

PUBLIC SERVICE COMPANY OF OKLAHOMA (PSO)

NORTHEASTERN POWER STATION



Groundwater Monitoring Network Report

Revision 1 – May 2018

Record of Plan Revisions		
Revision Number	Date	Revision Description
1	May 2018	<p>3.1.2 Overall Flow Conitions – revised description to include gw information from all MWs screened in the shale Unit. This modified the gw flow to a radial flow.</p> <p>3.3.1 Overview – revised to include a description of the 17 wells set in the deep shale unit.</p> <p>3.3.1.3 Key Flow Directions – revised to indicate a gw radial flow, not a north to south gw flow.</p> <p>3.3.2 Gaps in the monitoring Well Network – changed to recommend further evaluation of gw to identify unimpacted locations that might serve as background wells.</p> <p>3.3.3 Recommended Monitoring Well Network- Changed to recommend MWs 1D-6D, 9D-13D, and 14-17 as monitoring well network.</p>

Report 1 - Groundwater Monitoring Network for CCR Compliance

Public Service Company of Oklahoma
Northeastern Station 3&4
Non-Hazardous Industrial Waste (NHIW) Landfill
Permit No. FA3566010

May 2018
Project No. 35157123/35187096



**PUBLIC SERVICE
COMPANY OF
OKLAHOMA**SM

A unit of American Electric Power

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Environmental



Facilities



Geotechnical



Materials

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1.0 Objective

The purpose of this Groundwater Monitoring Network Report (GWMNR) is to demonstrate adequacy and compliance of the existing monitoring well network with EPA Coal Combustion Residuals (CCR) regulations (40 CFR 257) and with ODEQ's (Oklahoma Department of Environmental Quality) CCR rule OAC 252.517 at the Public Service Company of Oklahoma – Northeastern Stations 3 & 4 Ash Landfill (Permit No. 3555050). The Public Service of Oklahoma is a unit of American Electric Power (AEP).

2.0 Background Information

2.1 Facility Location Description

The Northeastern Power Station facility is located at the junction of U.S. Highway 169 and Oklahoma Highway 88 approximately 1 mile south of Oologah, Rogers County, Oklahoma. The facility property consists of approximately 1230 acres located in Sections 3 and 4, Township 22 North, Range 15 East, and Sections 33 and 34, Township 23 North, Range 15 East (I.M.) in Rogers County, Oklahoma. Four (4) electric generating Units are present at the facility. Units 1&2 are gas fired while Units 3&4 are coal fired units. Unit 4 ceased operation in April of 2016. A site location map and plant and CCR unit location map showing the general location of the landfill is presented in **FIGURES 1 & 2**.

2.2 Description of CCR Unit

2.2.1 Embankment Configuration

Based on the 1970 USGS topographic map (**FIGURE 1**) it appears the landfill was constructed in an area where gravel pit mining or limestone quarrying operations took place. Portions of the upper limestone rock appear to have been removed, primarily within the western portion of the landfill. A dike structure defining the south edge of the disposal facility was built as a part of initial plant construction. This dike was built to an elevation of 610 feet MSL having a crest width of 10 to 12 feet and 3:1 side slopes (**Volume 1 Major Mod 2011 Terracon Project No. 35107130**)¹. The dike acted as a barrier between the disposal area and the Verdigris River. An additional construction event raised the dike to the current crest elevations of greater than 630 feet MSL, with a crest width of about 25 feet. Side-slopes of the dike, running down to the river basin, are on the order of 30 degrees from horizontal and consist of red-brown clay with limestone gravel mixed with varying amounts of ash material and larger rock. Limestone with some thin shale beds, followed by shale, underlies the constructed dike. The facility previously installed a slurry wall and grout curtain on the southeast side of the landfill within the constructed dike (**FIGURE 3**). The landfill embankments are constructed with 3:1 interior slopes. The outside embankment slopes vary from approximately 2.5:1 to 4:1 (AEP, "**Ash Landfill Modification – Construction Drawings**", Northeastern Plant, Dated September 2014)².

2.2.2 Area/Volume

The current Northeastern Ash Landfill site consists of approximately 44 acres located in the southeastern portion of the property and adjacent to the Verdigris River. The total landfill capacity for disposal is 2.463 MCY.

2.2.3 Construction and Operational History

The Ash Landfill is an existing landfill that was permitted by the Oklahoma State Department of Health in March 1978. The landfill permit has subsequently been modified and re-issued through the Oklahoma Department of Environmental Quality. The landfill currently operates in accordance with Permit No. 3566010. The landfill is located in an area that historically has been quarried. The facility has utilized this quarried depression to dispose of CCR. Currently CCR from Unit 3 is disposed of in the landfill as Unit 4 has been shut down. In 2012-2013, a landfill improvement project was completed which resulted in the construction of a 3 ft wide by 25 ft deep 2200-foot-long slurry wall followed by a 1400-foot-long grout curtain. The construction of the slurry wall involved excavating out 25 feet of overburden and keying into 0.5-1 foot of the limestone unit. The grout curtain involved the injection of bentonite to elevations of 590-595 ft amsl. As a result, this project created an imperious bentonite slurry wall/grout curtain from ground surface to depth of 590- 600 ft amsl along the southern edge of the landfill. (**Hydrogeologic Summary Report, Terracon, March 2017**)³. This barrier system effectively prevents groundwater to flow out of the landfill. Additionally, a geosynthetic intermediate liner and a leachate collection system have been installed above existing waste in the landfill. The elevation of the liner system slopes downward from west to east (towards the leachate collection pond) from approximately 645 ft to 615 ft in elevation.

2.2.4 Surface Water Control

OAC 252:515-17 establishes standards and requirements for the management of stormwater associated CCR landfills which address the management and control of run-on and run-off stormwater derived from a 24-hour, 25-year storm event.

The Landfill perimeter ditches are generally sloped to drain to the northeast portion of the Landfill to Basin C. These perimeter ditches convey the stormwater to Basin C prior to impacting the waste disposal area. Contact stormwater is managed as part of the facility OPDES program. As designed, the run-on and run-off control systems are capable of managing and controlling a 24-hour, 25-year storm event. Stormwater discharges associated with the landfill will be managed as part of the facility OPDES program (**Volume 3 Major Mod 2011 Terracon Project No. 35107130**)⁴.

2.3 Previous Investigations

Geotechnical

§ 2004 – Terracon Project No. 040445147

Groundwater and Other Environmental

§ 2008 – Terracon Project No. 35077150

§ 2009 – Terracon Project No. 35107130

2.4 Hydrogeologic Setting

Groundwater encountered in bedrock in this region occurs in secondary openings, such as joints, fractures, and solution cavities. Groundwater occurs in most of the geologic units in the region; however, many of the units do not yield significant amounts of water.

Groundwater yields from the Oologah Formation, Labette Formation, and Fort Scott Limestone are small. The average yield of wells in the Pennsylvanian and Mississippian Age rocks is estimated to be 0.5 gallons per minute (Marcher, 1971). A review of the Oklahoma Geological Survey Hydrologic Atlas map titled *Maps Showing Principal Groundwater Resources and Recharge Areas in Oklahoma (Sheet 2 - Bedrock Aquifers and Recharge Areas, 1988)* indicates that the site is not located within a principal bedrock aquifer or recharge area.

The largest yields are found in unconsolidated material along streams and rivers. Alluvium along the lower portion of the Verdigris River can be utilized as a source of water and yields of up to 30 gallons per minute have been reported (Marcher, 1971), (**Well Install Report 2011, Terracon**)⁵.

2.4.1 Climate

Oologah receives an average of 42 inches of rainfall annually. The average temperature annually ranges from 35°F to 85°F (<http://www.city-data.com/city/Oologah-Oklahoma.html>)⁶.

2.4.2 Regional and Local Geologic Setting

Soils

According to the USDA Soil Survey of Rogers County, Oklahoma (July, 2007), the two predominant soils in the vicinity of the landfill are the Hector-Endshaw complex (Rs) and Claremore silt loam (CmB). The Shidler stony silty clay loam (So) and Verdigris silty clay loam (Vf) are also present near the landfill but to a lesser extent. A majority of the soils in the vicinity of the landfill have been altered or removed during site development.

The Claremore consists of a reddish brown silty clay loam approximately 19 to 24 inches thick and is underlain by bedrock. The Claremore is well drained with a low to moderately low water capacity.

The Hector-Endshaw consists of a gravelly fine sandy loam approximately 15 to 25 inches thick and is underlain by bedrock. The Hector-Endshaw is well drained with a very low to moderately high water capacity.

The landfill is located in an area underlain by the Pennsylvanian Age Oologah Formation, which is the major geologic formation outcropping in this area. Although some Quaternary Age Alluvial deposits (consisting of sand, gravel and clay) are located along the Verdigris River, alluvial deposits were not identified within the boundary of the landfill or on PSO property within the reviewed reports.

Geology

The Oologah Formation dips gently to the northwest at 30 to 50 feet per mile (Oakes, 1952) and rests conformably on the Labette Shale. The Oologah Formation consists of marine limestones and shales and is divided into three distinct members : (1) Altamont Limestone (upper), (2) Bandera Shale (middle), and (3) Pawnee Limestone (lower).

The Altamont Limestone is comprised of a carbonate marine limestone deposited on a broad offshore platform. The Altamont consists of light gray to dark gray limestone, moderately fossiliferous, and massive to thin-bedded. The Altamont Limestone is not present at this site.

The Bandera Shale was deposited during a major fluctuation in sea level which caused an influx of mud to be deposited on the normally non-turbid offshore platform. The middle shaly zone is typically only a few feet thick in the latitude of this region, but is thicker southward reaching a maximum thickness of 15 to 20 feet. The Bandera consists of gray to black shale, all more or less calcareous in fresh exposures. The Bandera is an aquitard that can produce temporary perched water table conditions within the overlying Altamont under certain conditions. The Bandera Shale is not present at this site.

The Pawnee Limestone is similar to the Altamont in composition and depositional environment. The formation consists of light gray to dark gray limestone, moderately fossiliferous and somewhat cherty with some thin beds of shale. According to the original landfill permit (Oklahoma State Department of Health - August 3, 1978), the Oologah Formation within the disposal area is represented by the lower Pawnee Limestone member. The Oologah Limestone rests conformably on the Labette shale.

The Labette Shale was deposited as muds on an offshore bank. The formation consists of clay shale and silty to sandy shale with some thin beds of sandstone and limestone. In this region, the Labette is 180 to 250 feet thick (Oakes, 1952) and rests conformably upon the Pennsylvanian Age Fort Scott Limestone. (**Volume 2 Major Mod 2011 Terracon Project No. 35107130**)⁷

Local Geologic Setting

The 1970 USGS topographic map (**FIGURE 1**) shows the area where the landfill is located prior to its inception. Cross-section A-A' (**APPENDIX 2, SHEET 2**) illustrates that the top of the limestone unit follows the local topographic surface, which has an approximate elevation of 640 ft amsl northwest of the landfill. The area where the landfill has been constructed the top of limestone ranged from 630-590 ft amsl. In two locations, where the limestone dips down to approximately 610-590 ft amsl on the southeast side of the landfill, there are 2 apparent surface water flow channels that extend to the edge of the embankment and include the location of the southeastern berm of the landfill, as seen on **FIGURE 1**. Additionally, the limestone unit is absent in various locations on the southern border of the landfill (cross-section D-D', **APPENDIX 2, SHEET 2**). This variation in the limestone unit from north to south and the lack of the limestone unit in this area is to be expected since the area was historically quarried before the **FIGURE 1** USGS topo map was prepared.

Cross-section A-A' (**APPENDIX 2, SHEET 2**) also shows the top of the shale unit rising from an elevation of approximately 583 ft amsl northwest of the landfill to an approximately elevation of 600 ft amsl southeast of the landfill, conforming to the bottom of the limestone unit. As shown on cross-section D-D' (**APPENDIX 2, SHEET 3**) the shale unit is encountered at approximately 598-605 ft amsl along the southern western edge of the landfill and then dips to approximately 583 ft amsl along the southern eastern edge of the landfill. The bottom of the shale unit has not been determined during monitoring well installation borings. Literature estimates its thickness at 180 to 250 ft.

2.4.3 Surface Water/Groundwater Interactions

The Verdigris River is adjacent to the southeast property boundary of the landfill and maintains an approximate river elevation of 542 ft amsl. River flow is controlled by the Oologah Dam (Corps of Engineers – U.S. Army) located approximately 1 mile north and east of the site. Based on the

groundwater potentiometric data collected in the shale aquifer unit, the average groundwater elevation is 596 ft amsl.

Currently not enough data has been collected to determine if there is surface to groundwater communication.

2.4.4 Water Users

According to the Oklahoma Water Resources Board map, there are no known groundwater wells within a 1 mile of the site. There is a well located approximately 2 miles from the site which has been plugged (**FIGURE 7**).

3.0 Certified Groundwater Monitoring Network

The existing monitoring well network present at the Site was evaluated to determine if any of the wells were viable for continued use as part of the groundwater monitoring well network or also retained as part of a larger groundwater hydraulic monitoring well network. The hydrogeologic conditions were also identified and evaluated to determine if the uppermost aquifer unit has an effective well network. The evaluation was completed in accordance with 40 CRF 257.91 and OAC 252:517-9-2 in establishing a monitoring well network that effectively monitors the uppermost aquifer with a downgradient monitoring system at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer.

3.1 Hydrostratigraphic Units

Hydrostratigraphic units comprise geologic units grouped together on the basis of similar hydraulic conductivity. Slug testing conducted in the limestone unit exhibits an average hydraulic conductivity of 1.87×10^{-3} cm/sec. Slug tests conducted in the shale unit exhibit an average hydraulic conductivity of 2.52×10^{-6} cm/sec (Terracon Project No. 35077150). The hydraulic conductivity results indicate that these units are different units. This has also been confirmed by the geophysical logging of the units (**APPENDIX 3**). Additionally, during the hydrogeological investigations at the site, little to no water was encountered within either of these units.

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Geologic data from soil borings collected at the site indicate that the first geological unit encountered is a limestone unit. However, quarrying of the limestone before the construction of the power plant has extensively removed this unit within the current footprint of the landfill. The thicknesses of the limestone unit beneath the landfill range from 10 feet to 0 feet. In the eastern, unquarried area of the landfill footprint, the limestone thickness is approximately 20 feet thick. Below the limestone unit, the top of the shale unit is encountered which conforms to the bottom

of the limestone unit. The full depth of the shale unit was not determined during monitoring well installation borings. Literature estimates its thickness at 180 ft to 250 ft.

Extensive geologic cross-sections of the Landfill area are shown in **APPENDIX 2**. The base of the landfill was determined to be at an approximate elevation of 610 ft amsl. However, the limestone unit is discontinuous along the southern edge of the landfill as seen in cross-section D-D'. This is to be expected from this quarried area. In these discontinuous areas, there are outcroppings of the shale unit.

3.1.2 Overall Flow Conditions

The average potentiometric elevation of the shale unit is 596 ft amsl. The average hydraulic conductivity through the shale unit at the site is reported to be 2.52×10^{-6} cm/sec. Pump tests completed on the shale unit indicated a yield of less than 150 gallons per day. Available groundwater elevations are summarized in **TABLE 1**. There appears to be seasonal and temporal fluctuations in the groundwater flow. The most recent comprehensive groundwater data set from October 2017 is depicted on **FIGURE 6**. Based on water elevations from the October 2017 sampling event there appears to be groundwater mounding occurring beneath the landfill area. The result of this mounding has created radial flow pattern within the landfill area

3.2 Uppermost Aquifer

3.2.1 CCR Rule Definition

“**Aquifer**” means a geologic formation, group of formations or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

“**Uppermost Aquifer**” means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility’s property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.

Common Definitions:

“**Aquifer**” is a geologic formation(s) that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs. Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people’s uses. (USGS, Water Science Glossary of Terms)

3.2.2 Identified Onsite Hydrostratigraphic Unit

As shown in cross-section D-D' (**APPENDIX 2**) the limestone unit along the southern edge of the landfill is only present east of MW-6D. Additionally, the bentonite slurry wall/grout curtain along the southern edge of the landfill (**FIGURE 3**) has established an impervious wall preventing groundwater flow in the limestone unit that is present in that area.

Therefore, for the purpose of specifying the uppermost aquifer, the on-site hydrostratigraphic unit in the area of the landfill is identified to be the shale unit which is first encountered at approximately 590-600 ft amsl.

3.3 Review of Existing Monitoring Network

3.3.1 Overview

Seventeen (17) monitoring wells (MWs 1D, 2D 3D, 4D, 5D, 6D, 7D, 8D, 9D, 10D, 11D, 12D, 13D, 14, 15, 16, and 17) have been fully constructed within the shale unit around the landfill. The screen interval for MW-2D intercepts both the limestone and shale units, while the sand pack for MW4-D intercepts both the limestone and shale units. A well construction table that summarizes the location, ground surface elevation, borehole depth, installation data, and associated well construction details for the proposed monitoring well network is included in **TABLE 2**.

Also, noted during this review is that of the 17 deep shale monitoring wells 7 of the wells (MW-14, MW-10D, MW-1D, MW-11D, MW-16, MW-9D and MW-17) have historically been dry wells. This information indicates that the deep shale aquifer does not appear to be interconnected within the monitoring well network at the landfill .

3.3.1.1 Well Construction Summary Table

Please refer to **TABLE 2** for a summary of existing monitoring network construction details.

3.3.1.2 Depth Ranges and Hydrostratigraphic units monitored

Please refer to **TABLE 1** for a summary of water-level data from the existing monitoring network. The hydrostratigraphic unit monitored includes the Labette Shale unit.

3.3.1.3 Key Flow Directions

Based on the potentiometric surface elevations from the October 2017 sampling event, there appears to be mounding that creates a radial flow pattern within the landfill area with the highest potentiometric elevations at MW – 5D, 6D and 12D. This mounding is approximately 20 feet higher

in elevation than the observed potentiometric elevations in the surrounding wells also set in the shale formation.

3.3.1.4 Key Users/Receptors Not Protected

Currently groundwater is not being used within a one mile radius of the facility.

3.3.2 Gaps in the Monitoring Well Network

Due to groundwater mounding at the landfill, MW 7D and MW-8D may not be appropriate for statistical analyses using interwell comparisons. MW-8D is excluded as representing background in the shale aquifer per the ODEQ letter dated July 25, 2014. MW-8D and MW-7D are located approximately 780 feet and 140 feet, respectively, from the landfill's waste placement boundary.

Since the deep shale aquifer does not appear to be interconnected within the monitoring well network at the landfill, Northeastern Power Station will continue to evaluate appropriate locations that would represent un-impacted groundwater from the landfill within the shale aquifer that will meet the performance standard of the federal and State CCR regulations.

3.3.3 Recommended Monitoring Well Network

The recommended groundwater monitoring well network is intended to meet specifications stated in 252:517-9-2 and 40 CFR 257.91.

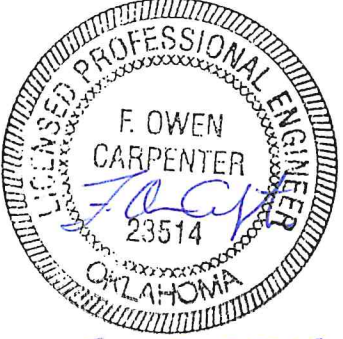
A total of 15 monitoring wells (existing monitoring wells 1D thru 6D, 9D thru 13D and monitoring wells 14 thru 17) are recommended to establish a groundwater quality monitoring network for the landfill.

4.0 Certification

4.1 Limitations

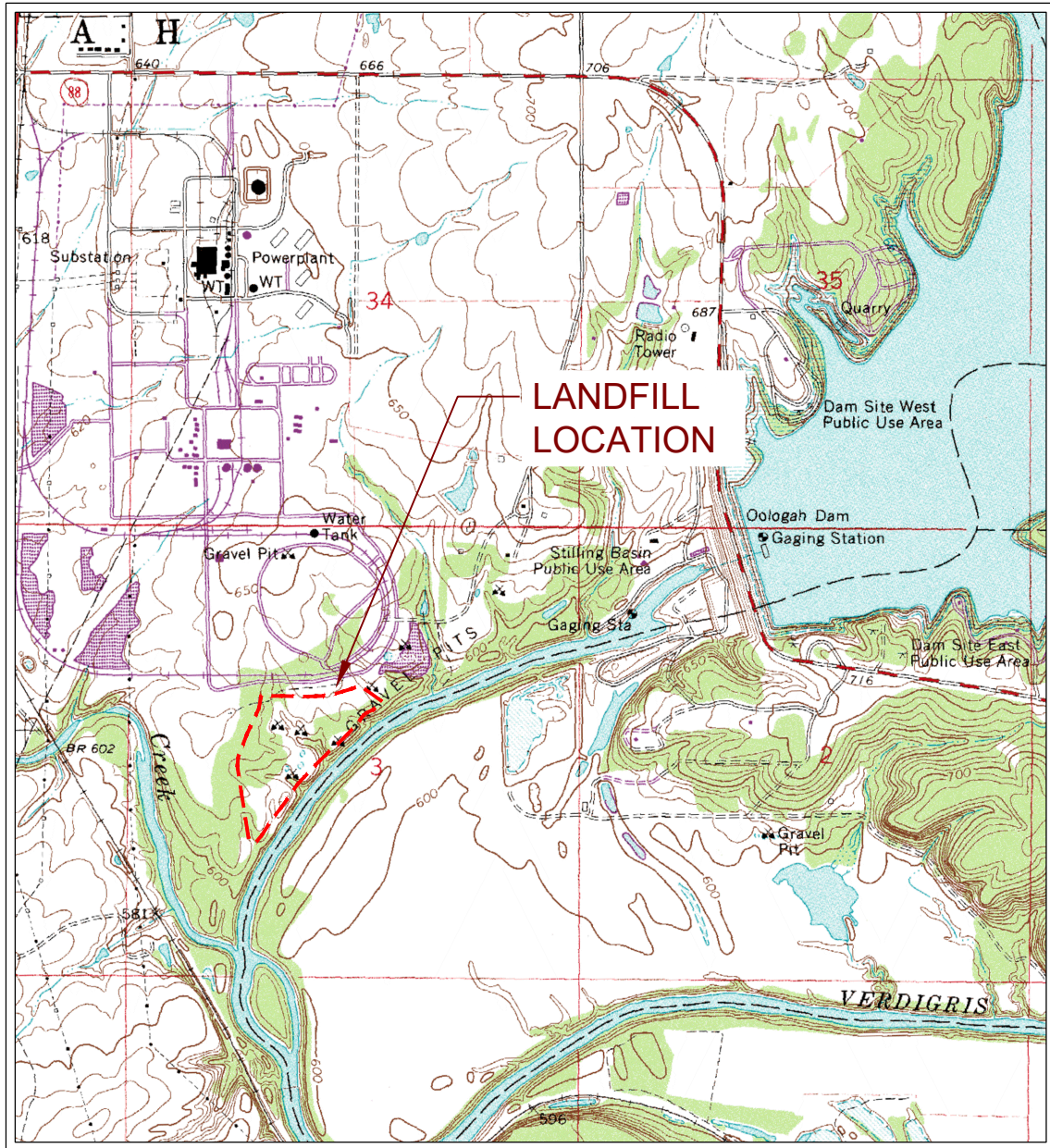
The findings and conclusions resulting from this investigation are based upon information derived from the on-site activities and other services performed under the scope of work as described in this report; such information is subject to change over time if additional information is obtained. Please note that Terracon does not warrant the work of laboratories, regulatory agencies or other third parties supplying information used in the preparation of the report.

4.2 PE Certification

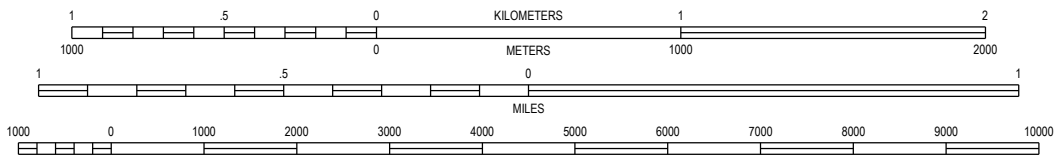
Name: <i>F. Owen Carpenter</i>	Date: <i>5-22-2018</i>	 <i>Exp. 31-OCT-19</i> Stamp
Company: <i>Terracon</i>	Expiration Date: <i>10-31-2019</i>	

Bibliography

- 1 Volume 1 Major Mod 2011 Terracon Project No. 35107130.
- 2 AEP, "Ash Landfill Modification – Construction Drawings", Northeastern Plant, Dated September 2014.
- 3 Hydrogeologic Summary Report, Terracon, March 2017.
- 4 Volume 3 Major Mod 2011 Terracon Project No. 35107130.
- 5 Well Installation Report, Terracon, May 2011.
- 6 <http://www.city-data.com/city/Oologah-Oklahoma.html>.
- 7 Volume 2 Major Mod 2011 Terracon Project No. 35107130.




SCALE 1:24 000

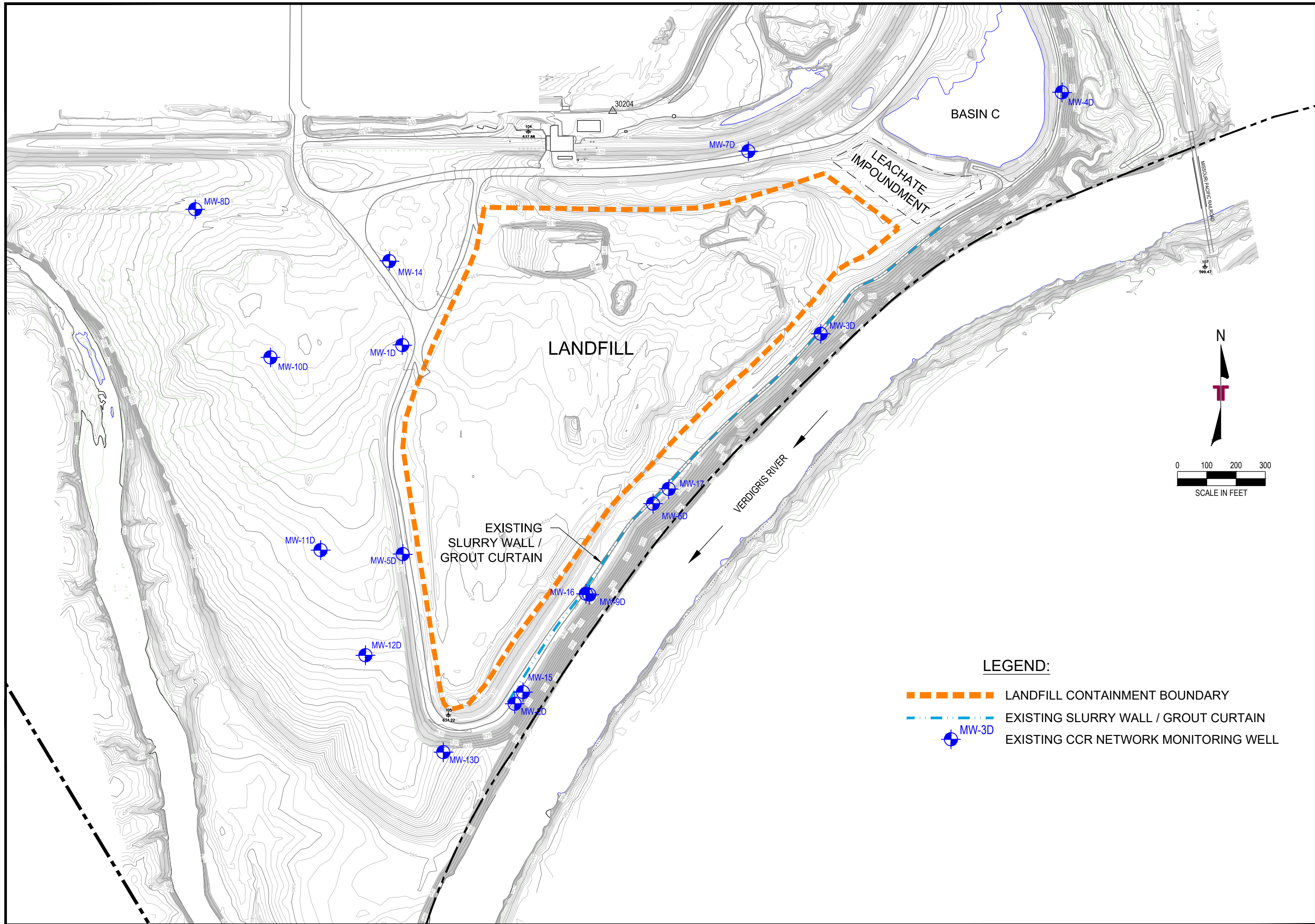


CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

OOLOGAH, OKLAHOMA
QUADRANGLE
1970 (PHOTO REVISED 1980)
7.5 MINUTE SERIES (TOPOGRAPHIC)



Project Mngr: DCM	Project No. 216-003-35157123	 Consulting Engineers and Scientists 25809 I-30 SOUTH BRYANT, AR 72022 PH. (501) 847-9292 FAX. (501) 847-9210	7.5 MINUTE SERIES (TOPOGRAPHIC)	FIG. No.
Drawn By: TLB	Scale: AS SHOWN		GROUNDWATER MONITORING NETWORK	1
Checked By: TLB	File No. 001		AMERICAN ELECTRIC POWER	
Approved By: DCM	Date: 04/10/2018		NORTHEASTERN STATIONS 3 & 4	
			OOLOGAH OKLAHOMA	



LEGEND:

- - - - - LANDFILL CONTAINMENT BOUNDARY
- - - - - EXISTING SLURRY WALL / GROUT CURTAIN
- EXISTING CCR NETWORK MONITORING WELL

FIGURE 3

DESIGNED BY:	TLB
DRAWN BY:	TLB
APPROV. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4/10/2018
JOB NO.	216-003-35157123
ACAD NO.	003
SHEET NO.:	3 OF 7

CCR UNIT LAYOUT AND WELL LOCATIONS

GROUNDWATER MONITORING NETWORK

AMERICAN ELECTRIC POWER

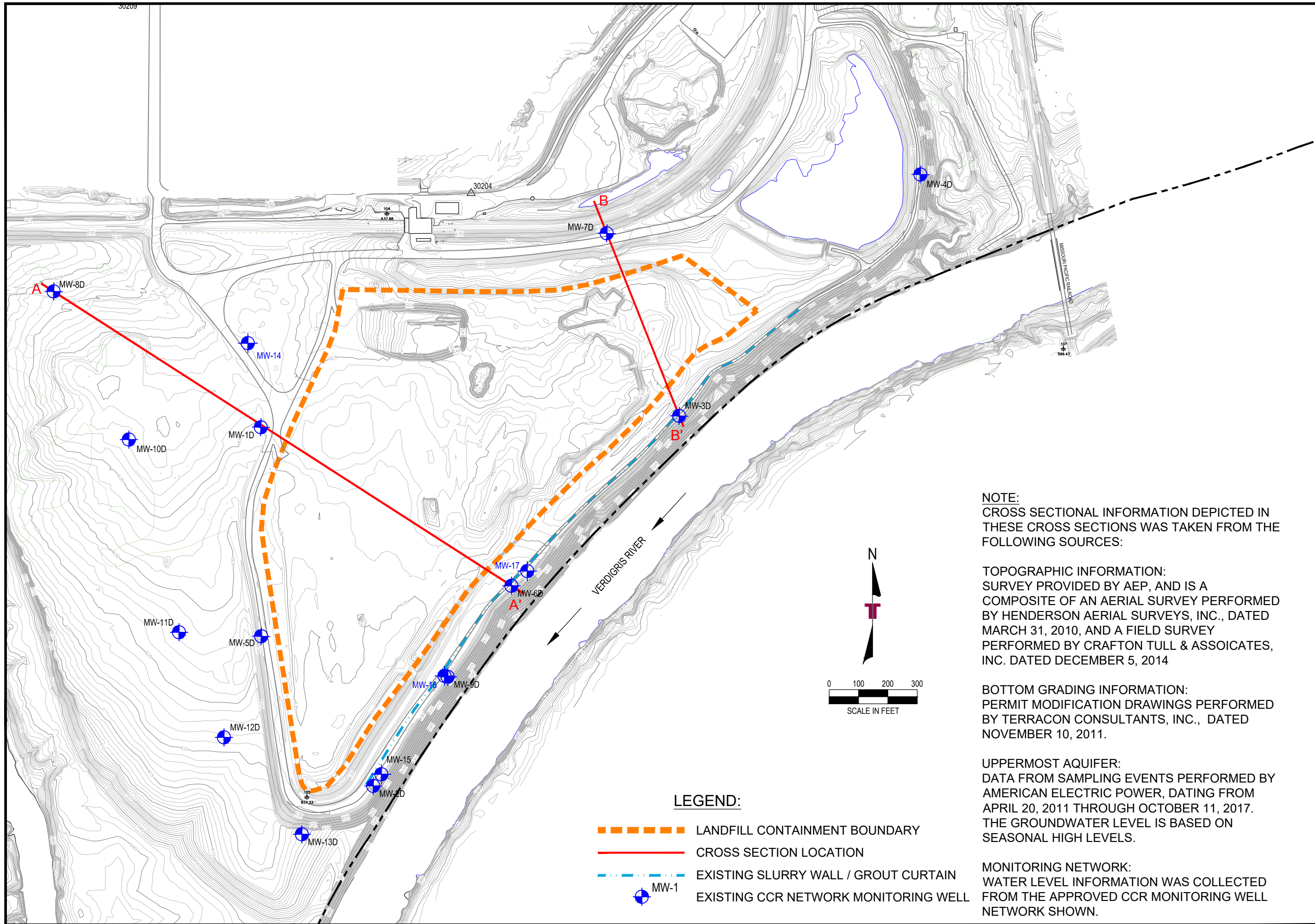
NORTHEAST STATION UNITS 3 & 4

OKLAHOMA

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REV.	DATE	BY	DESCRIPTION



LEGEND:

- - - - - LANDFILL CONTAINMENT BOUNDARY
- CROSS SECTION LOCATION
- - - - - EXISTING SLURRY WALL / GROUT CURTAIN
- EXISTING CCR NETWORK MONITORING WELL

NOTE:
 CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WAS TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
 SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED MARCH 31, 2010, AND A FIELD SURVEY PERFORMED BY CRAFTON TULL & ASSOCIATES, INC. DATED DECEMBER 5, 2014

BOTTOM GRADING INFORMATION:
 PERMIT MODIFICATION DRAWINGS PERFORMED BY TERRACON CONSULTANTS, INC., DATED NOVEMBER 10, 2011.

