

Report 1 - Groundwater Monitoring Network for CCR Compliance

SWEPCO – John W. Turk, Jr. Power Plant

Class 3N Landfill

Permit No. 0311-S3N-R1

AFIN: 29-00506

October 2016

Project No. 35157126



A unit of American Electric Power

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Terracon

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 at the SWEPCO – John W. Turk, Jr Power Plant Class 3N Landfill (Permit No. 0311-S3N-R1) facility. Southwestern Electric Power Company (SWEPCO) is a unit of American Electric Power (AEP).

2.0 Background Information

2.1 Facility Location Description

Southwestern Electric Power Company owns and operates a coal-fired power plant (John W. Turk, Jr. Power Plant) with a Class 3 Non- Commercial (3N) solid waste facility (Class 3N Landfill) associated with the Power Plant. The site is located approximately 2.2 miles north of Fulton (Hempstead County), Arkansas. The Power Plant produces up to 600 Megawatts (MW) of electrical power utilizing western subbituminous coal. The Class 3N Landfill is used for disposal of fly ash, bottom ash, and other byproducts from the coal-fired Power Plant. The waste materials are non-hazardous and non-putrescible. (**FIGURE 1 & 2**)

2.2 Description of CCR Unit

2.2.1 Embankment Configuration

The landfill location is shown on **FIGURE 3**. The landfill embankments are being constructed with 3:1 interior slopes. The outside embankment slopes are approximately 3:1. A composite liner system and a leachate collection system have been installed. (**2011 Permit Application, Volume 3, Appendix B Design Drawings, Terracon Consultants Inc., February 2011**)¹

2.2.2 Area/Volume

The Solid Waste Landfill permit 0311-S3N-R1, with an effective date of July 15, 2011, grants the Turk Facility Landfill 73 acres of disposal area. This disposal area correlates to 6,884,226 Cubic Yards of disposal Volume. Currently 14 acres (Cell 1) of the 73 acre Class 3N landfill have been constructed and are active.

2.2.3 Construction and Operational History

During field activities, groundwater monitoring wells were installed around the Class 3N Landfill in accordance with the approved Groundwater Monitoring Well Installation Workplan, Revised August 1, 2011.

The monitoring wells are identified as MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9D, and MW-10. The 10 monitoring wells were installed to depths ranging from 20 to 148 feet below ground surface (bgs). Each well installation was performed in accordance with ASTM D 5092-90 Design and Installation of Groundwater Monitoring Wells in Aquifers.

Each monitoring well was constructed using 2-inch diameter 0.010 slotted PVC screen. A 5-inch bottom cap was installed on the bottom of each screened interval. The screened interval was threaded to a solid 2-inch diameter PVC riser to bring the well to approximately 3 feet above ground. The annulus of each well was filled with 12/20 mesh silica sand from the bottom of the boring to a minimum of two feet above the screened interval. A minimum of two feet of coated bentonite pellets were then placed in the annulus on top of the sand filter pack and then hydrated. The remaining annulus was filled with bentonite chips to within approximately 1 foot of ground surface. A tremmie pipe was utilized to install sand, coated bentonite pellets, and bentonite chips in deep monitoring well MW-9D. A cement seal was then installed to ground surface.

The solid PVC riser in each well was brought to approximately 3 feet above ground surface. A 4-foot long metal protective locking collar was then installed over the PVC. A concrete pad with four (4) bollard posts was constructed around each well. (**Groundwater Monitoring Well Installation Report, Terracon Consultants Inc., December 2011**)²

An additional monitoring well, MW-11, was installed on March 24, 2016. MW-11 is located between the landfill and the leachate collection pond. The well was added to bring the groundwater monitoring network into compliance with CCR requirements.

2.2.4 Surface Water Control

The site has been designed with a series of berms, ditches, and drainage conveyances to direct stormwater away from and around the active disposal area. Stormwater diversion is necessary and desirable to minimize contact with waste while limiting the potential for leachate production. Each active waste cell will be constructed with a perimeter diversion berm to assist in separating leachate and stormwater.

The surface of the Landfill will be shaped and contoured to promote proper drainage away from Landfill. A series of internal ditches will be necessary to divert stormwater run-off from the Landfill to the perimeter ditches. The final cover system will also include a series of drainage

conveyances designed to control drainage off the Landfill surface while minimizing erosion. Surface water run-off will be directed to stormwater sediment ponds located adjacent to the proposed disposal area footprint. All ditches, swales, berms, conveyances, and stormwater sedimentation basins have been designed to control the run-off from a 25-year, 24-hour storm event.

2.3 Previous Investigations

Geotechnical

§ Hydrogeologic and Geotechnical Report, Terracon, Revised October 2010

Groundwater and Other Environmental

§ Hydrogeologic and Geotechnical Report, Terracon, Revised October 2010

§ Groundwater analysis reports are done quarterly throughout each year

§ Annual Engineering Inspections reports are done yearly.

§ Groundwater Separation Distance Determination Report, Turk Permit Application, Volume 4, Appendix K.

2.4 Hydrogeologic Setting

2.4.1 Climate

The climate in this area of the state is humid with warm summers. Mean temperatures range from 81.6 °F in July to 45.7 °F in January. The average annual temperature is 64.1 °F. Recorded temperature extremes are 114 °F and -5 °F. The average annual rainfall is about 49 inches a year (**U.S.D.A Soil Conservation Commission, Arkansas State Water Plan, Feb. 1987, pg. 7**)³.

2.4.2 Regional and Local Geologic Setting

The landfill is located within the Gulf Coastal Plain Physiographic Province and underlain by Cretaceous Age sediments. The landfill is underlain by the Arkadelphia Marl Formation. Quaternary terrace deposits are present to the south of the site and Quaternary alluvial deposits associated with Bridge Creek are present just to the north of the site; however, Quaternary deposits are not present within the landfill area.

The hydrogeologic investigation conducted in February through May, 2008 confirmed that the site is underlain by the Cretaceous Age Arkadelphia Marl, which is then underlain by the Nacatoch Sand Formation. The hydrogeologic units identified during the investigation were grouped together based upon similar geologic, geotechnical and hydrogeologic properties. Hydrogeologic “Unit A” is part of the Arkadelphia Marl Geologic Unit and contains clay with some intermittent Chert gravel. Some silty clay and sandy clay is present. Clayey gravel intervals are present primarily in the northern portion of the site. Gypsum veins are generally

present near the lower contact of the unit. The Hydrologic Characteristics include: Groundwater can occur as secondary porosity in gypsum veins under confined conditions, groundwater is also present in gravel intervals in the northern portion of the site, groundwater may move through the formation due to the blocky fissile nature of the material, average vertical permeability of 5.21×10^{-8} cm/sec based on lab geotechnical samples, average horizontal conductivity of 6.47×10^{-5} cm/sec based on slug tests, and average horizontal conductivity of 8.33×10^{-4} cm/sec based on pump test data. Hydrogeologic "Unit B" is part of the Arkadelphia Marl Geologic Unit and contains Shaley Clay/Clayey Shale, is hard, and fissile in nature. Trace bivalve fossils are present and strong HCL reaction. The Hydrologic Characteristics include: Average vertical permeability of 1.13×10^{-7} cm/sec based on lab geotechnical samples. Hydrogeologic "Unit C" is part of the Nacatoch Formation Geologic Unit and contains Sandstone with calcareous cement overlying fine grained, loosely cemented sand. The Hydrologic Characteristics include: Groundwater occurs under confined conditions within the loosely cemented sand. Average horizontal conductivity is 4.25×10^{-4} cm/sec based on slug test data.

The Arkadelphia Marl is mostly a dark gray to black marl or marly clay with some limy, gray sandstone, gray sandy clay, sandy limestone, concretionary limestone, with to light brown impure chalk. The sandy marls and limestone are found at or near the base of the unit, while the impure chinks are found closer to the top. The Arkadelphia Marl rests with slight unconformity upon the Nacatoch Sand. The marl is 120 to 160 feet thick. (R.T. Hill – 1888). The underlying Nacatoch Sand is composed of cross-bedded, yellowish and gray fine quartz sand; hard, fossiliferous sandy limestone; coarse, highly glauconitic sand; fine-grained, argillaceous blue-black sand; bedded light-gray clay and marl. The sands in the Nacatoch are generally unconsolidated. At the base of the unit hard, fossiliferous limestone and marl are found. The Nacatoch Sand appears to have an unconformity at its base. The unit is 150 to 400 feet thick.

2.4.3 Surface Water/Groundwater Interactions

The landfill is drained primarily to the south and east toward the perennial stream Bridge Creek. Bridge Creek flows into Boise d'Arc Creek approximately five miles southeast of the site. The southern portion of the site drains south toward unnamed intermittent drainages that flow into the Red River near Fulton, Arkansas (**Terracon Consultant's Inc., Permit Modification Application, Volume 4, pg. 3**)⁴. Groundwater elevations are shown on **FIGURES 4 & 5**.

In 2012 Cell 1 an engineered designed cell with a composite liner system was constructed to meet CCR requirements. With this liners system in place there should be no interaction between the landfill and groundwater or surface water. In addition a groundwater monitoring system is in place to detect any interaction (ie, release) should it occur. The groundwater potentiometric map shows groundwater flowing toward Bridge Creek. Bridge Creek is likely a gaining stream at this location. Surface water does impact groundwater. Periodically there has been evidence of temporary groundwater mounding as noted during the February 3, 2015 sampling event at MW-3.

2.4.4 Water Users

A water well inventory was conducted on wells within a one-half mile radius of the Class 3N landfill. The well inventory was conducted by utilizing Water Well Construction reports on file at the Arkansas Geological Commission.

Water well inquiry forms were submitted to property owners located within ½-mile radius of the site. Mr. Rosenbaum (property owner located approximately 2,000 feet west of the proposed landfill boundary), on July 10, 2010, verbally stated there are three (3) wells at his home and near the adjacent chicken houses. Water well construction reports were not identified for the wells. The estimated locations of the wells are shown on **FIGURE 7. (Terracon Consultant's Inc., Permit Modification Application, Volume 4, pg. 7)**⁵

3.0 Certified Groundwater Monitoring Network

3.1 Hydrostratigraphic Units

The hydrogeologic investigation conducted in February through May, 2008 confirmed that the site is underlain by the Cretaceous Age Arkadelphia Marl, which is then underlain by the Nacatoch Sand Formation. The hydrogeologic units identified during the investigation were grouped together based upon similar geologic, geotechnical and hydrogeologic properties. Hydrogeologic "Unit A" is part of the Arkadelphia Marl Geologic Unit and contains clay with some intermittent Chert gravel. Some silty clay and sandy clay is present. Clayey gravel intervals are present primarily in the northern portion of the site. Gypsum veins are generally present near the lower contact of the unit. Only Unit A is being monitored with the groundwater monitoring network. Hydrogeologic "Unit B" is part of the Arkadelphia Marl Geologic Unit and contains Shaley Clay/Clayey Shale, is hard, and fissile in nature. Trace bivalve fossils are present and strong HCL reaction. Hydrogeologic "Unit C" is part of the Nacatoch Formation Geologic Unit and contains Sandstone with calcareous cement overlying fine grained, loosely cemented sand.

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Horizontal monitoring well locations relative to the CCR Unit are provided in **FIGURE 6**. Vertical positioning of monitoring wells is shown in **TABLE 2 – WELL CONSTRUCTION DETAILS**.

3.1.2 Overall Flow Conditions

Based on water level elevations, groundwater flow is to the northeast across the landfill (**FIGURE 6**).

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

3.2.2.1 Relative Position to CCR Unit

Based on water level elevations, groundwater flow is to the north and northeast of the landfill (**FIGURE 6**). The groundwater monitoring network consists of up gradient well MW-1 and down gradient wells MW-2, MW-3, MW-4, MW-5 and MW-10.

3.2.3.2 Water Quality

The majority of the data presented in this section was taken from the Arkansas State Water Plan – Red River Basin Below Fulton prepared in 1987 by the Arkansas Soil and Water Conservation Commission (ASWCC).

Water from the Nacatoch Sand generally is soft or moderately hard near the outcrop area. Calcium and bicarbonate are the principal constituents. Down-dip for a distance of about 20 miles in the formation, the sodium and chloride content increases with corresponding increase in dissolved-solids content (**Terracon Consultant’s Inc., Permit Modification Application, Volume 4, pg. 6**)⁶.

3.2.3.3 Users/Receptors

A water well inventory was conducted on wells within a one-half mile radius of the proposed Class 3N landfill. The well inventory was conducted by utilizing Water Well Construction reports on file at the Arkansas Geological Commission.

Water well inquiry forms were submitted to property owners located within ½-mile radius of the site. Mr. Rosenbaum (property owner located approximately 2,000 feet west of the proposed landfill boundary), on July 10, 2010, verbally stated there are three (3) wells at his home and near the adjacent chicken houses. Water well construction reports were not identified for the wells. The estimated locations of the wells are shown on **FIGURE 7. (Terracon Consultant’s Inc., Permit Modification Application, Volume 4, pg. 7)**⁵

3.3 Review of Existing Monitoring Network

3.3.1 Overview

There are currently eleven (11) groundwater monitoring wells installed to monitor the groundwater around the Turk Facility. The monitoring wells are identified as MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9D, MW-10, and MW-11. The 11 monitoring wells were installed to depths ranging from 20 to 148 feet below ground surface (bgs). Cell 1 is currently the only active landfill cell. The current certified groundwater monitoring network for Cell 1 at the landfill consists of up gradient monitoring well MW-1 and down gradient monitoring wells MW-2, MW-3, MW-4, MW-5, and MW-10. Additional site wells will be incorporated into the groundwater monitoring network when future cells are constructed. The location of future cells 2, 3, 4, and 5 have been identified in the ADEQ landfill permit. Existing monitoring wells monitor some of these unbuilt lateral expansions to the existing CCR landfill. The table below shows the areas monitored by wells outside of the certified network. As part of the CCR requirements the current system was evaluated to determine if it is effectively monitoring the uppermost aquifer as defined by the CCR requirements. The findings are presented below.

Monitoring Well	Monitors:
MW-6	Leachate Pond (not a CCR unit)
MW-7	Leachate Pond (not a CCR unit)
MW-8	Leachate Pond (not a CCR unit)
MW-9D	A lower aquifer. The CCR regulations do not require monitoring of this lower aquifer
MW-11	Cell 2

3.3.1.1 Well Construction Summary Table

Please refer to **Table 2** for well construction details.

3.3.1.2 Depth Ranges and Hydrostratigraphic units monitored

Please refer to **Tables 1A & 1B** for groundwater elevations take from the monitoring network.

3.3.1.3 Position in Terms of Flow Directions and Distance from Waste Boundary

Based on water level elevations from the April, 2016 sampling event, groundwater flow is to the northeast of the landfill (**FIGURE 6**). The groundwater monitoring network consists of up gradient well MW-1, and down gradient wells MW-2, MW-3, MW-4, MW-5, and MW-10.

