E	BY: AJD	REVISIONS
DATE: SEPT., 2017	CHECKED: PJB	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

Appendix D

Aquifer Test Data



WELL TEST ANALYSIS

Data Set: J:\...\AXMW-1 Slug IN.aqt
Date: 11/18/15 Time: 09:52:45

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Well: AXMW-1
Test Date: 10-5-15

AQUIFER DATA

Saturated Thickness: 28.12 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AXMW-1)

Initial Displacement: 2.2 ft
Total Well Penetration Depth: 28.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 28.12 ft
Screen Length: 20. ft
Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.002861 cm/sec
y0 = 1.155 ft

Data Set: J:\5164 - Luminant CCR Well Installation and GW Sampling\5164-E_Sandow 5\Slug Tests\Sandow Slug Tests
Date: 11/18/15
Time: 09:54:08

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Date: 10-5-15
Test Well: AXMW-1

AQUIFER DATA

Saturated Thickness: 28.12 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: AXMW-1

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 28.12 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 20. ft
Total Well Penetration Depth: 28.12 ft

No. of Observations: 581

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.	0.	292.	0.1014
2.	1.982	293.	0.1027
3.	1.863	294.	0.1017
4.	1.948	295.	0.0993
5.	1.764	296.	0.0987
6.	0.6431	297.	0.0982
7.	1.533	298.	0.0996
8.	1.023	299.	0.0957
9.	1.279	300.	0.0959
10.	1.14	301.	0.0983
11.	1.21	302.	0.0938
12.	1.136	303.	0.0929
13.	1.156	304.	0.0948
14.	1.127	305.	0.0921
15.	1.118	306.	0.0927
16.	1.103	307.	0.0909
17.	1.091	308.	0.0923
18.	1.079	309.	0.0896
19.	1.068	310.	0.0897
20.	1.054	311.	0.0887
21.	1.042	312.	0.0873
22.	1.03	313.	0.0866
23.	1.019	314.	0.0875
24.	1.008	315.	0.0852
25.	0.9967	316.	0.0859
26.	0.986	317.	0.0878
27.	0.9766	318.	0.0835
28.	0.967	319.	0.0826
29.	0.9552	320.	0.0849
30.	0.9458	321.	0.0835

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
31.	0.9365	322.	0.0816
32.	0.9254	323.	0.0802
33.	0.9172	324.	0.0805
34.	0.9065	325.	0.0829
35.	0.8997	326.	0.0795
36.	0.8888	327.	0.0794
37.	0.881	328.	0.0783
38.	0.8712	329.	0.0783
39.	0.862	330.	0.0788
40.	0.8491	331.	0.0761
41.	0.8427	332.	0.0772
42.	0.8348	333.	0.0763
43.	0.8269	334.	0.0736
44.	0.8193	335.	0.076
45.	0.8087	336.	0.0752
46.	0.8022	337.	0.073
47.	0.7927	338.	0.0741
48.	0.7861	339.	0.0735
49.	0.778	340.	0.0716
50.	0.7705	341.	0.0728
51.	0.7625	342.	0.0712
52.	0.7556	343.	0.0707
53.	0.7474	344.	0.0717
54.	0.7415	345.	0.0697
55.	0.7362	346.	0.0682
56.	0.7277	347.	0.0695
57.	0.7192	348.	0.0678
58.	0.7137	349.	0.0679
59.	0.7056	350.	0.0691
60.	0.6999	351.	0.0697
61.	0.6924	352.	0.0701
62.	0.6885	353.	0.0671
63.	0.6815	354.	0.0659
64.	0.677	355.	0.0668
65.	0.6682	356.	0.0669
66.	0.6623	357.	0.0657
67.	0.6552	358.	0.0645
68.	0.648	359.	0.0642
69.	0.641	360.	0.0645
70.	0.6368	361.	0.0652
71.	0.6305	362.	0.0637
72.	0.6238	363.	0.0649
73.	0.618	364.	0.06
74.	0.6139	365.	0.0629
75.	0.6058	366.	0.0635
76.	0.6021	367.	0.0605
77.	0.5965	368.	0.0603
78.	0.5901	369.	0.0591
79.	0.5845	370.	0.0596
80.	0.5806	371.	0.0606
81.	0.5745	372.	0.0589
82.	0.5708	373.	0.0601
83.	0.5635	374.	0.0603
84.	0.5584	375.	0.0572
85.	0.5528	376.	0.0568
86.	0.5472	377.	0.0575
87.	0.5431	378.	0.0582
88.	0.5386	379.	0.0583
89.	0.5342	380.	0.0561
90.	0.5283	381.	0.0563
91.	0.5256	382.	0.0563
92.	0.5203	383.	0.0557
93.	0.5139	384.	0.0537
94.	0.5121	385.	0.0532
95.	0.5049	386.	0.0545
96.	0.4992	387.	0.0543