UPPERMOST AQUIFER:
 DATA FROM SAMPLING EVENTS PERFORMED BY AMERICAN ELECTRIC POWER, DATING FROM APRIL 20, 2011 THROUGH OCTOBER 11, 2017. THE GROUNDWATER LEVEL IS BASED ON SEASONAL HIGH LEVELS.

MONITORING NETWORK:
 WATER LEVEL INFORMATION WAS COLLECTED FROM THE APPROVED CCR MONITORING WELL NETWORK SHOWN.

FIGURE 4

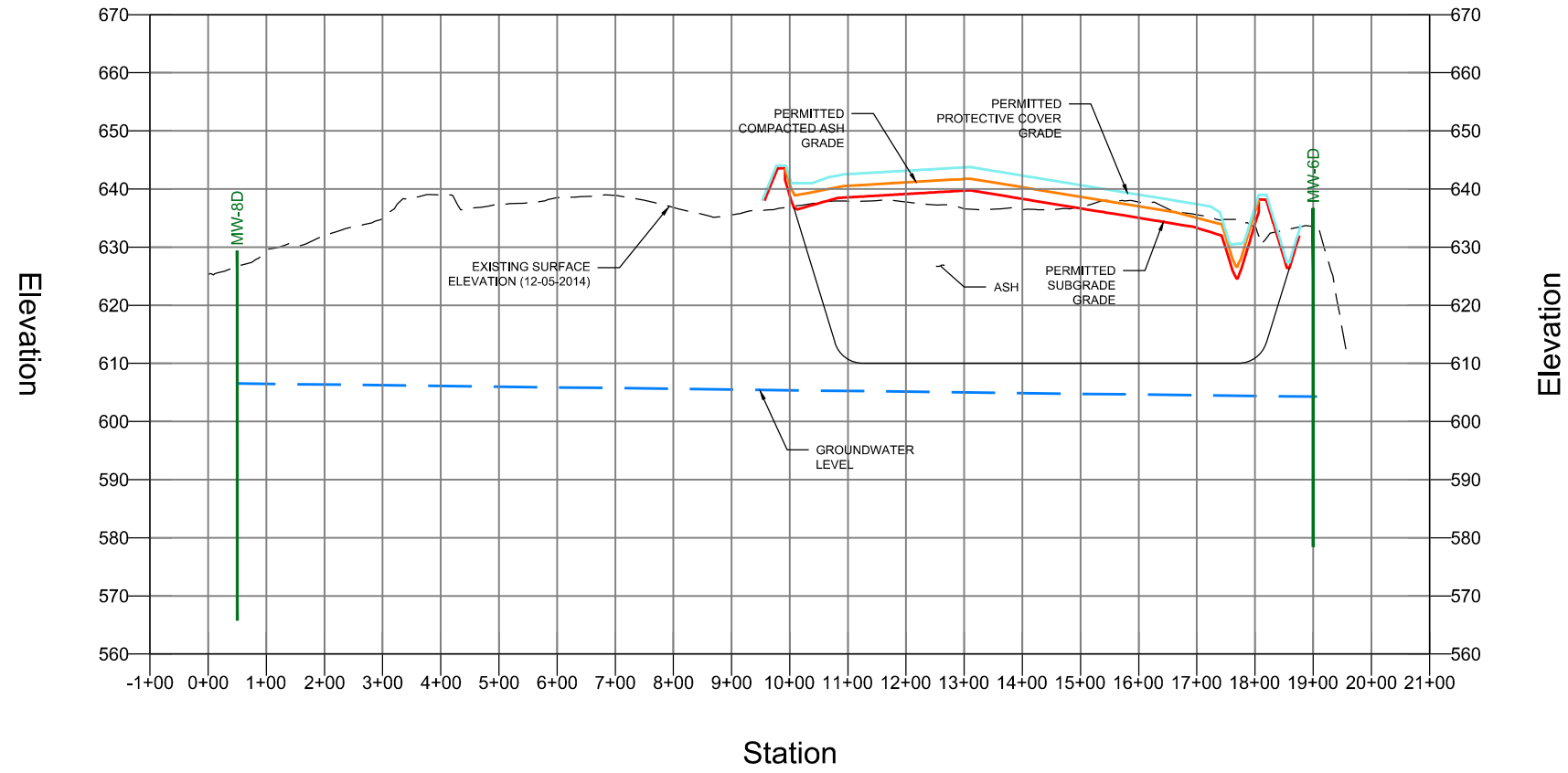
DESIGNED BY:	TLB
DRAWN BY:	SRE
APP'D BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10/03/2017
JOB NO.	216-003-35157123
ACAD NO.	004
SHEET NO.:	4 OF 7

CROSS SECTION LOCATIONS MAP
 GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
 NORTHEASTERN STATIONS 3 & 4
 OKLAHOMA

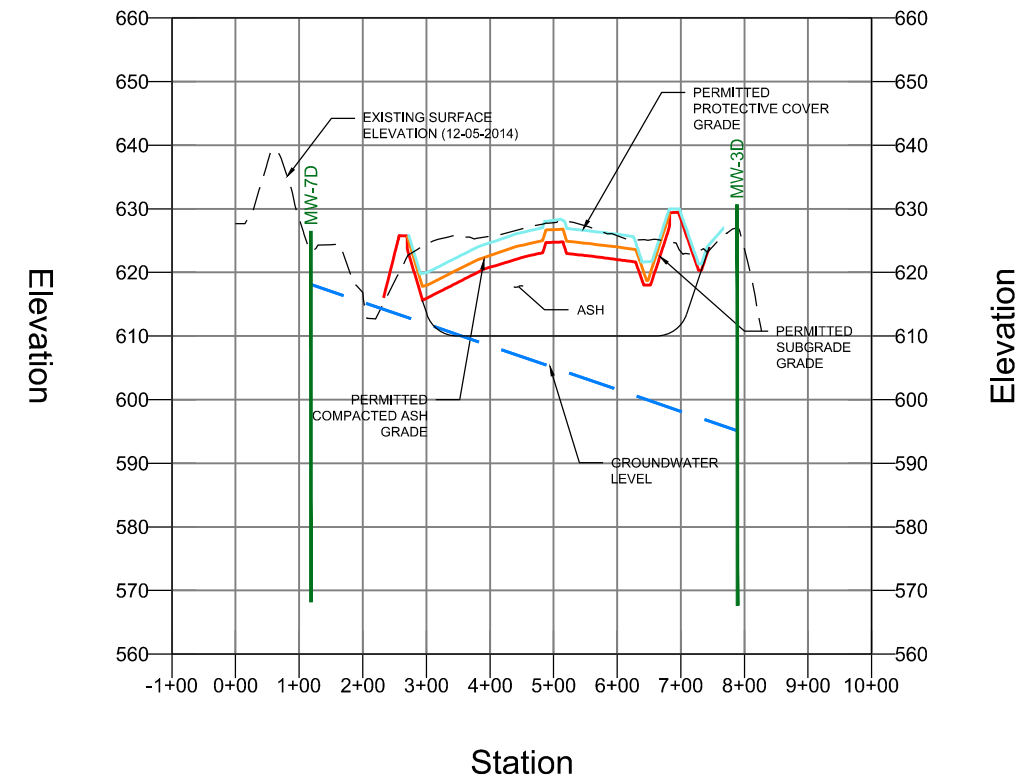
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 Consulting Engineers and Scientists
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 BRYANT, AR 72022
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 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

CROSS SECTION A-A'



CROSS SECTION B-B'



NOTE:
 CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WAS TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
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UPPERMOST AQUIFER:
 DATA FROM SAMPLING EVENTS PERFORMED BY AMERICAN ELECTRIC POWER, DATING FROM APRIL 20, 2011 THROUGH OCTOBER 11, 2017. THE GROUNDWATER LEVEL IS BASED ON SEASONAL HIGH LEVELS.

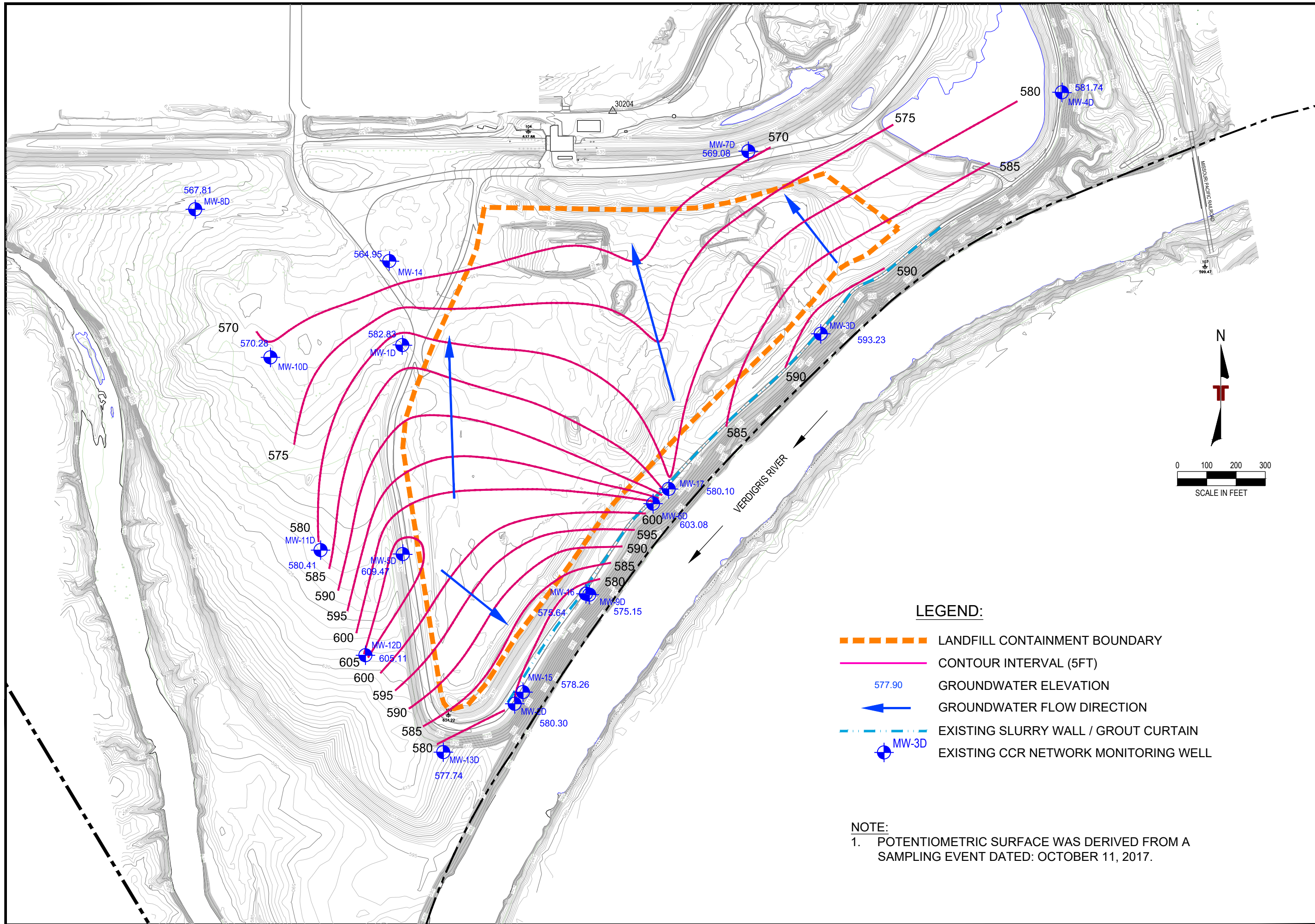
MONITORING NETWORK:
 WATER LEVEL INFORMATION WAS COLLECTED FROM THE APPROVED CCR MONITORING WELL NETWORK (SEE FIGURE 4).

FIGURE 5						
DESIGNED BY:	TLB	DRAWN BY:	TLB	APP'D BY:	DCM	SCALE:
DATE:	4/10/2018	JOB NO:	216-003-35157123	ACAD NO:	005	SHEET NO.:
						5 OF 7

CROSS SECTIONS
 GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
 NORTHEASTERN STATIONS 3 & 4
 OKLAHOMA
 OOLOGAH

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REV.	DATE	BY	DESCRIPTION



LEGEND:

- - - - LANDFILL CONTAINMENT BOUNDARY
- CONTOUR INTERVAL (5FT)
- 577.90 GROUNDWATER ELEVATION
- ← GROUNDWATER FLOW DIRECTION
- - - - EXISTING SLURRY WALL / GROUT CURTAIN
- ⊕ EXISTING CCR NETWORK MONITORING WELL

NOTE:
 1. POTENTIOMETRIC SURFACE WAS DERIVED FROM A SAMPLING EVENT DATED: OCTOBER 11, 2017.

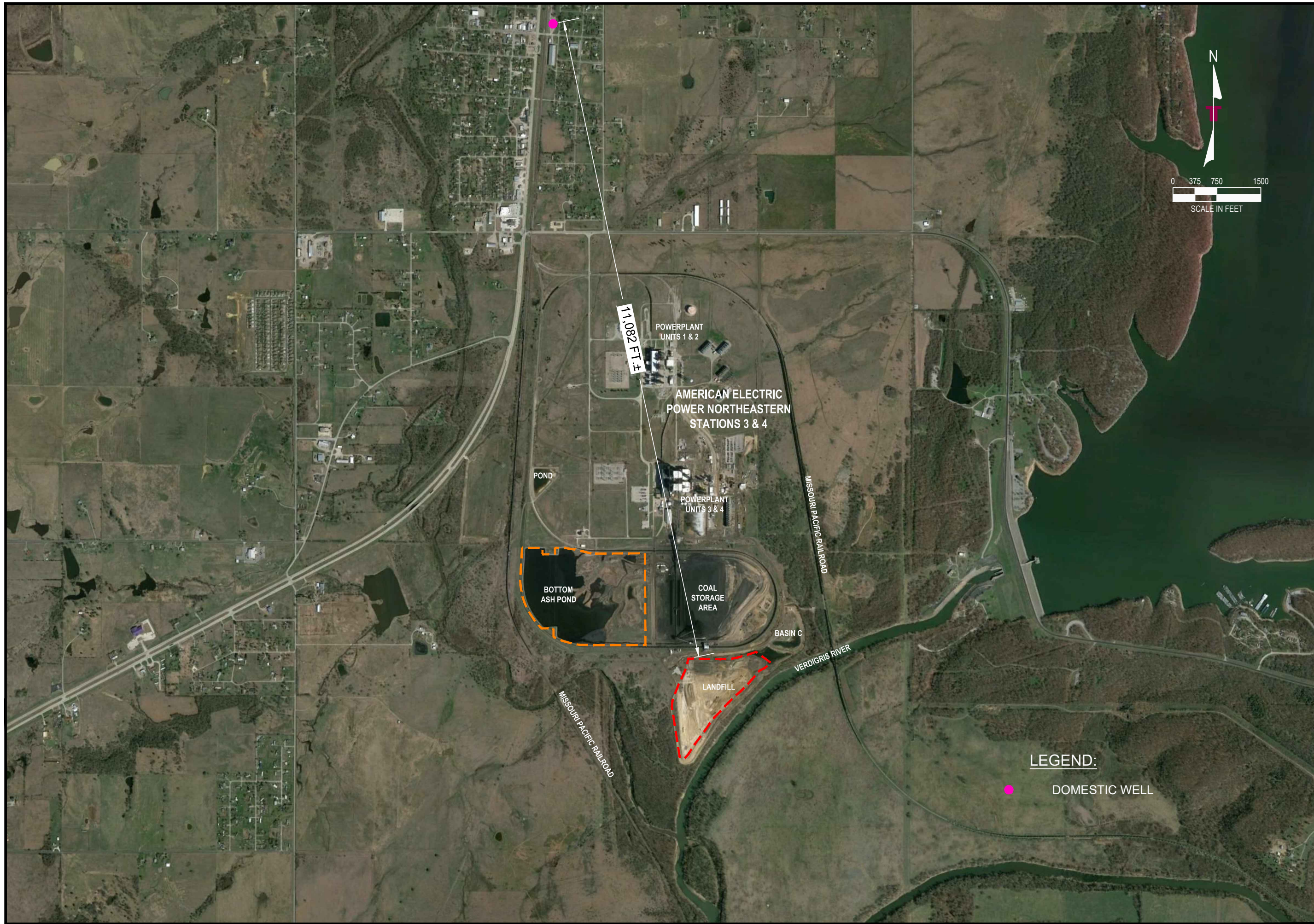
FIGURE 6

DESIGNED BY:	TLB
DRAWN BY:	TLB
APPROV. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4/23/2018
JOB NO.	216-003-35157123
ACAD. NO.	006
SHEET NO.:	6 OF 7

POTENTIOMETRIC SURFACE MAP
 GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
 NORTHEASTERN STATIONS 3 & 4
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REV.	DATE	BY	DESCRIPTION



LEGEND:
● DOMESTIC WELL



REV.	DATE	BY	DESCRIPTION

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NEAREST DOMESTIC WELL LOCATION
 GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
 NORTHEASTERN STATIONS 3 & 4
 OOLOGAH OKLAHOMA

FIGURE 7

DESIGNED BY:	TLB
DRAWN BY:	TLB
APPRD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	04/10/2018
JOB NO.	216-003-35157123
ACAD. NO.	007
SHEET NO.:	7 OF 7

TABLE 1
 NORTHEASTERN STATION 3 & 4
 NON-HAZARDOUS INDUSTRIAL WASTE (NHIW) LANDFILL
 WELL LEVEL DATA
 GROUNDWATER ELEVATIONS (FMSL)

Well	MW-1D	MW-2D	MW-3D	MW-4D	MW-5D	MW-6D	MW-7D	MW-8D	MW-9D	MW-10D	MW-11D	MW-12D	MW-13D	MW-14	MW-15	MW-16	MW-17
Date																	
03/20/08		597.19	595.14	583.00													
07/01/08		592.76	594.65	581.80													
10/01/08		588.30	594.20	581.35													
11/11/08	587.02	589.20	594.10	581.57	591.89	600.51	586.54	569.47									
11/20/08	581.61	593.71	593.81	581.38	586.31	600.59	574.25	567.12									
03/13/09	585.17	583.06	593.70	582.02	616.25	599.49	581.24	574.67									
06/16/09	585.83	585.66	593.74	581.44	616.29	599.98	577.00	576.20									
09/29/09	582.60	585.41	593.53	581.47	615.95	599.83	574.77	574.36									
12/28/09	582.84	585.68	593.44	578.48	615.14	599.76	575.28	577.70									
03/09/10	580.25	585.37	593.70	582.28	618.54	599.98	571.96	576.87									
06/16/10	583.91	595.40	593.52	581.76	616.35	600.27	572.64	587.94	586.32	568.21	578.10	609.56	587.19				
09/14/10	581.71	580.27	593.04	581.08	612.95	599.53	573.57	575.19	585.01	568.18	Dry(576.93)	604.83	577.93				
12/14/10	582.60	578.73	593.16	581.34	612.64	599.45	571.36	571.56	583.30	Dry(567.99)	Dry(576.93)	604.16	575.18				
03/08/11	Dry	583.30	593.29	582.01	614.51	599.61	571.08	578.62	583.56	Dry(567.99)	Dry(576.93)	605.84	574.22				
06/07/11	583.31	584.39	593.04	581.41	614.65	599.98	572.38	584.69	584.97	568.53	Dry(576.93)	606.56	582.72				
09/13/11	582.54	582.41	594.45	581.20	613.82	600.18	573.44	586.35	584.25	Dry(567.99)	Dry(576.93)	605.78	576.90				
12/13/11	583.63	586.47	593.70	581.69	616.03	600.48	572.49	590.51	584.96	569.18	578.19	608.52	602.42				
03/13/12	584.68	587.19	593.52	581.98	613.47	600.45	573.19	603.46	584.08	569.57	578.20	610.64	579.21				
06/12/12	582.23	582.77	593.42	581.42	613.31	600.39	573.52	602.35	584.45	569.97	578.22	606.33	581.63				
09/18/12	583.23	577.91	593.30	581.37	611.00	600.01	573.25	592.89	582.42	570.28	578.31	604.03	577.57				
12/10/12	583.72	579.40	593.34	581.60	611.77	600.39	573.42	595.63	582.16	570.56	578.40	604.53	575.42				
03/12/13	584.34	579.46	593.38	582.06	614.66	600.78	575.33	600.19	582.33	570.86	578.55	607.36	578.37				
06/11/13	583.02	588.22	593.42	581.74	615.37	601.38	575.74	604.77	582.71	569.07	578.71	608.69	580.37				
09/24/13	583.73	582.71	593.36	581.42	614.04	601.93	578.97	599.83	583.58	568.31	578.30	606.49	581.38				
12/17/13	584.28	581.38	593.37	583.76	610.97	601.91	579.75	597.83	582.28	569.86	578.94	605.50	579.81				
03/05/14	581.73	578.89	593.44	582.02	611.96	601.49	583.91	606.54	581.95	570.13	579.03	604.06	579.17				
06/09/14	582.46	587.92	593.65	581.96	612.38	601.90	587.37	603.14	581.17	570.49	579.11	608.19	576.62				
09/09/14	582.99	582.89	593.51	581.31	613.56	601.90	593.30	598.66	582.00	570.81	Dry(576.93)	606.40	578.46				
03/10/15	584.03	580.88	593.76	582.01	612.72	601.85	599.76	599.14	581.43	571.40	Dry(576.93)	605.72	577.07				
06/15/15	584.65	591.00	593.81	582.09	619.73	604.26	618.12	589.88	582.32	571.29	Dry(576.93)	605.48	580.87				
12/14/15	585.76	529.04	593.78	581.98	615.29	603.57	596.11	585.16	581.41	572.33	579.75	615.49	582.68				
03/16/16	586.65	584.14	592.57	581.94	612.75	601.89	612.87	597.03	581.63	572.71	579.88	607.16	581.85	565.11	582.77	576.97	578.89
05/16/16	587.10	583.76	593.61	582.05	616.09	603.16	596.80	586.54	581.35	572.93	579.97	607.09	587.31	564.73	581.72	577.08	581.64
07/20/16	-	-	-	-	-	-	-	583.39	-	-	-	-	-	565.87	577.33	576.85	584.02
09/19/16	587.68	578.79	592.95	581.59	611.55	602.91	603.59	577.05	581.02	573.33	Dry(576.93)	603.41	580.00	566.86	576.57	576.15	586.96
10/06/16	-	-	593.00	-	-	-	-	570.72	-	-	-	-	-	Dry	576.43	Dry	Dry
03/14/17	584.74	579.38	593.50	582.08	612.34	601.86	604.65	582.44	579.45	573.28	Dry(576.93)	604.96	577.78	603.60	573.39	575.02	586.60
05/18/17	581.36	591.93	576.24	581.61	583.90	603.00	576.65	568.34	578.12	570.97	579.02	610.96	576.09	564.19	591.14	578.54	579.68
06/15/17	-	-	593.39	-	-	603.44	617.31	569.53	580.75	-	-	-	-	564.76	581.95	577.01	580.58
06/27/17	-	-	593.34	-	-	603.37	598.96	567.86	576.69	-	-	-	-	562.97	579.07	574.59	580.91
07/12/17	-	-	592.63	-	-	602.60	582.74	568.45	576.68	-	-	-	-	563.26	577.90	575.65	579.49
08/04/17	-	-	593.33	-	611.96	603.28	578.17	569.40	577.18	571.28	-	-	581.48	563.65	577.72	575.51	580.10
08/17/17	-	-	593.33	-	612.12	603.49	573.50	568.21	576.64	571.34	-	-	581.27	563.89	577.80	575.93	580.44
18/30/17	582.51	579.90	593.33	581.08	612.22	603.42	569.58	567.66	576.25	571.38	Dry(576.93)	604.90	580.98	564.15	577.52	575.58	579.08
09/13/17	582.64	579.34	593.36	-	612.08	603.49	569.81	567.44	576.29	571.44	Dry(576.93)	604.81	581.10	564.38	577.07	575.56	578.83
09/20/17	582.72	579.13	593.15	581.22	611.99	603.55	569.02	566.07	575.69	571.46	Dry(576.93)	606.53	580.64	564.56	576.93	575.65	579.63
10/04/17	582.86	578.69	593.32	581.60	608.37	603.24	569.42	567.34	575.40	570.38	578.35	605.61	580.29	564.85	576.59	575.47	579.69
10/11/17	582.83	580.30	593.23	581.74	609.47	603.08	569.08	567.81	575.15	570.28	580.41	605.11	577.74	564.95	578.26	575.64	580.10
Seasonal High	587.68	597.19	595.14	583.76	619.73	604.26	618.12	606.54	586.32	573.33	580.41	615.49	602.42	603.60	591.14	578.54	586.96

TABLE 2
 NORTHEASTERN STATION 3 & 4
 NON-HAZARDOUS INDUSTRIAL WASTE (NHIW) LANDFILL
 MONITORING WELL/PIEZOMETER CONSTRUCTION DETAILS

Well Number	Latitude	Longitude	Ground Surface Elevation	Top of Casing Elevation	Borehole Depth ft. bls	Date Installed	Screen Material	Well Diameter inches	Top of Screen Depth ft. bls	Top of Screen Elevation ft. msl	Bottom of Screen Depth ft. bls	Bottom of Screen Elevation ft. msl
MW-1D	36° 24' 59.77052"	95° 42' 01.47166"	635.23	638.07	55	10/23/2008	PVC	2	44	594.07	54.3	580.93
MW-2D	36° 24' 47.66667"	95° 41' 56.78442"	634.82	638.19	59	3/4/2008	PVC	2	48.7	589.49	59	575.82
MW-3D	36° 25' 00.14299"	95° 41' 44.01366"	627.66	630.65	60	2/21/2008	PVC	2	49.7	580.95	60	567.66
MW-4D	36° 25' 08.28346"	95° 41' 33.94072"	621.93	625.00	50	2/22/2008	PVC	2	39.7	585.30	50	571.93
MW-5D	36° 24' 52.71851"	95° 42' 01.46047"	633.83	636.84	55	10/23/2008	PVC	2	44.72	592.12	55.02	578.81
MW-6D	36° 24' 54.41869"	95° 41' 51.01306"	633.72	636.66	55	10/23/2008	PVC	2	44.92	591.74	55.22	578.50
MW-7D	36° 25' 06.30327"	95° 41' 47.03123"	623.74	626.46	55	10/22/2008	PVC	2	45.25	581.21	55.55	568.19
MW-8D	36° 25' 04.35228"	95° 42' 10.11303"	626.04	629.32	60	10/21/2008	PVC	2	49.95	579.37	60.25	565.79
MW-9D	36° 24' 50.88110"	95° 41' 54.22530"	633.90	637.04	60	4/6/2010	PVC	2	49.7	587.34	60	573.90
MW-10D	36° 24' 59.15060"	95° 42' 08.24123"	636.14	639.32	68	4/12/2010	PVC	2	57.7	581.62	68	568.14
MW-11D	36° 24' 52.64970"	95° 42' 06.15274"	625.97	628.27	48	4/14/2010	PVC	2	37.7	590.57	48	577.97
MW-12D	36° 24' 49.10233"	95° 42' 04.28302"	620.91	623.67	42	4/19/2010	PVC	2	31.7	591.97	42	578.91
MW-13D	36° 24' 45.83379"	95° 42' 01.03384"	616.11	619.06	45	4/20/2010	PVC	2	34.7	584.36	45	571.11
MW-14	36° 25' 02.6262"	95° 42' 02.0302"	637.61	640.89	76	3/1/2016	PVC	2	65.5	575.39	75.9	561.71
MW-15	36° 24' 48.0816"	95° 41' 56.4658"	634.34	637.71	71	2/23/2016	PVC	2	61.05	576.66	71.45	562.89
MW-16	36° 24' 51.3998"	95° 41' 53.8320"	634.06	637.26	61	2/25/2016	PVC	2	50.8	586.46	61.2	572.86
MW-17	36° 24' 54.9351"	95° 41' 50.3775"	633.25	636.52	56	2/29/2016	PVC	2	45.5	591.02	55.9	577.35
LP-2	36° 24' 59.19078"	95° 41' 56.77149"	638.10	641.15	30	10/15/2008	PVC	2	19.59	621.56	29.89	608.21
LP-3	36° 24' 57.22396"	95° 41' 54.31981"	646.40	649.39	40	10/17/2008	PVC	2	30.1	619.29	40.4	606.00

APPENDIX 1
Boring & Monitoring Well Installation Logs

Boring Logs



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FIELD BORING LOG

BORING NO.: B-1/MW-1

PAGE: 1 of 1

TOTAL DEPTH: 35 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35077150-003

DRILLING CO.: MOHAWK

LOGGED BY: MR

DRILLER: KEVIN

DATE DRILLED: 2/18/08

RIG TYPE: STRATASTAR 25

DRILLING METHOD: AIR HAMMER

SAMPLING METHOD: NX ROCK CORE

Depth BGS	N:	E:	TOC:	Litho. Symbol	Run #	% Recovery	RQD	Remarks
	DESCRIPTION							
0								
								0'-4' Hollow Stem Auger Cored 4'-35' Reamed out with 6" Air Hammer
5					1 4'-14'	95	73	Penetration Rate (P.R.) = 0.5 ft/min
10								
15					2 14'-24'	95	83	(P.R.) = 0.5 ft/min
20								
25					3 24'-34'	60	NA	Hard at 30' Wet zones at 31'-33'
30								
35								NA = Not Available Core sample stuck in barrel and damaged during retrieval.
	Total Depth = 35'							

FIELD BORING LOG

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BORING NO.: B-2/MW-2

PAGE: 1 of 2

TOTAL DEPTH: 59 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35077150-004

DRILLING CO.: MOHAWK

LOGGED BY: MR

DRILLER: KEVIN

DATE DRILLED: 2/19/08

RIG TYPE: STRATASTAR 25

DRILLING METHOD: HSA / AIR HAMMER

SAMPLING METHOD: CONTINUOUS SAMPLER

Depth BGS	N:	E:	TOC:	Litho. Symbol	Run #	% Recovery	RQD	Remarks
	DESCRIPTION							
0								
0-9'	GRAVELY CLAY, red to brown, dry, trace silt, firm.							H.S.A. 0'-28'. Air Hammer 28'-59'
5								5'-7' Pushed shelby tube. Poor recovery due to gravel.
9-10'	SILTY SAND, gray, dry							
10-22'	SILT, tan, soft to hard bedded layers, dry to 19'.							
15								
20								Wet at 19'.
22-28'	GRAVELY CLAY, brown, some limestone rock fragments, wet.							Hard Limestone bed 23' to 24'.
25								
28-33'	LIMESTONE, gray, massive bedded, dry.							Auger refusal at 28' (Limestone).
30								
33-55'	SHALE, gray to black, hard to weathered, dry.							
35								



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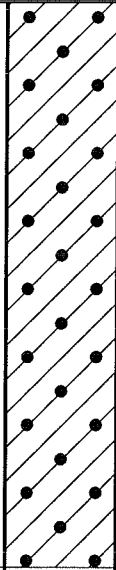
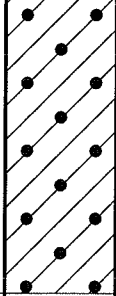

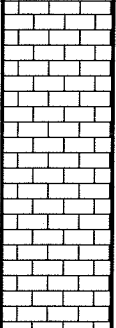
FIELD BORING LOG

BORING NO.: B-3/MW-3 PAGE: 1
TOTAL DEPTH: 60 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: NE PLANT LANDFILL
JOB NO.: 216-003-35077150-005	DRILLING CO.: MOHAWK
LOGGED BY: MR	DRILLER: KEVIN
DATE DRILLED: 2/20/08	RIG TYPE: STRATASTAR 25

DRILLING METHOD: HSA / AIR HAMMER

SAMPLING METHOD: CONTINUOUS SAMPLER

Depth BGS	N:	E:	ELEV:	Litho. Symbol	Run #	% Recovery	RQD	Remarks
DESCRIPTION								
0								
0-17'	GRAVELY CLAY, brown, dry, trace silt and fine sand							H.S.A. 0'-20' Reamed out with 6" air hammer.
5								
8'-10'	Limestone rock fragments							8'-10' Pushed shelly tube. Poor recovery.
10								
15								
17'-25'	SHALE, hard to weathered, some thin clay beds.							Moist zone at 17.5'. Moist zone at 19.5'. Tried to core beginning at 20', but rock too hard.
20								
25								
25'-45'	LIMESTONE, dark gray, some thin shale beds, dry, massive bedding.							
30								



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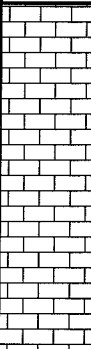

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FIELD BORING LOG

BORING NO.: B-3/MW-3

PAGE: 2

TOTAL DEPTH: 60 FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
40						
45	45'-60' SHALE, black, hard, dry.					No show of groundwater, but water seeped in boring overnight.
50						
55						
60	T.D. @ 60'					
65						
70						
75						



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FIELD BORING LOG

BORING NO.: B-4/MW-4 PAGE: 1

TOTAL DEPTH: 50 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35077150-006

DRILLING CO.: MOHAWK

LOGGED BY: MR

DRILLER: KEVIN

DATE DRILLED: 2/21/08

RIG TYPE: STRATASTAR 25

DRILLING METHOD: HSA / AIR HAMMER

SAMPLING METHOD: CONTINUOUS SAMPLER / NX ROCK CORE

Depth BGS	N:	E:	ELEV:	Litho. Symbol	Run #	% Recovery	RQD	Remarks			
	DESCRIPTION										
0											
0-16'	GRAVELY CLAY, brown, dry, some limestone rock fragments.							H.S.A. 0'-16' cored 16'-35'. Reamed out with 6" air hammer.			
13'	Some silt and fine sand.										
16'-38'	LIMESTONE, gray, massive bedding, some thin shale beds, some horizontal bedding plane features.				1			Rock at 16'			
					16'-20'	50	60				
					2				20'-25'	80	50
					3				25'-30'	95	80
				4			30'-35'	95	75		
	2" Vertical fracture.										