3.3.1.4 Uppermost Useable Aquifer

The current groundwater monitoring system at the John W. Turk Class 3N Landfill consists of 6 groundwater monitoring wells ranging in depths from 25 ft. to 40ft bgs. The monitoring wells are installed in the Cretaceous Age Arkadelphia Marl which consists of black marl or marly clay with some limy, gray sandstone, gray sandy clay, sandy limestone, concretionary limestone, with light brown impure chalk. The wells are labeled MW-1 through MW-5 and MW-10.

3.3.1.5 Insufficient Definition of Background Water Quality

Background water quality data will need to be reestablished according to the new requirements set by 40 CFR 257 using Appendix III and IV Constituents for groundwater monitoring at CCR units.

Appendix III to Part 257—Constituents for Detection Monitoring

Common Name¹
Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids

¹ Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common Name ¹
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 and 228 combined

¹ Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

3.3.1.6 Key Downgradient

Groundwater flow at the facility is to the northeast and is currently monitored by 5 down gradient groundwater monitoring wells located at the landfill (MW-2, MW-3, MW-4, MW-5, and MW-10). (See FIGURE 6)

3.3.1.7 Key Users/Receptors Not Protected




Key users/receptors are be protected with the groundwater monitoring network.

4.0 Certification

4.1 Limitations

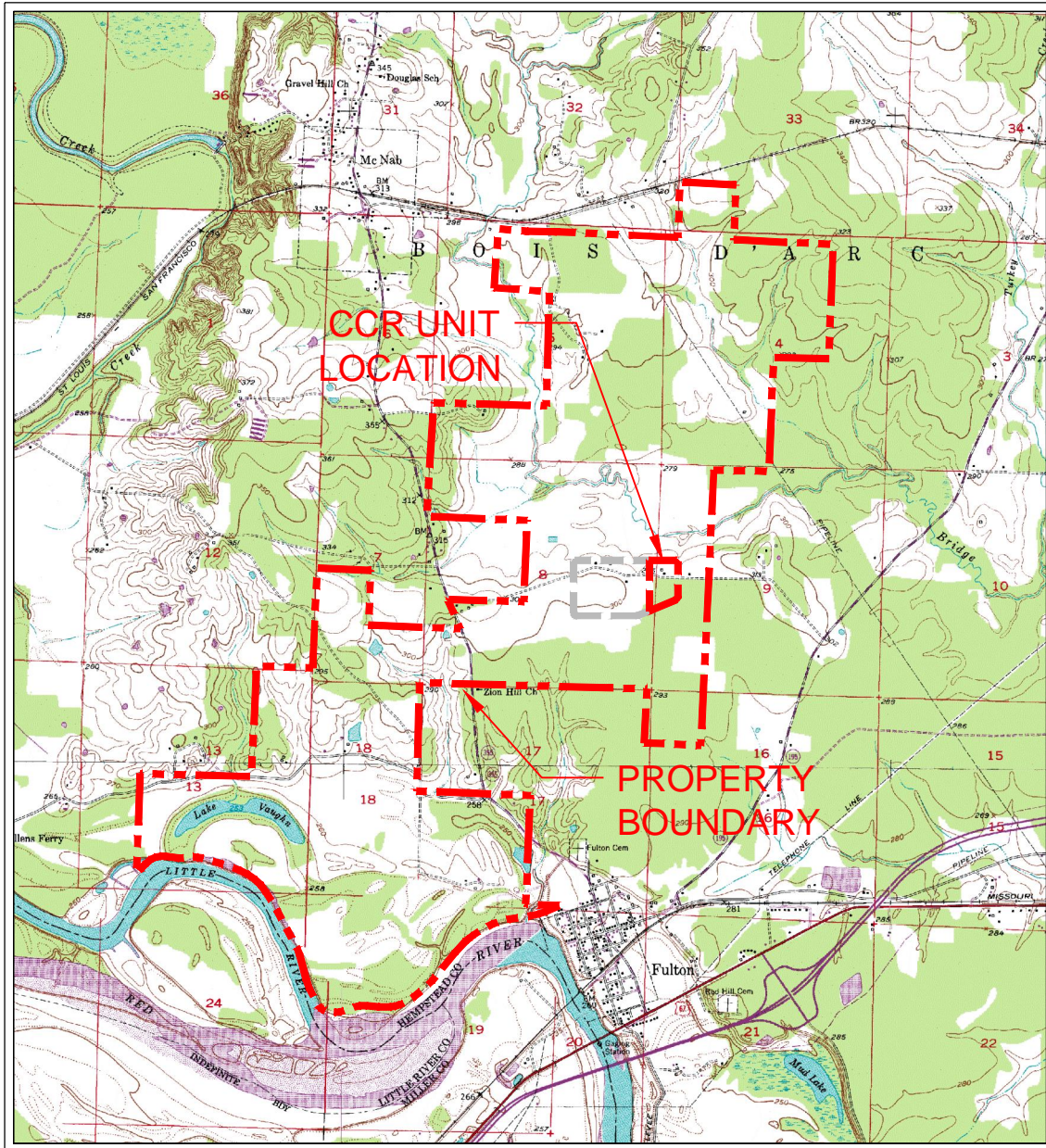
The findings and conclusions resulting from this investigation are based upon information derived from the on-site activities and other services performed under the scope of work as described in this report; such information is subject to change over time if additional information is obtained. Please 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

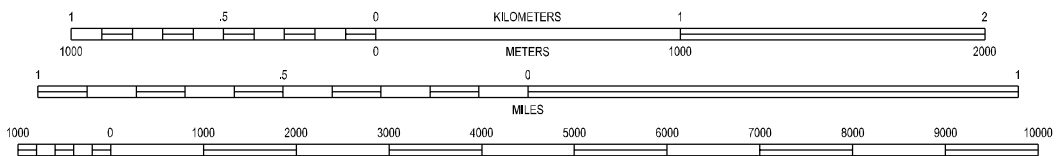
Name: 	Date: 10/7/16	 Stamp
Company:  COA #223	Expiration Date: 12/31/17	

Bibliography

1. 2011 Permit Application, Volume 3, Appendix B Design Drawings, Terracon Consultants Inc., February 2011.
2. Groundwater Monitoring Well Installation Report, Terracon Consultants Inc., December 2011
3. U.S.D.A Soil Conservation Commision, Arkansas State Water Plan, Feb. 1987, pg. 7
4. Terracon Consultant's Inc., Permit Modification Application, Volume 4, pg. 3
5. Terracon Consultant's Inc., Permit Modification Application, Volume 4, pg. 7
6. Terracon Consultant's Inc., Permit Modification Application, Volume 4, pg. 6




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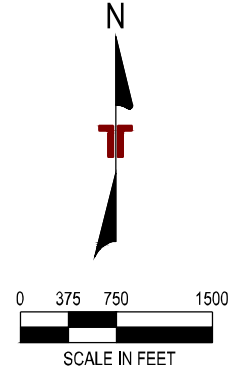
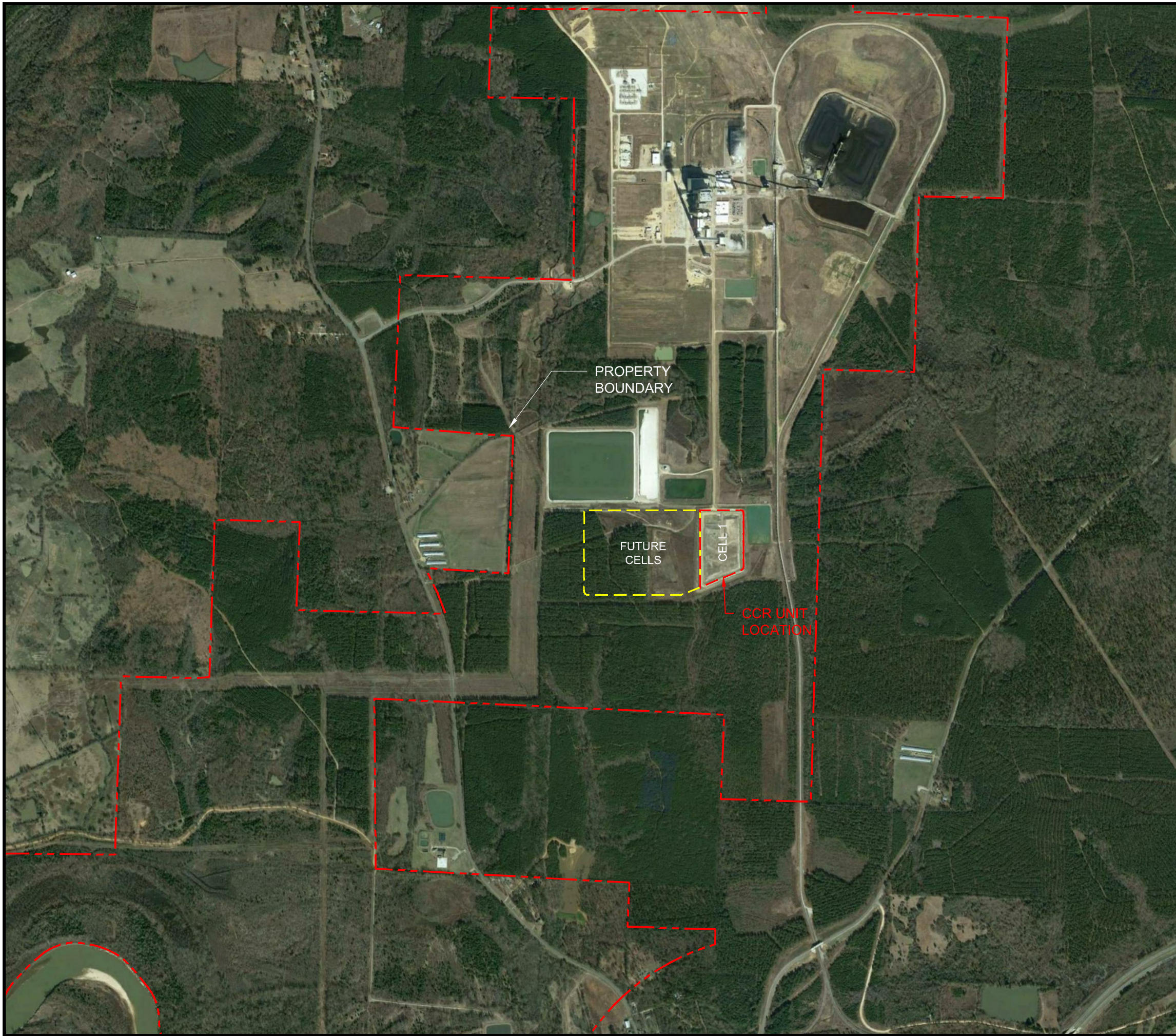


CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FULTON / MCNAB
QUADRANGLES
1951 - Revised 1970 & 1975
7.5 MINUTE SERIES (TOPOGRAPHIC)



Project Mngr: DCM	Project No. 216-002-35157126	 Consulting Engineers and Scientists 25809 I-30 SOUTH BRYANT, AR 72022 PH. (501) 847-9292 FAX. (501) 847-9210	SITE LOCATION MAP	FIG. No.	
Drawn By: TLB	Scale: AS SHOWN		GROUNDWATER MONITORING NETWORK	AMERICAN ELECTRIC POWER JOHN W. TURK, JR. POWER PLANT ARKANSAS	1
Checked By: TLB	File No. R-1/001		FULTON		
Approved By: DCM	Date: 8/17/16				



NOTE:
FUTURE CELLS ARE NOT PART
OF THE CURRENT CCR UNIT.

REV.	DATE	BY	DESCRIPTION

Terracon
Consulting Engineers and Scientists

25809 I-30 SOUTH
PH. (501) 847-9292

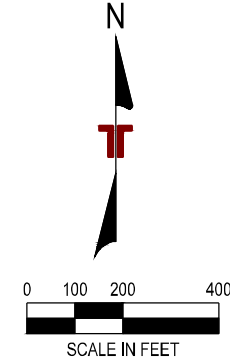
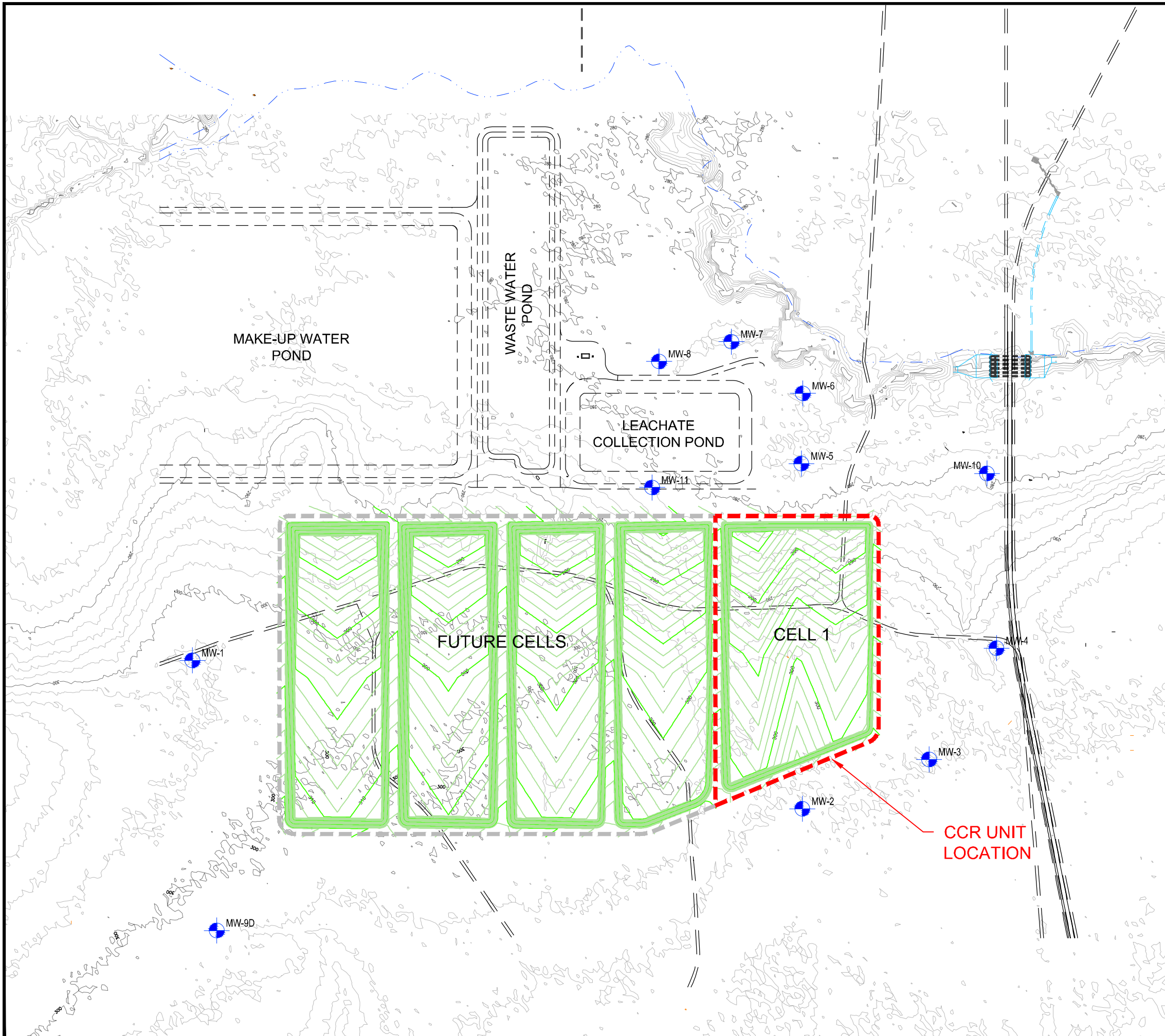
BRYANT, AR 72022
FAX. (501) 847-9210

PLANT & CCR UNIT LOCATION MAP

GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
JOHN W. TURK, JR. POWER PLANT
FULTON ARKANSAS

FIGURE 2

DESIGNED BY:	DCM
DRAWN BY:	TLB
APPRD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	8-17-16
JOB NO.:	216-002-351517126
ACAD NO.:	R-11002
SHEET NO.:	2 OF 7



NOTE:
FUTURE CELLS ARE NOT PART
OF THE CURRENT CCR UNIT.