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
97.	0.4949	388.	0.0549
98.	0.4915	389.	0.0541
99.	0.4884	390.	0.0534
100.	0.4841	391.	0.052
101.	0.4803	392.	0.054
102.	0.4748	393.	0.0529
103.	0.4699	394.	0.0526
104.	0.4666	395.	0.0505
105.	0.4615	396.	0.0517
106.	0.4595	397.	0.0519
107.	0.4522	398.	0.0519
108.	0.4496	399.	0.0495
109.	0.4447	400.	0.0506
110.	0.4431	401.	0.051
111.	0.4383	402.	0.0509
112.	0.4338	403.	0.0486
113.	0.4307	404.	0.049
114.	0.4274	405.	0.0466
115.	0.4204	406.	0.0506
116.	0.4155	407.	0.0486
117.	0.4145	408.	0.0499
118.	0.4115	409.	0.0471
119.	0.4049	410.	0.0473
120.	0.4027	411.	0.0469
121.	0.3999	412.	0.0464
122.	0.3969	413.	0.0471
123.	0.3926	414.	0.0457
124.	0.3907	415.	0.0463
125.	0.3872	416.	0.0457
126.	0.3829	417.	0.0445
127.	0.3824	418.	0.0428
128.	0.38	419.	0.0436
129.	0.3753	420.	0.0451
130.	0.372	421.	0.0455
131.	0.3683	422.	0.0449
132.	0.3667	423.	0.0422
133.	0.3632	424.	0.0427
134.	0.3598	425.	0.0431
135.	0.3568	426.	0.0414
136.	0.3544	427.	0.0437
137.	0.3502	428.	0.0434
138.	0.3475	429.	0.0405
139.	0.3456	430.	0.0439
140.	0.3422	431.	0.0404
141.	0.3388	432.	0.0406
142.	0.3383	433.	0.0421
143.	0.3315	434.	0.043
144.	0.3316	435.	0.043
145.	0.3278	436.	0.0383
146.	0.3241	437.	0.0397
147.	0.3221	438.	0.04
148.	0.3198	439.	0.0416
149.	0.3154	440.	0.0399
150.	0.3145	441.	0.0403
151.	0.3115	442.	0.0396
152.	0.3086	443.	0.0396
153.	0.3052	444.	0.0409
154.	0.3045	445.	0.0391
155.	0.3014	446.	0.0367
156.	0.2978	447.	0.0397
157.	0.298	448.	0.0395
158.	0.2931	449.	0.0369
159.	0.2905	450.	0.0389
160.	0.2887	451.	0.0396
161.	0.2853	452.	0.0385
162.	0.2822	453.	0.0368

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
163.	0.2818	454.	0.036
164.	0.2789	455.	0.0362
165.	0.2769	456.	0.0356
166.	0.2731	457.	0.0373
167.	0.2708	458.	0.0362
168.	0.2686	459.	0.0367
169.	0.268	460.	0.0369
170.	0.2657	461.	0.0368
171.	0.2625	462.	0.0367
172.	0.2612	463.	0.0349
173.	0.2584	464.	0.0335
174.	0.2558	465.	0.0367
175.	0.2557	466.	0.0353
176.	0.2509	467.	0.0344
177.	0.25	468.	0.0338
178.	0.2467	469.	0.0355
179.	0.2451	470.	0.0326
180.	0.2442	471.	0.0349
181.	0.2421	472.	0.0329
182.	0.2397	473.	0.0344
183.	0.2353	474.	0.0338
184.	0.2357	475.	0.034
185.	0.2316	476.	0.0331
186.	0.2318	477.	0.0314
187.	0.2296	478.	0.0349
188.	0.2252	479.	0.031
189.	0.2258	480.	0.032
190.	0.2249	481.	0.0331
191.	0.2222	482.	0.0314
192.	0.2212	483.	0.033
193.	0.2194	484.	0.0306
194.	0.2155	485.	0.0306
195.	0.2164	486.	0.0306
196.	0.2149	487.	0.0298
197.	0.2121	488.	0.0298
198.	0.2103	489.	0.0321
199.	0.2078	490.	0.0297
200.	0.2082	491.	0.03
201.	0.2054	492.	0.0289
202.	0.2031	493.	0.0317
203.	0.2033	494.	0.0307
204.	0.2005	495.	0.0315
205.	0.1987	496.	0.0319
206.	0.198	497.	0.0312
207.	0.1926	498.	0.0319
208.	0.1927	499.	0.0305
209.	0.192	500.	0.0298
210.	0.1891	501.	0.03
211.	0.19	502.	0.0293
212.	0.1866	503.	0.0291
213.	0.1876	504.	0.0279
214.	0.1846	505.	0.0283
215.	0.1829	506.	0.0284
216.	0.1817	507.	0.0294
217.	0.1797	508.	0.0271
218.	0.1789	509.	0.0299
219.	0.179	510.	0.0263
220.	0.1753	511.	0.028
221.	0.1738	512.	0.0272
222.	0.1722	513.	0.0272
223.	0.1711	514.	0.0291
224.	0.1695	515.	0.0292
225.	0.168	516.	0.0283
226.	0.1694	517.	0.0264
227.	0.168	518.	0.0285
228.	0.165	519.	0.0263