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FIELD BORING LOG

BORING NO.: MW-1D

PAGE: 1 of 2

TOTAL DEPTH: 55 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-017

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 9/30/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 24' 59.77"	E: 95° 92' 01.47"	G.S. ELEV. 635.23	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-3.5' GRAVELLY CLAY dark brown, Limestone fragments								
	5	3.5'-41' LIMESTONE gray, crystalline, some thin mud seams, some bedding plane fractures, dry				1	95	40		
	10					2	40	0		PR=0.5ft/min. Void at 9'-11.5'
	15					3	100	44		
	20					4	85	27		Wet zones 18.5'-20' PR=0.35ft/min.
	25					5	90	28		
	30					6	90	45		
	35					7	100	68		PR=0.25ft/min.
						8				



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FIELD BORING LOG

BORING NO.: MW-1D

PAGE: 2 of 2

TOTAL DEPTH: 55 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
	40							
	41'-55'	SHALE dark gray to black, hard, some bedding plane fractures		8	60	64		
	45			9	80	65		
	50			10	100	48		
	55	Total Depth = 55'						
	60							
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-2S

PAGE: 1 of 1

TOTAL DEPTH: 33.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-018

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 9/30/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 24' 47.57"	E: 95° 41' 56.87"	G.S. ELEV. 634.45	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-9' CLAY dark brown, Limestone fragments							4-5-6 6	Wet at 12'
	5								4-6-4 6	
									5-6-8 6	
	10	9'-9.5' ASH gray to dark gray, dry							9-6-7 6	
		9.5'-10.5' GRAVELLY CLAY brown, dry							3-3-3 6	
	15	10.5'-21' ASH tan, very fine, wet at 12'							9-17-17 6	
	20								2-8-9 6	
									1 6	
	21	21'-25' GRAVELLY CLAY red to black, trace silt, moist								
	25	25'-28.5' LIMESTONE gray, massive bedded					1	20	70	
	30	28.5'-33.5' LIMESTONE gray with increasing thin interlayered shale beds					2	40	29	
	35	Total Depth = 33.5'								



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FIELD BORING LOG

BORING NO.: MW-3S

PAGE: 1 of 1

TOTAL DEPTH: 29 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-019

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/1/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 25' 00.05"	E: 95° 41' 44.12"	G.S. ELEV. 627.09	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-10.5' GRAVELLY CLAY brown, dry with Limestone cobbles							4-4-5 6	
	5								6-5-4 6	
									8-8-6 6	
	10								11,50+ 6	
		10.5'-29' LIMESTONE dark gray, crystalline, thick interlayered fossils present				1	20	92		
	15					2	40	29		
	20					3	95	87		
	25					4	100	90		
	30	Total Depth = 29'								
	35									



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FIELD BORING LOG

BORING NO.: MW-4S

PAGE: 1 of 1

TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-020

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/2/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 25' 08.42"	E: 95° 41' 33.93"	G.S. ELEV. 621.44	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-12' GRAVELLY CLAY brown, some silt, hard, dry							4-5-6 6	
	ST 5	Shelby Tube from 3'-5'							6-17-17 6	
	10								7-7-8 6	
	12	12'-30' LIMESTONE gray to dark gray, crystalline, dry							29-25-50+ 6	
	15					1	20	50		
	20	- Some thin mud seams, dry				2	20	71		
	25					3	95	90		
	30	Total Depth = 30'								
	35									



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FIELD BORING LOG

BORING NO.: MW-5D

PAGE: 1 of 2

TOTAL DEPTH: 55 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-021

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/7/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 24' 52.71"	E: 95° 42' 01.46"	G.S. ELEV. 633.83	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-10' GRAVELLY CLAY brown, silty with orange mottles, dry							5-6-4 6	PR=0.2 ft/min.
	ST 5	Shelby Tube from 3'-5'							5-6-4 6	
	ST 10	Shelby Tube from 8'-10'								
	10	10'-40' LIMESTONE gray, crystalline, some bedding plane fractures				1	60	61		
	15	- Some thin shale beds				2	100	39		
	20					3	100	36		
	25					4	100	58		
	30					5	90	39		
	35					6	20	31		
						7	100	58		



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FIELD BORING LOG

BORING NO.: MW-5D

PAGE: 2 of 2

TOTAL DEPTH: 55 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
	40	40'-55' SHALE dark gray, dry						
	45			8	100	75		
	50			9	100	81		
	55			Total Depth = 55'				
	60							
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-5S

PAGE: 1 of 1

TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-022

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 9/30/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 24' 52.86"	E: 95° 42' 01.48"	G.S. ELEV. 633.62	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks	
		DESCRIPTION									
Elev.	Depth BGS										
	0	0'-22' GRAVELLY CLAY orange, mottled, dry, some thin shale layers							$\frac{4-6-4}{6}$	Wet at 18.5'	
	5								$\frac{5-21-9}{6}$		
	10								$\frac{9-12-13}{6}$		
	15								$\frac{3-4-5}{6}$		
	20								$\frac{8-8-4}{6}$		
	25	22'-30' LIMESTONE gray, crystalline, some thin shale layers					1	20	70		$\frac{5-6-8}{6}$
	30	Total Depth = 30'									$\frac{4-5-1}{6}$
	35							$\frac{36-50+}{6}$			



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FIELD BORING LOG

BORING NO.: MW-6D

PAGE: 1 of 2

TOTAL DEPTH: 57 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-023

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/2/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 24' 54.41"	E: 95° 41' 51.01"	G.S. ELEV. 633.72	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks	
		DESCRIPTION									
Elev.	Depth BGS										
	0	0'-12' GRAVELLY CLAY red to brown with orange mottles, dry, some limestone fragments							7-6-5 6		
	ST 5	Shelby Tube from 3'-5'							8-7-8 6		
	ST 10	Shelby Tube from 8'-10'						9-10-7 6			
	15	12'-15' ASH tan, wet						5-5-16 6			
	20	15'-28.5' GRAVELLY CLAY red to brown, dry						12-12-13 6			
	25							10-13-8 6			
	30							7-7-5 6			
	30	28.5'-33.5' LIMESTONE interbedded with thin shale beds				1	95	76	50+ 6		Wet at 28' PR=0.25 ft/min.
	35	33.5'-57' SHALE dark gray with some thin fissile beds, hard & brittle				2	100	83			



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FIELD BORING LOG

BORING NO.: MW-6D

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TOTAL DEPTH: 57 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
	40							
				3	100	90		
	45							
				4	100	67		
	50							
				5	100	92		
	55							
		Total Depth = 57'						
	60							
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-6S

PAGE: 1 of 1

TOTAL DEPTH: 25 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-024

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/6/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 24' 54.53"	E: 95° 41' 50.84"	G.S. ELEV. 633.66	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-12' GRAVELLY CLAY brown, dry, limestone fragments at 9.5'							$\frac{4-5-7}{6}$	
	5								$\frac{4-5-7}{6}$	
	10								$\frac{21-7-12}{6}$	
	12	12'-15' ASH tan, dry							$\frac{5-13-10}{6}$	
	15	15'-25' GRAVELLY CLAY brown, dry							$\frac{50+}{6}$	
	20	Limestone cobbles at 18.5'-19.5'							$\frac{22-20-12}{6}$	
	25	Limestone cobbles at 24.5'-25'							$\frac{10-9-50+}{6}$	
	25	Total Depth = 25'							$\frac{24-16-12}{6}$	
	30									
	35									



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FIELD BORING LOG

BORING NO.: MW-7D

PAGE: 1 of 2

TOTAL DEPTH: 55 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-025

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/9/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 25' 06.30"	E: 95° 41' 47.03"	G.S. ELEV. 623.58	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks	
		DESCRIPTION									
Elev.	Depth BGS										
	0	0'-16.5' GRAVELLY CLAY gray and red, mottled, wet									
	5										
	8	Shelby Tube from 8'-10', dry									
	10										
	12									12-6-6 6	Wet at 12'
	15									3-5-6 6	
	16.5	16.5'-38' LIMESTONE dark gray, fossiliferous, some thin shale bedding									
	20						1	100	79		
	25						2	100	100		
	30						3	100	96		
	35					4	90	100			
	38	38'-55' SHALE dark gray with intermittent limestone beds									



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FIELD BORING LOG

BORING NO.: MW-7D

PAGE: 2 of 2

TOTAL DEPTH: 55 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
	40							
	45	SHALE dark gray with intermittent limestone beds		5	100	88		
	50			6	100	87		
	55			7	100	91		
	55	Total Depth = 55'						
	60							
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-7S

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TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-026

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/2/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 25' 06.32"	E: 95° 41' 46.87"	G.S. ELEV. 623.74	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-18' GRAVELLY CLAY orange, some silt, mottled, hard, dry							$\frac{2-1-3}{6}$	Wet at 13'
	ST 5	Shelby Tube from 3'-5'							$\frac{4-6-7}{6}$	
	10								$\frac{3-4-6}{6}$	
	ST 15	Shelby Tube from 13'-15'								
	20	18'-30' LIMESTONE dark gray, thin shale bedding, fossiliferous				1	95	70		
	25					2	95	90		
	30	Total Depth = 30'								
	35									



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FIELD BORING LOG

BORING NO.: MW-8D

PAGE: 1 of 2

TOTAL DEPTH: 60 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-027

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/13/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 25' 04.35"	E: 95° 42' 10.11"	G.S. ELEV. 626.04	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-43' LIMESTONE light gray to dark gray, crystalline, some bedding plane fractures, fossiliferous, shale beds becoming thicker at 29'							5-17-50+ 6	
						1	90	79		
	5					2	90	79		
						3	100	79		
	10					4	100	79		
						5	100	79		
	15					6	100	79		
						7	100	79		
	20					8	100	79		
						9	100	79		
	25									
	30									
	35									



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FIELD BORING LOG

BORING NO.: MW-8D

PAGE: 2 of 2

TOTAL DEPTH: 60 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
	40							
	43	43'-60' SHALE dark gray, some mud seams, wet		10	100	66		Wet at 45'
	45			11	100	68		
	50			12	100	83		
	55			13	100	78		
	60	Total Depth = 60'						
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-8S

PAGE: 1 of 1

TOTAL DEPTH: 40 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-028

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN

DATE DRILLED: 10/15/08

RIG TYPE: STRATASTAR 25/CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON/NX ROCK CORE

		N: 36° 25' 04.37"	E: 95° 42' 10.30"	G.S. ELEV. 625.68	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-40' LIMESTONE light gray, crystalline, dry with bedding plane fractures				1	85	10		
	5					2	80	9		
	10					3	100	93		
	15					4	95	90		
	20									
	25									
	30									
	35									
		Total Depth = 40'								



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FIELD BORING LOG

BORING NO.: MW-9S

PAGE: 1 of 1

TOTAL DEPTH: 33.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-002

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/7/2010

RIG TYPE: GEFco

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON

		N: -8587.14	E: 1916.816	G.S. ELEV. 633.98	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
633.98	0	0'-10.5' GRAVELLY CLAY brown, silty, soft, dry								
		HSA								
628.98	5								5' - 6.5' 5-11-20 13	
623.98	10	10.5'-20' <u>ASH</u> tan, slightly gravelly, soft, moist							10' - 11.5' 7-12-10 15	Moist at 10.5'
618.98	15								15' - 16.5' 18-17-50/2 15	Hard layer from 16.5' - 17'
613.98	20	20'-26' <u>ASH</u> tan, slightly gravelly, soft, wet							20' - 21.5' 9-13-7 18	Wet at 20'
608.98	25	26'-28.5' <u>ASH</u> dark brown, slightly gravelly, soft, wet							25' - 26.5' 15-40-50/4 15	
603.98	30	28.5'-33.5' HSA - <u>SHALE</u>								Resistance at 28.5' (shale)
	35	Total Depth of Boring = 33.5' bgs								



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FIELD BORING LOG

BORING NO.: MW-9D

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TOTAL DEPTH: 60 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-001

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/6/2010

RIG TYPE: GEFco

DRILLING METHOD: HOLLOW STEM AUGER, AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: SPLIT SPOON & WIRE LINE CORING

		N: -8597.75	E: 1910.436	G.S. ELEV. 633.90	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
633.90	0	0'-5' <u>GRAVELLY CLAY</u> brown, slightly silty, soft, dry								HSA: 0' - 30' AIR HAMMER: 30' - 60' WLC: 30' - 58'
628.90	5	5'-10.5' <u>GRAVELLY CLAY</u> brown, slightly silty, soft, dry (gravel becoming larger)							5' - 6.5' 3-5-7 15	
623.90	10	10.5'-12' <u>ASH</u> gray to tan, slightly gravelly, soft, wet							10' - 11.5' 7-7-8 16	Wet at 10.5'
618.90	15	12'-20.5' <u>ASH</u> tan, slightly gravelly, soft, wet							15' - 16.5' 27-22-50/0.5 18	Hard layer from 16' - 17'
613.90	20	20.5'-21' <u>COAL</u> black							20' - 21.5' 10-10-4 18	Wet at 21'
608.90	25	21'-26.5' <u>ASH</u> tan, slightly gravelly, soft, wet							25' - 26.5' 9-21-18 18	
603.90	30	26.5'-27' <u>SANDY SHALE</u> gray								
		27'-28.5' <u>CLAY</u> brown, slightly gravelly, soft, wet								
		28.5'-30' <u>HSA - SHALE</u> dark gray								Resistance at 28.5' (shale)
598.90	35	30'-38' <u>SHALE</u> dark gray, thin horizontal bedding, some fossils present				30' - 38' 1	100	93		ROP=0.5ft/min.
		38'-40' <u>SHALE</u> dark gray, thin horizontal bedding, some fossils present				2	80	64		



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FIELD BORING LOG

BORING NO.: MW-9D

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TOTAL DEPTH: 60

FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
593.90	40	40'-60' <u>SHALE</u> dark gray, thin horizontal bedding, some fossils present		38' - 48'	80	64		ROP=0.25ft/min.
	45			2				
588.90								
	50			48' - 58'	100	96		ROP=0.5ft/min.
583.90	55			3				
578.90								
	60	Over drill to 60' with air hammer						
573.90		Total Depth of Boring = 60' bgs						
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-10D

PAGE: 1 of 2

TOTAL DEPTH: 68 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-003

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/7/2010 thru 4/9/2010

RIG TYPE: GEFco

DRILLING METHOD: AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: WIRE LINE CORING

		N: -7762.059	E: 764.463	G.S. ELEV. 636.14	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
636.14	0	0'-3' <u>TOPSOIL</u> HSA black								HSA: 0' - 3' AIR HAMMER: 3' - 68'
631.14	5	3'-22' <u>LIMESTONE</u> WLC light gray, fine graded, micritic, fossils and calcite crystals present, massive bedding, mostly horizontal bedding, some angular bedding @ ~30°				3' - 13' 1	90	76		WLC: 3' - 68' Resistance at 3' ROP=0.5ft/min.
626.14	10									
621.14	15					13' - 23' 2	100	94		ROP=0.5ft/min.
616.14	20									
611.14	25	22'-32' <u>LIMESTONE</u> becoming more gray, fine graded, micritic, fossils and calcite crystals present, massive bedding, mostly horizontal bedding present, massive bedding, mostly horizontal bedding, some angular bedding @ ~30°				23' - 33' 3	100	80		ROP=0.5ft/min. Wet at 29' - 30'
606.14	30	24' - 32' Becoming weathered and fossil increase 29' - 30' Highly weekend zone								
601.14	35	31' - 35' Thin shale layers in Limestone 32'-46' <u>LIMESTONE</u> gray, crystalline, fossils and calcite crystals present, bedding becoming thinner, moist between bedding planes, some small cavities with calcite crystal growth				33' - 46' 4	80	52		ROP=0.5ft/min.



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FIELD BORING LOG

BORING NO.: MW-10D

PAGE: 2 of 2

TOTAL DEPTH: 68 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks				
596.14	40	32'-46' LIMESTONE gray, crystalline, fossils and calcite crystals present, bedding becoming thinner, moist between bedding planes, some small cavities with calcite crystal growth		33' - 46'	80	52		ROP=0.5ft/min.				
	45			4								
591.14	45	46'-68' SHALE dark gray to black, few fossils, thin bedding, H.C. odor, dry, hard		46' - 53'	95	61		ROP=0.5ft/min.				
586.14	50			5								
581.14	55			53' - 63'					98	85		ROP=0.5ft/min.
576.14	60			6								
571.14	65	63' - 68'	95	48		ROP=0.25ft/min.						
	70	Total Depth of Boring = 68' bgs										
	75											
	80											
	85											
	90											
	95											



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FIELD BORING LOG

BORING NO.: MW-10S

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TOTAL DEPTH: 33 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-004

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/12/2010 & 4/13/2010

RIG TYPE: GEFco

DRILLING METHOD: AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: WIRE LINE CORING

		N: -7751.238	E: 763.103	G.S. ELEV. 636.36	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
636.36	0	0'-3' <u>TOPSOIL</u> brown with silty clay			HSA					HSA: 0' - 3' AIR HAMMER: 3' - 33'
631.36	5	3'-10' <u>LIMESTONE</u> gray, some fossils, micritic, massive bedding, dry			WLC	3' - 13' 1	90	62		WLC: 3' - 33' Resistance at 3' ROP=0.25ft/min.
626.36	10	10'-33' <u>LIMESTONE</u> gray, crystalline, some fossils, micritic, massive bedding, moist between bedding planes								
621.36	15					13' - 23' 2	100	100		ROP=0.25ft/min.
616.36	20									
611.36	25	26' - 33' Becomes weathered between bedding planes and becomes a darker gray				23' - 33' 3	100	64		ROP=0.5ft/min.
606.36	30									
	35	Total Depth of Boring = 33' bgs								



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FIELD BORING LOG

BORING NO.: MW-11D

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TOTAL DEPTH: 48 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-005

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/13/2010 / 4/14/2010

RIG TYPE: GEFco

DRILLING METHOD: AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: WIRE LINE CORING

		N: -8419.377	E: 935.471	G.S. ELEV. 625.97	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
625.97	0	0'-3' <u>LIMESTONE</u> WLC								AIR HAMMER: 0' - 3' & 3' - 48' WLC: 3' - 48' ROP=0.25ft/min. Moist at 10'
620.97	5	3'-27' <u>LIMESTONE</u> gray, crystalline, lots of fossils, calcite crystals, hard, few small cavities with crystal growth				3' - 13' 1	100	75		
615.97	10									
610.97	15	26' - 33' Becomes weathered between bedding planes and becomes a darker gray				13' - 23' 2	100	83		
605.97	20									
600.97	25	27'-32' <u>LIMESTONE</u> dark gray, some fossils, micritic, thin interlayered shale in LS			23' - 33' 3	90	33		ROP=0.25ft/min.	
595.97	30									
590.97	35	32'-48' <u>SHALE</u> dark gray to black, some fossils, thin bedding			33' - 43' 4	100	71		ROP=0.25ft/min.	



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FIELD BORING LOG

BORING NO.: MW-11D

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TOTAL DEPTH: 48 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
585.97	40			33' - 43' 4	100	71		ROP=0.25ft/min.
580.97	45			43' - 48' 5	100	91		ROP=0.25ft/min.
	50	Total Depth of Boring = 48' bgs						
	55							
	60							
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-12D

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TOTAL DEPTH: 42 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-007

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/15/2010 / 4/16/2010 / 4/19/2010

RIG TYPE: GEFco

DRILLING METHOD: AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: WIRE LINE CORING

		N: -8778.028	E: 1088.459	G.S. ELEV. 620.91	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
620.91	0	0'-2' <u>LIMESTONE</u> WLC								AIR HAMMER: 0' - 2' & 2' - 42' WLC: 2' - 42' ROP=0.1ft/min.
615.91	5	2'-11' <u>LIMESTONE</u> gray, crystalline, high fossil content, calcite crystal growth, dry				2' - 7' 1	95	15		
610.91	10	11' - 19' Becoming a darker gray 11' - 22' Very thin shale layers interbedded in limestone				7' - 12' 2	90	51		
605.91	15									
600.91	20	19'-22' <u>LIMESTONE</u> dark gray, becoming very crystalline, thin bedding, high fossil content, brittle				12' - 22' 3	95	29		
595.91	25	22'-42' <u>SHALE</u> dark gray, few fossils, natural gas odor				22' - 28' 4	100	74		
590.91	30				28' - 32' 5	100	80		Water at 32'	
585.91	35				32' - 42' 6	95	94			



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FIELD BORING LOG

BORING NO.: MW-12D

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TOTAL DEPTH: 42 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
580.91	40			32' - 42'				ROP=0.1ft/min.
				6	95	94		
		Total Depth of Boring = 42' bgs						
	45							
	50							
	55							
	60							
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-12S

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TOTAL DEPTH: 20 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-008

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/19/2010

RIG TYPE: GEFco

DRILLING METHOD: AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: WIRE LINE CORING

		N: -8786.771	E: 1083.029	G.S. ELEV. 620.65	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
620.65	0	0'-5' <u>LIMESTONE</u> WLC								AIR HAMMER: 0' - 5' & 5' - 20' WLC: 5' - 20'
615.65	5	5'-13.5' <u>LIMESTONE</u> gray, crystalline, high fossil content, calcite crystal growth in a few cavities, dry				5' - 13' 1	38	17		
610.65	10	13.5'-20' <u>LIMESTONE</u> dark gray, some calcite crystal growth, few fossils, few thin interbedded shale layers, dry				13' - 18' 2	80	62		
605.65	15					18' - 20' 3	100	83		
600.65	20	Total Depth of Boring = 20' bgs								
	25									
	30									
	35									



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FIELD BORING LOG

BORING NO.: MW-13D

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TOTAL DEPTH: 45 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-009

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/20/2010

RIG TYPE: GEFco

DRILLING METHOD: AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: WIRE LINE CORING

		N: -9108.428	E: 1354.192	G.S. ELEV. 616.11	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
616.11	0	0'-4' <u>LIMESTONE</u> WLC								AIR HAMMER: 0' - 4' & 4' - 45' WLC: 4' - 42'
611.11	5	4'-11' <u>LIMESTONE</u> dark gray, crystalline, fossils present, massive bedding, calcite crystal growth, biomicritic				4' - 11' 1	95	58		
606.11	10	11'-13' <u>LIMESTONE</u> gray, crystalline, high fossil content, dry								Very hard at 11' - 12' Switched to small air hammer (4") at 11' - 12'
601.11	15	13'-21' <u>SHALE</u> dark gray, HC odor, few fossils				11' - 22' 2	90	53		
596.11	20	21' - 42' Becoming darker and more fine				22' - 27' 3	100	90		
591.11	25					27' - 32' 4	100	100		
586.11	30					32' - 45' 5	95	78		
581.11	35									



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FIELD BORING LOG

BORING NO.: MW-13D

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TOTAL DEPTH: 45 FEET BELOW GROUND SURFACE (BGS)

Elev.	Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
576.11	40			32' - 42'				
				5	95	78		
		Air hammer to 45'						
571.11	45	Total Depth of Boring = 45' bgs						
	50							
	55							
	60							
	65							
	70							
	75							
	80							
	85							
	90							
	95							



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FIELD BORING LOG

BORING NO.: MW-13S

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TOTAL DEPTH: 15 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35107060-010

DRILLING CO.: MOHAWK

LOGGED BY: CLANCY McCLINTOCK

DRILLER: KEVIN WILKIE

DATE DRILLED: 4/20/2010 & 4/21/2010

RIG TYPE: GEFco

DRILLING METHOD: AIR HAMMER, WIRE LINE CORING WITH AIR

SAMPLING METHOD: WIRE LINE CORING

		N: -9107.785	E: 1344.689	G.S. ELEV. 616.20	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
616.20	0	0'-3.5' <u>LIMESTONE</u> WLC								AIR HAMMER: 0' - 3.5' & 3.5' - 15' WLC: 3.5' - 15'
611.20	5	3.5'-9' <u>LIMESTONE</u> gray, few fossils, micritic, calcite crystal growth, massive bedding, dry				3.5' - 8'	1	80	33	
606.20	10	9' - 10' Dark gray with interbedded thin shale layers 10' - 12.5' Gray with high fossil content, crystalline				8' - 13.5'	2	90	14	
601.20	15	12.5'-15' <u>SHALE</u> dark gray, limey				13.5' - 15'	3	100	51	
	15	Total Depth of Boring = 15' bgs								
	20									
	25									
	30									
	35									



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FIELD BORING LOG

BORING NO.: MW-15

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TOTAL DEPTH: 71' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP	PROJECT: NE - CCR WELL INSTALL
JOB NO.: 35157183	DRILLING CO.: AECI
LOGGED BY: RAH	DRILLER: GARY MOYERS
DATE DRILLED: 02/23/2016	RIG TYPE: CME 75 BUGGY
DRILLING METHOD: HSA / AIR ROTARY	
SAMPLING METHOD: 5' CONTINUOUS SAMPLER, LOGGED BY CUTTINGS	

N:	E:	G.S. ELEV.	Litho. Symbol	% Recovery	RQD	Remarks
DESCRIPTION						
Depth BGS						
0	0'-11' SILTY, GRAVELLY, CLAY FILL brown and red					
10	11'-15' ASH tan, fine and dry					
20	15'-27' SILTY CLAY W/ ZONES OF GRAVELLY CLAY stiff, brown, dry					
30	27'-30' WEATHERED L.S. W/ GRAVELLY CLAY					
40	30'-41' L.S. crystalline, hard, light gray to gray					30' - 71' logged by cuttings
50	41'-71' SHALE hard, gray to dingy					water not encountered while drilling
70	Total Depth of Boring at 71' bgs					BoB @ 71'
80						



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FIELD BORING LOG

BORING NO.: MW-16

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TOTAL DEPTH: 61' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP	PROJECT: NE - CCR WELL INSTALL
JOB NO.: 35157183	DRILLING CO.: AECI
LOGGED BY: RAH	DRILLER: GARY MOYERS
DATE DRILLED: 02/25/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HSA / AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER, LOGGED BY CUTTING

Depth BGS	Sample Interval	N:	E:	ELEV:	Litho. Symbol	Split Spoon Sample Interval	Recovery	Comments
		DESCRIPTION						
0		0'-10' SILTY CLAY W/ SOME GRAVEL dark brown						
5								
10		10'-26' ASH tan, fine						moisture beginning @ 19'
15								
20								
25		26'-27' SILTY CLAY dark gray to black						28' - 61' logged by cuttings
30		27'-28' clay w/ bentonite slurry greenish gray, dry						
35		28'-61' SHALE dark gray, hard						fractures w/ moist cuttings @ 30' and 52'
40								
45								
50								
55								BoB @ 61'
60		Total Depth of Boring at 61' bgs						
65								



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FIELD BORING LOG

BORING NO.: LP-1

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TOTAL DEPTH: 28 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-029

DRILLING CO.: MOHAWK

LOGGED BY: MERRICK ROTENBERRY

DRILLER: KEVIN

DATE DRILLED: 10/17/08

RIG TYPE: CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON

		N: 36° 24' 53.23"	E: 95° 41' 57.21"	G.S. ELEV. 634.68	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-28' ASH tan to gray, alternating silty to hard layers							3,8,7 6"	
	5								6,9,7 6"	
	10								3,7,21 6"	
	15	Soft							3,12,9 6"	
	20	No recovery, soft							13,31,21 6"	
	25	No recovery, soft							6,8,8 6"	
									6,5,2 6"	
									1,2,4 6"	
									1,1,1 6"	
		Total Depth = 28'								
	30									
	35									

Wet at 15'

Limestone at 28'



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FIELD BORING LOG

BORING NO.: LP-2

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TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-030

DRILLING CO.: MOHAWK

LOGGED BY: MERRICK ROTENBERRY

DRILLER: KEVIN

DATE DRILLED: 10/15/08

RIG TYPE: CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON

		N: 36° 24' 59.19"	E: 95° 41' 56.77"	G.S. ELEV. 638.10	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-29' ASH tan to gray, alternating silty to hard layers			[Lithology Symbol]				3,5,6 6"	
	5								46,50+ 6"	
	10								8,8,9 6"	
	15								7,6,10 6"	
	20								10,9,8 6"	Very moist at 12'
	25								4,3,2 6"	
	30								7,6,4 6"	Wet at 18'
	35								7,6,5 6"	
	30	29'-30' GRAVELLY CLAY dark brown, wet Total Depth = 30'			● ●				1,1,2 6"	
									2,2,4 6"	Limestone at 30'



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FIELD BORING LOG

BORING NO.: LP-3

PAGE: 1 of 1

TOTAL DEPTH: 40 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-031

DRILLING CO.: MOHAWK

LOGGED BY: MERRICK ROTENBERRY

DRILLER: KEVIN

DATE DRILLED: 10/16/08

RIG TYPE: CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON

		N: 36° 24' 57.22"	E: 95° 41' 54.31"	G.S. ELEV. 649.39	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-38.5' ASH tan to gray, alternating silty to hard layers							4,3,4 6"	
	5								2,1,2 6"	
	10								2,2,2 6"	
	15								2,1,2 6"	
	20								4,8,10 6"	
	25								8,14,28 6"	
	30								4,2,1 6"	
	35								7,8,5 6"	
	38.5								7,10,16 6"	Wet at 24'
	40								26,28,10 6"	
		Soft						1,2,2 6"		
								1 12"		
		38.5'-40' GRAVELLY CLAY dark brown						0,1,2 6"		
		Total Depth = 40'								Limestone at 40'



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FIELD BORING LOG

BORING NO.: LP-4

PAGE: 1 of 1

TOTAL DEPTH: 21 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-032

DRILLING CO.: MOHAWK

LOGGED BY: MERRICK ROTENBERRY

DRILLER: KEVIN

DATE DRILLED: 10/15/08

RIG TYPE: CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON

		N: 36° 25' 03.55"	E: 95° 41' 51.65"	G.S. ELEV. 627.79	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-20.5' ASH tan to gray, alternating silty to hard layers							16,16,12 6"	Wet at 9'
	5								13,13,33 6"	
	10	Soft							27,27,29 6"	
	15								4,4,4 6"	
	20	20.5'-21' GRAVELLY CLAY							1,1,1 6"	
	25	Total Depth = 21'							1,2,3 6"	
	30								3,3,4 6"	
	35							4,6,50+ 6"	Limestone at 21'	



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FIELD BORING LOG

BORING NO.: LP-5

PAGE: 1 of 1

TOTAL DEPTH: 27 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-033

DRILLING CO.: MOHAWK

LOGGED BY: MERRICK ROTENBERRY

DRILLER: KEVIN

DATE DRILLED: 10/16/08

RIG TYPE: CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: SPLIT SPOON

		N: 36° 24' 59.27"	E: 95° 41' 48.05"	G.S. ELEV. 634.29	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-26' ASH tan to gray, alternating silty to hard layers							6,9,35 6"	No recovery
	5								9,4,2 6"	
	10								2,3,3 6" 6" 5,5,5	Wet at 9'
	15	Soft							8,9,9 6"	
	20								6,12,29 6"	
	25								10,12,10 6"	
	26	26'-27' GRAVELLY CLAY							26,50+ 6"	
	27	Total Depth = 27'							29,8,9 6"	Limestone at 27'
	30									
	35									