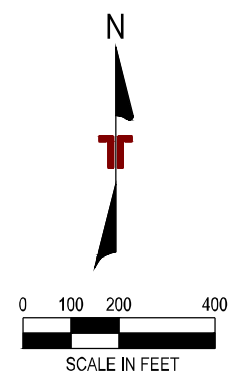
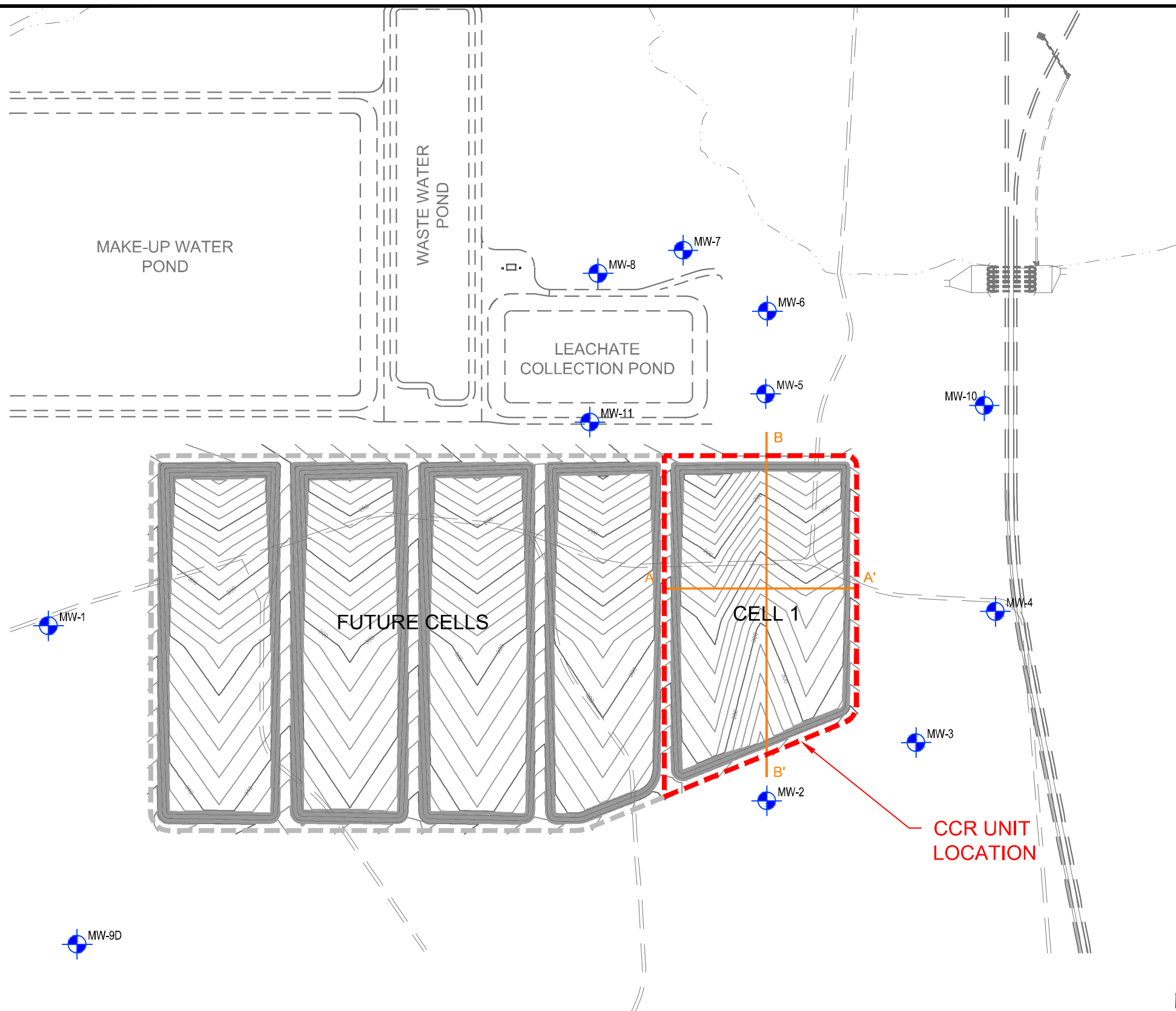
FIGURE 3

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARS/SCALE
DATE:	08-17-16
JOB NO.:	216-002-35157126
ACAD NO.:	R-11003
SHEET NO.:	3 OF 7

CCR UNIT LAYOUT & WELL LOCATIONS
 GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
 JOHN W. TURK, JR. POWER PLANT
 FULTON ARKANSAS

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REV.	DATE	BY	DESCRIPTION



LEGEND:

	PROPERTY BOUNDARY
	CCR UNIT BOUNDARY
	FUTURE CELL BOUNDARY
	MONITORING WELL

NOTE:
FUTURE CELLS ARE NOT PART OF THE CURRENT CCR UNIT.

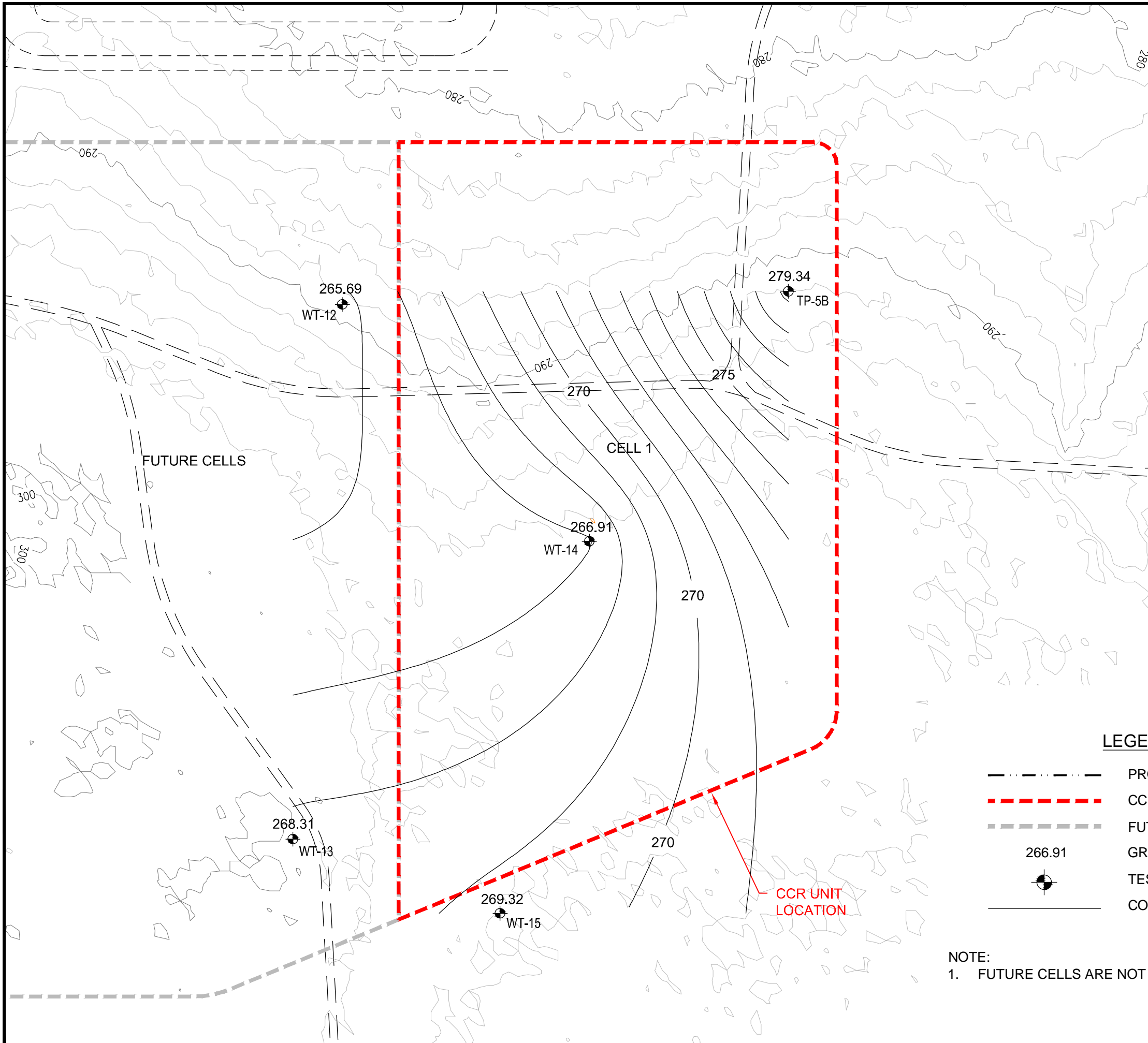
FIGURE 4

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DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARS/SCALE
DATE:	08-19-16
JOB NO.:	216-002-35157126
ACAD NO.:	R-1004
SHEET NO.:	4 OF 7

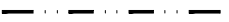





CROSS SECTION LOCATION MAP
GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
JOHN W. TURK, JR. POWER PLANT
FULTON ARKANSAS

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REV.	DATE	BY	DESCRIPTION



LEGEND:

-  PROPERTY BOUNDARY
-  CCR UNIT BOUNDARY
-  FUTURE CELL BOUNDARY
-  GROUNDWATER ELEVATION
-  TESTPIT/BORING LOCATION
-  CONTOUR INTERVAL: 1FT

NOTE:
 1. FUTURE CELLS ARE NOT PART OF THE CURRENT CCR UNIT.

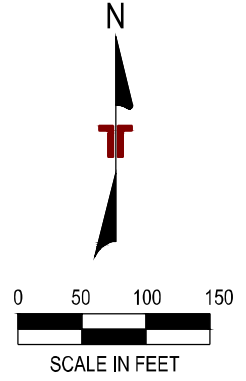


FIGURE 6A
 DESIGNED BY: DCM
 DRAWN BY: TLB
 APPVD. BY: DCM
 SCALE: SEE BARS/SCALE
 DATE: 08-17-16
 JOB NO. 216-002-35157126
 ACAD NO. R-1006A
 SHEET NO. 6A OF 7

PHREATIC SURFACE MAP
 GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
 JOHN W. TURK, JR. POWER PLANT
 FULTON ARKANSAS

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REV.	DATE	BY	DESCRIPTION

TABLE 1 A
 SWEPCO - JOHN W. TURK, JR. POWER PLANT
 CLASS 3N LANDFILL
 MONITORING WELL DATA
 POTENTIOMETRIC GROUNDWATER ELEVATIONS (FMSL)

Well	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9D	MW-10	MW-11
Date											
9/20/2011	284.28	264.25	266.16	273.23	273.26	261.26	270.28	<261.23	251.67	<262.99	-
12/30/2011	294.89	267.24	265.19	273.16	278.16	270.17	272.10	280.34	254.14	272.41	-
2/28/2012	295.83	267.40	269.42	272.69	278.33	271.15	272.41	279.96	254.54	274.22	-
5/17/2012	295.27	267.59	269.65	272.62	277.92	271.96	272.94	278.48	254.47	276.64	-
8/8/2012	293.35	267.64	269.64	272.51	275.16	271.78	271.46	275.80	252.43	276.89	-
11/7/2012	292.20	267.72	269.59	272.44	272.90	270.85	271.53	279.69	253.02	275.49	-
2/28/2013	294.29	267.94	270.03	272.32	278.71	272.53	272.77	280.87	253.93	278.06	-
5/20/2013	294.37	268.11	270.28	273.27	278.36	272.76	273.37	280.44	255.10	276.59	-
8/6/2013	293.69	267.99	270.68	273.31	278.35	273.03	272.89	279.61	253.71	277.66	-
11/4/2013	298.59	271.85	270.50	273.63	279.94	273.59	273.07	280.23	253.54	278.40	-
2/10/2014	296.87	268.35	270.65	275.18	279.81	274.90	273.79	281.08	254.15	278.94	-
5/5/2014	296.76	268.56	271.07	276.06	278.96	274.63	273.70	279.02	255.96	279.88	-
8/5/2014	297.03	272.81	276.01	276.03	279.77	277.85	274.02	280.09	254.21	278.59	-
11/5/2014	295.99	268.82	271.78	275.88	278.99	275.91	273.30	279.07	254.44	279.86	-
2/3/2015	298.75	272.90	286.87	276.30	279.89	278.41	274.00	280.64	253.31	280.42	-
5/5/2015	296.47	275.43	275.97	276.93	280.17	277.74	274.32	279.80	252.04	277.62	-
8/19/2015	295.02	270.66	274.04	277.45	277.96	273.69	272.99	277.97	252.65	280.05	-
11/18/2015	297.20	295.53	288.05	276.84	280.71	277.66	273.82	280.73	254.36	279.13	-
3/23/2016	297.35	281.27	282.69	277.92	280.25	277.87	274.09	279.08	256.98	280.60	-
4/26/2016	296.72	281.44	282.40	278.08	280.25	277.61	273.74	-	257.37	271.37	283.83
Seasonal High	298.75	295.53	288.05	278.08	280.71	278.41	274.32	281.08	257.37	280.60	283.83

Note: MW-9D is in the lower aquifer.