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
229.	0.1651	520.	0.0262
230.	0.1641	521.	0.0279
231.	0.1616	522.	0.0263
232.	0.1612	523.	0.0268
233.	0.1574	524.	0.0274
234.	0.1569	525.	0.0264
235.	0.1564	526.	0.0263
236.	0.1546	527.	0.0264
237.	0.1551	528.	0.0251
238.	0.1491	529.	0.0262
239.	0.1526	530.	0.0252
240.	0.1505	531.	0.0241
241.	0.1479	532.	0.0252
242.	0.1492	533.	0.0232
243.	0.1468	534.	0.0241
244.	0.1463	535.	0.0229
245.	0.1446	536.	0.0254
246.	0.144	537.	0.0258
247.	0.1428	538.	0.0247
248.	0.1424	539.	0.0243
249.	0.1399	540.	0.0238
250.	0.1377	541.	0.0259
251.	0.1381	542.	0.0235
252.	0.136	543.	0.022
253.	0.1371	544.	0.0238
254.	0.134	545.	0.0232
255.	0.1344	546.	0.0219
256.	0.1318	547.	0.0234
257.	0.1317	548.	0.0218
258.	0.1321	549.	0.0228
259.	0.1304	550.	0.0211
260.	0.1296	551.	0.0222
261.	0.1271	552.	0.0248
262.	0.1272	553.	0.0209
263.	0.1273	554.	0.0225
264.	0.1252	555.	0.021
265.	0.1253	556.	0.0224
266.	0.1232	557.	0.0235
267.	0.1213	558.	0.024
268.	0.122	559.	0.0212
269.	0.1208	560.	0.0235
270.	0.1213	561.	0.0236
271.	0.1197	562.	0.0226
272.	0.1161	563.	0.0216
273.	0.1159	564.	0.022
274.	0.115	565.	0.0221
275.	0.1123	566.	0.022
276.	0.1137	567.	0.0215
277.	0.1147	568.	0.0217
278.	0.1143	569.	0.0217
279.	0.1103	570.	0.022
280.	0.1114	571.	0.0191
281.	0.1091	572.	0.0238
282.	0.1106	573.	0.022
283.	0.1081	574.	0.0215
284.	0.1087	575.	0.0208
285.	0.1067	576.	0.0208
286.	0.1067	577.	0.0221
287.	0.1067	578.	0.0202
288.	0.1037	579.	0.0199
289.	0.1049	580.	0.0218
290.	0.1059	581.	0.0162
291.	0.1013		

SOLUTION

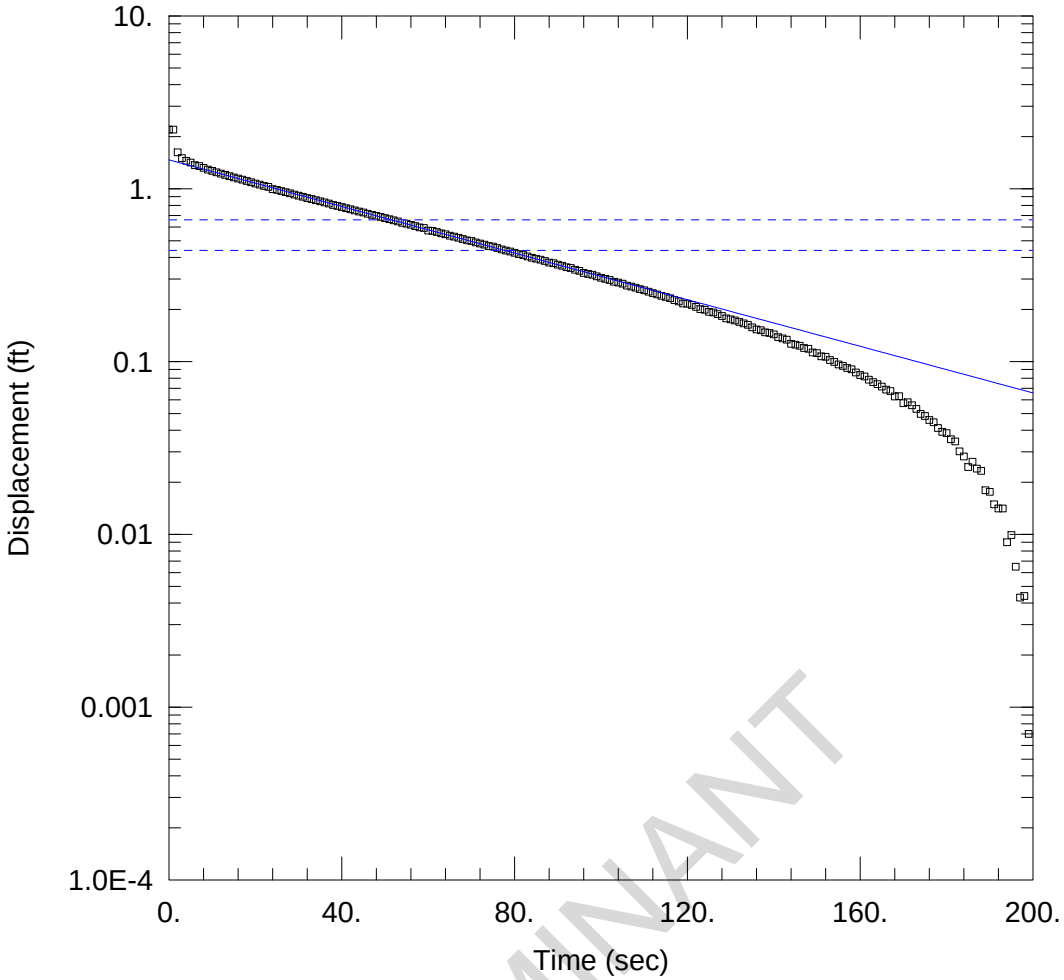
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 63.11