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FIELD BORING LOG

BORING NO.: LP-6

PAGE: 1 of 1

TOTAL DEPTH: 16.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: NE PLANT LANDFILL

JOB NO.: 216-003-35087115-034

DRILLING CO.: MOHAWK

LOGGED BY: MERRICK ROTENBERRY

DRILLER: KEVIN

DATE DRILLED: 10/16/08

RIG TYPE: CME 55

DRILLING METHOD: HOLLOW STEM AUGER

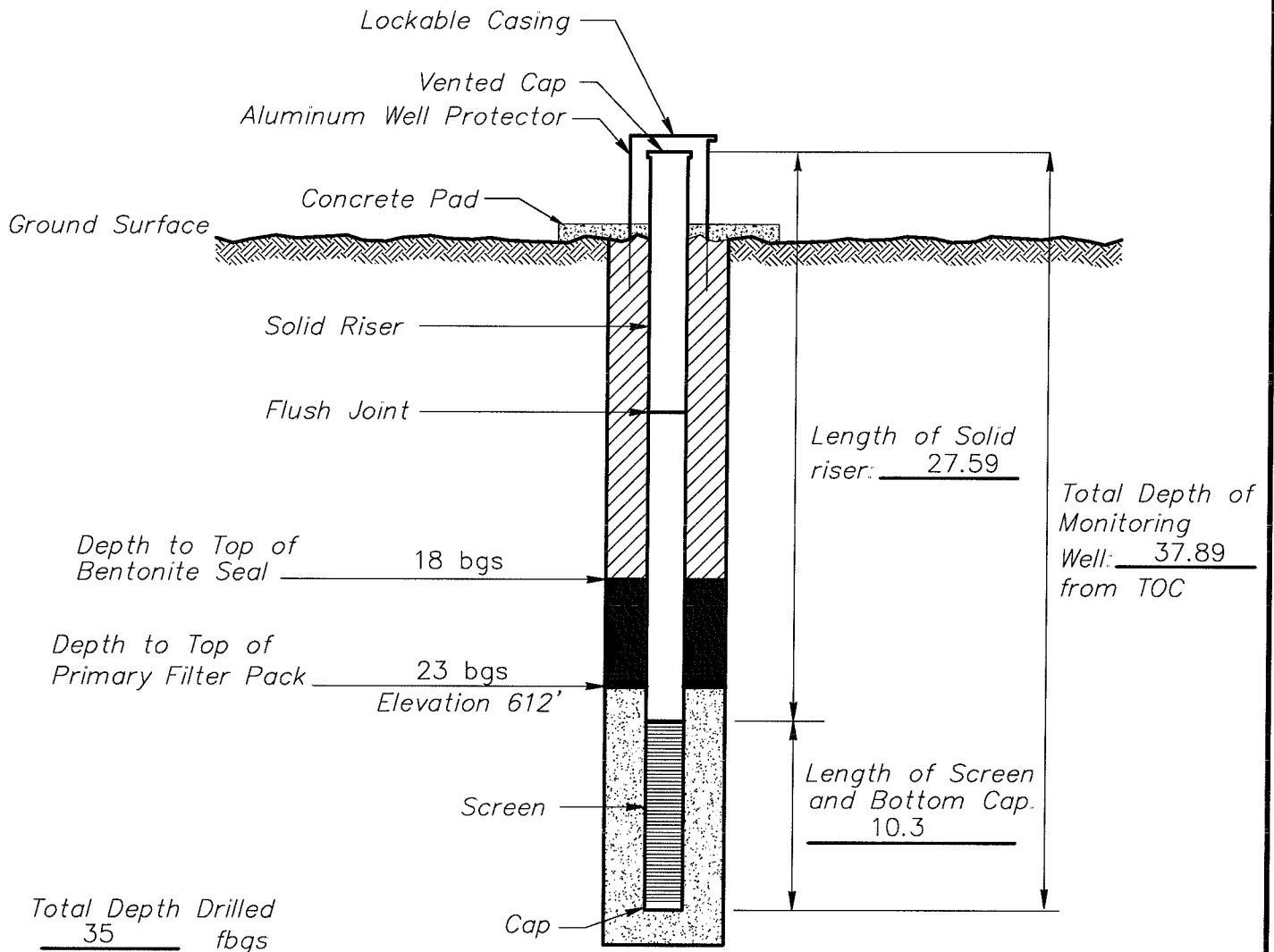
SAMPLING METHOD: SPLIT SPOON

		N: 36° 25' 03.97"	E: 95° 41' 45.21"	G.S. ELEV. 625.61	Litho. Symbol	Run #	% Recovery	RQD	Blow Count per 0.5'	Remarks
		DESCRIPTION								
Elev.	Depth BGS									
	0	0'-15' ASH tan to gray, alternating silty to hard layers							$\frac{2,5,7}{6''}$	Wet at 12'
	5								$\frac{7,12,11}{6''}$	
	10	Soft							$\frac{16,50+}{6''}$	
	15	15'-16.5' GRAVELLY CLAY							$\frac{4,7,7}{6''}$	
	15								$\frac{4,7,16}{6''}$	Limestone at 16.5'
	16.5	Total Depth = 16.5'								
	20									
	25									
	30									
	35									

Monitoring Well Installation Logs

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEASTERN PLANT LANDFILL		Well Number	MW-1	
Job Number	35077150	Installation Date	2/19/08	Location	OOLOGAH, OK.
Datum Elevation	638.89	Surface Elevation	635.75		
Datum for Water Level Measurement	T.O.C.				
Screen Diameter & Material	2" PVC	Slot Size	0.01		
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"		
Granular Backfill Material	12-20 SAND	Terracon Representative	MERRICK ROTENBERRY		
Drilling Method	AIR ROTARY	Drilling Contractor	MOHAWK		



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35077150

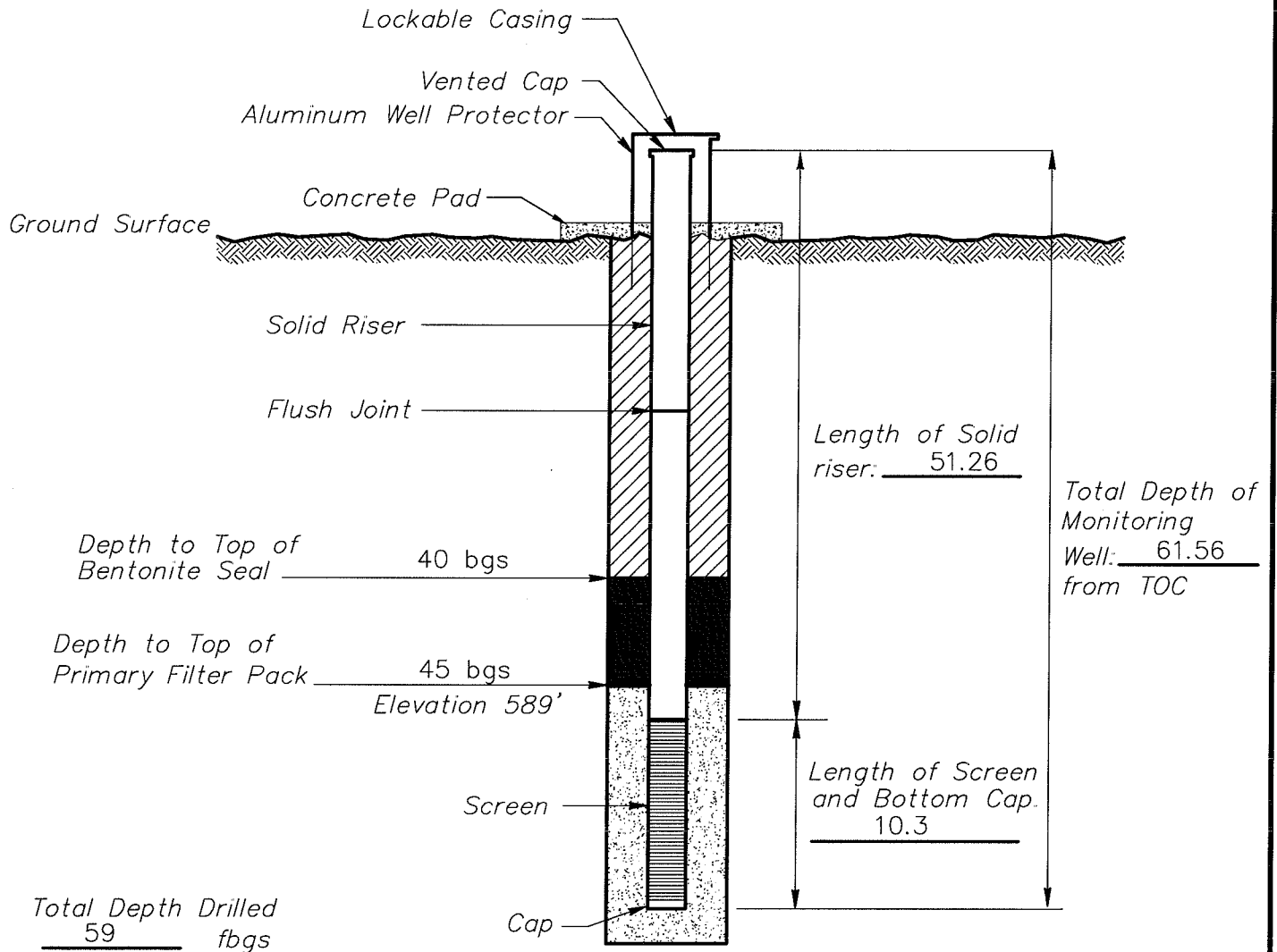
WELL NUMBER: MW-1

DRAWING NUMBER: 015

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEASTERN PLANT LANDFILL	Well Number	MW-2
Job Number	35077150	Installation Date	3/4/08
Location	Oologah, OK.		
Datum Elevation	638.19	Surface Elevation	634.82
Datum for Water Level Measurement	T.O.C.		
Screen Diameter & Material	2" PVC	Slot Size	0.01
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"
Granular Backfill Material	12-20 SAND	Terracon Representative	MERRICK ROTENBERRY
Drilling Method	AIR ROTARY	Drilling Contractor	MOHAWK



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35077150

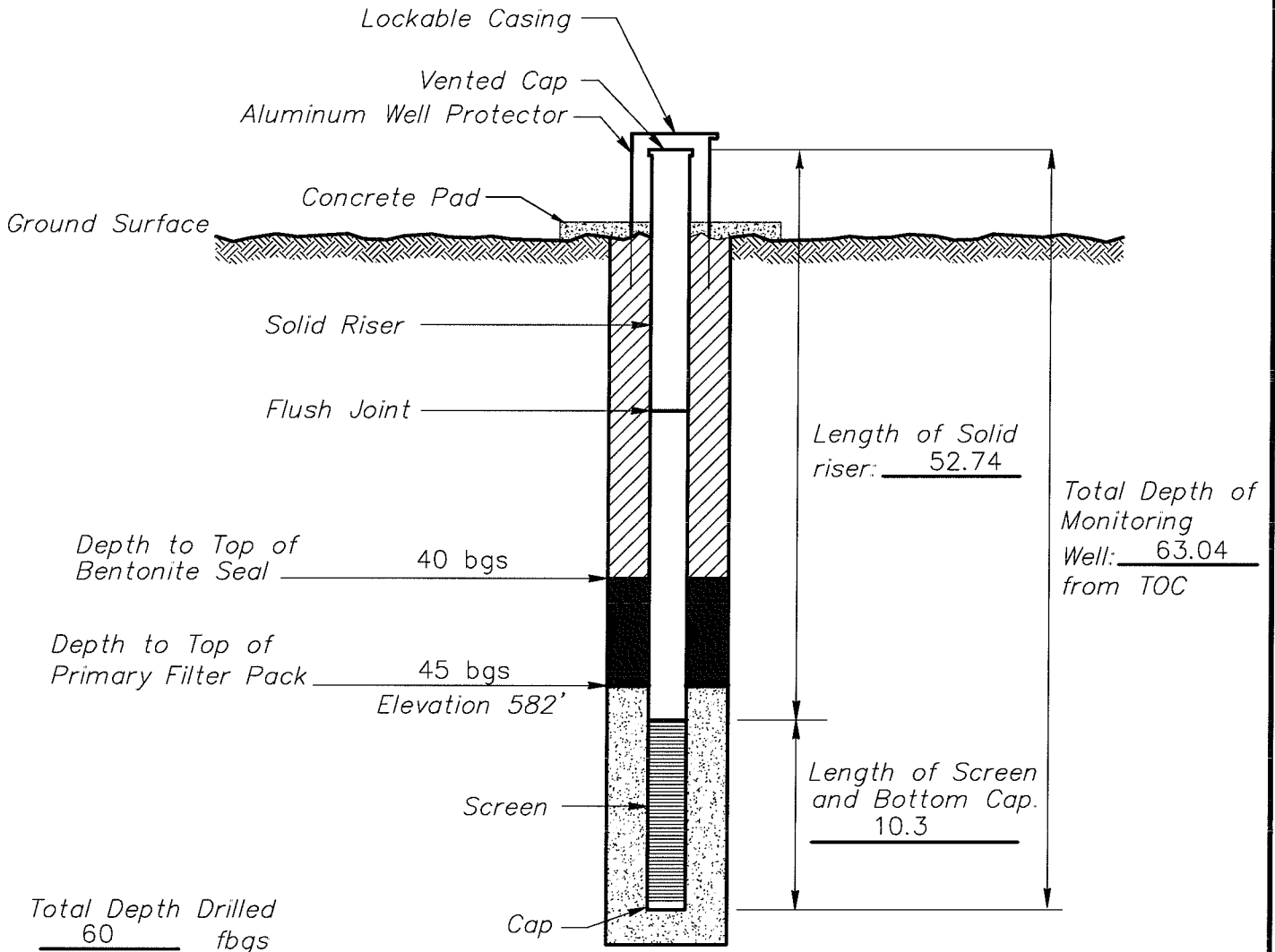
WELL NUMBER: MW-2

DRAWING NUMBER: 016

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP NORTHEASTERN PLANT LANDFILL Well Number MW-3
 Job Number 35077150 Installation Date 2/21/08 Location OOLOGAH, OK.
 Datum Elevation 630.65 Surface Elevation 627.66
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12-20 SAND Terracon Representative MERRICK ROTENBERRY
 Drilling Method AIR ROTARY Drilling Contractor MOHAWK



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35077150

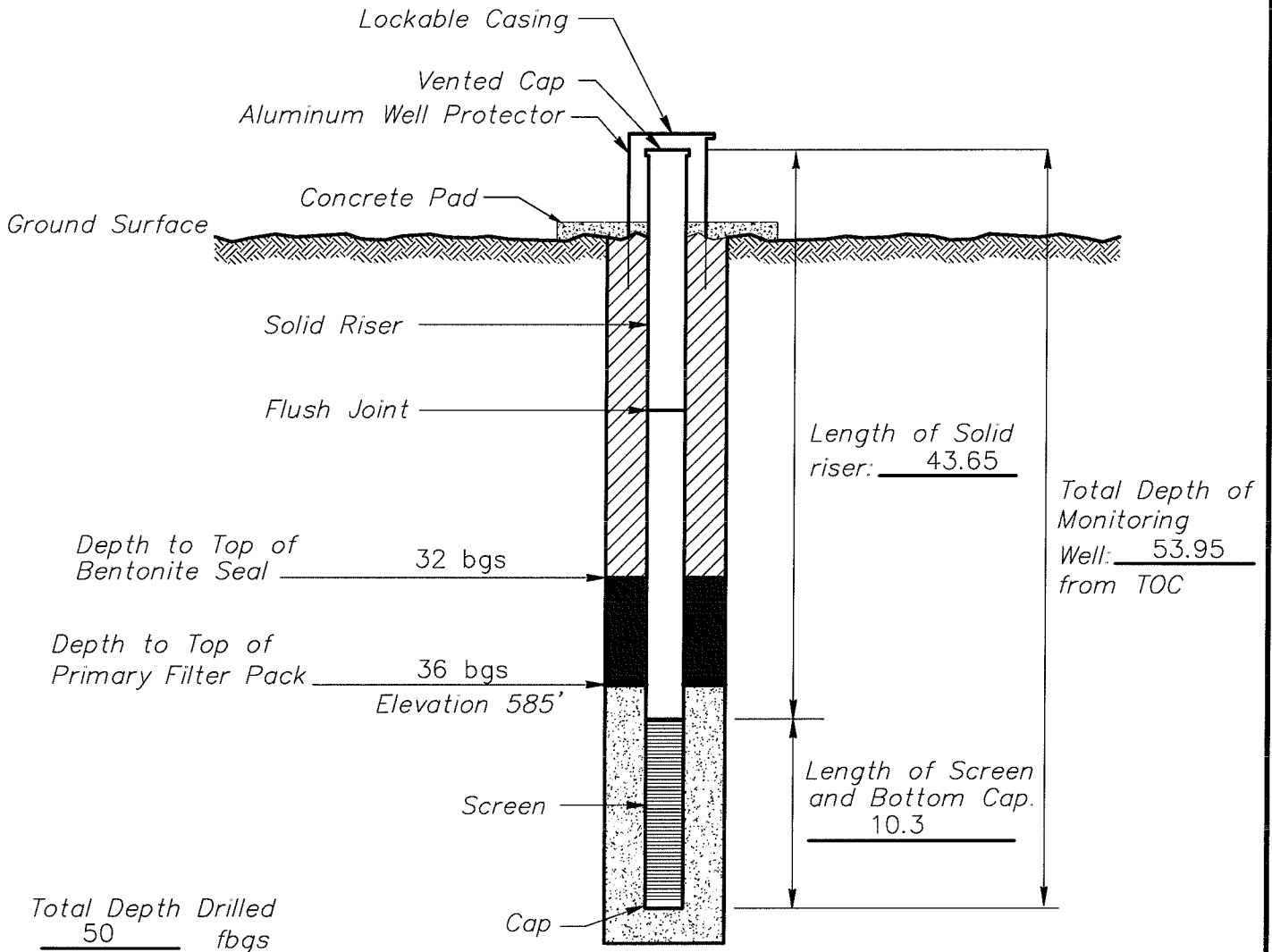
WELL NUMBER: MW-3

DRAWING NUMBER: 017

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEASTERN PLANT LANDFILL	Well Number	MW-4
Job Number	35077150	Installation Date	2/22/08
Datum Elevation	625.00	Location	OOLOGAH, OK.
Datum for Water Level Measurement	T.O.C.	Surface Elevation	621.93
Screen Diameter & Material	2" PVC	Slot Size	0.01
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"
Granular Backfill Material	12-20 SAND	Terracon Representative	MERRICK ROTENBERRY
Drilling Method	AIR ROTARY	Drilling Contractor	MOHAWK



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35077150

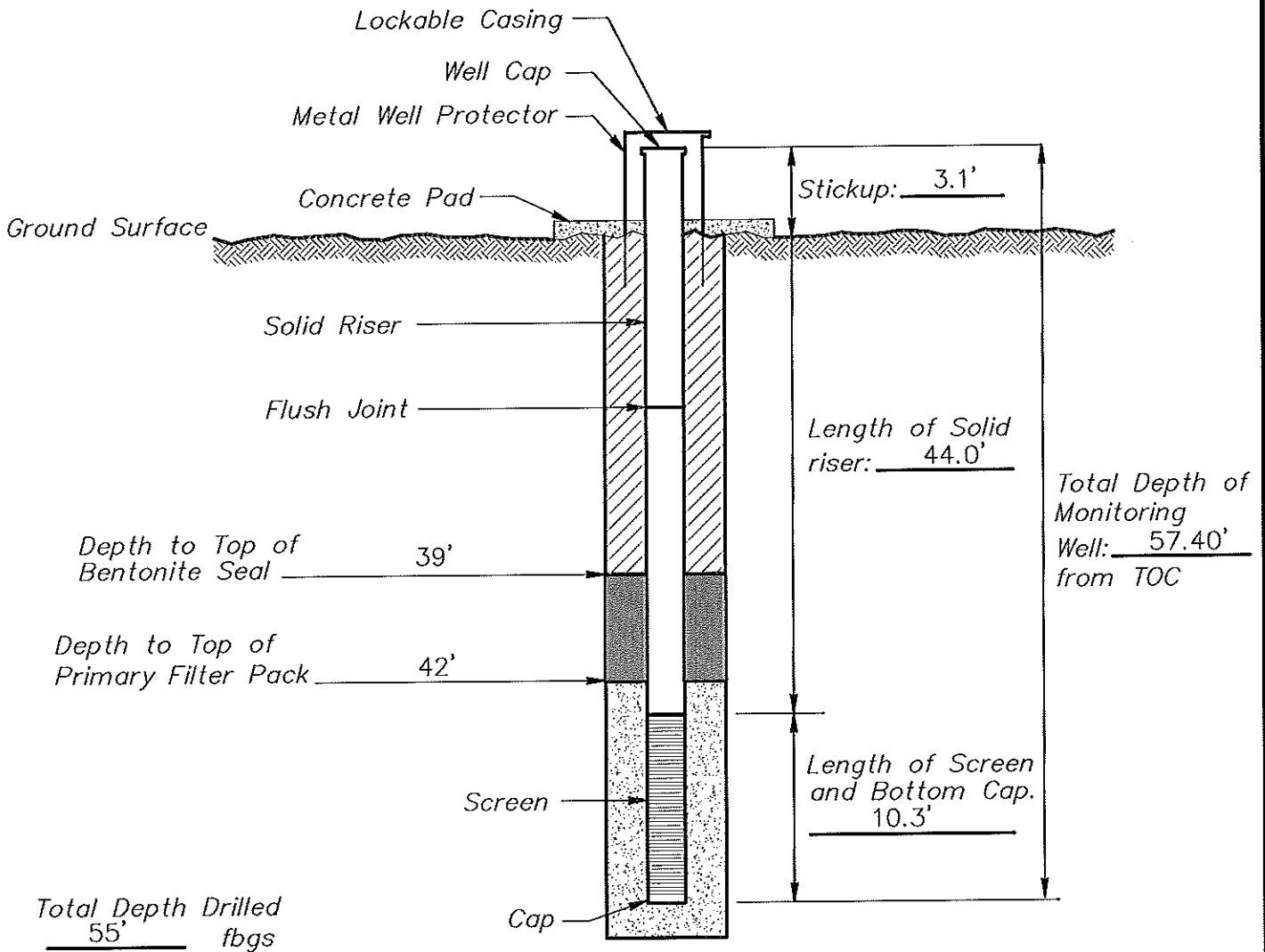
WELL NUMBER: MW-4

DRAWING NUMBER: 018

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AMERICAN ELECTRIC POWER – NE PLANT Well Number MW-1D
 Job Number 35087115 Installation Date 10/23/08 Location OOLOGAH, OK.
 Datum Elevation 638.07 Surface Elevation 635.23
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12-20 SAND Terracon Representative MR/JA
 Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

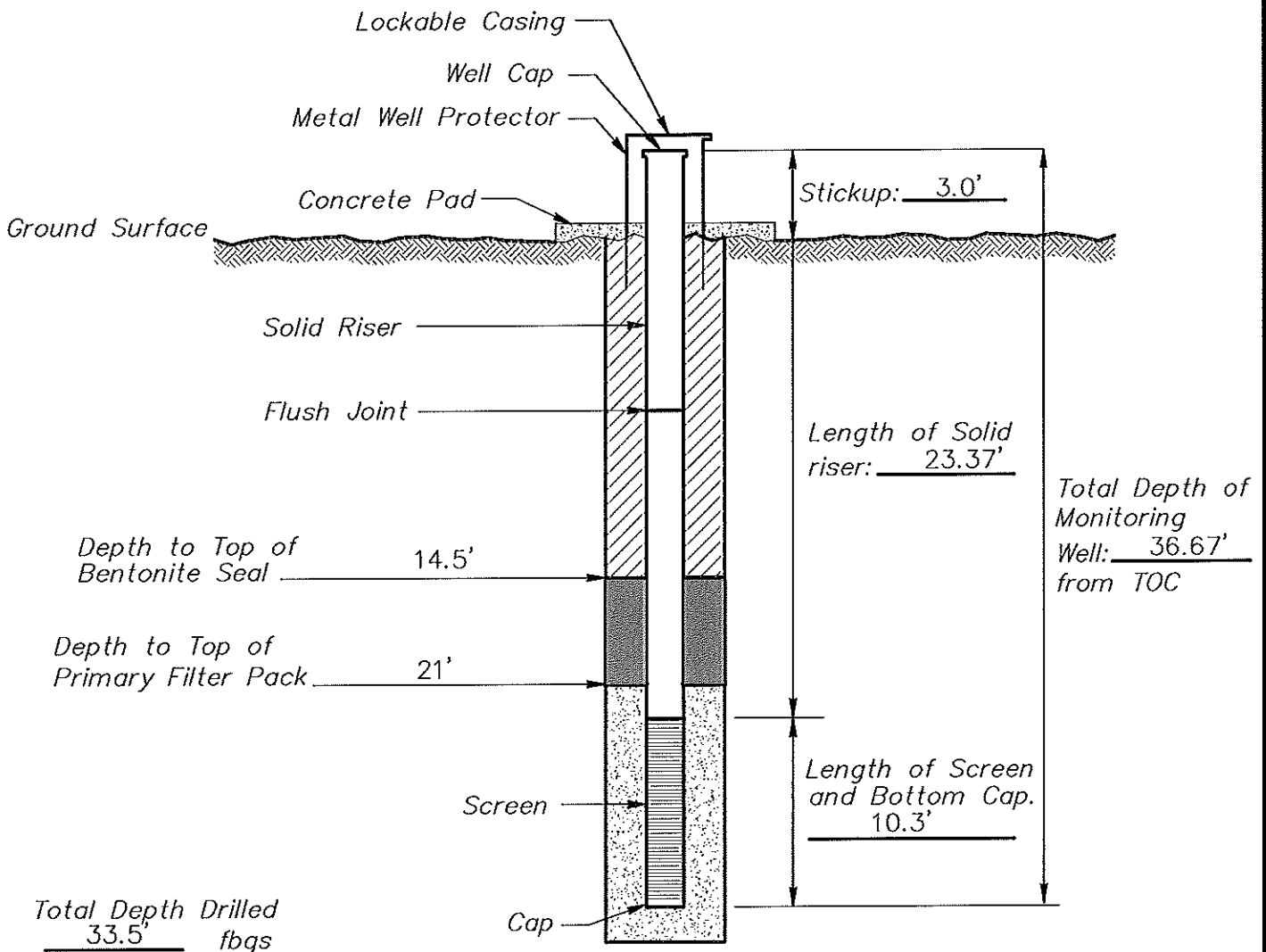
WELL NUMBER: MW-1D

DRAWING NUMBER: 035

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AMERICAN ELECTRIC POWER -- NE PLANT	Well Number	MW-2S
Job Number	35087115	Installation Date	10/13/08
Datum Elevation	637.37	Location	OOLOGAH, OK.
		Surface Elevation	634.45
Datum for Water Level Measurement	T.O.C.		
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"
Granular Backfill Material	12-20 SAND	Terracon Representative	MR/JA
Drilling Method	HOLLOW STEM AUGER/AIR ROTARY	Drilling Contractor	MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

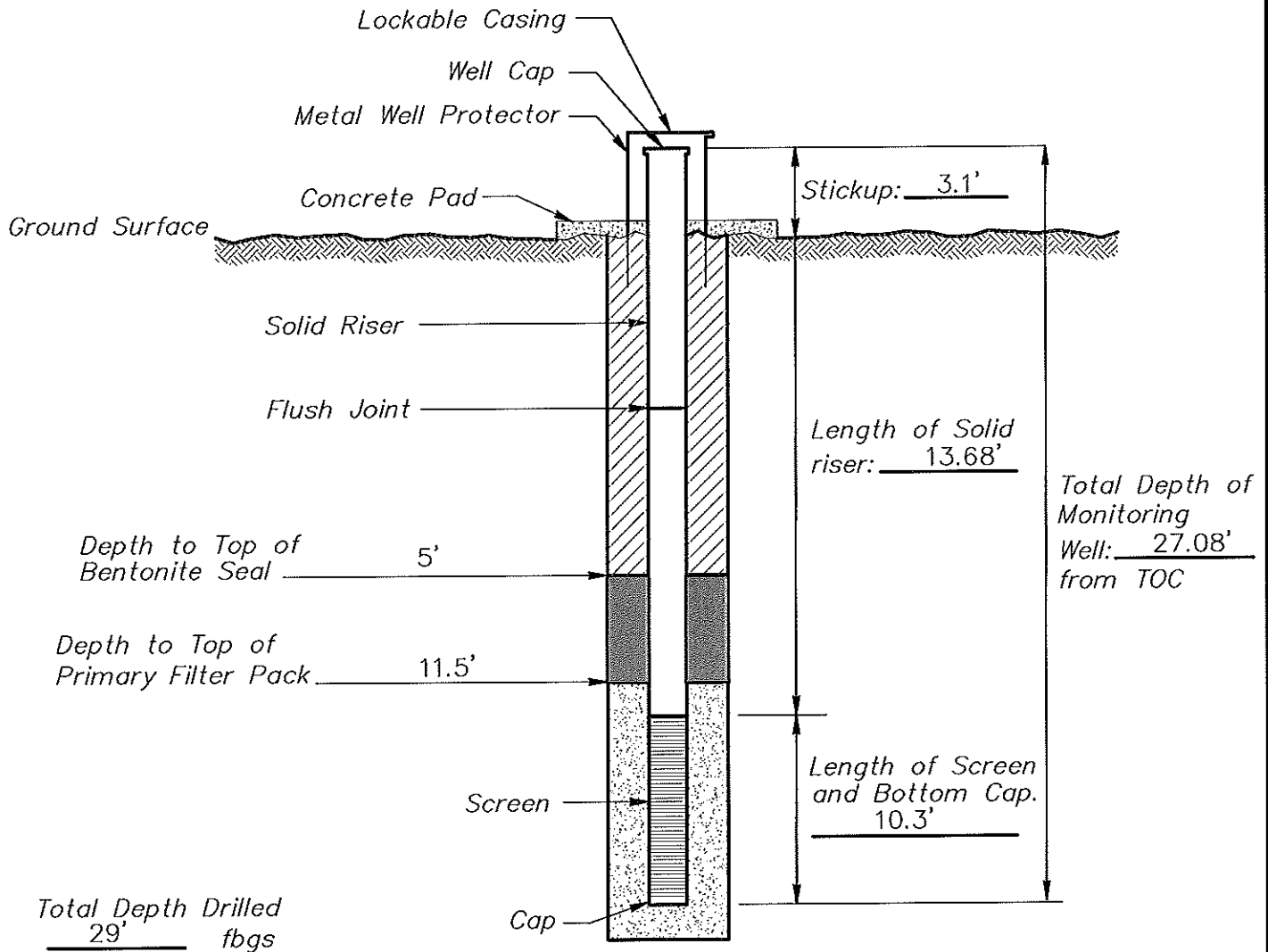
WELL NUMBER: MW-2S

DRAWING NUMBER: 036

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AMERICAN ELECTRIC POWER -- NE PLANT	Well Number	MW-3S
Job Number	35087115	Installation Date	10/13/08
Datum Elevation	630.19	Location	OOLOGAH, OK.
		Surface Elevation	627.09
Datum for Water Level Measurement	T.O.C.		
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"
Granular Backfill Material	12-20 SAND	Terracon Representative	MR/JA
Drilling Method	HOLLOW STEM AUGER/AIR ROTARY	Drilling Contractor	MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