TABLE 1 B
 SWEPCO - JOHN W. TURK, JR. POWER PLANT
 CLASS 3N LANDFILL
 PIEZOMETER DATA
 POTENTIOMETRIC GROUNDWATER ELEVATIONS (FMSL)

Well	PZ-1I	PZ-2I	PZ-3I	PZ-4I
Date				
5/15/2008	288.51	297.72	287.68	285.15
7/2/2008	284.96	296.36	286.07	283.45
8/8/2008	283.64	295.35	285.11	282.69
2/9/2009	288.39	297.47	287.74	286.19
3/3/2009	288.02	292.73	287.89	286.12
6/22/2009	288.00	297.04	288.47	286.37
10/6/2009	287.27	297.10	287.59	295.72
12/22/2009	288.70	297.49	288.81	286.95
4/14/2010	288.23	296.93	288.88	296.77
7/21/2010	285.91	294.85	287.20	285.52
10/27/2010	284.47	294.17	285.81	283.56
1/31/2011	284.40	294.07	285.20	283.41
4/28/2011	284.82	294.71	285.08	283.45
7/26/2011	284.29	294.25	285.50	283.69
2/28/2013	284.12	293.92	284.78	282.17
5/20/2013	284.27	294.13	285.33	283.60
8/6/2013	282.91	292.53	283.95	284.25
11/4/2013	285.75	292.80	284.76	284.30
2/10/2014	287.28	295.13	285.64	285.15
5/5/2014	286.05	296.52	286.25	285.90
8/5/2014	286.38	296.65	286.12	286.08
11/5/2014	286.07	296.42	285.78	286.08
3/2/2015	288.03	297.62	289.18	287.98
5/5/2015	287.28	295.83	289.59	287.20
8/19/2015	285.62	295.70	287.84	287.71
11/18/2015	287.31	296.55	289.88	289.12
3/23/2016	287.00	296.96	287.47	287.58
4/26/2016	-	-	-	-
Seasonal High	288.70	297.72	289.88	296.77

TABLE 2
 SWEPCO - JOHN W. TURK, JR. POWER PLANT
 CLASS 3N LANDFILL
 MONITORING WELL DATA
 WELL 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-1	33°38'12.0979"	93°49'06.72997"	301.88	304.93	33.05	8/24/2011	PVC	2	19.60	282.28	30.00	274.93
MW-2	33°38'06.5652"	93°48'37.3876"	396.19	299.24	43.05	8/24/2011	PVC	2	29.60	366.59	40.00	259.24
MW-3	33°38'08.6311"	93°48'31.3519"	295.87	298.77	42.90	8/24/2011	PVC	2	29.60	266.27	40.00	258.77
MW-4	33°38'13.1361"	93°48'28.2118"	297.44	300.44	42.05	8/25/2011	PVC	2	28.65	268.79	39.05	261.39
MW-5	33°38'20.4060"	93°48'37.7119"	283.26	286.16	27.70	8/25/2011	PVC	2	14.40	268.86	24.80	261.36
MW-6	33°38'23.2218"	93°48'37.6993"	278.08	281.03	22.95	8/26/2011	PVC	2	9.60	268.48	20.00	261.03
MW-7	33°38'25.2414"	93°48'41.1661"	279.18	282.28	23.10	8/29/2011	PVC	2	9.60	269.58	20.00	262.28
MW-8	33°38'24.4046"	93°48'44.6135"	281.23	284.23	23.00	8/26/2011	PVC	2	9.60	271.63	20.00	264.23
MW-9D	33°38'01.2854"	93°49'05.3426"	298.77	301.77	151.00	9/1/2011	PVC	2	137.60	161.17	148.00	153.77
MW-10	33°38'19.6903"	93°48'28.8011"	287.89	290.84	27.85	8/25/2011	PVC	2	14.50	273.39	24.90	265.94
MW-11	33°38'19.5525"	93°48'44.6009"	286.15	289.22	30.00	3/24/2016	PVC	2	20.00	266.15	30.25	258.97
PZ-1I	33°38'16.8047"	93°49'00.4745"	295.58	298.35	32.24	2/24/2008	PVC	2	19.60	275.98	30.00	268.35
PZ-2I	33°38'06.1893"	93°48'59.8878"	299.59	302.66	32.75	2/26/2008	PVC	2	19.35	280.24	29.75	272.91
PZ-3I	33°38'12.0032"	93°48'52.0137"	300.38	303.46	42.76	3/4/2008	PVC	2	29.36	271.02	39.76	263.70
PZ-4I	33°38'12.1242"	93°48'43.2711"	298.30	301.39	37.82	2/25/2008	PVC	2	24.42	273.88	34.82	266.57

APPENDIX 1
Boring & Monitoring Well Installation Logs

Boring Logs



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FIELD BORING LOG

BORING NO.: MW-1

PAGE: 1 of 1

TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-001

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/23/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1670228.19		E: 758862.22		G.S. ELEV. 301.88		Litho. Symbol	Run #	% Recovery	Remarks	
DESCRIPTION										
Depth BGS	0	0'-1' CLAY dark brown, blocky			1	0'-5' 15" rec.				
		1'-6' CLAY gray and tan, soft								
	5	6'-12.5' CLAY gray with tan mottles, calcareous nodules, firm							2	5'-10' 40" rec.
	10	12.5'-25' CLAY tan and gray mottled, blocky, firm							3	10'-15' 60" rec.
	15								4	15'-20' 60" rec.
	20								5	20'-25' 36" rec.
	25	25'-29' SHALEY CLAY tan, gypsum veins present, hard							6	25'-30' 60" rec.
	29'-30' CLAYEY SHALE dark gray									
	30	Total Depth of Boring = 30' bgs					Allowed boring to sit open for 15 hours and 30 min. at 30' bgs. boring remained dry.			
	35									
	40									



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FIELD BORING LOG

BORING NO.: MW-2

PAGE: 1 of 1

TOTAL DEPTH: 40 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-002

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/23/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1669625.08 E: 761332.72 G.S. ELEV. 296.19			Litho. Symbol	Run #	% Recovery	Remarks
DESCRIPTION						
Depth BGS 0 5 10 15 20 25 30 35 40	0'-1' CLAY dark gray and tan, mottled blocky, firm			1	0'-5' 48" rec.	
	1'-3' CLAY tan and gray, mottled					
	3'-7' CLAY dark gray, firm					
	7'-12' CLAY dark gray with tan silty mottles					
	12'-22' CLAY tan, blocky with orangish brown mottles, firm					
	22'-27' CLAY tan, blocky with trace amount of fossils, hard					
	27'-28' SHALEY CLAY dark gray					
	28'-30' CLAY tan, blocky with trace amount of fossils, hard					
	30'-35' SHALEY CLAY dark gray with intermittent beds of hard, blocky shale (approx. 8" thick)					
35'-40' SHALE dark gray		7	30'-35' 60" rec.			
		8	35'-40' 0" rec.			
Total Depth of Boring = 40' bgs						Allowed boring to sit open for 1 hour at 35' bgs. boring remained dry. Allowed boring to sit open for 3.5 hours at 40' bgs. boring remained dry.



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FIELD BORING LOG

BORING NO.: MW-3

PAGE: 1 of 1

TOTAL DEPTH: 40 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-003

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/24/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1669824.84			E: 761846.70			G.S. ELEV. 295.87			Litho. Symbol	Run #	% Recovery	Remarks
DESCRIPTION												
Depth BGS	0	0'-2' <u>CLAY</u> dark brown and gray, blocky, hard			1	0'-5' 45" rec.						
		2'-8' <u>CLAY</u> light gray with silt, firm										
	5	8'-13' <u>CLAY</u> gray and brown, mottled, firm										
	10	13'-17' <u>CLAY</u> reddish brown, firm with intermittent gravel within the clay from 16'-17'										
	15	17'-37' <u>CLAY</u> brown and tan, blocky, firm with intermittent gypsum veins from 27'-36' (veins are <1/4" thick)										
	20											
	25											
	30											
	35											
	37'-38' <u>SHALEY CLAY</u> dark gray			8	35'-40' 0" rec.							*Moisture was present on lead auger when pulled out of boring Allowed boring to sit open for 1 hour at 35' bgs. boring remained dry. Allowed boring to sit open for 3.5 hours at 40' bgs. boring remained dry.
	38'-39' <u>SHALEY CLAY</u> tan											
	39'-40' <u>SHALEY CLAY</u> dark gray											
40	Total Depth of Boring = 40' bgs											



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FIELD BORING LOG

BORING NO.: MW-4

PAGE: 1 of 1

TOTAL DEPTH: 39 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-004

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/24/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1670275.43 E: 762120.12 G.S. ELEV. 297.44			Litho. Symbol	Run #	% Recovery	Remarks			
DESCRIPTION									
Depth BGS 0 5 10 15 20 25 30 35 40	0'-1' <u>CLAY FILL</u> tan			1	0'-5' 18" rec.				
	1'-5' <u>CLAY FILL</u> dark gray with abundant roots, firm								
	5'-13' <u>CLAY</u> gray with reddish brown mottles, firm								
	13'-15.5' <u>CLAY</u> gray, tan, reddish brown and black, mottled, firm								
	15.5'-24' <u>CLAY</u> reddish brown, firm								
	24'-34' <u>CLAY</u> brown with trace silt, firm								
	34'-39' <u>GRAVELLY CLAY</u> brown, firm							9	35'-39' 48" rec.
	Total Depth of Boring = 39' bgs								

Allowed boring to sit open for 1 hour at 32' bgs. boring remained dry.

Allowed boring to sit open for 14 hours and 30 min. Water recharged to 24.7' bgs.



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FIELD BORING LOG

BORING NO.: MW-5

PAGE: 1 of 1

TOTAL DEPTH: 25 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-005

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/25/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1671024.33		E: 761330.05		G.S. ELEV. 283.26		Litho. Symbol	Run #	% Recovery	Remarks											
DESCRIPTION																				
Depth BGS	0	0'-7' <u>CLAY FILL</u> gray and brown, mottled			1	0'-5' 15" rec.														
	5	7'-14' <u>SANDY CLAY</u> gray and brown								2	5'-10' 4" rec.									
	10	14'-19.5' <u>CLAYEY SANDY GRAVEL</u> moist to wet at 17'											3	10'-15' 48" rec.						
	15	19.5'-25' <u>CLAY</u> tan, blocky, hard														4	15'-20' 36" rec.			
	20																		5	20'-25' 50" rec.
	25	Total Depth of Boring = 25' bgs																		
30																				
35																				
40																				

Allowed boring to sit open for 1 hour at 20' bgs. boring remained dry.
Allowed boring to sit open for 1 hour at 25' bgs. boring remained dry.



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FIELD BORING LOG

BORING NO.: MW-6

PAGE: 1 of 1

TOTAL DEPTH: 20 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-006

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/25/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1671308.88		E: 761336.15		G.S. ELEV. 278.08		Litho. Symbol	Run #	% Recovery	Remarks
DESCRIPTION									
Depth BGS	0	0'-1.5' <u>SANDY CLAY</u> tan, firm					1	0'-5' 60" rec.	Allowed boring to sit open for 1 hour at 15' bgs. boring remained dry.
		1.5'-5' <u>SILTY CLAY</u> gray with orangish brown mottles							
	5	5'-8' <u>SANDY CLAY</u> gray, sand is very fine grained							
		8'-10' <u>SANDY CLAY</u> gray and orangish brown with intermittent gravel, sand is fine to medium grained							
	10	10'-14' <u>CLAYEY SANDY GRAVEL</u> gravel consists of rounded chert, moist (approx. 1" in size)							
	15	14'-20' <u>CLAY</u> tan and gray, blocky, dry				3	10'-15' 10" rec.	Allowed boring to sit open at 20' bgs. for 14 hours. boring remained dry.	
						4	15'-20' 60" rec.		
	20	Total Depth of Boring = 20' bgs							
	25								
	30								
	35								
	40								



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FIELD BORING LOG

BORING NO.: MW-7

PAGE: 1 of 1

TOTAL DEPTH: 20 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-007

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/29/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1671518.16		E: 761046.71		G.S. ELEV. 279.18		Litho. Symbol	Run #	% Recovery	Remarks
DESCRIPTION									
Depth BGS	0	0'-8' <u>SILTY CLAY</u> gray with orangish brown mottles, soft			1	0'-5' 60" rec.			
	5	8'-12' <u>SANDY CLAY</u> gray with orangish brown mottles, firm, sand is very fine grained							
	10	12'-14.5' <u>CLAYEY SAND</u> gray and tan with intermittent gravel, wet			3	10'-15' 60" rec.			
	15	14.5'-20' <u>CLAY</u> tan and gray, blocky, hard							
	20	Total Depth of Boring = 20' bgs		Allowed boring to sit open for 1 hour at 15' bgs. Water recharged to 13.8'					
25									
30									
35									
40									



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FIELD BORING LOG

BORING NO.: MW-8

PAGE: 1 of 1

TOTAL DEPTH: 20 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-008

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/26/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1671438.76		E: 760753.81		G.S. ELEV. 281.23		Litho. Symbol	Run #	% Recovery	Remarks	
DESCRIPTION										
Depth BGS	0	0'-3' <u>GRAVELLY CLAY FILL</u> gray and tan, some woody debris present				1	0'-5' 48" rec.			
	5	3'-12' <u>SANDY CLAY</u> gray with orangish brown mottles, firm, sand is very fine grained							2	5'-10' 60" rec.
	10	12'-15' <u>CLAYEY GRAVEL</u> gravel consists of rounded chert, moist (approx. 1" in diameter)								
	15	15'-20' <u>CLAY</u> tan and gray, blocky, dry							4	15'-20' 12" rec.
	20	Total Depth of Boring = 20' bgs								
25			Allowed boring to sit open for 1 hour at 20' bgs. Boring remained dry.							
30										
35										
40										



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FIELD BORING LOG

BORING NO.: MW-9D

PAGE: 2 of 2

TOTAL DEPTH: 148

FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	Remarks
70	70'-126' SHALE dark gray				← 70'-71.5' 10" rec. Wash rotary
80					← 80'-81.5' 12" rec. Wash rotary
90					← 90'-91.5' 15" rec. Wash rotary
100					← 100'-101.5' 10" rec. Wash rotary
110					← 110'-111.5' 10" rec. Wash rotary
120					← 120'-121.5' 12" rec. Wash rotary
126	126'-127' SANDSTONE				
127	127'-129' SANDY CLAY soft drilling				
129	129'-134' SANDSTONE				← 130'-131.5' No sample rock
134	134'-148' SAND loosely cemented				
140					← 140'-141.5' 5" rec. Wash rotary
150	Total Depth of Boring = 148' bgs				



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FIELD BORING LOG

BORING NO.: MW-10

PAGE: 1 of 1

TOTAL DEPTH: 25 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP - JOHN W. TURK - FULTON, AR.