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.002861	cm/sec
y0	1.155	ft

$T = K*b = 2.452$ cm²/sec



WELL TEST ANALYSIS

Data Set: J:\...\AXMW-1 Slug OUT.aqt
Date: 11/18/15 Time: 09:54:33

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Well: AXMW-1
Test Date: 10-5-15

AQUIFER DATA

Saturated Thickness: 28.12 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AXMW-1)

Initial Displacement: 2.2 ft
Total Well Penetration Depth: 28.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 28.12 ft
Screen Length: 20. ft
Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.005144 cm/sec
y0 = 1.469 ft

Data Set: J:\5164 - Luminant CCR Well Installation and GW Sampling\5164-E_Sandow 5\Slug Tests\Sandow Slug Tests
Date: 11/18/15
Time: 09:55:06

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Date: 10-5-15
Test Well: AXMW-1

AQUIFER DATA

Saturated Thickness: 28.12 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: AXMW-1

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 28.12 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 20. ft
Total Well Penetration Depth: 28.12 ft

No. of Observations: 201

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.	0.	101.	0.3006
1.	2.2	102.	0.2966
2.	1.624	103.	0.2894
3.	1.503	104.	0.2862
4.	1.45	105.	0.282
5.	1.418	106.	0.2748
6.	1.369	107.	0.2717
7.	1.353	108.	0.2673
8.	1.321	109.	0.2624
9.	1.289	110.	0.2585
10.	1.269	111.	0.2538
11.	1.245	112.	0.249
12.	1.224	113.	0.2446
13.	1.204	114.	0.2399
14.	1.183	115.	0.2362
15.	1.163	116.	0.2324
16.	1.145	117.	0.2264
17.	1.127	118.	0.2227
18.	1.109	119.	0.2167
19.	1.091	120.	0.2162
20.	1.073	121.	0.2124
21.	1.055	122.	0.2071
22.	1.039	123.	0.201
23.	1.024	124.	0.1994
24.	0.9947	125.	0.1937
25.	0.9847	126.	0.1922
26.	0.9697	127.	0.1882
27.	0.9548	128.	0.1835
28.	0.941	129.	0.1778
29.	0.9261	130.	0.1752

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
30.	0.9109	131.	0.1727
31.	0.8974	132.	0.1695
32.	0.8825	133.	0.1664
33.	0.8714	134.	0.163
34.	0.8585	135.	0.1578
35.	0.8453	136.	0.1535
36.	0.8336	137.	0.1517
37.	0.8205	138.	0.1477
38.	0.8057	139.	0.1463
39.	0.7959	140.	0.1436
40.	0.7838	141.	0.1385
41.	0.7712	142.	0.136
42.	0.7607	143.	0.1338
43.	0.7495	144.	0.1267
44.	0.7377	145.	0.1251
45.	0.7287	146.	0.1234
46.	0.7168	147.	0.1198
47.	0.7063	148.	0.1184
48.	0.6969	149.	0.1129
49.	0.6865	150.	0.1118
50.	0.6767	151.	0.1072
51.	0.6668	152.	0.1064
52.	0.6563	153.	0.1021
53.	0.6462	154.	0.0995
54.	0.6342	155.	0.0962
55.	0.628	156.	0.0944
56.	0.6178	157.	0.0918
57.	0.6079	158.	0.0902
58.	0.5972	159.	0.0865
59.	0.5924	160.	0.0835
60.	0.5732	161.	0.082
61.	0.5702	162.	0.0785
62.	0.5623	163.	0.076
63.	0.5521	164.	0.0739
64.	0.5447	165.	0.0716
65.	0.5347	166.	0.0688
66.	0.5278	167.	0.0675
67.	0.5199	168.	0.0628
68.	0.511	169.	0.063
69.	0.5031	170.	0.0574
70.	0.4984	171.	0.0581
71.	0.489	172.	0.0558
72.	0.4819	173.	0.0532
73.	0.4749	174.	0.0497
74.	0.4661	175.	0.0484
75.	0.4625	176.	0.0459
76.	0.4534	177.	0.0445
77.	0.4454	178.	0.0412
78.	0.4385	179.	0.0392
79.	0.433	180.	0.0385
80.	0.4256	181.	0.0355
81.	0.4188	182.	0.0345
82.	0.4135	183.	0.0302
83.	0.4051	184.	0.0282
84.	0.3984	185.	0.0245
85.	0.3933	186.	0.0263
86.	0.3886	187.	0.024
87.	0.3818	188.	0.0233
88.	0.3737	189.	0.018
89.	0.3705	190.	0.0176
90.	0.3636	191.	0.0149
91.	0.3583	192.	0.0141
92.	0.3512	193.	0.0141
93.	0.3475	194.	0.009
94.	0.3399	195.	0.0099
95.	0.3349	196.	0.0065