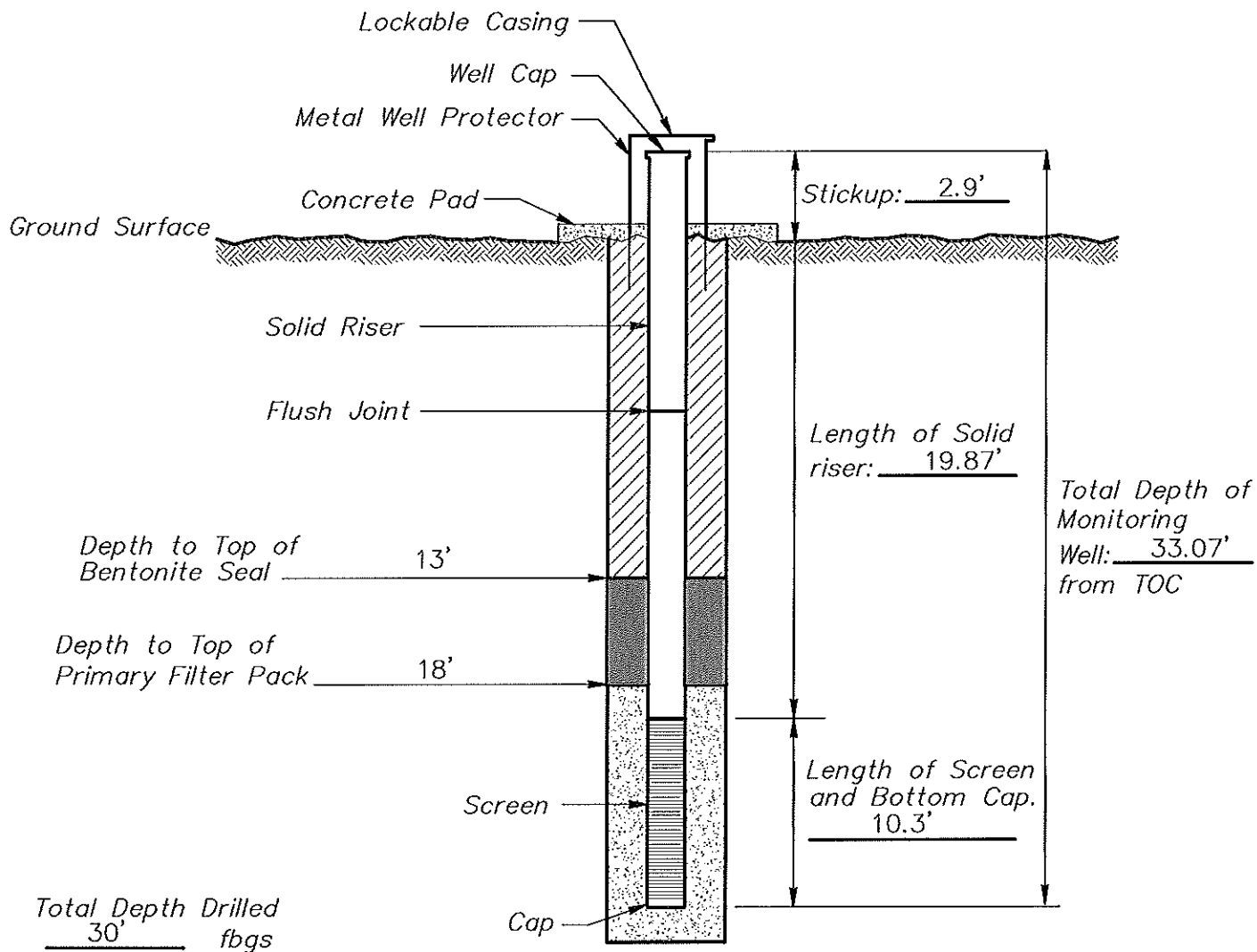
WELL NUMBER: MW-3S

DRAWING NUMBER: 037

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AMERICAN ELECTRIC POWER – NE PLANT Well Number MW-4S
 Job Number 35087115 Installation Date 10/13/08 Location OOLOGAH, OK.
 Datum Elevation 624.54 Surface Elevation 621.44
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12-20 SAND Terracon Representative MR/JA
 Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

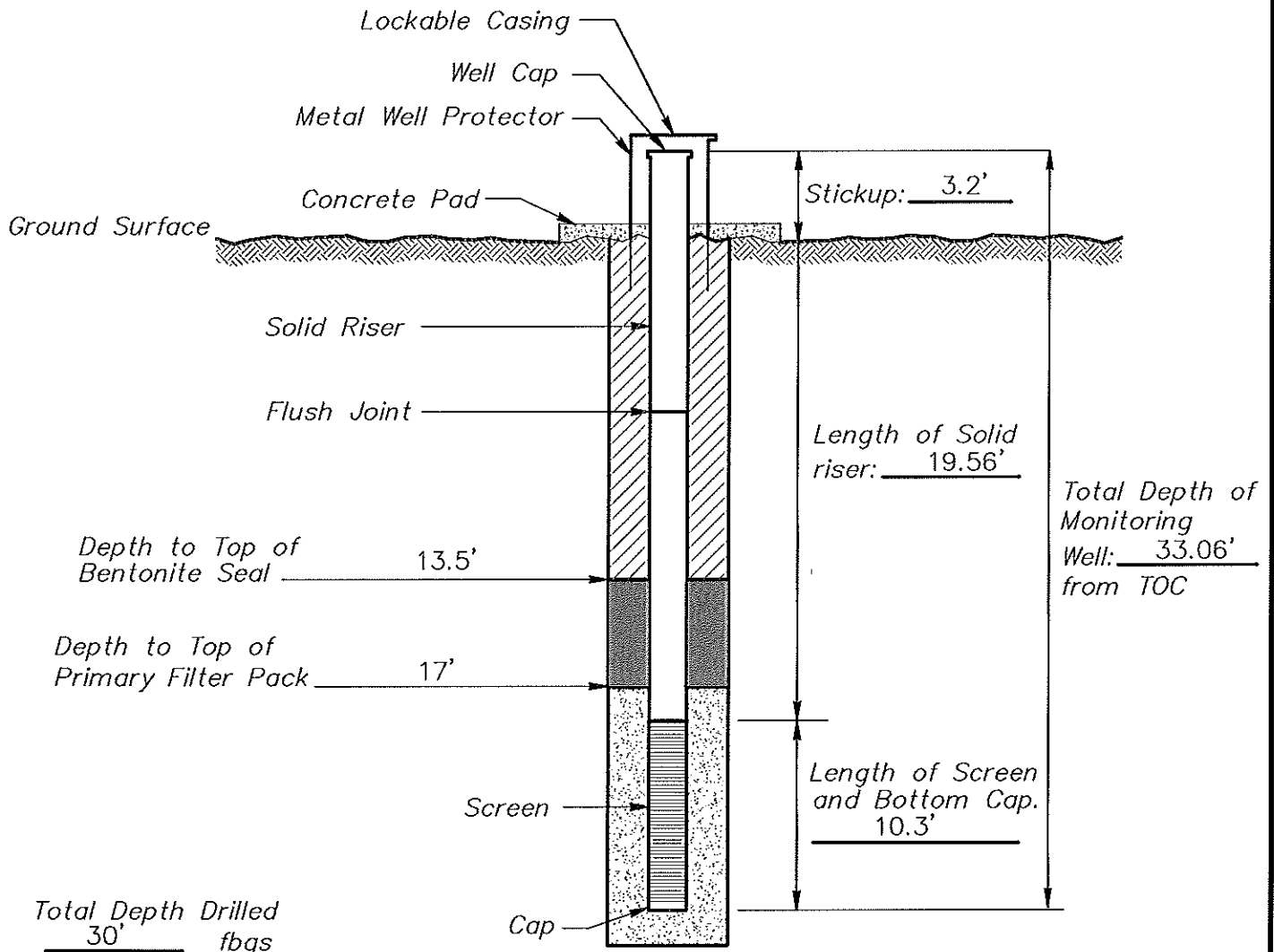
PROJECT NUMBER: 216-003-35087115
WELL NUMBER: MW-4S

DRAWING NUMBER: 038

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AMERICAN ELECTRIC POWER – NE PLANT	Well Number	MW-5S
Job Number	35087115	Installation Date	10/21/08
Datum Elevation	636.72	Location	OOLOGAH, OK.
Datum for Water Level Measurement	T.O.C.	Surface Elevation	633.62
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"
Granular Backfill Material	12-20 SAND	Terracon Representative	MR/JA
Drilling Method	HOLLOW STEM AUGER/AIR ROTARY	Drilling Contractor	MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

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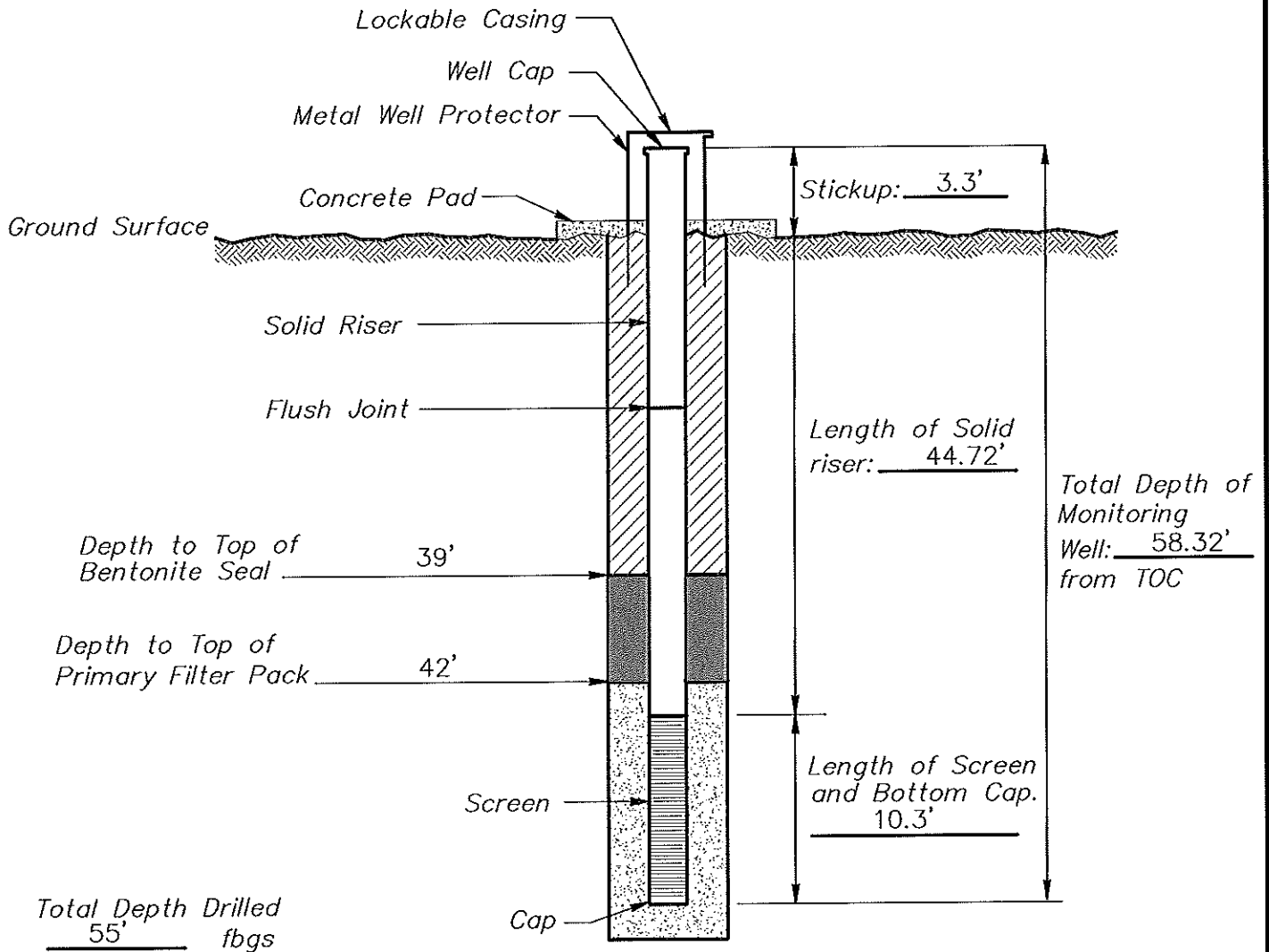
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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115
WELL NUMBER: MW-5S
DRAWING NUMBER: 039 **CHECKED BY:** MR

MONITORING WELL INSTALLATION RECORD

Job Name	AMERICAN ELECTRIC POWER – NE PLANT	Well Number	MW-5D
Job Number	35087115	Installation Date	10/23/08
Datum Elevation	636.84	Location	OOLOGAH, OK.
Datum for Water Level Measurement	T.O.C.	Surface Elevation	633.83
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"
Granular Backfill Material	12-20 SAND	Terracon Representative	MR/JA
Drilling Method	HOLLOW STEM AUGER/AIR ROTARY	Drilling Contractor	MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

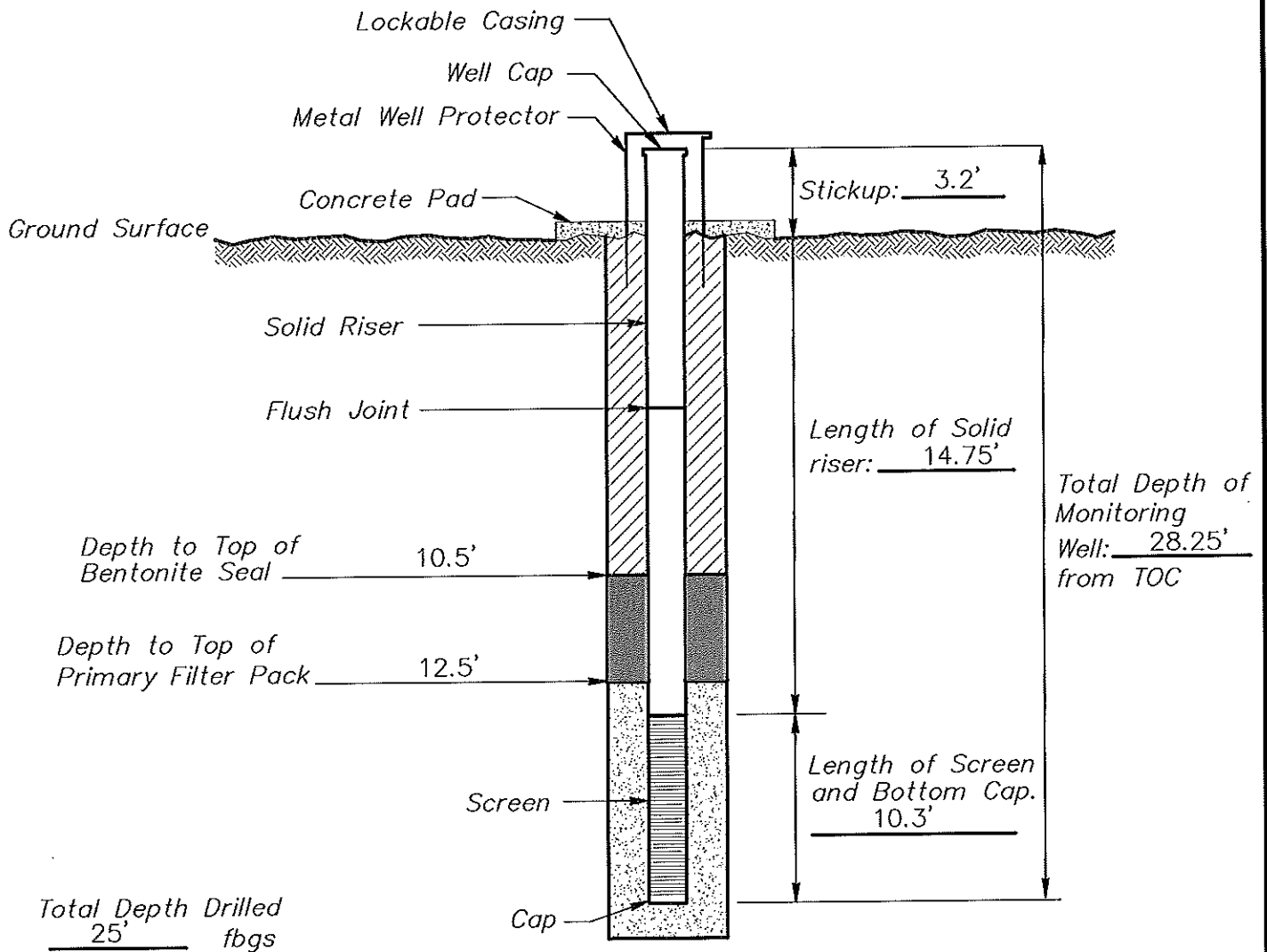
WELL NUMBER: MW-5D

DRAWING NUMBER: 040

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AMERICAN ELECTRIC POWER - NE PLANT Well Number MW-6S
 Job Number 35087115 Installation Date 10/6/08 Location OOLOGAH, OK.
 Datum Elevation 636.80 Surface Elevation 633.66
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12-20 SAND Terracon Representative MR/JA
 Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

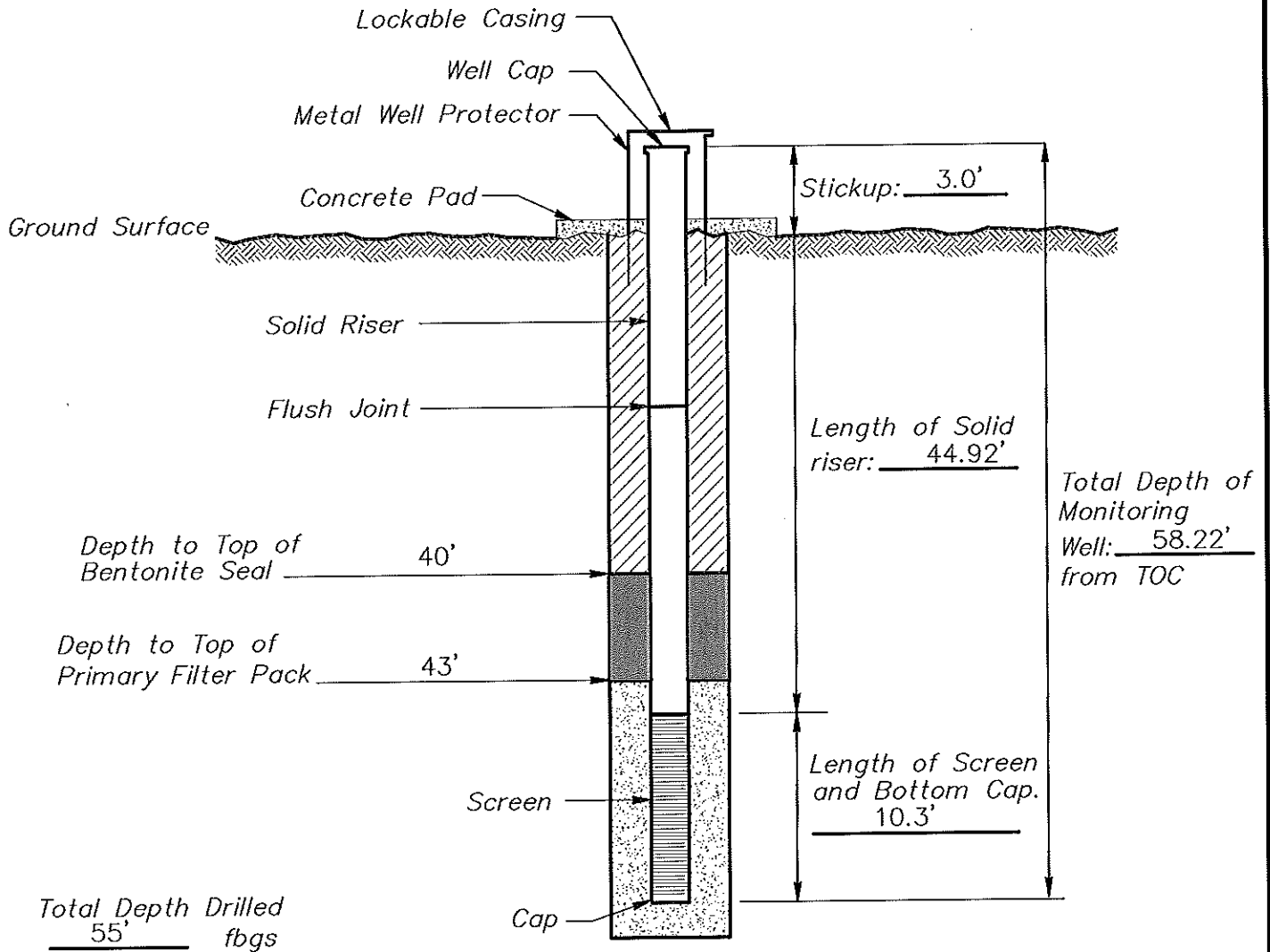
WELL NUMBER: MW-6S

DRAWING NUMBER: 041

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AMERICAN ELECTRIC POWER – NE PLANT Well Number MW-6D
 Job Number 35087115 Installation Date 10/23/08 Location OOLOGAH, OK.
 Datum Elevation 636.66 Surface Elevation 633.72
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12-20 SAND Terracon Representative MR/JA
 Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

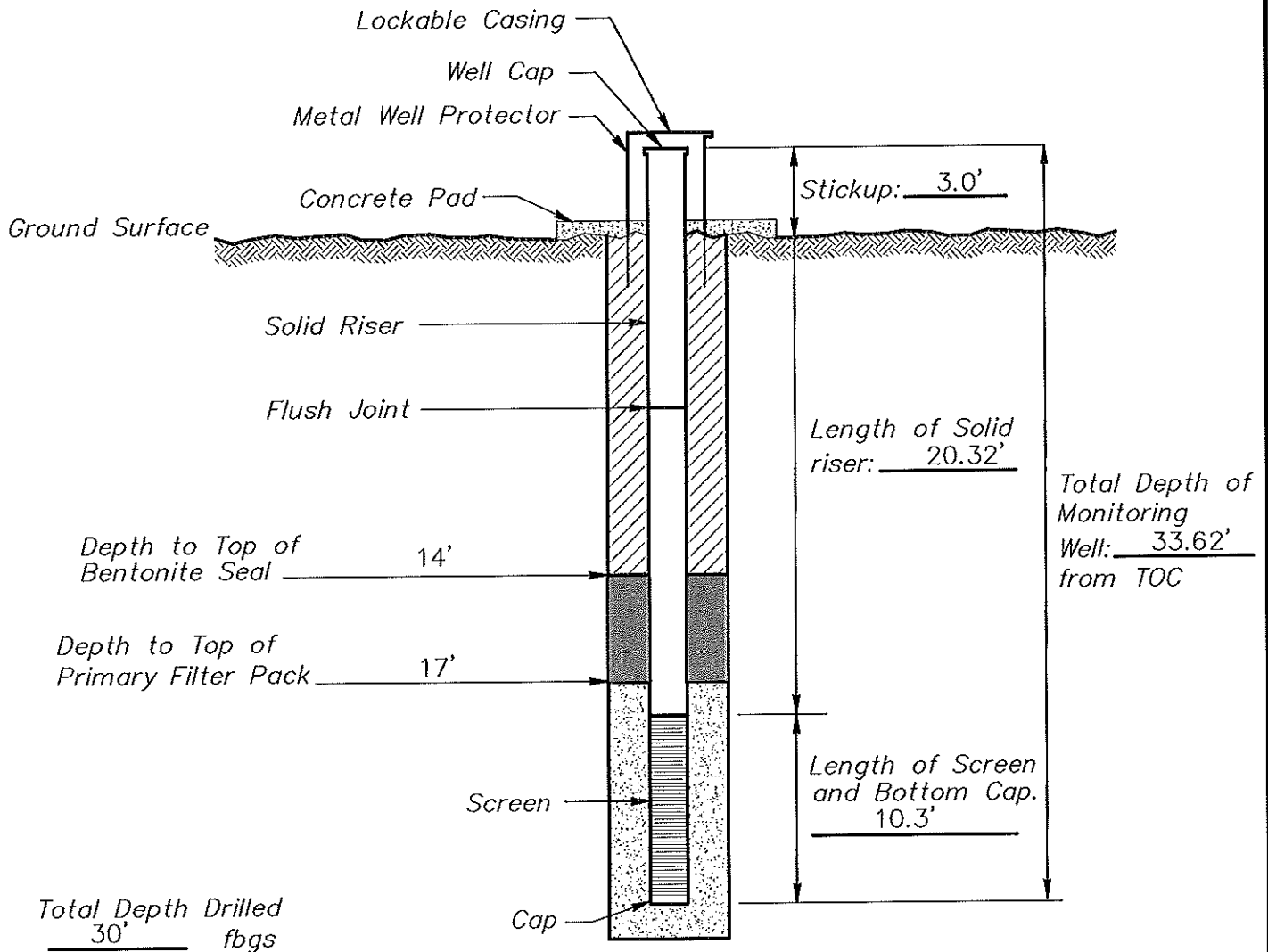
WELL NUMBER: MW-6D

DRAWING NUMBER: 042

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AMERICAN ELECTRIC POWER – NE PLANT Well Number MW-7S
 Job Number 35087115 Installation Date 10/22/08 Location OOLOGAH, OK.
 Datum Elevation 626.45 Surface Elevation 623.58
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12-20 SAND Terracon Representative MR/JA
 Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

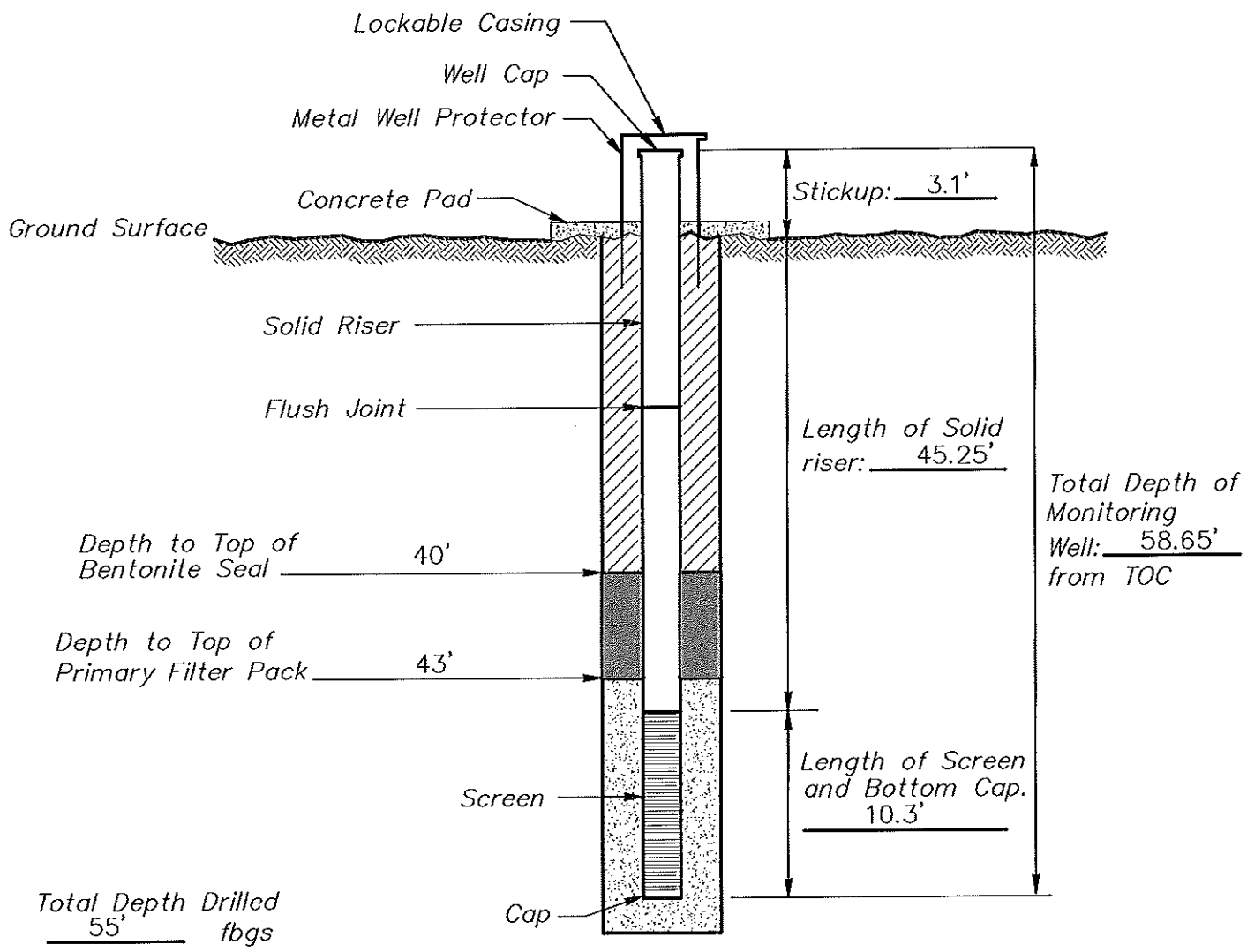
WELL NUMBER: MW-7S

DRAWING NUMBER: 043

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AMERICAN ELECTRIC POWER – NE PLANT Well Number MW-7D
 Job Number 35087115 Installation Date 10/22/08 Location OOLOGAH, OK.
 Datum Elevation 626.46 Surface Elevation 623.74
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12--20 SAND Terracon Representative MR/JA
 Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

Terracon

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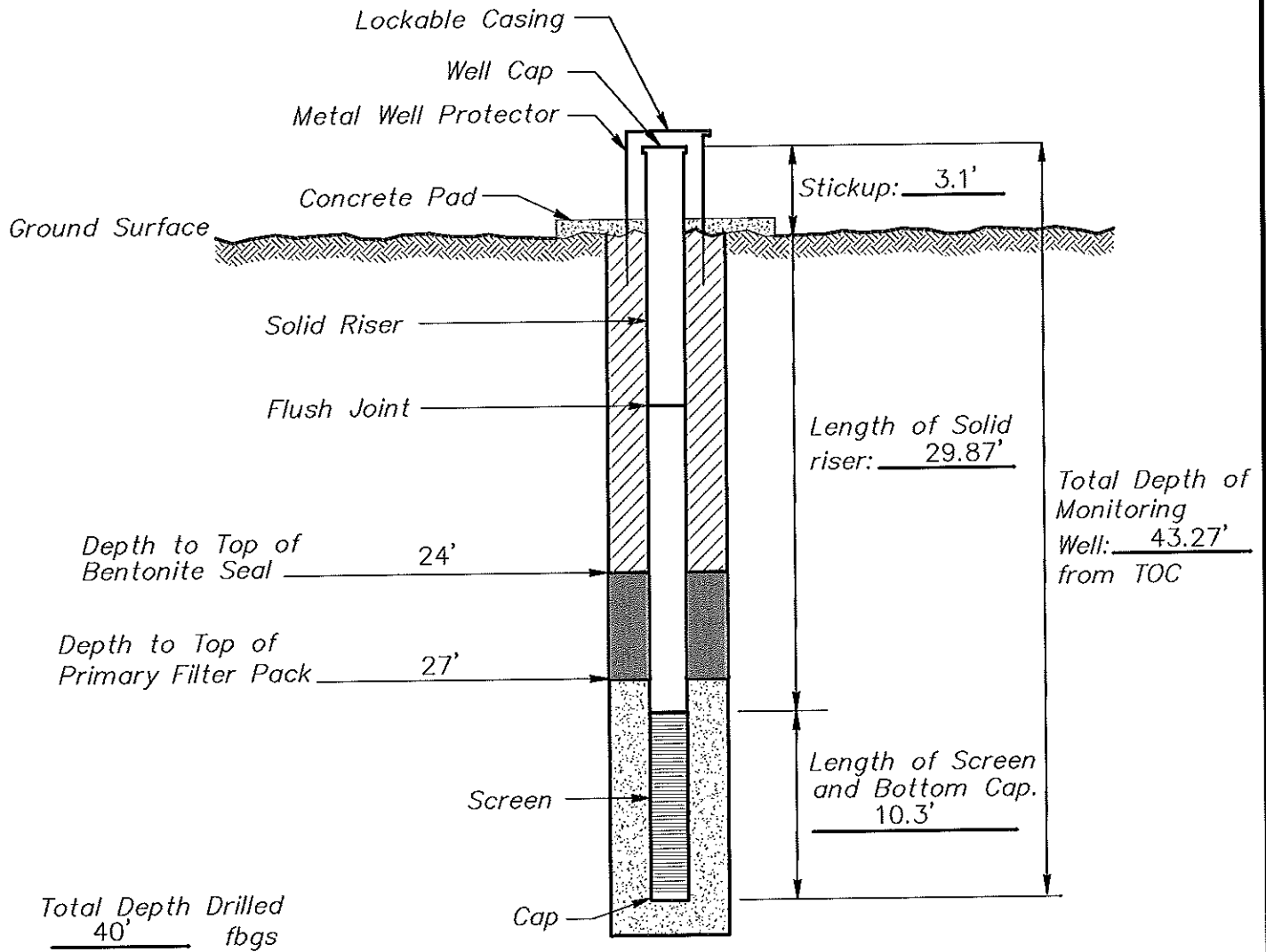
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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115
WELL NUMBER: MW-7D
DRAWING NUMBER: 044 **CHECKED BY:** MR

MONITORING WELL INSTALLATION RECORD

Job Name AMERICAN ELECTRIC POWER - NE PLANT Well Number MW-8S
 Job Number 35087115 Installation Date 10/21/08 Location OOLOGAH, OK.
 Datum Elevation 628.71 Surface Elevation 625.68
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6.25"
 Granular Backfill Material 12-20 SAND Terracon Representative MR/JA
 Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35087115