PROJECT: GROUNDWATER WELL INSTALLATION

JOB NO.: 216-002-35117123-010

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 8/25/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLER

N: 1670983.69		E: 762082.01		G.S. ELEV. 287.89		Litho. Symbol	Run #	% Recovery	Remarks
DESCRIPTION									
Depth BGS	0	0'-1' GRAVELLY CLAY FILL brown							
		1'-8' CLAY FILL brown, gray and tan, mottled				1	0'-5' 30" rec.		
	5	8'-13' CLAY gray with reddish brown mottles, firm				2	5'-10' 8" rec.		
	10	13'-17' CLAY gray, firm				3	10'-15' 60" rec.		
	15	17'-19' CLAYEY GRAVEL (clay is red) gravel consists of approx. 1" rounded chert				4	15'-20' 50" rec.		
	20	19'-25' CLAY tan and gray, blocky, hard				5	20'-25' 60" rec.		
25	Total Depth of Boring = 25' bgs								Allowed boring to sit open for 1 hour at 20' bgs. boring remained dry. Allowed boring to sit open for 1 hour at 25' bgs. boring remained dry.
30									
35									
40									



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FIELD BORING LOG

BORING NO.: MW-11

PAGE: 1 of 1

TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AEP	PROJECT: MONITORING WELL INSTALLATION
JOB NO.: 35167095	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS	DRILLER: GARRY MOYERS
DATE DRILLED: 03/24/2016	RIG TYPE: CME 55

DRILLING METHOD: HOLLOW STEM AUGER

SAMPLING METHOD: CONTINUOUS SAMPLE

Depth BGS	N: 1670948.39 E: 760746.19 G.S. ELEV. 286.15			Litho. Symbol	P.I.D. (ppm)	Remarks
	DESCRIPTION					
0	0'-4'				0'-5' 100% rec	
5	4'-6'				5'-10' 100% rec	
10	6'-12'				10'-15' 100% rec	
15	12'-18'				15'-20' 40% rec	
20	18'-21'				20'-25' 100% rec	<u>▽</u> at 18'
25	21'-25'				25'-30' 100% rec	
30	25'-30'				100% rec	
30	Total Depth of Boring at 30' bgs					
35						
40						

LOG OF BORING NO. PZ-1 I

CLIENT **American Electric Power**

SITE **Fulton, Arkansas** PROJECT **John W. Turk Landfill**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	SAMPLES			TESTS			
						RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	FIELD VAPOR TEST (PPM)*	SOIL SAMPLE SENT TO LABORATORY		
4	SILTY CLAY dark brown, soft, roots present, damp				CS	18						
5	CLAY light gray with reddish brown silty mottles, firm, plastic, moist				CS	12						
10	SILTY CLAY medium brown, hard, dry, plastic, trace gravel		CH		CS	54					LL=68 PL=22 PI=47	
13	SILTY CLAY tan with gray mottles, firm, tacky, trace gravel				CS	60						
16.5	GRAVELLY CLAY medium brown, hard, moist in spots											
20			CH		CS	30						
23	CLAY light brown, blocky, hard, dry										LL=59 PL=27	
25	CLAY tan and light gray, mottled, blocky, hard, dry		CH		CS	60					PI=41	
30											LL=62 PL=22	
	BOTTOM OF BORING AT 30 FEET Drilling Method: 8.25" O.D. Hollow Stem Auger Ground Surface Elevation: 295.58 N: 35718.72 E: 28419.06 Sampling Method: CS: Continuous Sampler										PI=40	

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* ND indicates a reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

WATER LEVEL OBSERVATIONS, ft

WL	▽ 16.5	▽ 5.97
WL	▽	▽
WL	Open symbol: Depth while drilling	



BORING STARTED	2-26-08
BORING COMPLETED	2-26-08
RIG	CME-55
FOREMAN	GM
APPROVED	JBA
JOB #	35087014

BOREHOLE 99 35087014.GPJ TERRACON.GDT 9/3/10

LOG OF BORING NO. PZ-3 I

CLIENT
American Electric Power

SITE
Fulton, Arkansas

PROJECT
John W. Turk Landfill

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	SAMPLES			TESTS		
						RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	FIELD VAPOR TEST (PPM)*	SOIL SAMPLE SENT TO LABORATORY	
1	SILTY CLAY gray, moist, soft, low plasticity, roots present				CS	24					
6	SILTY CLAY medium gray with orangish brown mottles, trace chert gravel, firm, dry	5			CS	60					
12	CLAY gray, some silt present, hard, blocky, trace river gravel and iron concretions present, dry	10			CS	60					
20	SILTY CLAY gray, blocky, hard, trace chert gravel, iron staining and concretions abundant, dry	15			CS	60					
25	CLAY light gray with tan mottles, plastic, some silt present, trace chert gravel, trace gypsum veins present, dry	20			CS	60					
26	SILTY CLAY tan, soft, moist	25			CS	54					
28	SILTY CLAY brown, blocky, some chert gravel present, dry										
29	GRAVELLY CLAY medium brown, dry										
35	SILTY CLAY medium brown, hard, dry	30			CS	60					
38	SHALEY CLAY medium brown, dry, moist gypsum veins present	35			CS	60					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* ND indicates a reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

WATER LEVEL OBSERVATIONS, ft


WL	▽ 25	▽ 13.9
WL	▽	▽
WL	Open symbol: Depth while drilling	



BORING STARTED		2-26-08	
BORING COMPLETED		2-26-08	
RIG	CME-55	FOREMAN	GM
APPROVED	JBA	JOB #	35087014

BOREHOLE 99 35087014.GPJ TERRACON.GDT 9/3/10

LOG OF BORING NO. PZ-3 I

CLIENT American Electric Power		PROJECT John W. Turk Landfill										
SITE Fulton, Arkansas												
GRAPHIC LOG				SAMPLES				TESTS				
				DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	FIELD VAPOR TEST (PPM)*	SOIL SAMPLE SENT TO LABORATORY
	40	SHALEY CLAY dark gray, hard, dry		40								
BOTTOM OF BORING AT 40 FEET Drilling Method: 8.25" O.D. Hollow Stem Auger Ground Surface Elevation: 300.38 N: 35220.75 E: 29125.72 Sampling Method: CS: Continuous sampler												

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* ND indicates a reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

WATER LEVEL OBSERVATIONS, ft

WL	▼ 25		▼ 13.9
WL	▼		▼
WL	Open symbol: Depth while drilling		



BORING STARTED		2-26-08	
BORING COMPLETED		2-26-08	
RIG	CME-55	FOREMAN	GM
APPROVED	JBA	JOB #	35087014

BOREHOLE 99 35087014.GPJ TERRACON.GDT 9/3/10

LOG OF BORING NO. PZ-4 I

CLIENT
American Electric Power

SITE
Fulton, Arkansas

PROJECT
John W. Turk Landfill

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
			NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	FIELD VAPOR TEST (PPM)*	SOIL SAMPLE SENT TO LABORATORY
1		CH		CS					
<p>SANDY CLAY dark brown, moist, roots present</p> <p>CLAY medium gray, some silt, plastic, firm, damp, trace coarse sand and gravel</p>									
7				CS					
<p>SILTY CLAY medium brown and gray, mottled with black iron staining, trace river gravel, dry</p>									
13				CS					
<p>CLAY medium brown, blocky, trace amounts of sand and river gravel, hard, dry, reaction to HCL</p>									
15				CS					
<p>SILTY CLAY gray with tan and orangish brown mottles, dry, chert gravel present, reaction to HCL</p>									
20				CS					
<p>SILTY CLAY medium brown with chert gravel, blocky, hard, trace calcareous nodules</p>									
25				CS					
<p>SILTY CLAY tan, some silt, moist zones</p>									
30				CS					
<p>CLAY medium brown, blocky, hard</p>									
35									
<p>BOTTOM OF BORING AT 35 FEET</p>									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* ND indicates a reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

WATER LEVEL OBSERVATIONS, ft

WL	▽ 24	▽ 13.93
WL	▽	▽
WL	Open symbol: Depth while drilling	



BORING STARTED		2-25-08	
BORING COMPLETED		2-25-08	
RIG	CME-55	FOREMAN	GM
APPROVED	JBA	JOB #	35087014

BOREHOLE 99 35087014.GPJ TERRACON.GDT 9/3/10

LOG OF BORING NO. PZ-4 I

CLIENT **American Electric Power**

SITE **Fulton, Arkansas** PROJECT **John W. Turk Landfill**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	FIELD VAPOR TEST (PPM)*	SOIL SAMPLE SENT TO LABORATORY
	Drilling Method: 8.25" O.D. Hollow Stem Auger Ground Surface Elevation: 298.30 N: 35219.89 E: 29865.03 Sampling Method: CS: Continuous sampler									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

* ND indicates a reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

WATER LEVEL OBSERVATIONS, ft					
WL	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;">▼ 24</td> <td style="width: 50%; border-bottom: 1px solid black;">▼ 13.93</td> </tr> <tr> <td style="border-bottom: 1px solid black;">▼</td> <td style="border-bottom: 1px solid black;">▼</td> </tr> </table>	▼ 24	▼ 13.93	▼	▼
▼ 24	▼ 13.93				
▼	▼				
WL	Open symbol: Depth while drilling				



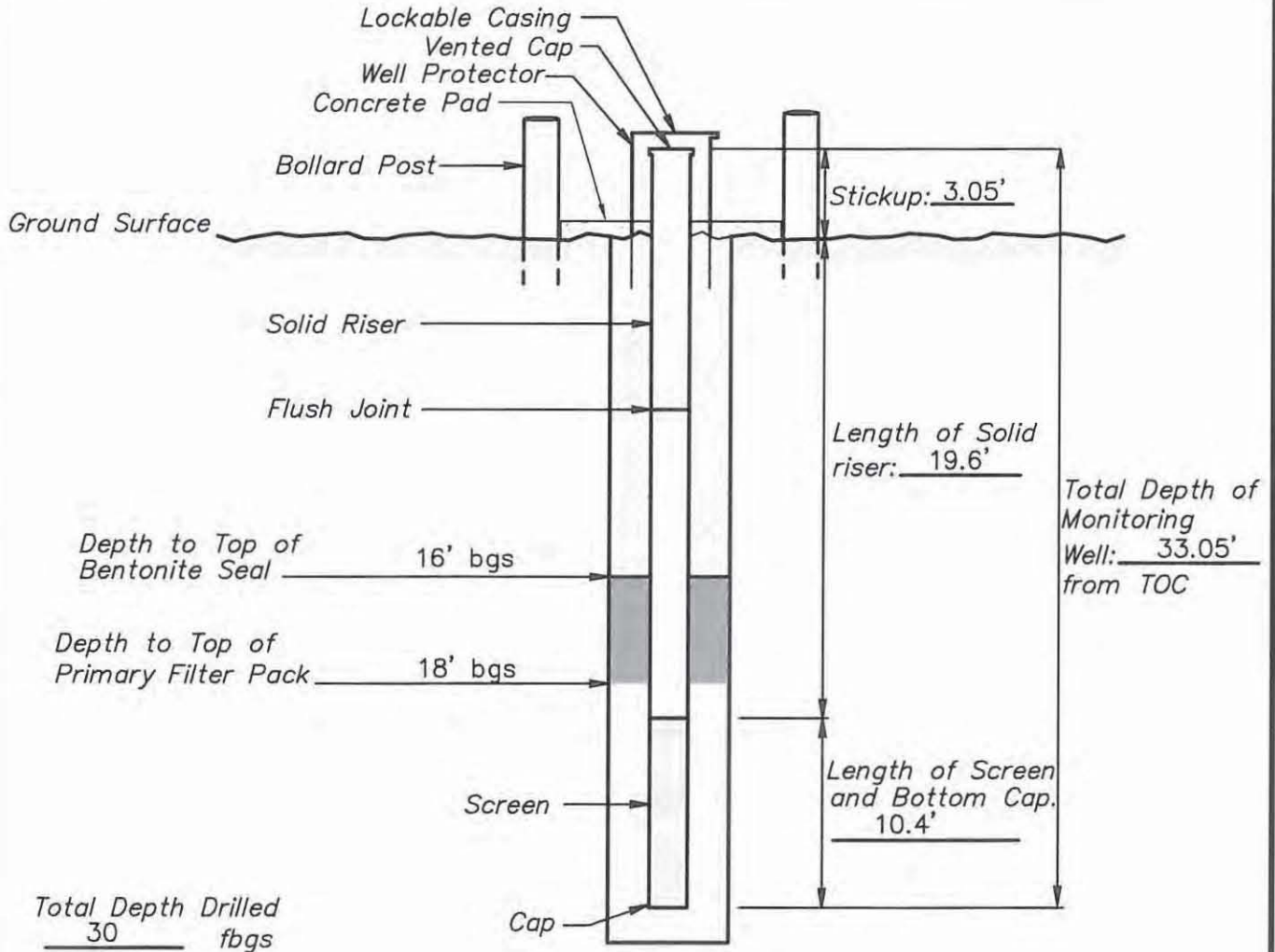
BORING STARTED		2-25-08	
BORING COMPLETED		2-25-08	
RIG	CME-55	FOREMAN	GM
APPROVED	JBA	JOB #	35087014

BOREHOLE 99_35087014.GPJ TERRACON.GDT 9/3/10

Monitoring Well Installation Logs

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-1
 Job Number 35117123 Installation Date 8/24/2011 Location FULTON, AR.
 Datum Elevation 304.93 Surface Elevation 301.88
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