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
96.	0.3258	197.	0.0043
97.	0.321	198.	0.0044
98.	0.3178	199.	0.0007
99.	0.3113	200.	0.
100.	0.3055		

SOLUTION

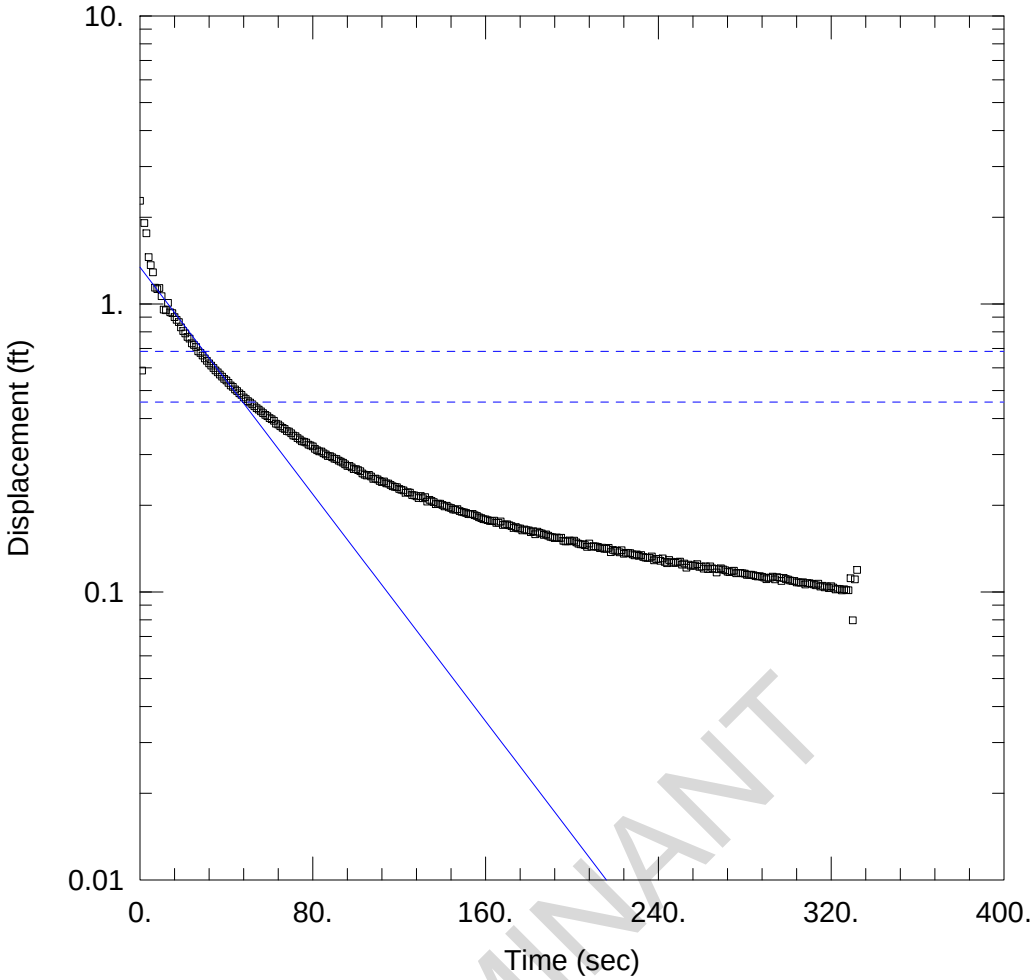
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 63.11

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.005144	cm/sec
y0	1.469	ft

$T = K*b = 4.409$ cm²/sec



WELL TEST ANALYSIS

Data Set: J:\...\AXMW-2 Slug IN.aqt
Date: 11/18/15 Time: 10:02:45

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Well: AXMW-2
Test Date: 10-5-15

AQUIFER DATA

Saturated Thickness: 39.22 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AXMW-2)

Initial Displacement: 2.28 ft Static Water Column Height: 39.22 ft
Total Well Penetration Depth: 39.22 ft Screen Length: 20. ft
Casing Radius: 0.083 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
K = 0.0004255 cm/sec y0 = 1.341 ft

Data Set: J:\5164 - Luminant CCR Well Installation and GW Sampling\5164-E_Sandow 5\Slug Tests\Sandow Slug Tests
Date: 11/18/15
Time: 10:03:01

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Date: 10-5-15
Test Well: AXMW-2

AQUIFER DATA

Saturated Thickness: 39.22 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: AXMW-2

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.28 ft
Static Water Column Height: 39.22 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 20. ft
Total Well Penetration Depth: 39.22 ft