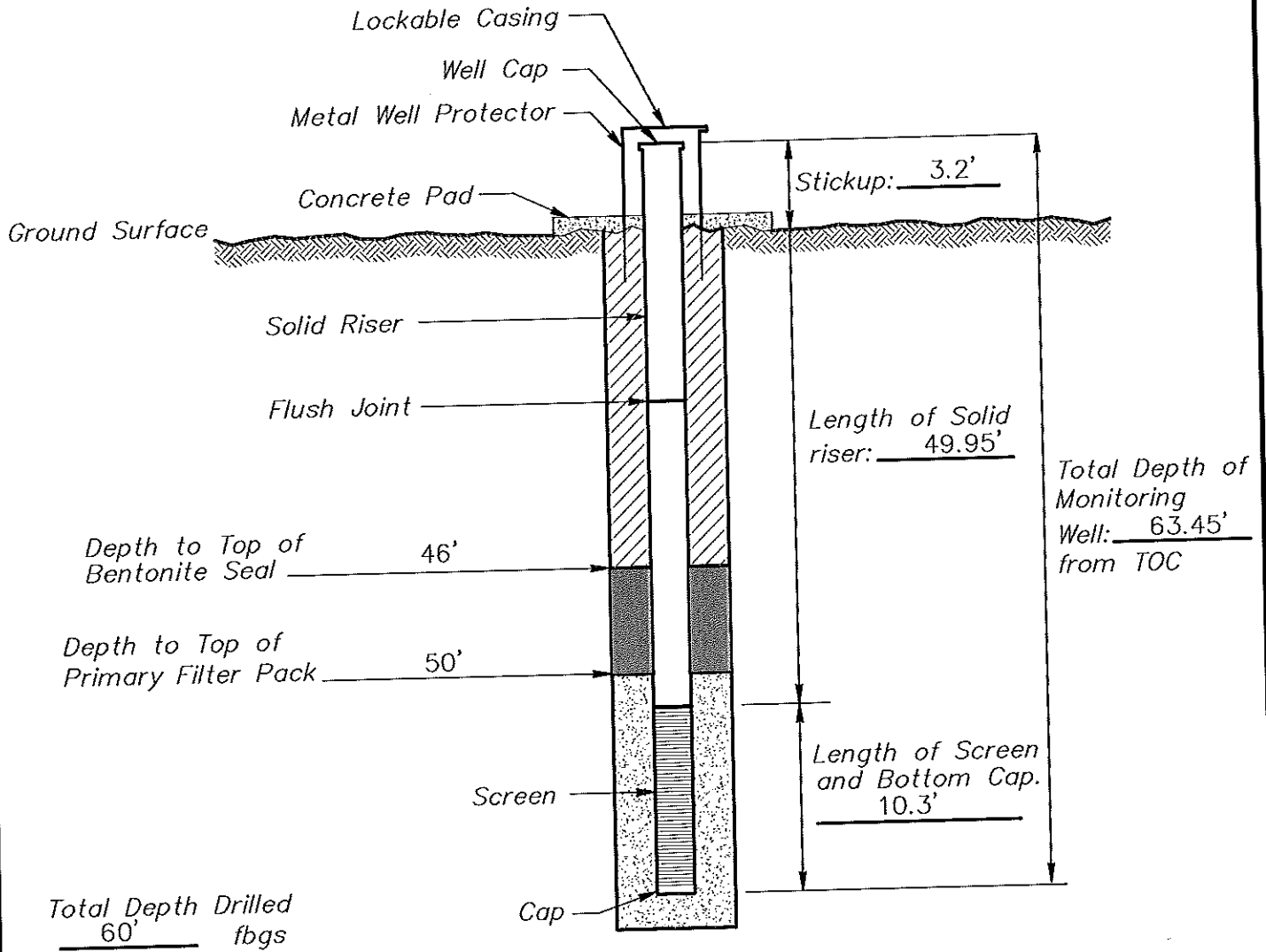
WELL NUMBER: MW-8S

DRAWING NUMBER: 045

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AMERICAN ELECTRIC POWER - NE PLANT	Well Number	MW-8D
Job Number	35087115	Installation Date	10/21/08
Datum Elevation	629.32	Location	OOLOGAH, OK.
Datum for Water Level Measurement	T.O.C.	Surface Elevation	626.04
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6.25"
Granular Backfill Material	12-20 SAND	Terracon Representative	MR/JA
Drilling Method	HOLLOW STEM AUGER/AIR ROTARY	Drilling Contractor	MOHAWK



- Portland/Bentonite Grout
- Bentonite Pellets
- Granular Backfill

(Not to Scale)

Terracon

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25809 Interstate-30 South
PH. (501) 847-9292

BRYANT, AR. 72022
FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

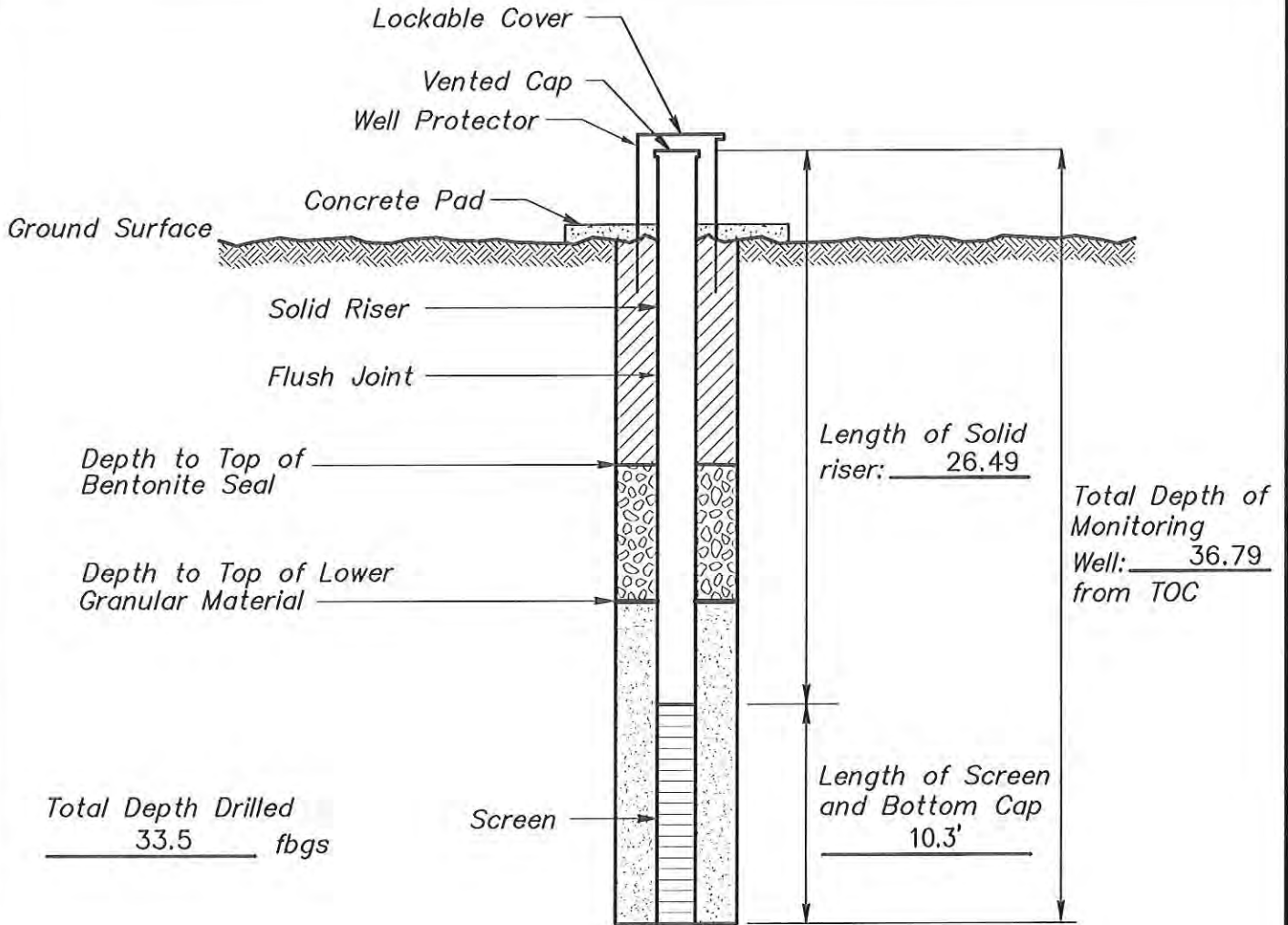
PROJECT NUMBER: 216-003-35087115
WELL NUMBER: MW-8D

DRAWING NUMBER: 046

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION	Well Number	MW-9S
Job Number	35107060	Installation Date	4/7/2010
Datum Elevation	636.94'	Location	OOLOGAH, OK.
Datum for Water Level Measurement	TOP OF CASING		
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6"
Granular Backfill Material	12-20 SAND	Terracon Representative	CLANCY McCLINTOCK
Drilling Method	H.S.A., W.L.C., AIR HAMMER	Drilling Contractor	MOHAWK



- Portland-Bentonite Grout
- Bentonite Plug
- Granular Backfill Material

(Not to Scale)

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BRYANT, AR 72202
FAX (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

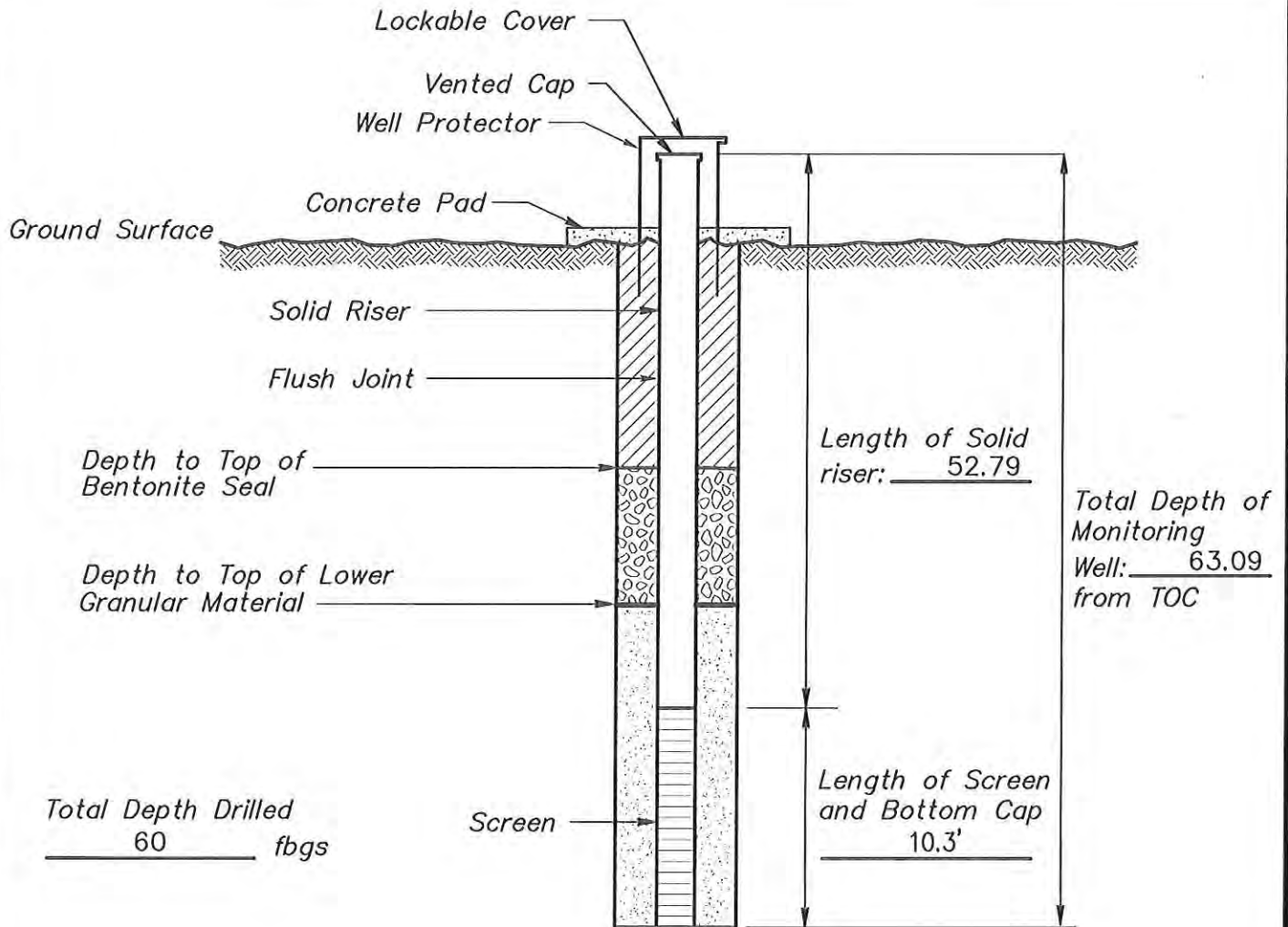
WELL NUMBER: MW-9S

DRAWING NUMBER: 011

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION	Well Number	MW-9D
Job Number	35107060	Installation Date	4/6/2010
Datum Elevation	637.04'	Location	OOLOGAH, OK.
Datum for Water Level Measurement	TOP OF CASING		
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6"
Granular Backfill Material	12-20 SAND	Terracon Representative	CLANCY McCLINTOCK
Drilling Method	H.S.A., W.L.C., AIR HAMMER	Drilling Contractor	MOHAWK



- Portland-Bentonite Grout
- Bentonite Plug
- Granular Backfill Material

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

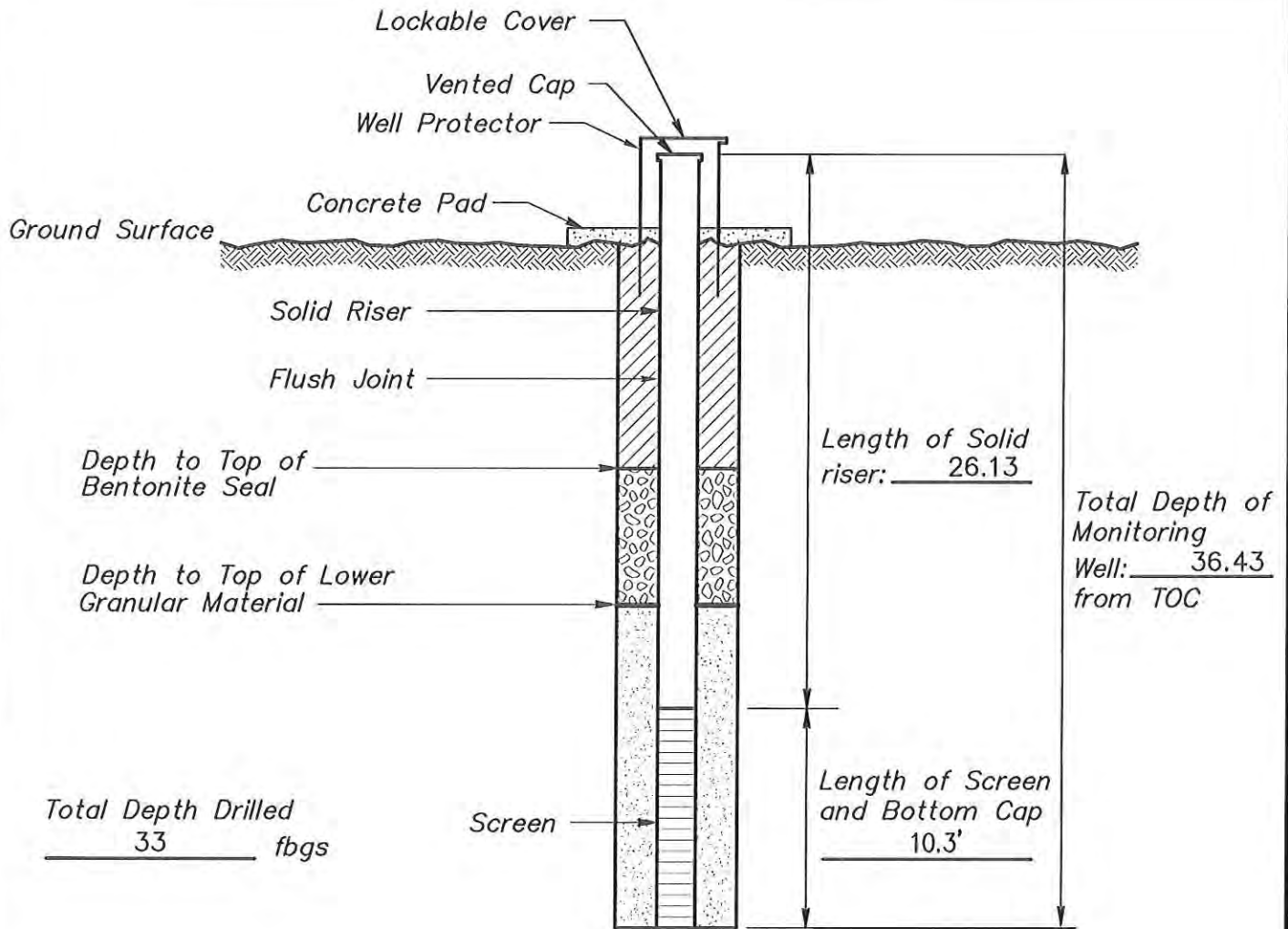
WELL NUMBER: MW-9D

DRAWING NUMBER: 012

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION	Well Number	MW-10S
Job Number	35107060	Installation Date	4/13/2010
Datum Elevation	639.58'	Location	OOLOGAH, OK.
Datum for Water Level Measurement	TOP OF CASING		
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6"
Granular Backfill Material	12-20 SAND	Terracon Representative	CLANCY McCLINTOCK
Drilling Method	W.L.C., AIR HAMMER	Drilling Contractor	MOHAWK



- Portland-Bentonite Grout
- Bentonite Plug
- Granular Backfill Material

(Not to Scale)

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FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

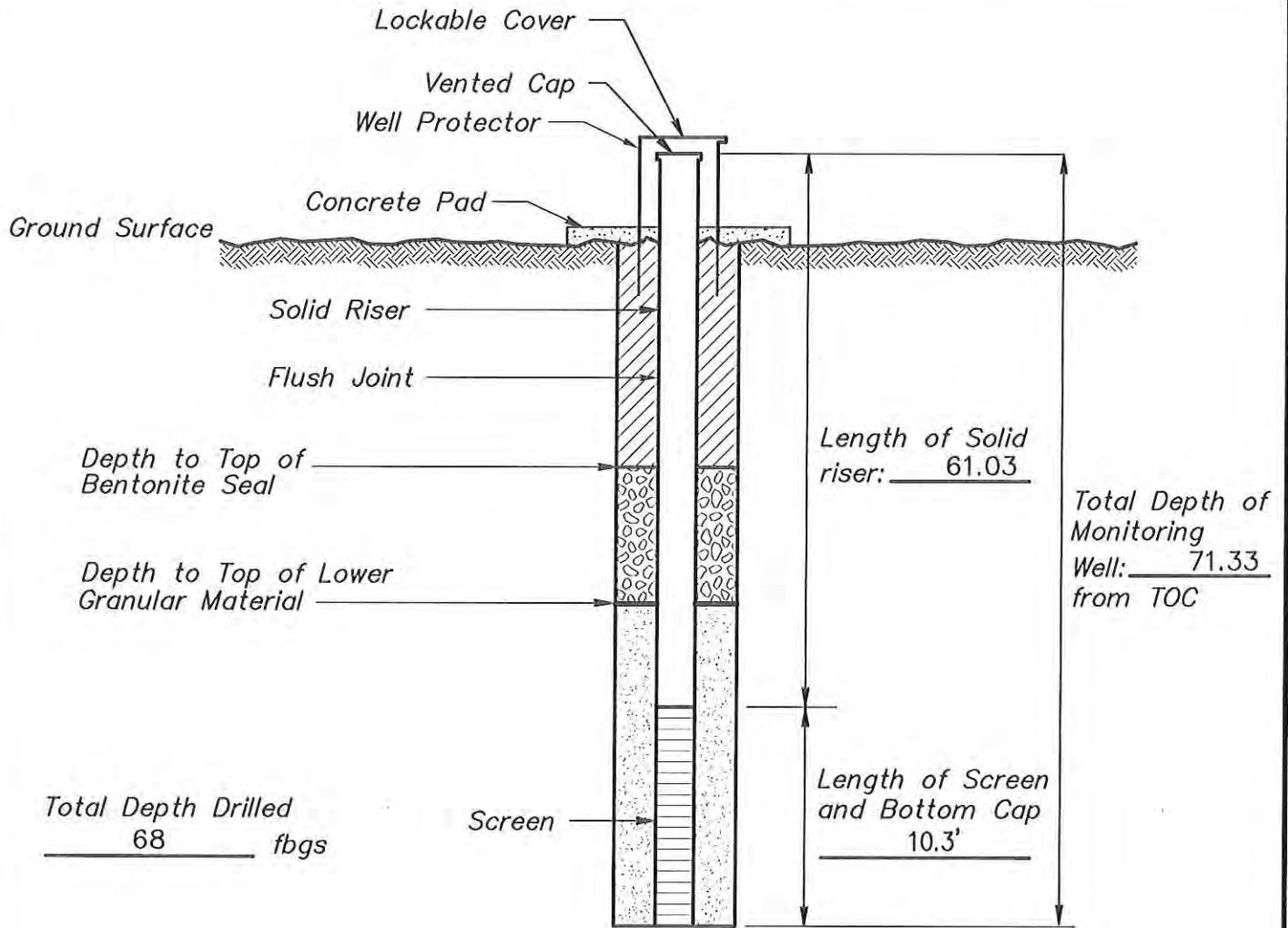
WELL NUMBER: MW-10S




DRAWING NUMBER: 013

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION Well Number MW-10D
 Job Number 35107060 Installation Date 4/12/2010 Location OOLOGAH, OK.
 Datum Elevation 639.32' Surface Elevation 636.14'
 Datum for Water Level Measurement TOP OF CASING
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6"
 Granular Backfill Material 12-20 SAND Terracon Representative CLANCY McCLINTOCK
 Drilling Method W.L.C., AIR HAMMER Drilling Contractor MOHAWK



-  Portland-Bentonite Grout
-  Bentonite Plug
-  Granular Backfill Material

(Not to Scale)

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FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

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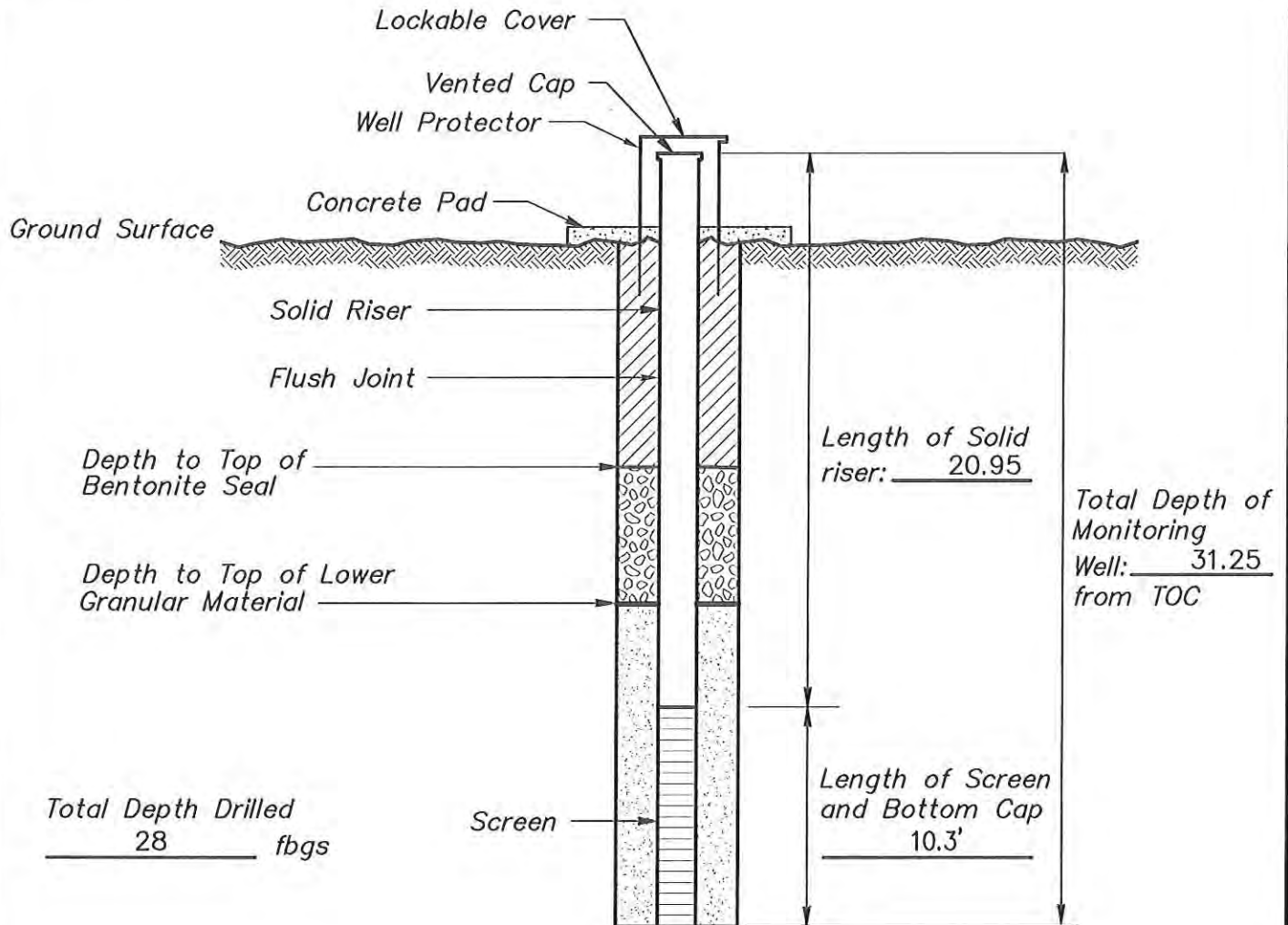
WELL NUMBER: MW-10D

DRAWING NUMBER: 014

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION	Well Number	MW-11S
Job Number	35107060	Installation Date	4/15/2010
Datum Elevation	628.75'	Location	OOLOGAH, OK.
Datum for Water Level Measurement	TOP OF CASING		
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6"
Granular Backfill Material	12-20 SAND	Terracon Representative	CLANCY McCLINTOCK
Drilling Method	W.L.C., AIR HAMMER	Drilling Contractor	MOHAWK



- Portland-Bentonite Grout
- Bentonite Plug
- Granular Backfill Material

(Not to Scale)



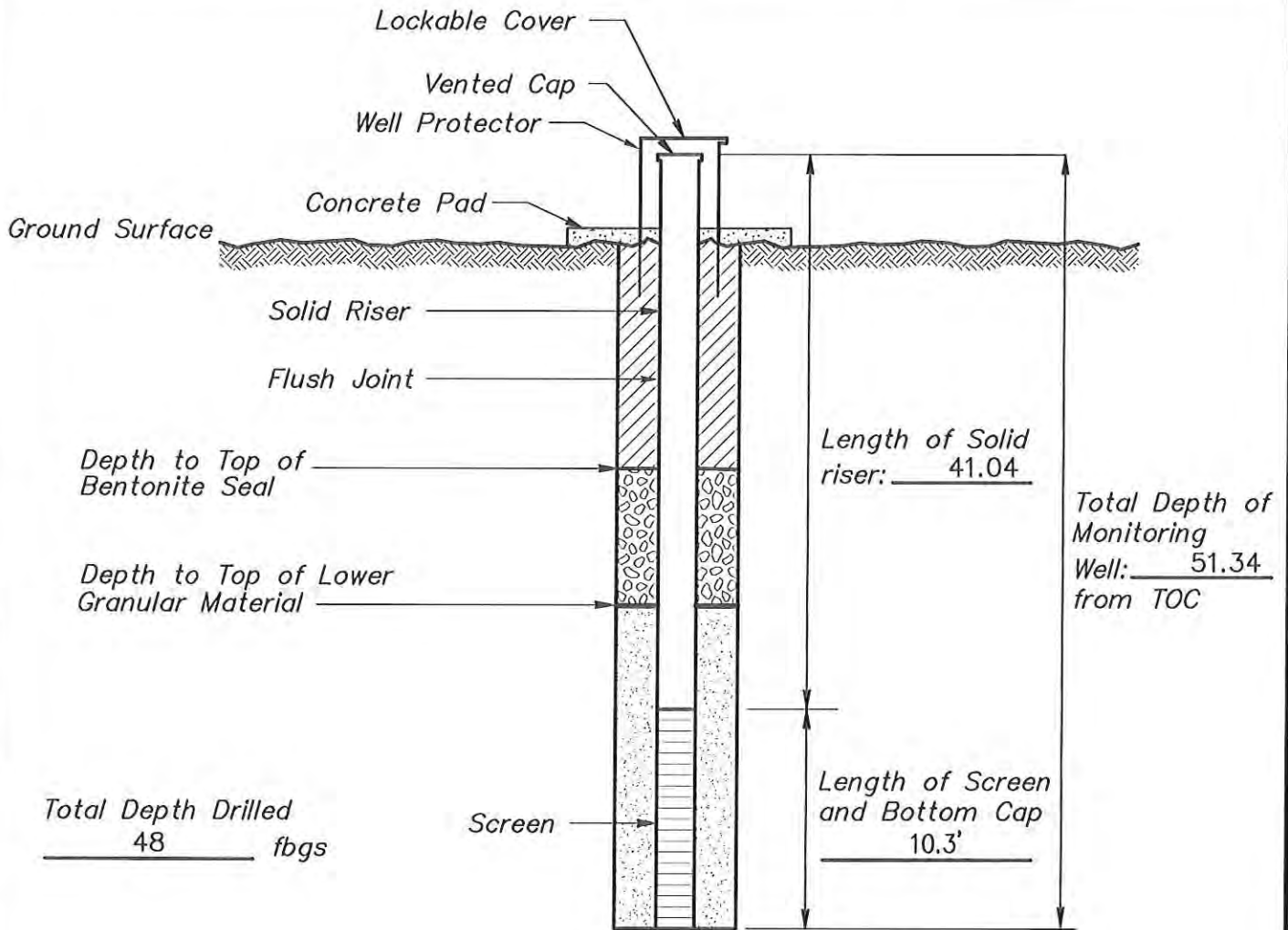
25809 INTERSTATE 30 S BRYANT, AR 72202
 PH. (501) 847-9292 FAX (501) 847-9210




MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060
WELL NUMBER: MW-11S
DRAWING NUMBER: 015 **CHECKED BY:** MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION Well Number MW-11D
 Job Number 35107060 Installation Date 4/14/2010 Location OOLOGAH, OK.
 Datum Elevation 628.27' Surface Elevation 625.97'
 Datum for Water Level Measurement TOP OF CASING
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6"
 Granular Backfill Material 12-20 SAND Terracon Representative CLANCY McCLINTOCK
 Drilling Method W.L.C., AIR HAMMER Drilling Contractor MOHAWK



-  Portland-Bentonite Grout
-  Bentonite Plug
-  Granular Backfill Material

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

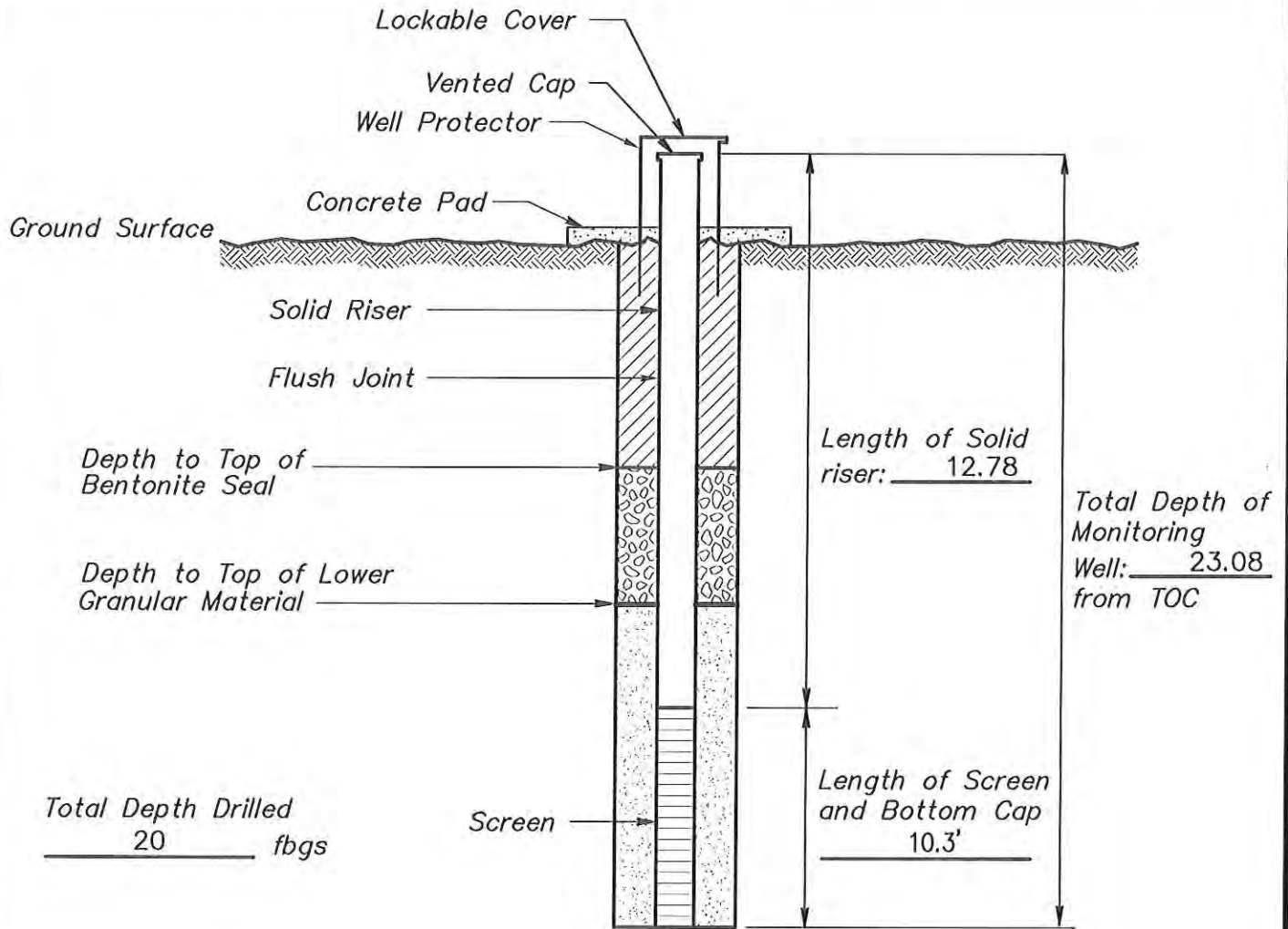
WELL NUMBER: MW-11D

DRAWING NUMBER: 016

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION		Well Number	MW-12S	
Job Number	35107060	Installation Date	4/19/2010	Location	OOLOGAH, OK.
Datum Elevation	623.50'	Surface Elevation	620.65'		
Datum for Water Level Measurement	TOP OF CASING				
Screen Diameter & Material	2" PVC		Slot Size	0.01"	
Riser Diameter & Material	2" PVC		Borehole Diameter	6"	
Granular Backfill Material	12-20 SAND		Terracon Representative	CLANCY McCLINTOCK	
Drilling Method	W.L.C., AIR HAMMER		Drilling Contractor	MOHAWK	