Terracon

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123

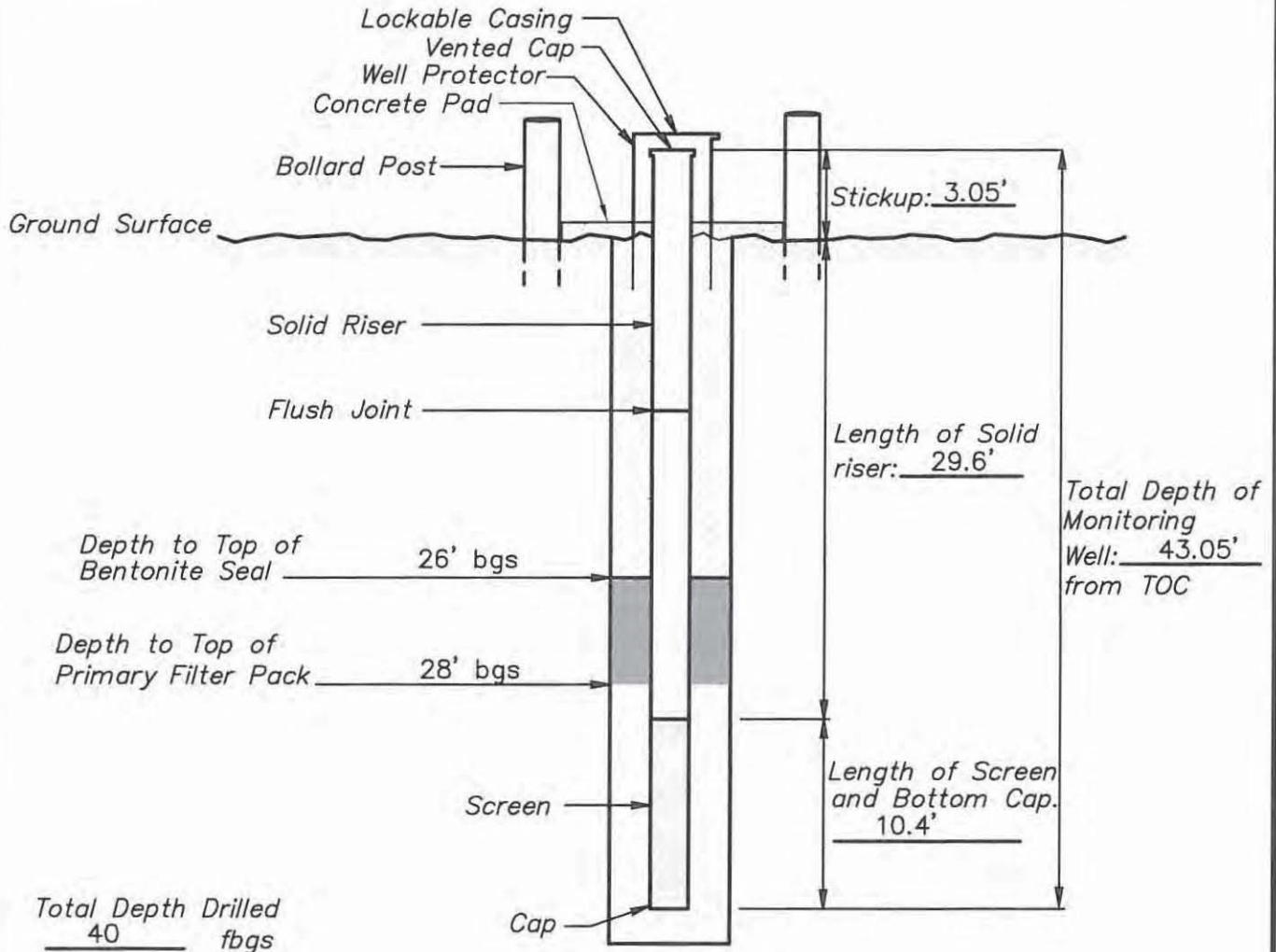
WELL NUMBER: MW-1

DRAWING NUMBER: 011

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-2
 Job Number 35117123 Installation Date 8/24/2011 Location FULTON, AR.
 Datum Elevation 299.24 Surface Elevation 296.19
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123

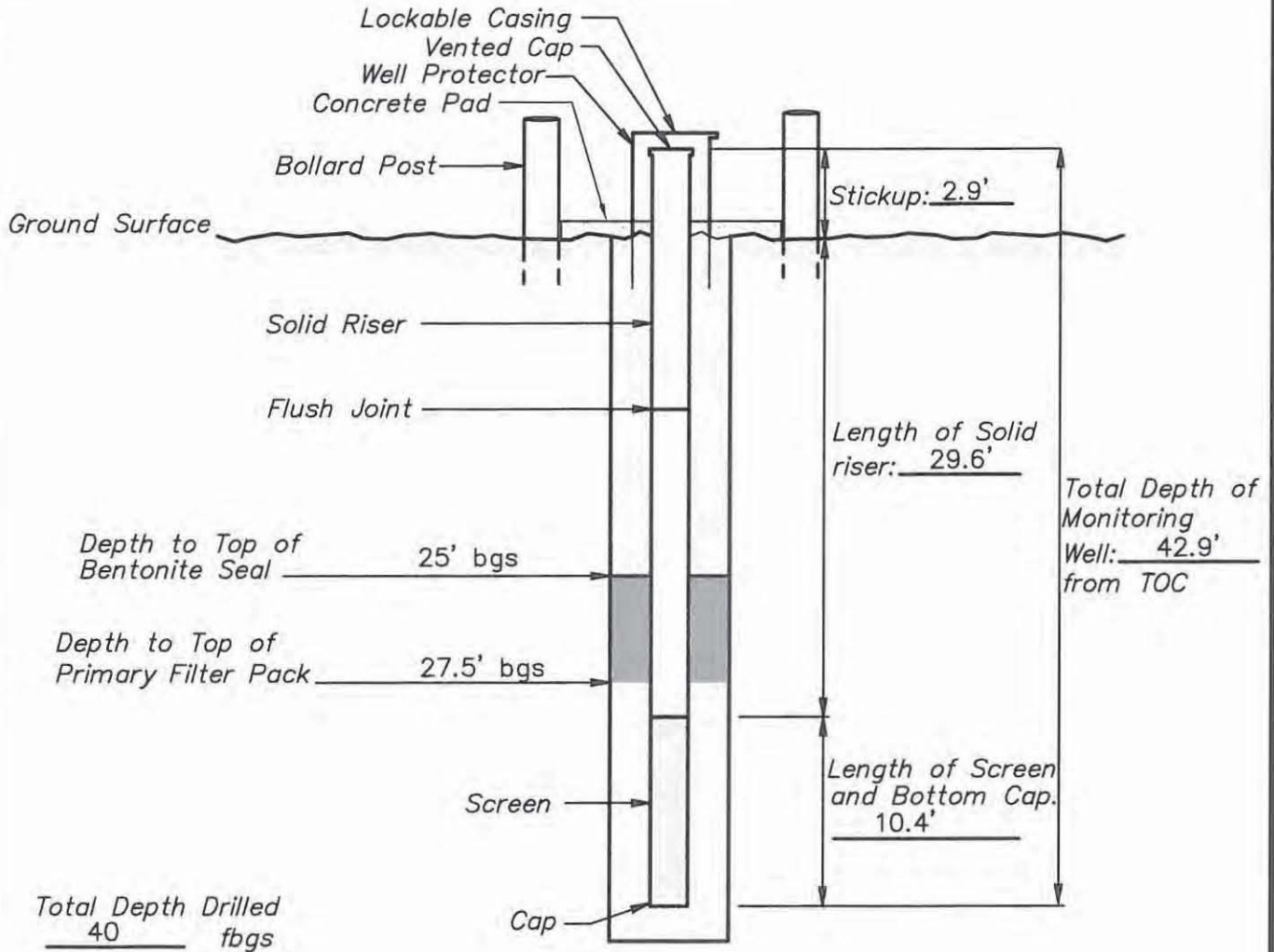
WELL NUMBER: MW-2

DRAWING NUMBER: 012

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-3
 Job Number 35117123 Installation Date 8/24/2011 Location FULTON, AR.
 Datum Elevation 298.77 Surface Elevation 295.87
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

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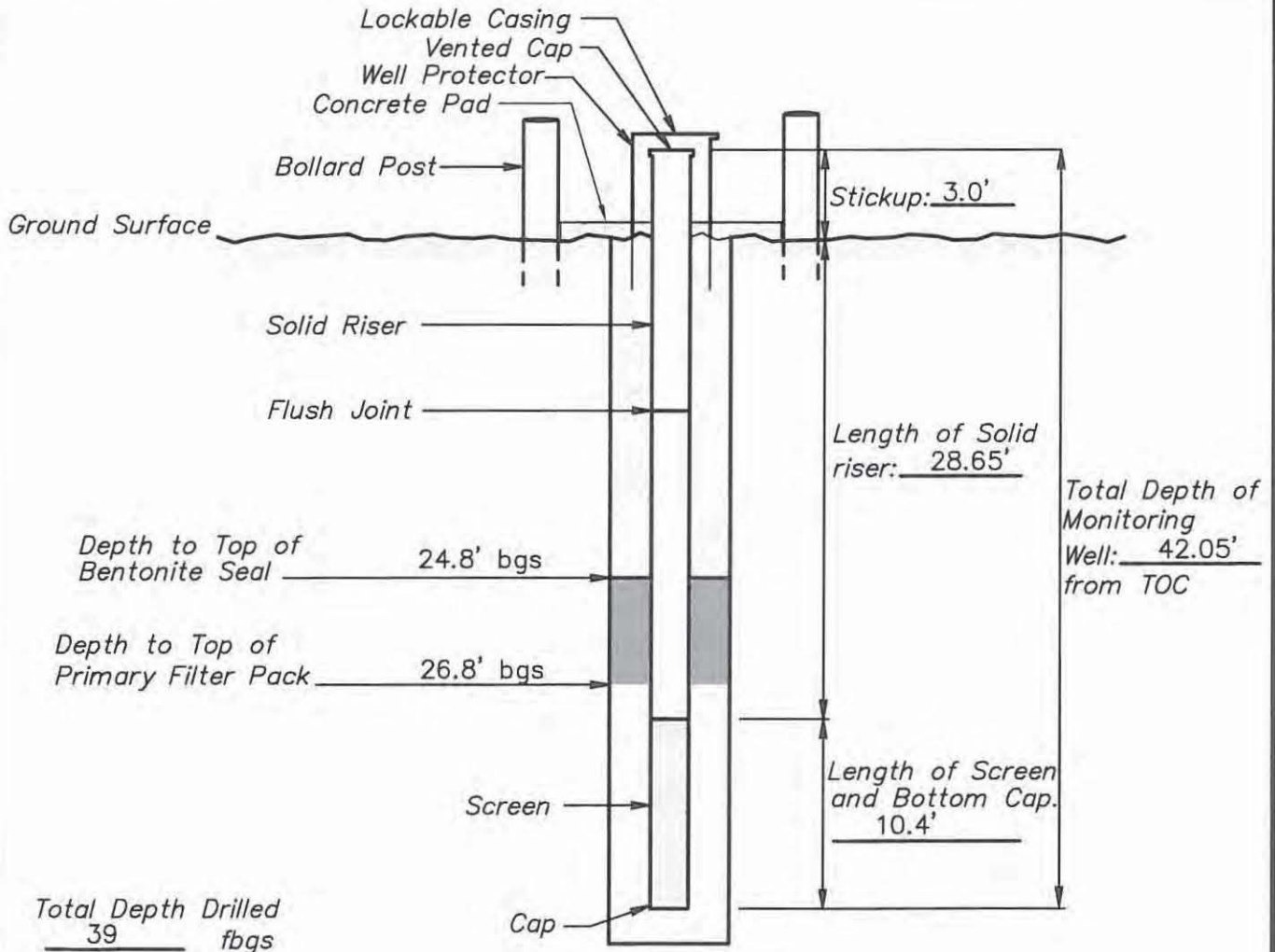
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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123
 WELL NUMBER: MW-3
 DRAWING NUMBER: 013 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-4
 Job Number 35117123 Installation Date 8/25/2011 Location FULTON, AR.
 Datum Elevation 300.44 Surface Elevation 297.44
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

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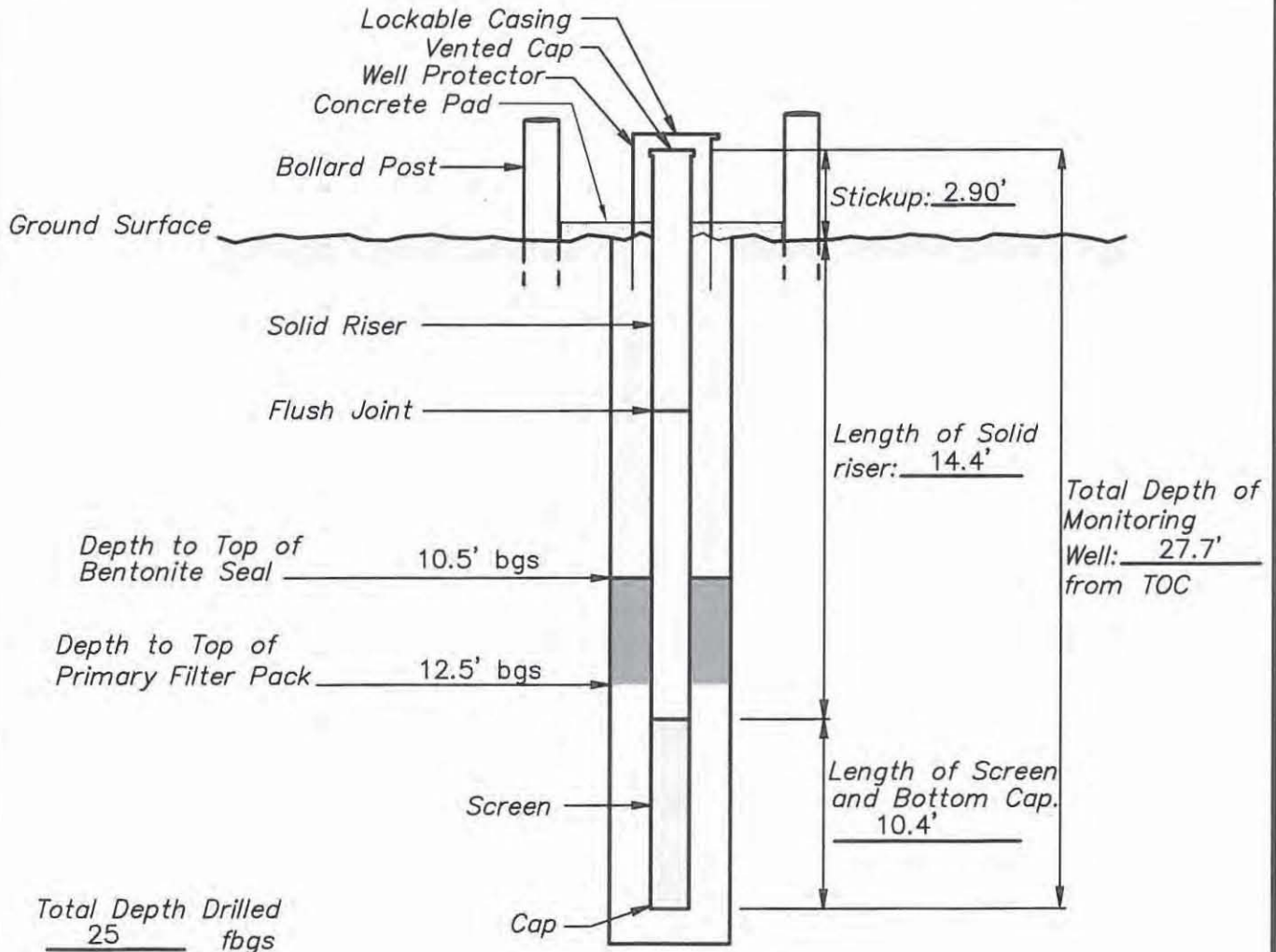
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PH: (501) 847-9292 FAX: (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123
 WELL NUMBER: MW-4
 DRAWING NUMBER: 014 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-5
 Job Number 35117123 Installation Date 8/25/2011 Location FULTON, AR.
 Datum Elevation 286.16 Surface Elevation 283.26
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123