No. of Observations: 333

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.	0.	167.	0.1756
1.	0.5873	168.	0.1709
2.	1.91	169.	0.1715
3.	1.76	170.	0.1717
4.	1.453	171.	0.1703
5.	1.363	172.	0.1692
6.	1.287	173.	0.1666
7.	1.139	174.	0.168
8.	1.126	175.	0.1662
9.	1.136	176.	0.166
10.	1.064	177.	0.1635
11.	0.9551	178.	0.1649
12.	0.9512	179.	0.1637
13.	1.009	180.	0.1635
14.	0.9347	181.	0.1612
15.	0.9296	182.	0.1625
16.	0.8993	183.	0.1586
17.	0.8808	184.	0.1618
18.	0.8647	185.	0.1605
19.	0.8291	186.	0.1597
20.	0.8047	187.	0.1578
21.	0.7895	188.	0.1583
22.	0.7677	189.	0.1567
23.	0.7579	190.	0.1554
24.	0.73	191.	0.1548
25.	0.7201	192.	0.1537
26.	0.7084	193.	0.1545
27.	0.6841	194.	0.1537
28.	0.6756	195.	0.1541
29.	0.6616	196.	0.1505

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
30.	0.6468	197.	0.1497
31.	0.6343	198.	0.15
32.	0.6221	199.	0.1509
33.	0.6105	200.	0.15
34.	0.5989	201.	0.1506
35.	0.5879	202.	0.1486
36.	0.5784	203.	0.147
37.	0.5683	204.	0.1463
38.	0.5594	205.	0.1463
39.	0.5491	206.	0.1453
40.	0.542	207.	0.1434
41.	0.532	208.	0.1473
42.	0.5212	209.	0.1435
43.	0.5153	210.	0.1441
44.	0.5046	211.	0.1439
45.	0.4984	212.	0.1434
46.	0.4895	213.	0.1418
47.	0.4831	214.	0.1425
48.	0.4736	215.	0.1411
49.	0.4677	216.	0.1412
50.	0.4598	217.	0.1423
51.	0.4545	218.	0.1375
52.	0.4482	219.	0.1399
53.	0.4412	220.	0.1391
54.	0.4346	221.	0.1388
55.	0.4294	222.	0.1373
56.	0.4237	223.	0.1396
57.	0.4176	224.	0.1357
58.	0.4116	225.	0.1368
59.	0.4074	226.	0.1365
60.	0.4015	227.	0.1364
61.	0.3981	228.	0.1349
62.	0.3926	229.	0.1339
63.	0.3839	230.	0.135
64.	0.3813	231.	0.1334
65.	0.3759	232.	0.1343
66.	0.3711	233.	0.1323
67.	0.3678	234.	0.1315
68.	0.362	235.	0.1312
69.	0.3607	236.	0.1314
70.	0.3555	237.	0.1327
71.	0.3493	238.	0.1288
72.	0.3476	239.	0.13
73.	0.3421	240.	0.1302
74.	0.3382	241.	0.1283
75.	0.3335	242.	0.1307
76.	0.3324	243.	0.1271
77.	0.3302	244.	0.1258
78.	0.3245	245.	0.129
79.	0.3224	246.	0.1272
80.	0.32	247.	0.1262
81.	0.3142	248.	0.1261
82.	0.3106	249.	0.1271
83.	0.3077	250.	0.1274
84.	0.3074	251.	0.1243
85.	0.3031	252.	0.1255
86.	0.3004	253.	0.1214
87.	0.2963	254.	0.1244
88.	0.296	255.	0.1232
89.	0.2933	256.	0.1234
90.	0.29	257.	0.1234
91.	0.2893	258.	0.1249
92.	0.2856	259.	0.1221
93.	0.2833	260.	0.1225
94.	0.2808	261.	0.1205
95.	0.2772	262.	0.1226

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
96.	0.274	263.	0.12
97.	0.274	264.	0.1227
98.	0.2707	265.	0.1207
99.	0.2668	266.	0.1202
100.	0.267	267.	0.1168
101.	0.2648	268.	0.1199
102.	0.2625	269.	0.1207
103.	0.2579	270.	0.1197
104.	0.2552	271.	0.1189
105.	0.2537	272.	0.1176
106.	0.255	273.	0.1171
107.	0.2516	274.	0.1182
108.	0.2468	275.	0.1185
109.	0.2474	276.	0.116
110.	0.246	277.	0.1164
111.	0.2428	278.	0.1164
112.	0.2408	279.	0.116
113.	0.2419	280.	0.1157
114.	0.2382	281.	0.1146
115.	0.2379	282.	0.1148
116.	0.2351	283.	0.1147
117.	0.2327	284.	0.1143
118.	0.2317	285.	0.1136
119.	0.2309	286.	0.1132
120.	0.2279	287.	0.1134
121.	0.2263	288.	0.1129
122.	0.2252	289.	0.1121
123.	0.221	290.	0.1107
124.	0.2221	291.	0.1118
125.	0.2212	292.	0.1122
126.	0.217	293.	0.113
127.	0.2164	294.	0.1105
128.	0.2148	295.	0.1125
129.	0.2117	296.	0.112
130.	0.2152	297.	0.1091
131.	0.2114	298.	0.1119
132.	0.2133	299.	0.1109
133.	0.2059	300.	0.1104
134.	0.2088	301.	0.1096
135.	0.2069	302.	0.1092
136.	0.2052	303.	0.1091
137.	0.2017	304.	0.1079
138.	0.2025	305.	0.1079
139.	0.2024	306.	0.1076
140.	0.2004	307.	0.108
141.	0.1981	308.	0.1061
142.	0.1992	309.	0.1074
143.	0.1966	310.	0.1072
144.	0.1955	311.	0.1067
145.	0.1934	312.	0.1061
146.	0.1929	313.	0.1055
147.	0.1938	314.	0.1068
148.	0.191	315.	0.1044
149.	0.1897	316.	0.105
150.	0.1889	317.	0.1037
151.	0.1879	318.	0.1045
152.	0.1864	319.	0.103
153.	0.186	320.	0.1047
154.	0.1866	321.	0.1036
155.	0.1847	322.	0.102
156.	0.1835	323.	0.1025
157.	0.1816	324.	0.1023
158.	0.1804	325.	0.1012
159.	0.1788	326.	0.1021
160.	0.1787	327.	0.1015
161.	0.1775	328.	0.1013