- Portland-Bentonite Grout
- Bentonite Plug
- Granular Backfill Material

(Not to Scale)

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FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

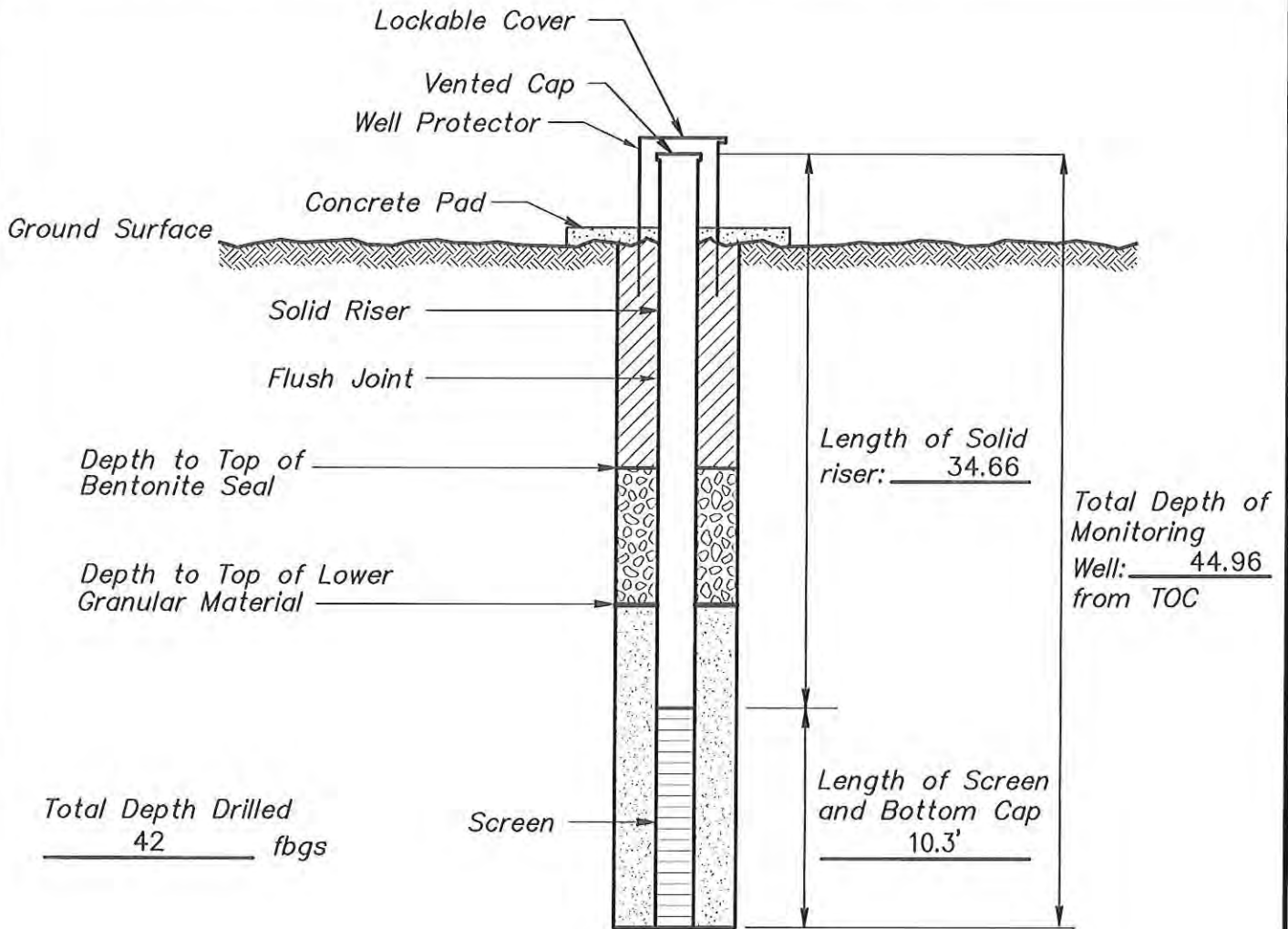
WELL NUMBER: MW-12S




DRAWING NUMBER: 017

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION Well Number MW-12D
 Job Number 35107060 Installation Date 4/19/2010 Location OOLOGAH, OK.
 Datum Elevation 623.67' Surface Elevation 620.91'
 Datum for Water Level Measurement TOP OF CASING
 Screen Diameter & Material 2" PVC Slot Size 0.01"
 Riser Diameter & Material 2" PVC Borehole Diameter 6"
 Granular Backfill Material 12-20 SAND Terracon Representative CLANCY McCLINTOCK
 Drilling Method W.L.C., AIR HAMMER Drilling Contractor MOHAWK



-  Portland-Bentonite Grout
-  Bentonite Plug
-  Granular Backfill Material

(Not to Scale)

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FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

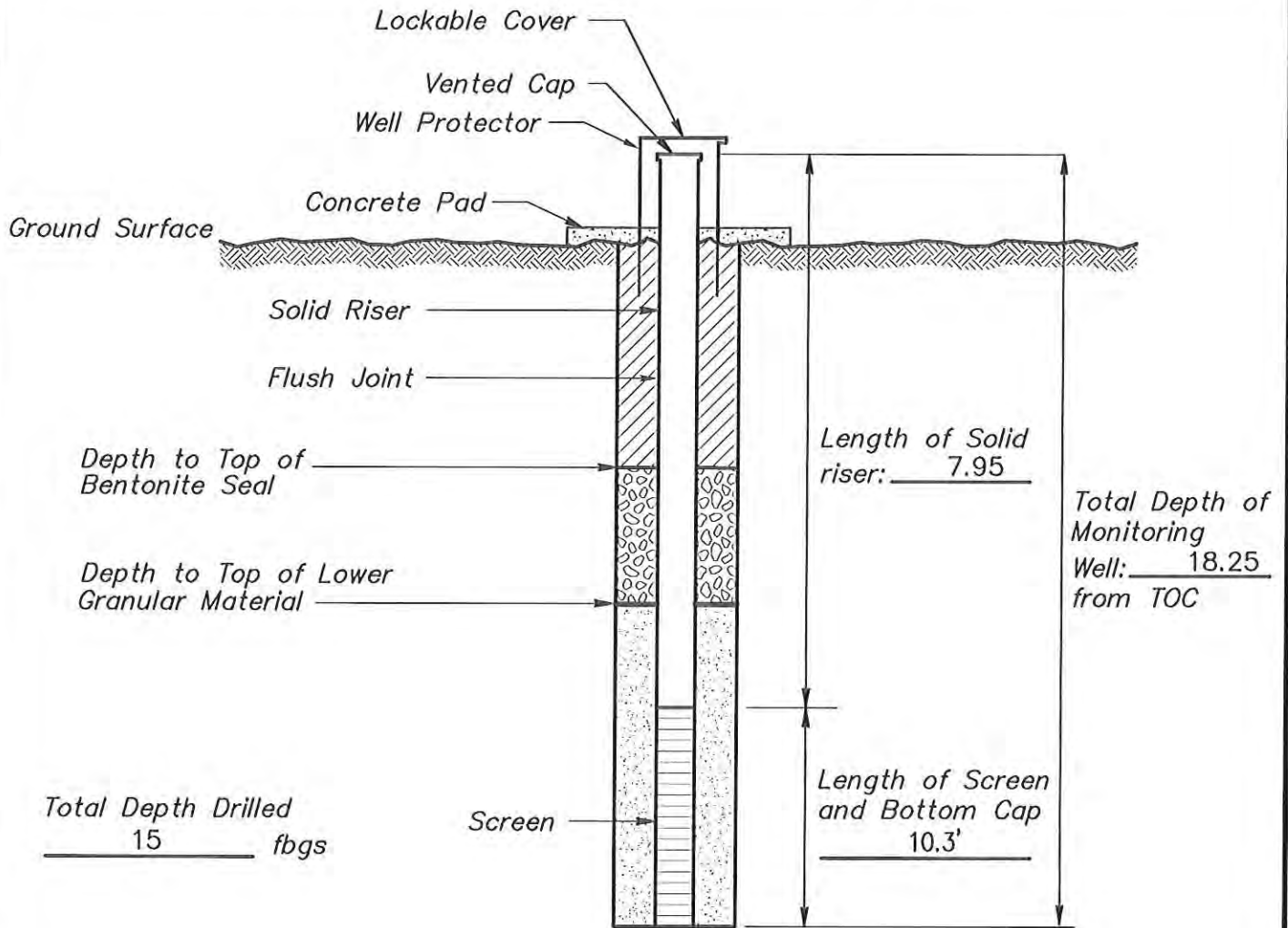
WELL NUMBER: MW-12D

DRAWING NUMBER: 018

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION	Well Number	MW-13S
Job Number	35107060	Installation Date	4/21/2010
Datum Elevation	619.15'	Location	OOLOGAH, OK.
		Surface Elevation	616.19'
Datum for Water Level Measurement	TOP OF CASING		
Screen Diameter & Material	2" PVC	Slot Size	0.01"
Riser Diameter & Material	2" PVC	Borehole Diameter	6"
Granular Backfill Material	12-20 SAND	Terracon Representative	CLANCY McCLINTOCK
Drilling Method	W.L.C., AIR HAMMER	Drilling Contractor	MOHAWK



- Portland-Bentonite Grout
- Bentonite Plug
- Granular Backfill Material

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FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

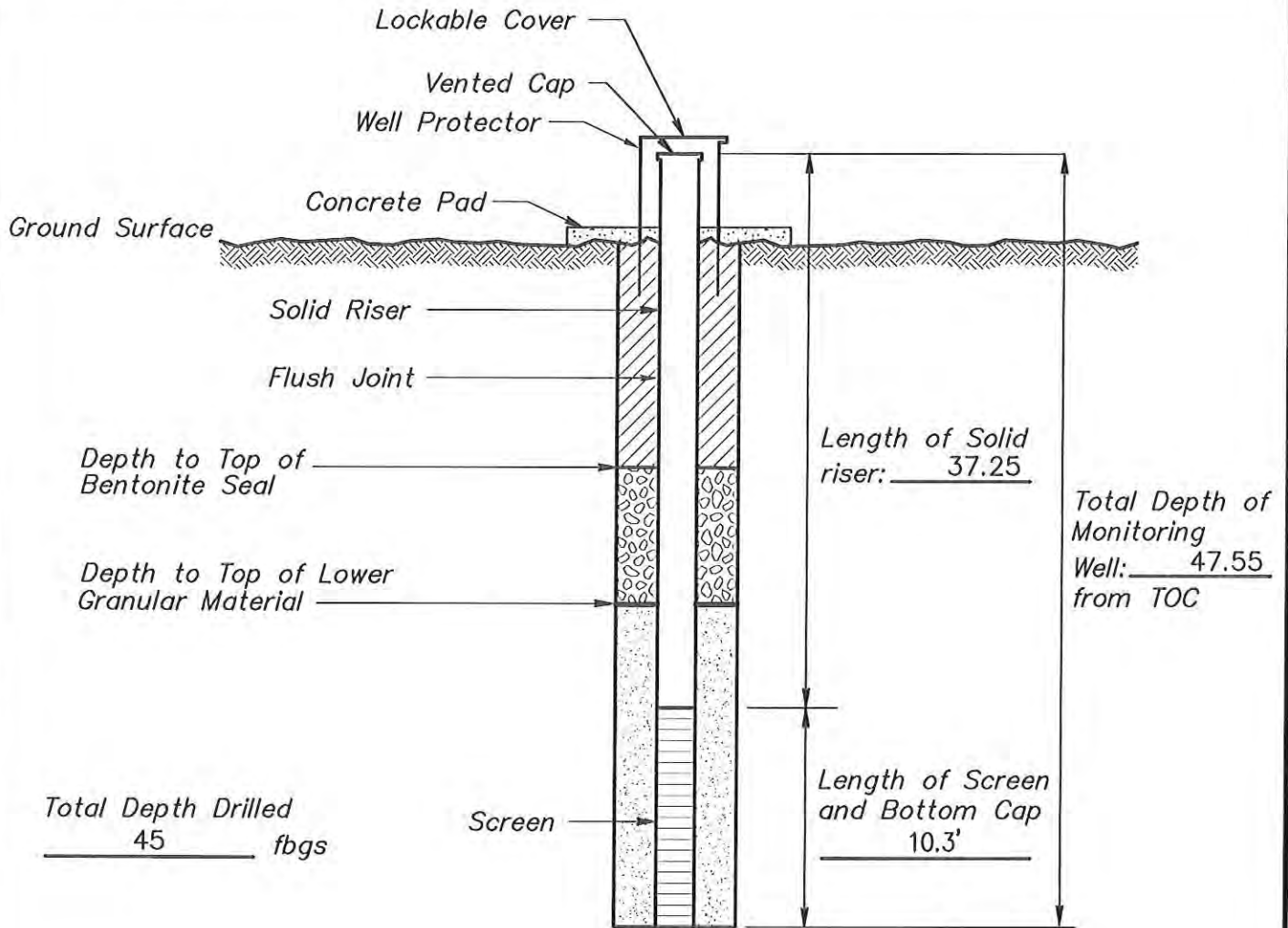
WELL NUMBER: MW-13S

DRAWING NUMBER: 019

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name	AEP NORTHEAST STATION HYDROGEOLOGIC INVESTIGATION		Well Number	MW-13D	
Job Number	35107060	Installation Date	4/20/2010	Location	OOLOGAH, OK.
Datum Elevation	619.06'	Surface Elevation	616.11'		
Datum for Water Level Measurement	TOP OF CASING				
Screen Diameter & Material	2" PVC	Slot Size	0.01"		
Riser Diameter & Material	2" PVC	Borehole Diameter	6"		
Granular Backfill Material	12-20 SAND	Terracon Representative	CLANCY McCLINTOCK		
Drilling Method	W.L.C., AIR HAMMER	Drilling Contractor	MOHAWK		



- Portland-Bentonite Grout
- Bentonite Plug
- Granular Backfill Material

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-003-35107060

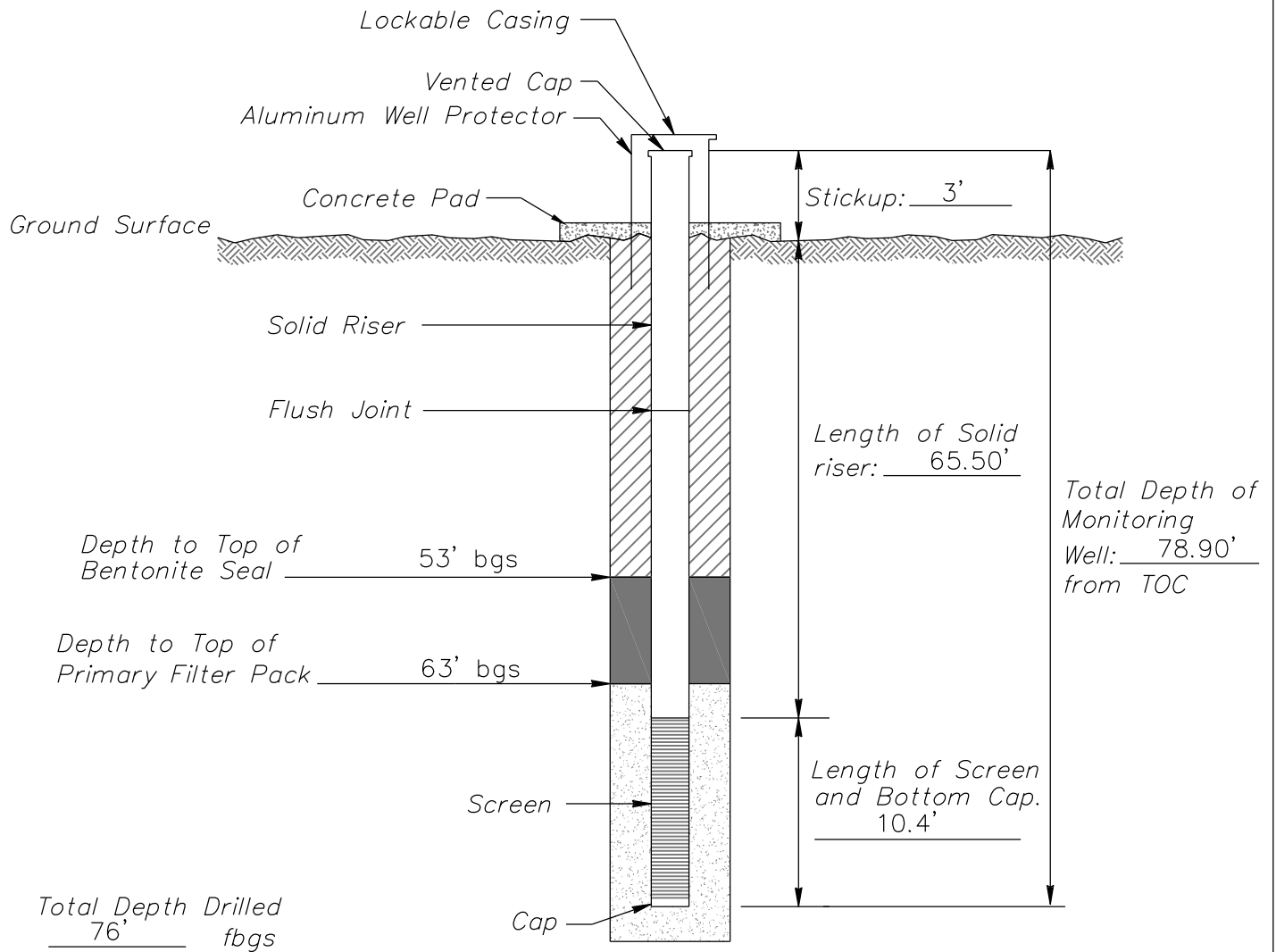
WELL NUMBER: MW-13D

DRAWING NUMBER: 020

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name NORTHEASTERN STATIONS 3+4-CCR WELL INSTALLATION Well Number MW-14
 Job Number 35157183 Installation Date 03/01/15 Location AEP-PSONE STATIONS 3+4
 Datum Elevation N/A Surface Elevation N/A
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.010
 Riser Diameter & Material 2" PVC Borehole Diameter 8"
 Granular Backfill Material 16/30 SAND Terracon Representative RAH
 Drilling Method HSA AND AIR ROTARY Drilling Contractor AECI



- Cement/Bentonite Grout
- Bentonite Pellet Plug
- Granular Backfill

(Not to Scale)



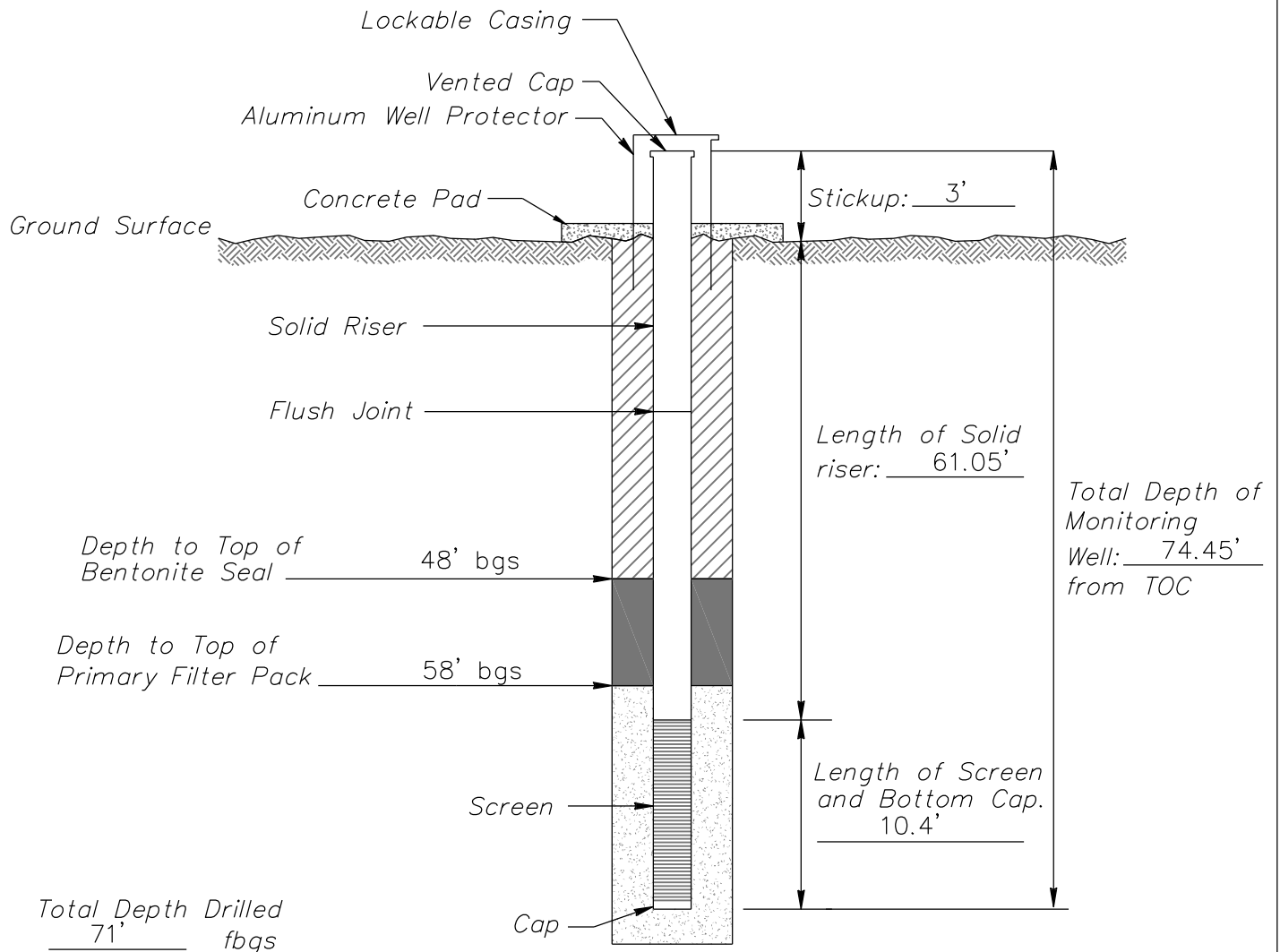
25809 I-30 South BRYANT, AR. 72022
 PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 35157183
 WELL NUMBER: MW-14
 DRAWING NUMBER: 000 CHECKED BY: 00

MONITORING WELL INSTALLATION RECORD

Job Name NORTHEASTERN STATIONS 3+4-CCR WELL INSTALLATION Well Number MW-15
 Job Number 35157183 Installation Date 02/23/16 Location AEP-PSONE STATIONS 3+4
 Datum Elevation N/A Surface Elevation N/A
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.010
 Riser Diameter & Material 2" PVC Borehole Diameter 8"
 Granular Backfill Material 16/30 SAND Terracon Representative RAH
 Drilling Method HSA AND AIR ROTARY Drilling Contractor AECI



- Cement/Bentonite Grout
- Bentonite Pellet Plug
- Granular Backfill

(Not to Scale)



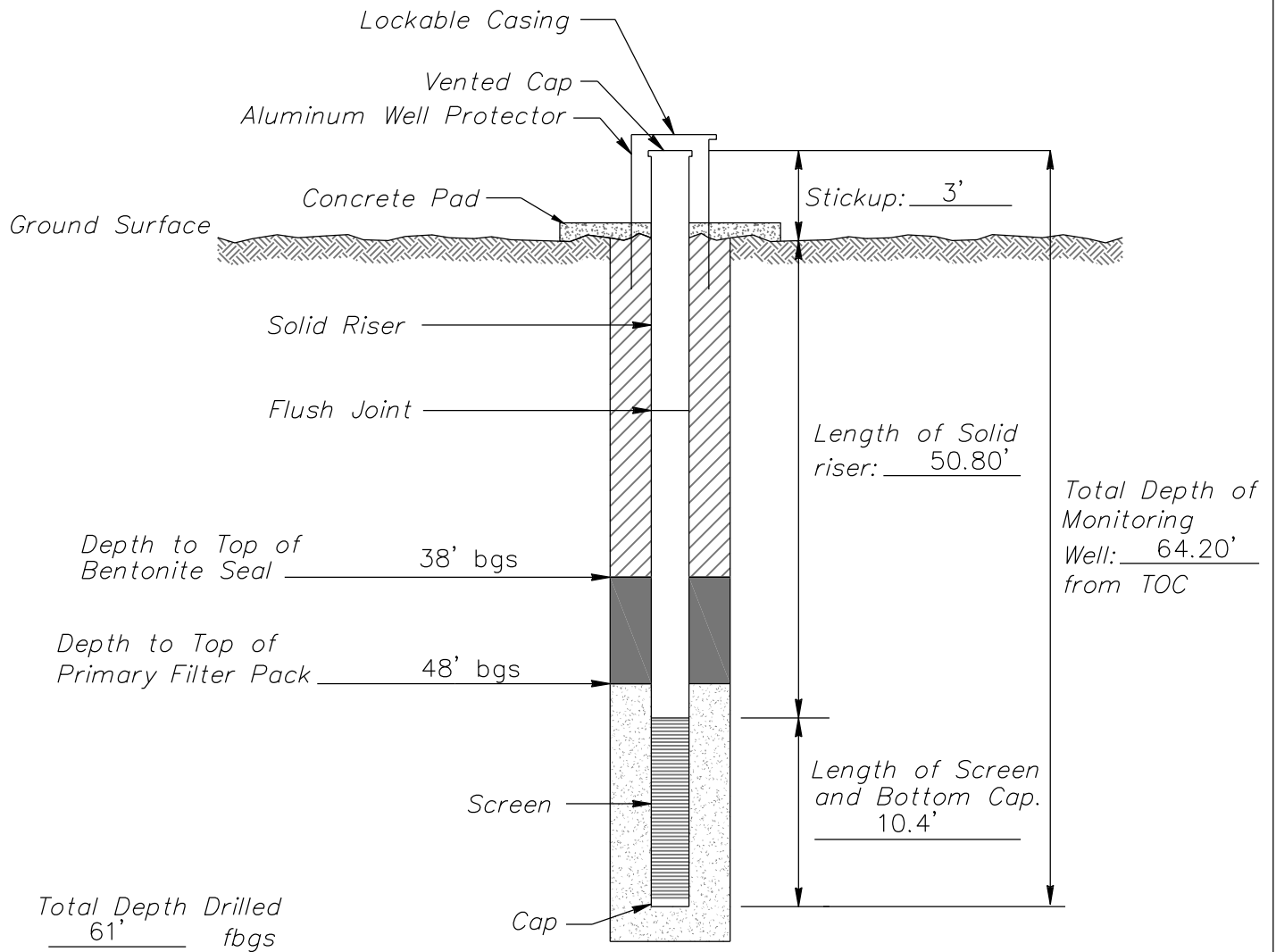
25809 I-30 South BRYANT, AR, 72022
 PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 35157183
 WELL NUMBER: MW-15
 DRAWING NUMBER: 000 CHECKED BY: 00

MONITORING WELL INSTALLATION RECORD

Job Name NORTHEASTERN STATIONS 3+4-CCR WELL INSTALLATION Well Number MW-16
 Job Number 35157183 Installation Date 02/25/16 Location AEP-PSONE STATIONS 3+4
 Datum Elevation N/A Surface Elevation N/A
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.010
 Riser Diameter & Material 2" PVC Borehole Diameter 8"
 Granular Backfill Material 16/30 SAND Terracon Representative RAH
 Drilling Method HSA AND AIR ROTARY Drilling Contractor AECI



- Cement/Bentonite Grout
- Bentonite Pellet Plug
- Granular Backfill

(Not to Scale)



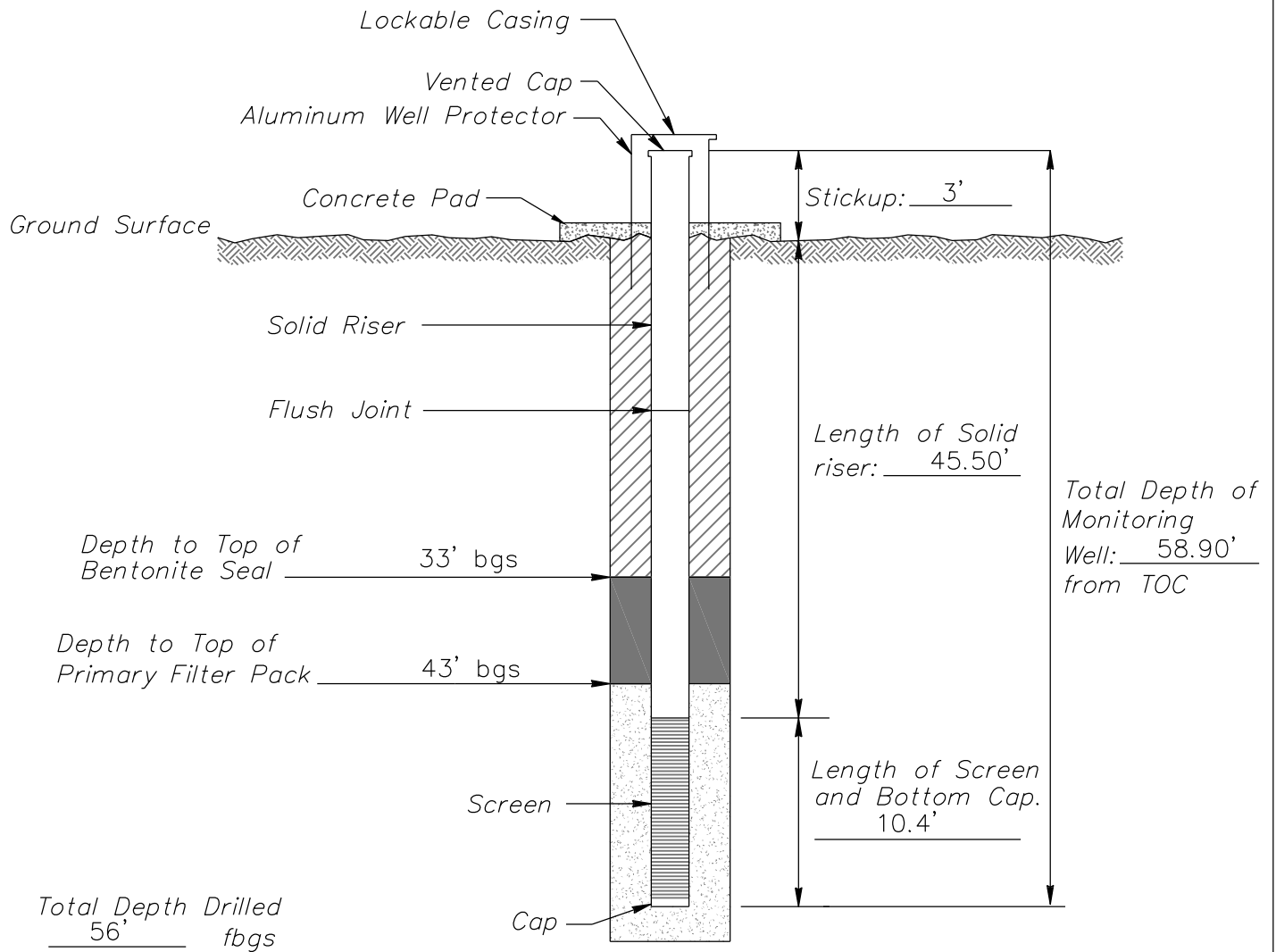
25809 I-30 South BRYANT, AR. 72022
 PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 35157183
 WELL NUMBER: MW-16
 DRAWING NUMBER: 000 CHECKED BY: 00