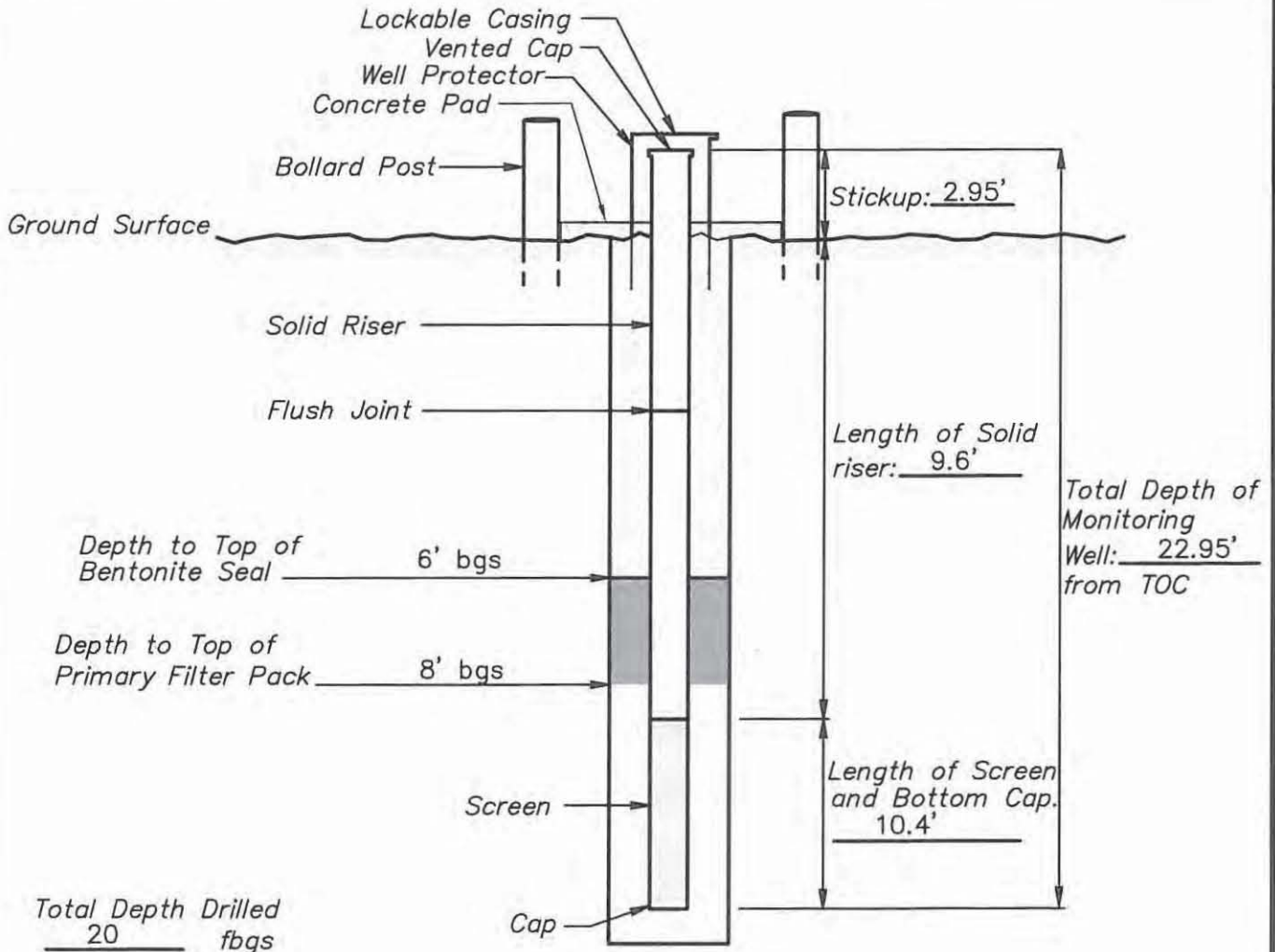
WELL NUMBER: MW-5

DRAWING NUMBER: 015

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-6
 Job Number 35117123 Installation Date 8/26/2011 Location FULTON, AR.
 Datum Elevation 281.03 Surface Elevation 278.08
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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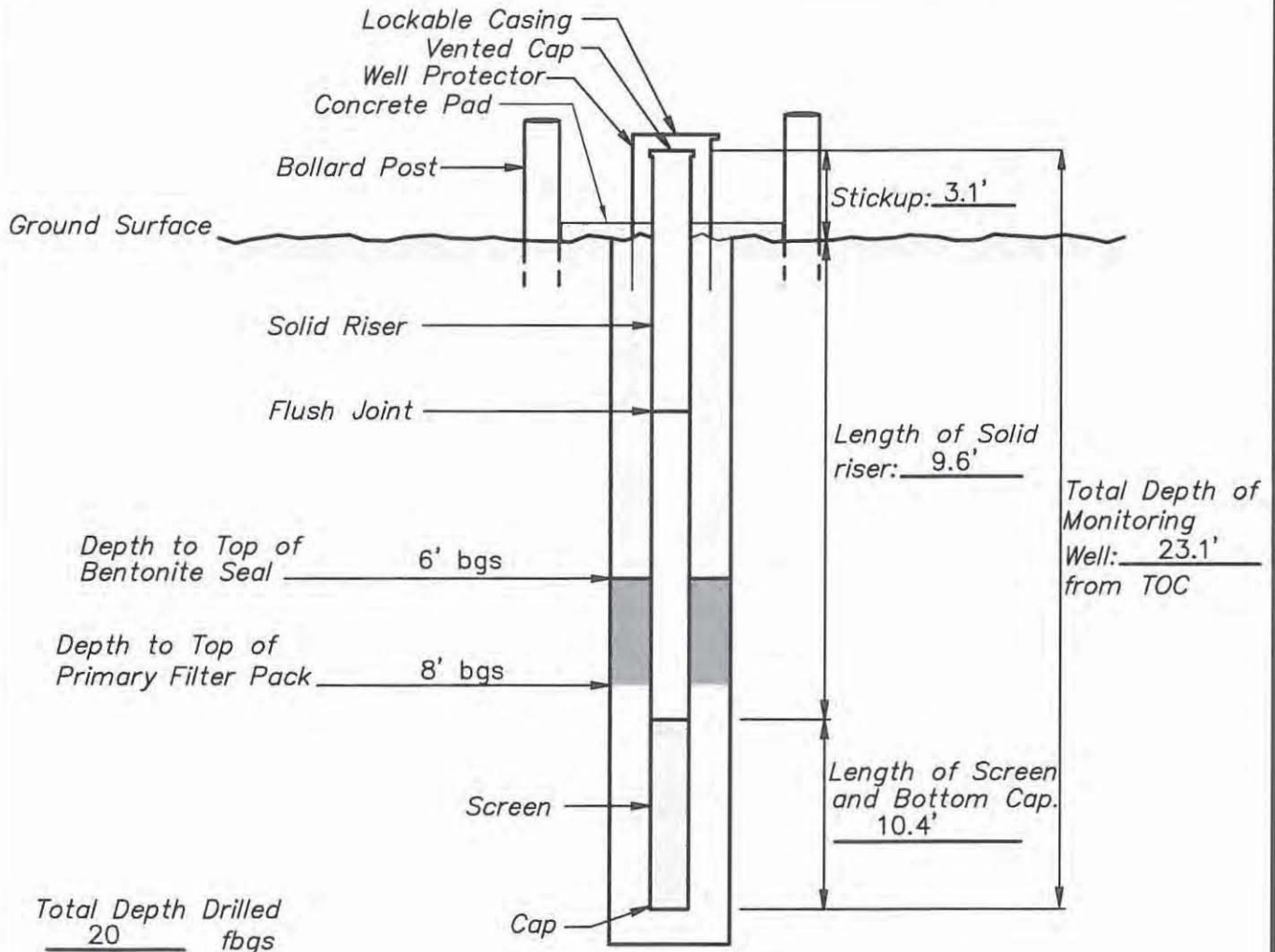
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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123
 WELL NUMBER: MW-6
 DRAWING NUMBER: 016 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-7
 Job Number 35117123 Installation Date 8/29/2011 Location FULTON, AR.
 Datum Elevation 282.28 Surface Elevation 279.18
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123

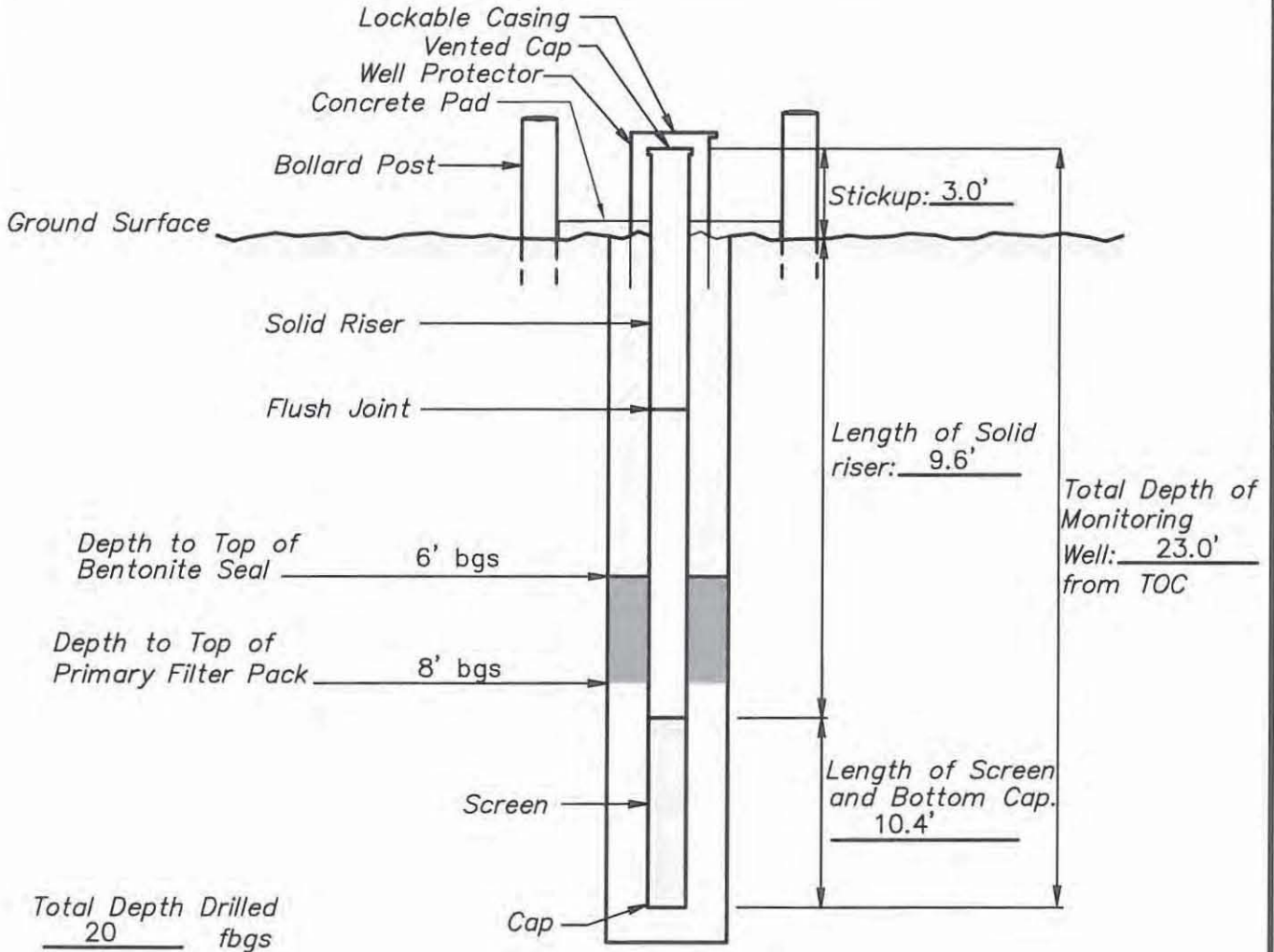
WELL NUMBER: MW-7

DRAWING NUMBER: 017

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-8
 Job Number 35117123 Installation Date 8/26/2011 Location FULTON, AR.
 Datum Elevation 284.23 Surface Elevation 281.23
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123

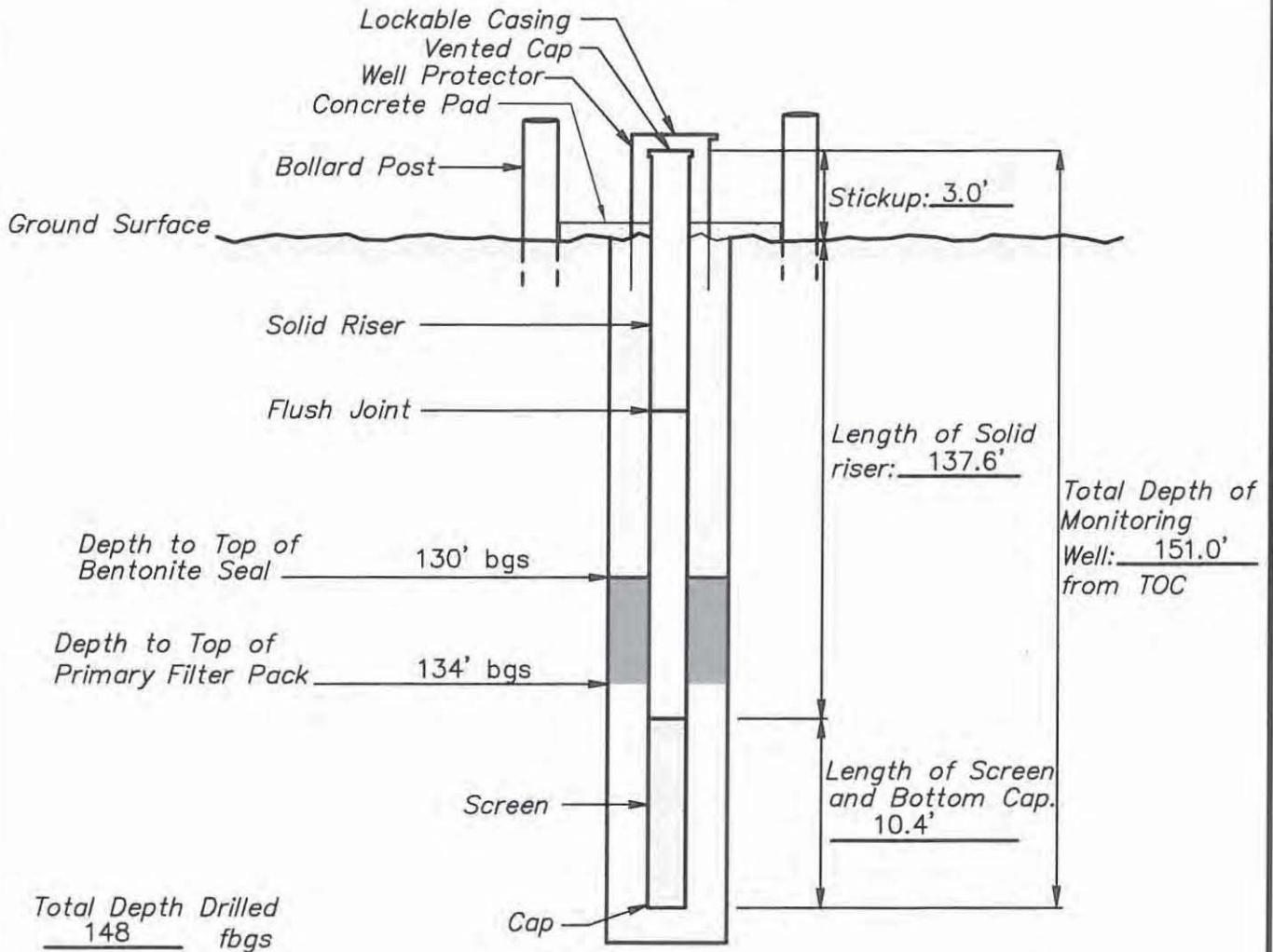
WELL NUMBER: MW-8

DRAWING NUMBER: 018

CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-9D
 Job Number 35117123 Installation Date 9/1/2011 Location FULTON, AR.
 Datum Elevation 301.77 Surface Elevation 298.77
 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", 3.75"
 Granular Backfill Material 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER, WASH ROTARY Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