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
162.	0.1763	329.	0.1116
163.	0.1761	330.	0.0797
164.	0.1767	331.	0.1106
165.	0.1737	332.	0.1192
166.	0.174		

SOLUTION

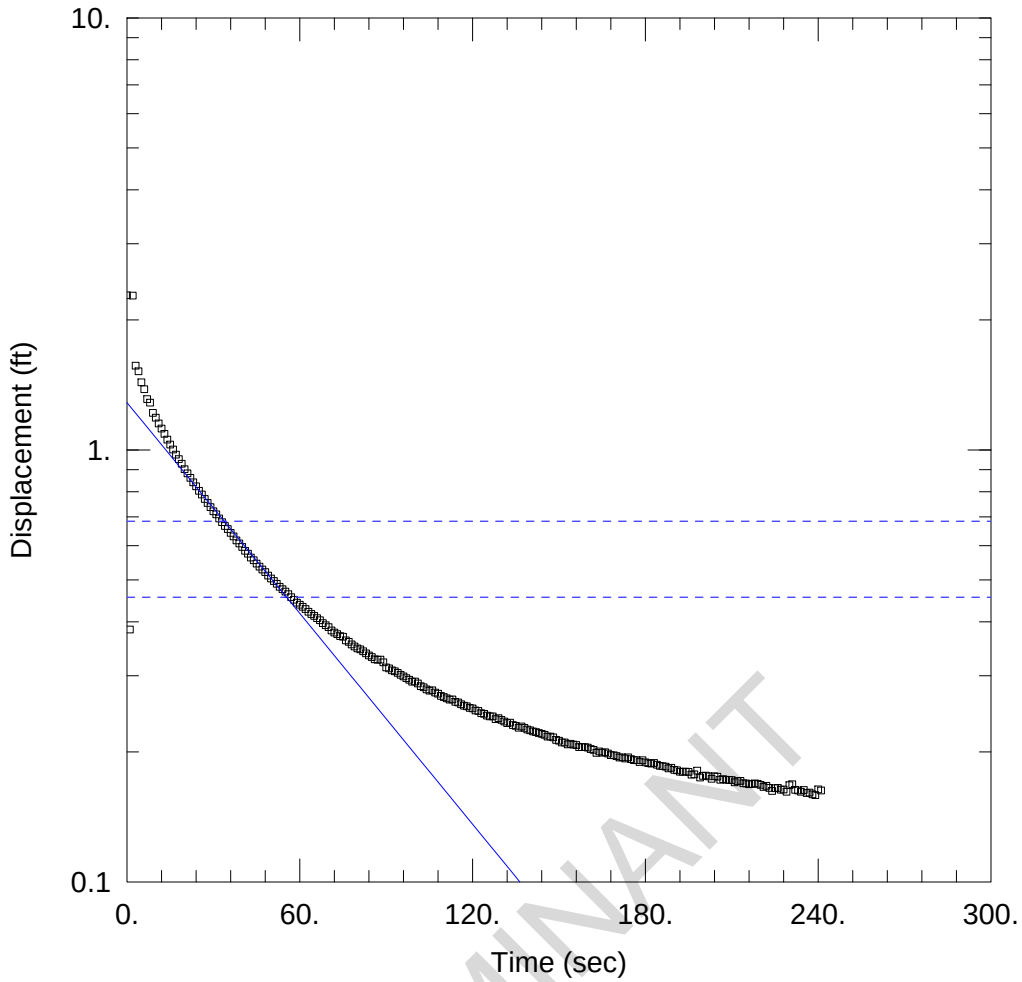
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.573

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0004255	cm/sec
y0	1.341	ft

T = K*b = 0.5086 cm²/sec



WELL TEST ANALYSIS

Data Set: J:\...\AXMW-2 Slug OUT.aqt
Date: 11/18/15 Time: 10:03:36

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Well: AXMW-2
Test Date: 10-5-15

AQUIFER DATA

Saturated Thickness: 39.22 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.28 ft
Total Well Penetration Depth: 39.22 ft
Casing Radius: 0.083 ft
Static Water Column Height: 39.22 ft
Screen Length: 20. ft
Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003512 cm/sec
y0 = 1.287 ft

Data Set: J:\5164 - Luminant CCR Well Installation and GW Sampling\5164-E_Sandow 5\Slug Tests\Sandow Slug Tests
Date: 11/18/15
Time: 10:03:55

PROJECT INFORMATION

Company: PBW
Client: Luminant
Project: 5164-E
Location: Sandow AX
Test Date: 10-5-15
Test Well: AXMW-2