MONITORING WELL INSTALLATION RECORD

Job Name NORTHEASTERN STATIONS 3+4-CCR WELL INSTALLATION Well Number MW-17
 Job Number 35157183 Installation Date 02/29/16 Location AEP-PSONE STATIONS 3+4
 Datum Elevation N/A Surface Elevation N/A
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.010
 Riser Diameter & Material 2" PVC Borehole Diameter 8"
 Granular Backfill Material 16/30 SAND Terracon Representative RAH
 Drilling Method HSA AND AIR ROTARY Drilling Contractor AECI



- Cement/Bentonite Grout
- Bentonite Pellet Plug
- Granular Backfill

(Not to Scale)

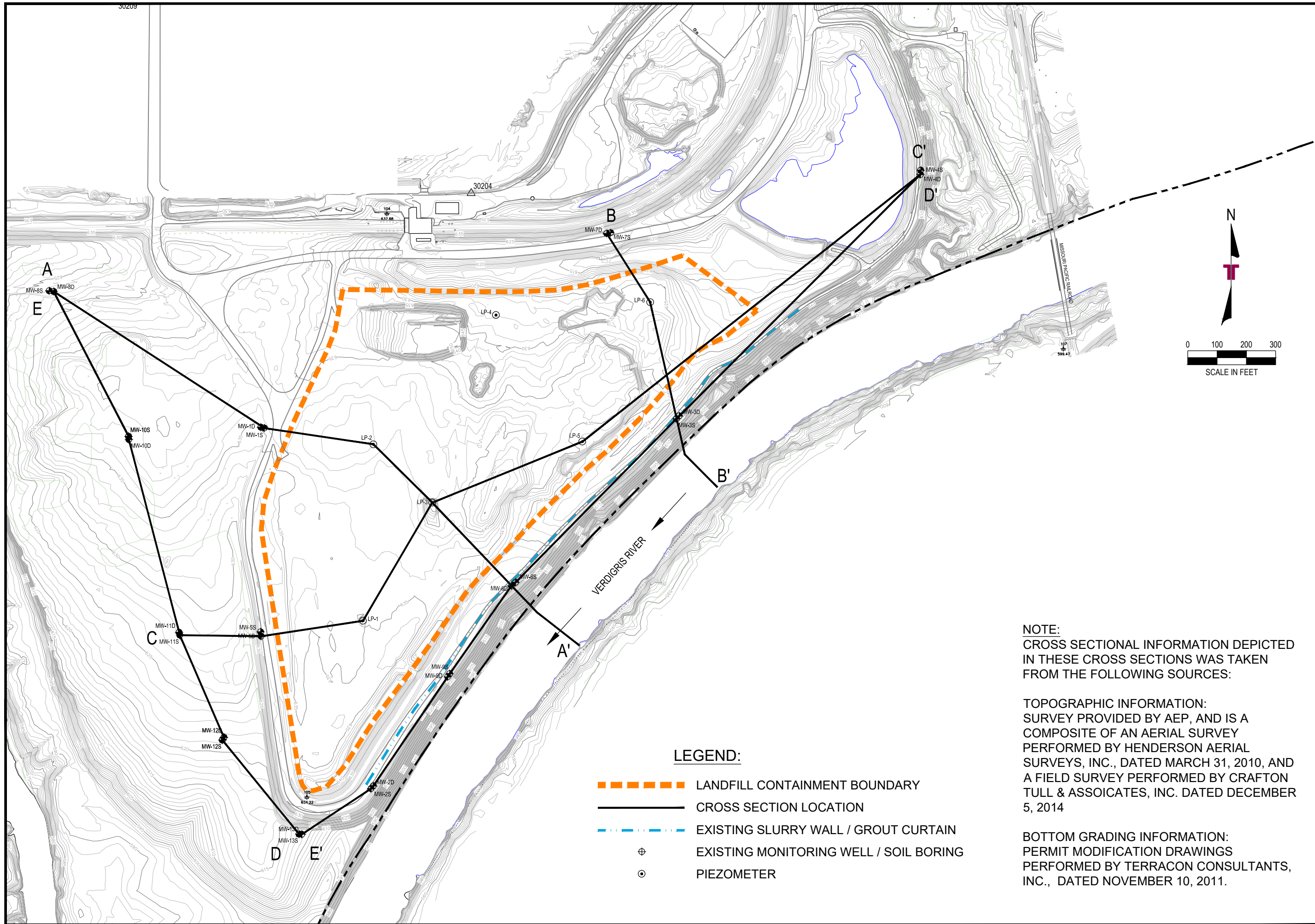


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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 35157183
 WELL NUMBER: MW-17
 DRAWING NUMBER: 000 CHECKED BY: 00

APPENDIX 2
Geologic Cross Sections



LEGEND:

- - - - - LANDFILL CONTAINMENT BOUNDARY
- CROSS SECTION LOCATION
- - - - - EXISTING SLURRY WALL / GROUT CURTAIN
- ⊕ EXISTING MONITORING WELL / SOIL BORING
- ⊙ PIEZOMETER

NOTE:
 CROSS SECTIONAL INFORMATION DEPICTED
 IN THESE CROSS SECTIONS WAS TAKEN
 FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
 SURVEY PROVIDED BY AEP, AND IS A
 COMPOSITE OF AN AERIAL SURVEY
 PERFORMED BY HENDERSON AERIAL
 SURVEYS, INC., DATED MARCH 31, 2010, AND
 A FIELD SURVEY PERFORMED BY CRAFTON
 TULL & ASSOICATES, INC. DATED DECEMBER
 5, 2014

BOTTOM GRADING INFORMATION:
 PERMIT MODIFICATION DRAWINGS
 PERFORMED BY TERRACON CONSULTANTS,
 INC., DATED NOVEMBER 10, 2011.

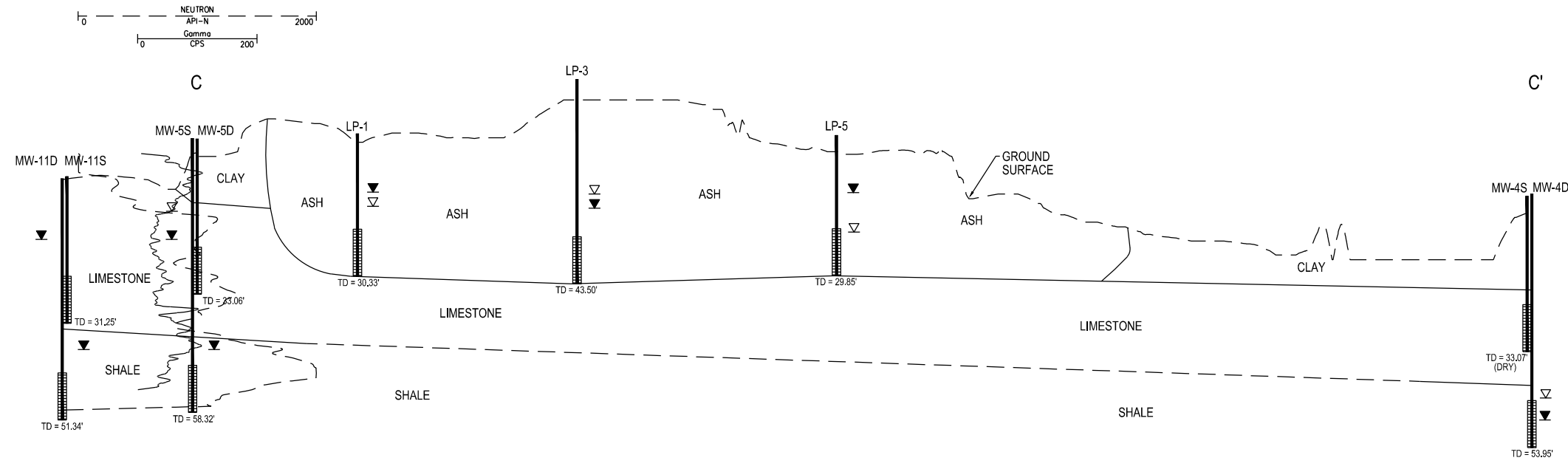
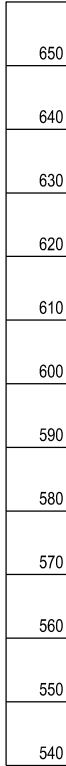
SHEET 1					
DESIGNED BY:	MR	DRAWN BY:	TLB	APP'D BY:	MR
SCALE:	SEE BARSCALE	DATE:	10/14/2017	JOB NO.	216-003-35157123
ACAD NO.	030	SHEET NO.:	1	OF	4

CROSS SECTION LOCATIONS MAP
 GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
 NORTHEASTERN STATIONS 3 & 4
 OKLAHOMA
 OOLOGAH

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 BRYANT, AR 72022
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 FAX. (501) 847-9210

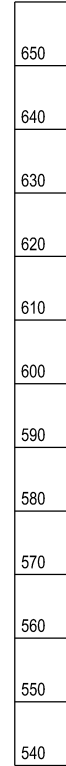
REV.	DATE	BY	DESCRIPTION

ELEVATION

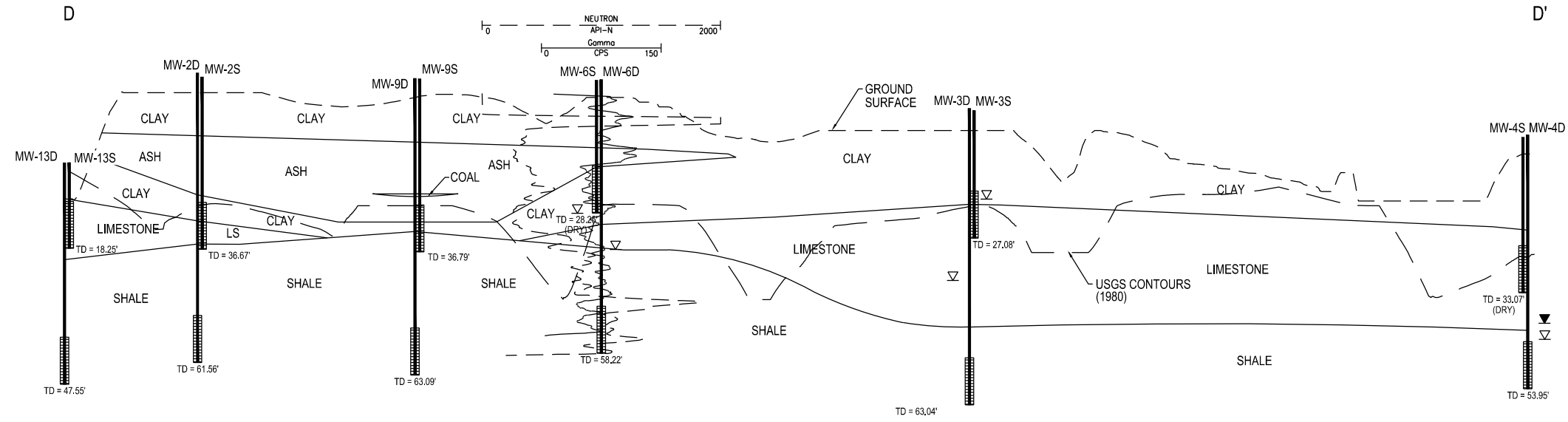
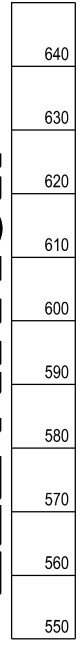


CROSS SECTION C - C'

ELEVATION

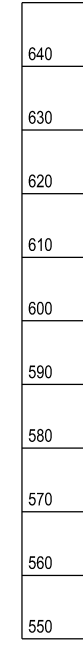


ELEVATION



CROSS SECTION D - D'

ELEVATION



SCALES:
 1" = 300' (HORIZONTAL)
 1" = 30' (VERTICAL)
 VERTICAL EXAGGERATION = x 10

- LEGEND:**
- ▽ STATIC WATER LEVEL (11-11-08)
 - ▼ GROUNDWATER ENCOUNTERED WHILE DRILLING
 - ▤ SCREENED INTERVAL OF WELL

NOTE: GROUNDWATER WAS NOT OBSERVED DURING DRILLING ACTIVITIES IN MW-2D, MW-3S, MW-3D, MW-4S, MW-6S, MW-6D, MW-13S, AND MW-13D

NOTE: TOTAL DEPTHS ARE MEASURED FROM TOP OF CASING

NOTE: CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WAS TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION: SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED MARCH 31, 2010, AND A FIELD SURVEY PERFORMED BY CRAFTON TULL & ASSOCIATES, INC. DATED DECEMBER 5, 2014

BOTTOM GRADING INFORMATION: PERMIT MODIFICATION DRAWINGS PERFORMED BY TERRACON CONSULTANTS, INC., DATED NOVEMBER 10, 2011.

USGS CONTOURS TAKEN FROM THE OOLOGAH, OKLAHOMA QUADRANGLE 1970 (REVISED 1980)

SHEET 3					
DESIGNED BY:	MR	TLB	MR	SCALE:	SEE BARSCALE
DRAWN BY:	TLB	MR	DATE:	10/13/2017	
APPROVED BY:	MR	SCALE:	DATE:	10/13/2017	
JOB NO.	216-003-35157123	ACAD NO.	032	SHEET NO.	3 OF 4

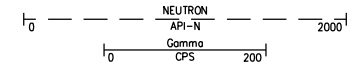
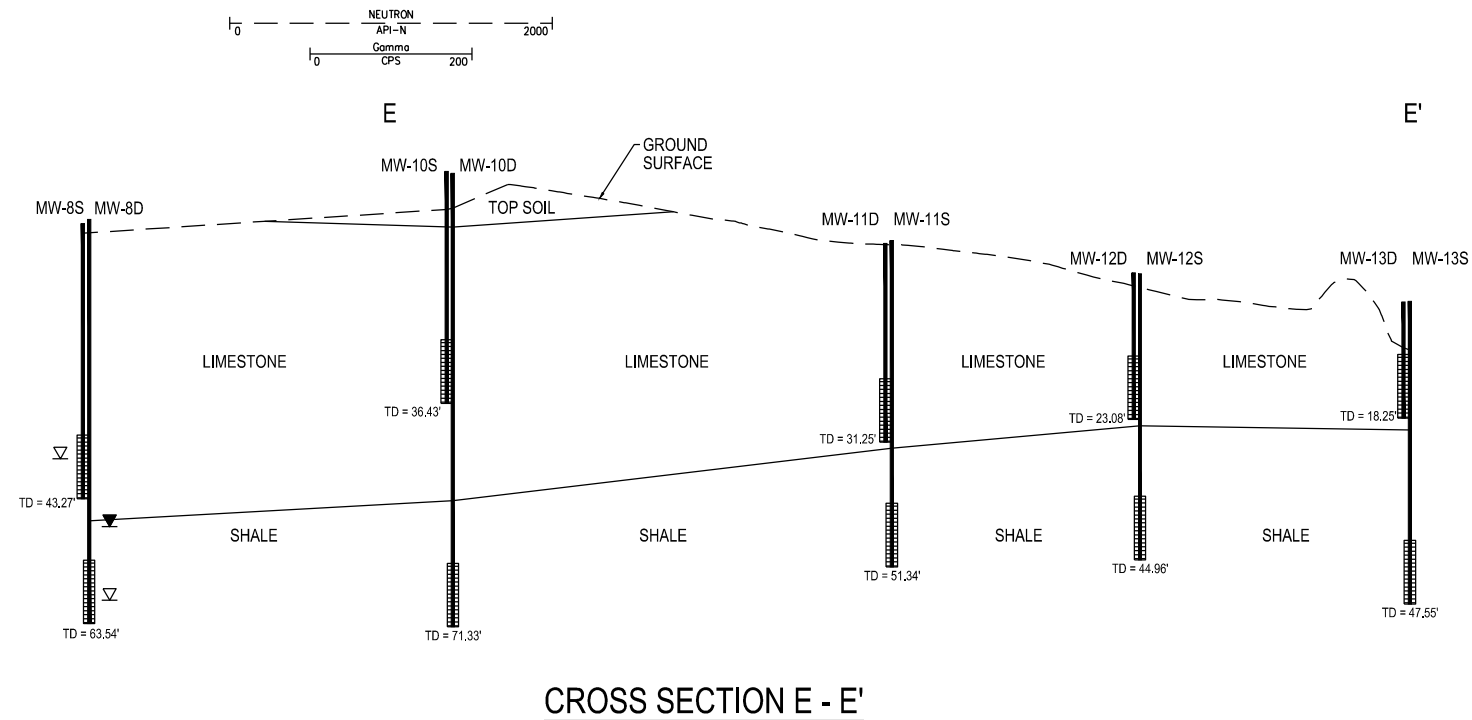
CROSS SECTIONS C-C' & D-D'
 GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
 NORTHEASTERN STATIONS 3 & 4
 OOLOGAH, OKLAHOMA

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 Consulting Engineers and Scientists
 25809 I-30 SOUTH
 BRYANT, AR 72022
 PH. (501) 847-9292
 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ELEVATION

650
640
630
620
610
600
590
580
570
560
550
540



ELEVATION

650
640
630
620
610
600
590
580
570
560
550
540

LEGEND:

- ∇ STATIC WATER LEVEL (11-11-08)
- ▼ GROUNDWATER ENCOUNTERED WHILE DRILLING
- ▤ SCREENED INTERVAL OF WELL

SCALES:

- 1" = 300' (HORIZONTAL)
- 1" = 30' (VERTICAL)
- VERTICAL EXAGGERATION = x 10

NOTE: GROUNDWATER WAS NOT OBSERVED DURING DRILLING ACTIVITIES IN MW-2D, MW-10, MW-11, MW-12, AND MW-13

NOTE: TOTAL DEPTHS ARE MEASURED FROM TOP OF CASING

NOTE:

CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WAS TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:

SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED MARCH 31, 2010, AND A FIELD SURVEY PERFORMED BY CRAFTON TULL & ASSOCIATES, INC. DATED DECEMBER 5, 2014

BOTTOM GRADING INFORMATION:

PERMIT MODIFICATION DRAWINGS PERFORMED BY TERRACON CONSULTANTS, INC., DATED NOVEMBER 10, 2011.

REV. DATE BY DESCRIPTION

Terracon
Consulting Engineers and Scientists


25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

CROSS SECTIONS E-E'
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
NORTHEASTERN STATIONS 3 & 4
OKLAHOMA
OOLOGAH

SHEET 4

DESIGNED BY: MR	TLB
DRAWN BY: TLB	TLB
APPROV. BY: MR	TLB
SCALE: SEE BARSCALE	TLB
DATE: 10/13/2017	TLB
JOB NO. 216-003-35157123	TLB
ACAD NO. 033	TLB
SHEET NO. 4	OF 4

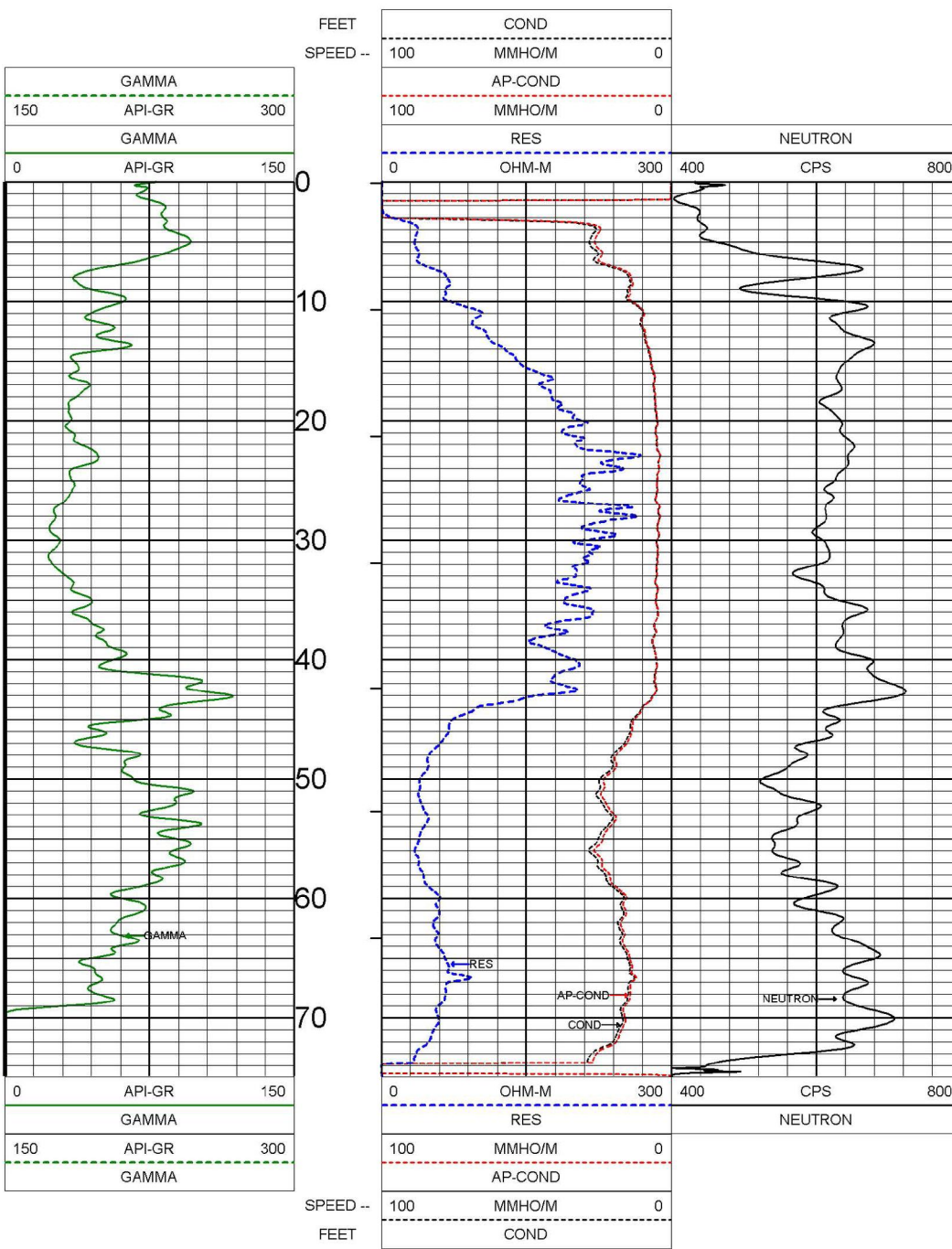
APPENDIX 3
Downhole Geophysics

		AMERICAN ELECTRIC POWER GAMMA-CONDUCTIVITY-NEUTRON MW-14	
COMPANY : AMERICAN ELECTRIC POWER WELL : MW-14 WELL EXT : FIELD : NA COUNTY : ROGERS STATE : OKLAHOMA COUNTRY : USA API NO. : UNIQ ID :		LOCATION : N/A LATITUDE : N/A LONGITUDE : N/A SECTION : N/A TOWNSHIP : N/A RANGE : N/A	
PERMANENT DATUM : N/A LOG MEASURED FROM : ELEV. FROM DATUM :		ELEVATIONS : KB : N/A OF : N/A QL : N/A FT : N/A IN : N/A LB/GAL : N/A	
DATE : 05/04/16 12:57 DEPTH DRILLER : 78 DEPTH LOGGER : FIRST READING : LAST READING : BIT SIZE : 4 CASING - DRILLER : 78 CASING - LOGGER : CASING O.D. : 2.0 CASING THICKNESS : CASING TYPE : CASING WEIGHT : CASING TYPE : CASING WEIGHT : CASING TYPE : CASING WEIGHT :		OTHER SERVICES : FT : N/A IN : N/A LB/GAL : N/A	
RECORDED BY : R HECK REMARKS 1 : 9510_9068 REMARKS 2 : LOG MEASURED -36.25 INCHES /3.02 FT TOP OF CASING REMARKS 3 : ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS			

1:120, GAMMA-CONDUCTIVITY-NEUTRON MW-14 05/04/16

LOG PARAMETERS

MATRIX DENSITY : 2.71	NEUTRON MATRIX : LIMESTONE	MATRIX DELTA T : 49
MAGNETIC DECL : 40	ELECT. CUTOFF : 99999	BIT SIZE : 4 IN
PRESENTATION NAME/DATE: 9512 - Slim Hole Induction - Conduction - Neutron - NEUDISPLAY7_JL38/2016		



1:120, GAMMA-CONDUCTIVITY-NEUTRON MW-14 05/04/16

LOG PARAMETERS

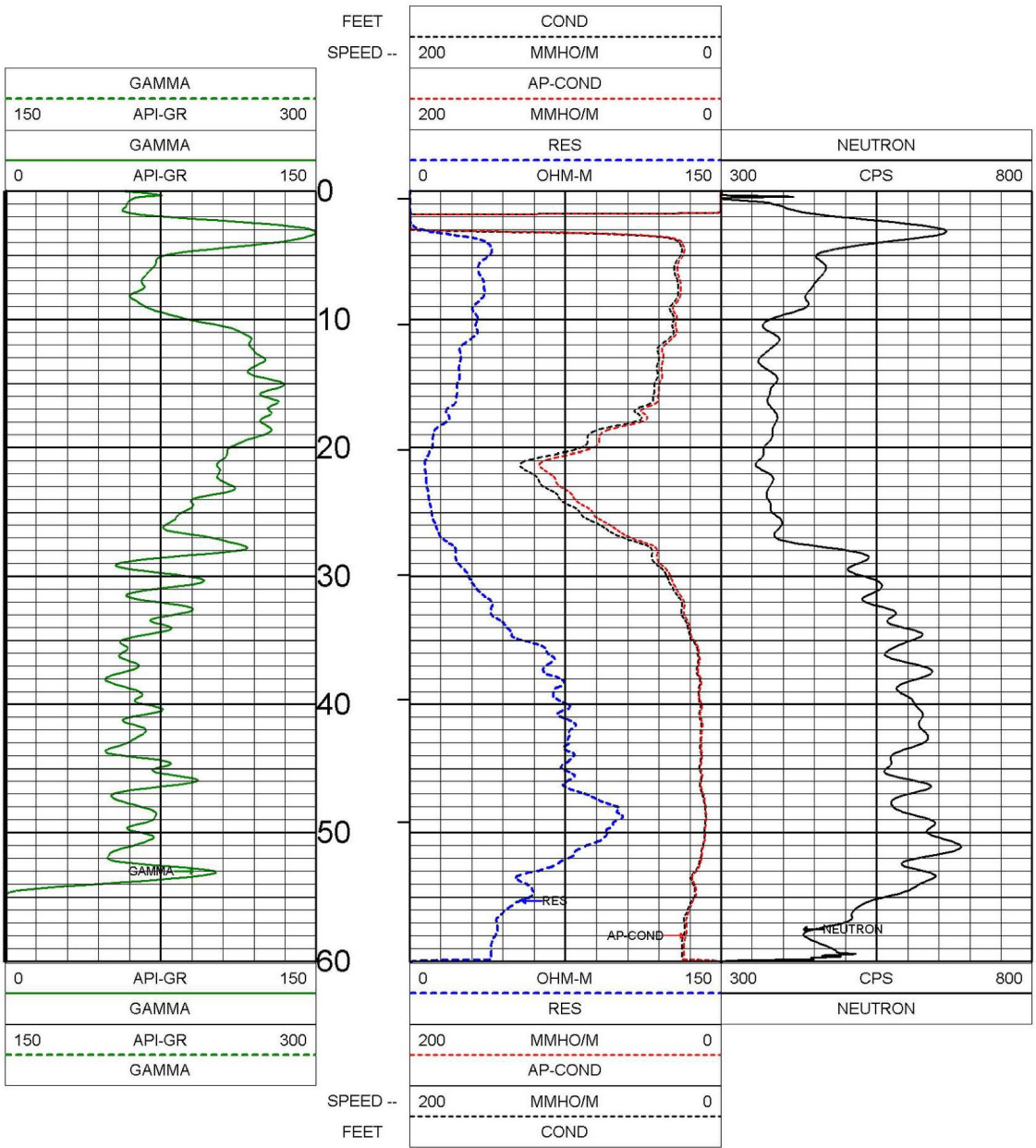
MATRIX DENSITY : 2.71	NEUTRON MATRIX : LIMESTONE	MATRIX DELTA T : 49
MAGNETIC DECL : 40	ELECT. CUTOFF : 99999	BIT SIZE : 4 IN
PRESENTATION NAME/DATE: 9512 - Slim Hole Induction - Conduction - Neutron - NEUDISPLAY7_JL38/2016		

TOOL CALIBRATION MW-14 05/04/16 12:57						
TOOL 9510A TM VERSION 2002						
SERIAL NUMBER 747						
DATE	TIME	SENSOR	STANDARD	Point1	Point2	RESPONSE [CPS]
1	Nov13,13	15:12:07	GAMMA [API-GR]	1.000	340.000	0.000 335
2	May04,16	12:57:22	AP-COND [MMHO/M]	0.000	690.000	52789 88982
3	Sep25,14	13:19:22	TEMP [DEG-F]	39.500	132.600	26556 31296
4	Sep25,14	13:26:21	A []	0.350		0.000
5	Mar27,03	10:28:37	B [CPS]	Default		Default

TOOL CALIBRATION MW-14 Mar27,03 10:28:37						
TOOL 9068A TM VERSION 2002						
SERIAL NUMBER 642						
DATE	TIME	SENSOR	STANDARD	Point1	Point2	RESPONSE [CPS]
1	Apr28,16	10:26:20	NEUTRON [UNKNOW]	1.000		0.000

		AMERICAN ELECTRIC POWER GAMMA-CONDUCTIVITY-NEUTRON MW-16	
COMPANY : AMERICAN ELECTRIC POWER WELL : MW-16 FIELD EXT : FIELD : NA COUNTY : ROGERS STATE : OKLAHOMA COUNTRY : USA API NO. : UNIQ ID :			
LOCATION : LATITUDE : LONGITUDE :			
DISPLAY7_JL38 SECTION: N/A TOWNSHIP: N/A RANGE: N/A			
PERMANENT DATUM DRL MEASURED FROM LOG MEASURED FROM ELEV PERM DATUM		Elevation: KB N/A DF N/A FT N/A FT N/A N/A N/A	
DATE DEPTH DRILLER DEPTH LOGGER FIRST READING LAST READING		Other Services: N/A N/A N/A N/A	
BIT SIZE CASING -- DRILLER CASING -- LOGGER CASING O.D. CASING THICKNESS CASING TYPE FLUID TYPE FLUID DENSITY FLUID VISCOSITY		DRILL M LB/GAL 8.3 N/A N/A N/A N/A N/A N/A	
MUD SOURCE RMF @ MEAS TEMP RMF @ MEAS TEMP CIRC STOPPED		N/A @ N/A F N/A @ F N/A @ F N/A	
RECORDED BY : R HECK REMARKS 1 : 9510_9068 REMARKS 2 : LOG MEASURED -35.00 INCHES -1.2 92 FT TOP OF CASING REMARKS 3 : ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS			

1:120, GAMMA-CONDUCTIVITY-NEUTRON MW-16 05/04/16		
LOG PARAMETERS		
MATRIX DENSITY : 2.71 MAGNETIC DECL : 40 PRESENTATION NAME/DATE: 9512 - Slim Hole Induction - Conduction - Neutron - NEUDISPLAY7_JL38/2016	NEUTRON MATRIX : LIMESTONE ELECT. CUTOFF : 99999	MATRIX DELTA T : 49 BIT SIZE : 4 IN



1:120, GAMMA-CONDUCTIVITY-NEUTRON MW-16 05/04/16		
LOG PARAMETERS		
MATRIX DENSITY : 2.71 MAGNETIC DECL : 40 PRESENTATION NAME/DATE: 9512 - Slim Hole Induction - Conduction - Neutron - NEUDISPLAY7_JL38/2016	NEUTRON MATRIX : LIMESTONE ELECT. CUTOFF : 99999	MATRIX DELTA T : 49 BIT SIZE : 4 IN

TOOL CALIBRATION MW-16 05/04/16 14:01 TOOL 9510A TM VERSION 2002 SERIAL NUMBER 747							
				STANDARD		RESPONSE [CPS]	
	DATE	TIME	SENSOR	Point1	Point2	Point1	Point2
1	Nov13,13	15:12:07	GAMMA [API-GR]	1.000	340.000	0.000	335
2	May04,16	17:47:50	AP-COND [MMHO/M]	0.000	690.000	52809	88982
3	Sep25,14	13:19:22	TEMP [DEG-F]	39.500	132.600	26556	31296
4	Sep25,14	13:26:21	A []	0.350		0.000	
5	Mar27,03	10:28:37	B [CPS]	Default		Default	

TOOL CALIBRATION MW-16 Mar27,03 10:28:37 TOOL 9068A TM VERSION 2002 SERIAL NUMBER 642							
				STANDARD		RESPONSE [CPS]	
	DATE	TIME	SENSOR	Point1	Point2	Point1	Point2
1	Apr28,16	10:26:20	NEUTRON [UNKNOW]	1.000		0.000	