AQUIFER DATA

Saturated Thickness: 39.22 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: New Well

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.28 ft
Static Water Column Height: 39.22 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 20. ft
Total Well Penetration Depth: 39.22 ft

No. of Observations: 242

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.	0.	121.	0.2493
1.	0.3839	122.	0.2487
2.	2.276	123.	0.2458
3.	1.566	124.	0.2449
4.	1.52	125.	0.2427
5.	1.434	126.	0.2416
6.	1.382	127.	0.2416
7.	1.311	128.	0.2381
8.	1.287	129.	0.2394
9.	1.218	130.	0.2371
10.	1.187	131.	0.2352
11.	1.151	132.	0.2332
12.	1.121	133.	0.2338
13.	1.089	134.	0.2308
14.	1.057	135.	0.2297
15.	1.029	136.	0.2274
16.	1.002	137.	0.2289
17.	0.9751	138.	0.2273
18.	0.9519	139.	0.2253
19.	0.9287	140.	0.2243
20.	0.9024	141.	0.2231
21.	0.8825	142.	0.2222
22.	0.8617	143.	0.2212
23.	0.8413	144.	0.2201
24.	0.8234	145.	0.2191
25.	0.804	146.	0.217
26.	0.7887	147.	0.2171
27.	0.7703	148.	0.216
28.	0.7537	149.	0.2132
29.	0.7375	150.	0.2123

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
30.	0.721	151.	0.2102
31.	0.7095	152.	0.2103
32.	0.6941	153.	0.2082
33.	0.6805	154.	0.2089
34.	0.6665	155.	0.2079
35.	0.6559	156.	0.2075
36.	0.6424	157.	0.2052
37.	0.6306	158.	0.2052
38.	0.6174	159.	0.2052
39.	0.6075	160.	0.2046
40.	0.5961	161.	0.2031
41.	0.5839	162.	0.2022
42.	0.575	163.	0.1989
43.	0.5636	164.	0.2004
44.	0.5556	165.	0.1991
45.	0.5458	166.	0.1996
46.	0.537	167.	0.1982
47.	0.5287	168.	0.1966
48.	0.5213	169.	0.1964
49.	0.5119	170.	0.1956
50.	0.504	171.	0.194
51.	0.4972	172.	0.1942
52.	0.49	173.	0.1931
53.	0.4821	174.	0.1943
54.	0.4758	175.	0.1925
55.	0.4701	176.	0.1914
56.	0.4635	177.	0.1913
57.	0.4563	178.	0.1895
58.	0.4501	179.	0.1912
59.	0.443	180.	0.1891
60.	0.4382	181.	0.1884
61.	0.4332	182.	0.1879
62.	0.4283	183.	0.1885
63.	0.4219	184.	0.1868
64.	0.4169	185.	0.1857
65.	0.4127	186.	0.1854
66.	0.4078	187.	0.1849
67.	0.4035	188.	0.1831
68.	0.3974	189.	0.1838
69.	0.3928	190.	0.1817
70.	0.3888	191.	0.1813
71.	0.382	192.	0.1799
72.	0.3777	193.	0.1799
73.	0.3746	194.	0.18
74.	0.3709	195.	0.1797
75.	0.3694	196.	0.1771
76.	0.3624	197.	0.1774
77.	0.3594	198.	0.181
78.	0.3546	199.	0.1745
79.	0.3509	200.	0.176
80.	0.3472	201.	0.1762
81.	0.3455	202.	0.1755
82.	0.3419	203.	0.1733
83.	0.338	204.	0.1757
84.	0.3343	205.	0.1752
85.	0.3316	206.	0.1724
86.	0.3275	207.	0.173
87.	0.3268	208.	0.1724
88.	0.327	209.	0.1722
89.	0.3224	210.	0.1721
90.	0.3137	211.	0.1701
91.	0.3121	212.	0.171
92.	0.3088	213.	0.1714
93.	0.3072	214.	0.1692
94.	0.3046	215.	0.169
95.	0.3017	216.	0.1683

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
96.	0.299	217.	0.1686
97.	0.2962	218.	0.1691
98.	0.2938	219.	0.1688
99.	0.2907	220.	0.1678
100.	0.2909	221.	0.1659
101.	0.2881	222.	0.1669
102.	0.2838	223.	0.1651
103.	0.2823	224.	0.1624
104.	0.2792	225.	0.1648
105.	0.2773	226.	0.165
106.	0.2776	227.	0.1635
107.	0.2744	228.	0.1636
108.	0.2727	229.	0.1617
109.	0.2694	230.	0.1675
110.	0.2679	231.	0.1683
111.	0.266	232.	0.1633
112.	0.2643	233.	0.1628
113.	0.2645	234.	0.1617
114.	0.2611	235.	0.1632
115.	0.2603	236.	0.1606
116.	0.2577	237.	0.161
117.	0.2559	238.	0.1595
118.	0.255	239.	0.1588
119.	0.2529	240.	0.1638
120.	0.2522	241.	0.1628

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.573

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0003512	cm/sec
y0	1.287	ft

$T = K*b = 0.4199$ cm²/sec