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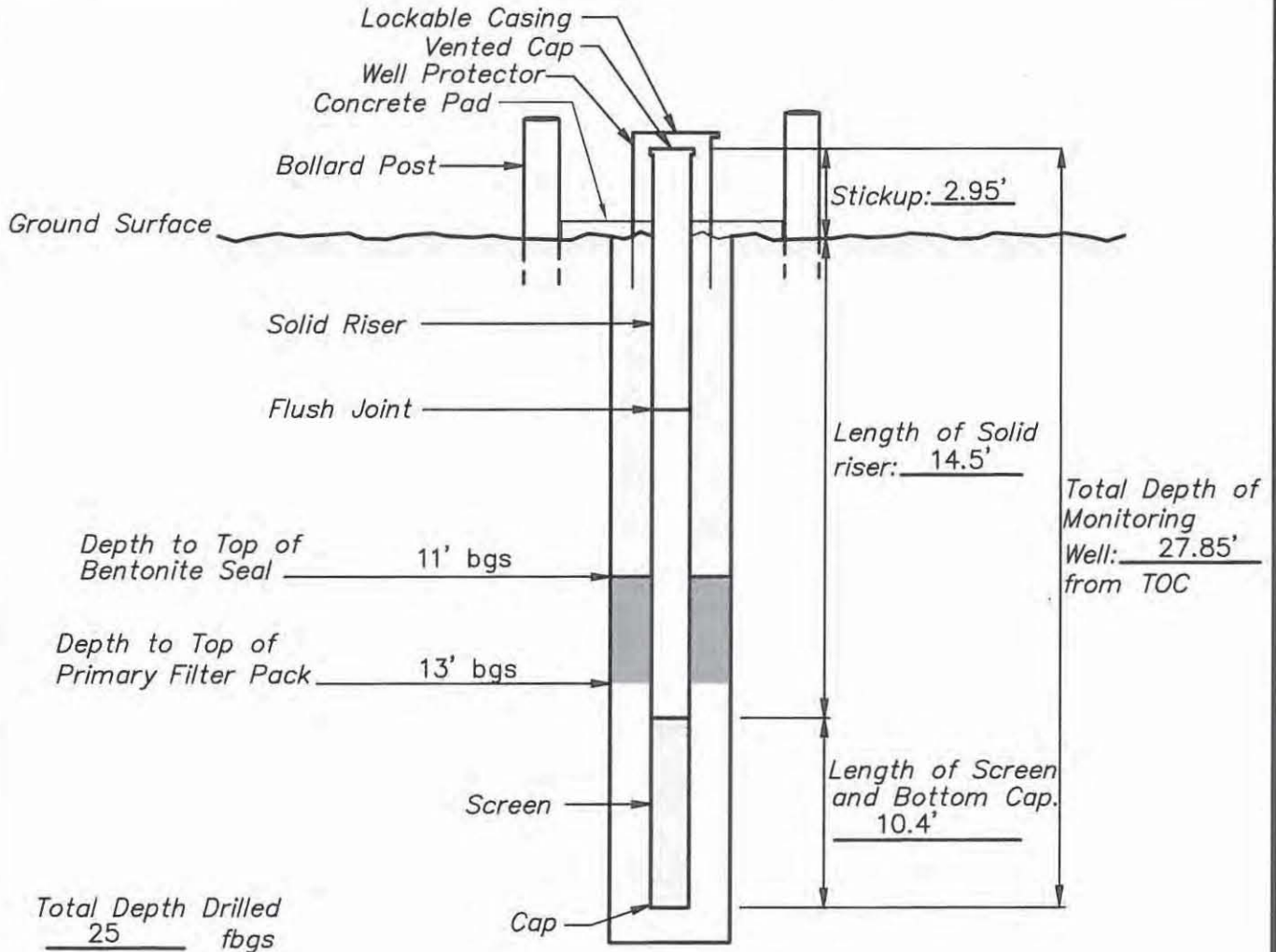
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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123
 WELL NUMBER: MW-9D
 DRAWING NUMBER: 019 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP-JOHN W. TURK-MONITORING WELL INSTALLATION Well Number MW-10
 Job Number 35117123 Installation Date 8/25/2011 Location FULTON, AR.
 Datum Elevation 290.84 Surface Elevation 287.89
 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 12-20 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Bentonite Chips
- Bentonite Plug
- Granular Backfill

(Not to Scale)

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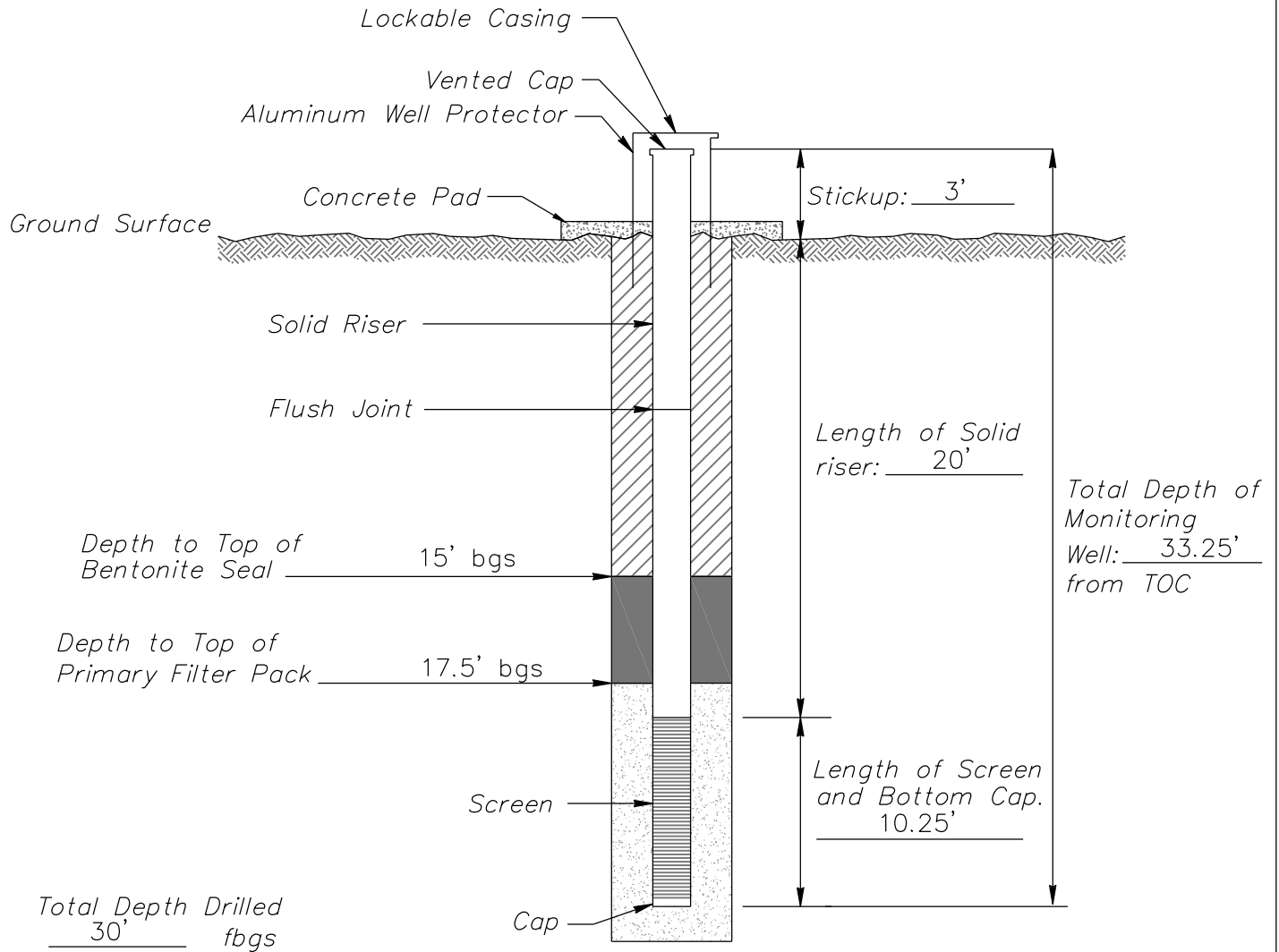
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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-002-35117123
 WELL NUMBER: MW-10
 DRAWING NUMBER: 020 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name JW TURK MONITORING WELL INSTALLATION Well Number MW-11
 Job Number 35167095 Installation Date 03/24/16 Location JO TURK PLANT
 Datum Elevation 289.22 Surface Elevation 286.15
 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 JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



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

(Not to Scale)



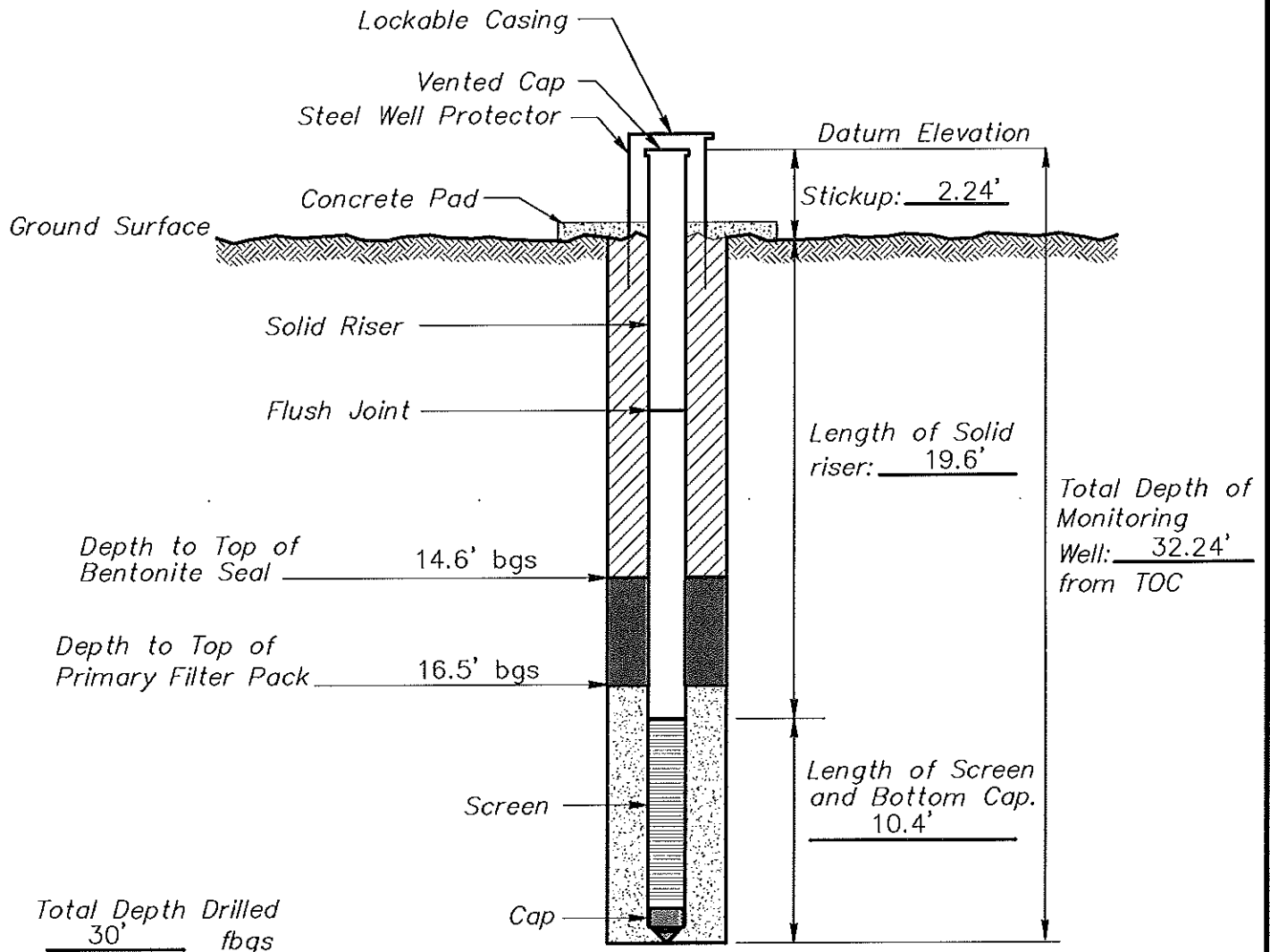
25809 I-30 South BRYANT, AR. 72022
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MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 35167095
 WELL NUMBER: MW-11
 DRAWING NUMBER: 000 CHECKED BY: 00

PIEZOMETER INSTALLATION RECORD

Job Name JOHN W. TURK JR. POWERPLANT - FULTON, AR. Well Number PZ-1 I
 Job Number 35087014 Installation Date 2/27/08 Location PROPOSED CLASS 3N LANDFILL
 Datum Elevation 298.35' Surface Elevation 295.58'
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.020"
 Riser Diameter & Material 2" PVC Borehole Diameter 8.25"
 Granular Backfill Material 20-40 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Grout
- Bentonite Plug
- Granular Backfill

(Not to Scale)

Ground Surface Elevation: 295.58
 Northing: 35718.72
 Easting: 28419.06

Terracon

Consulting Engineers and Scientists

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BRYANT, AR 72022
FAX (501) 847-9210

PIEZOMETER INSTALLATION RECORD

PROJECT NUMBER: 216-002-35087014

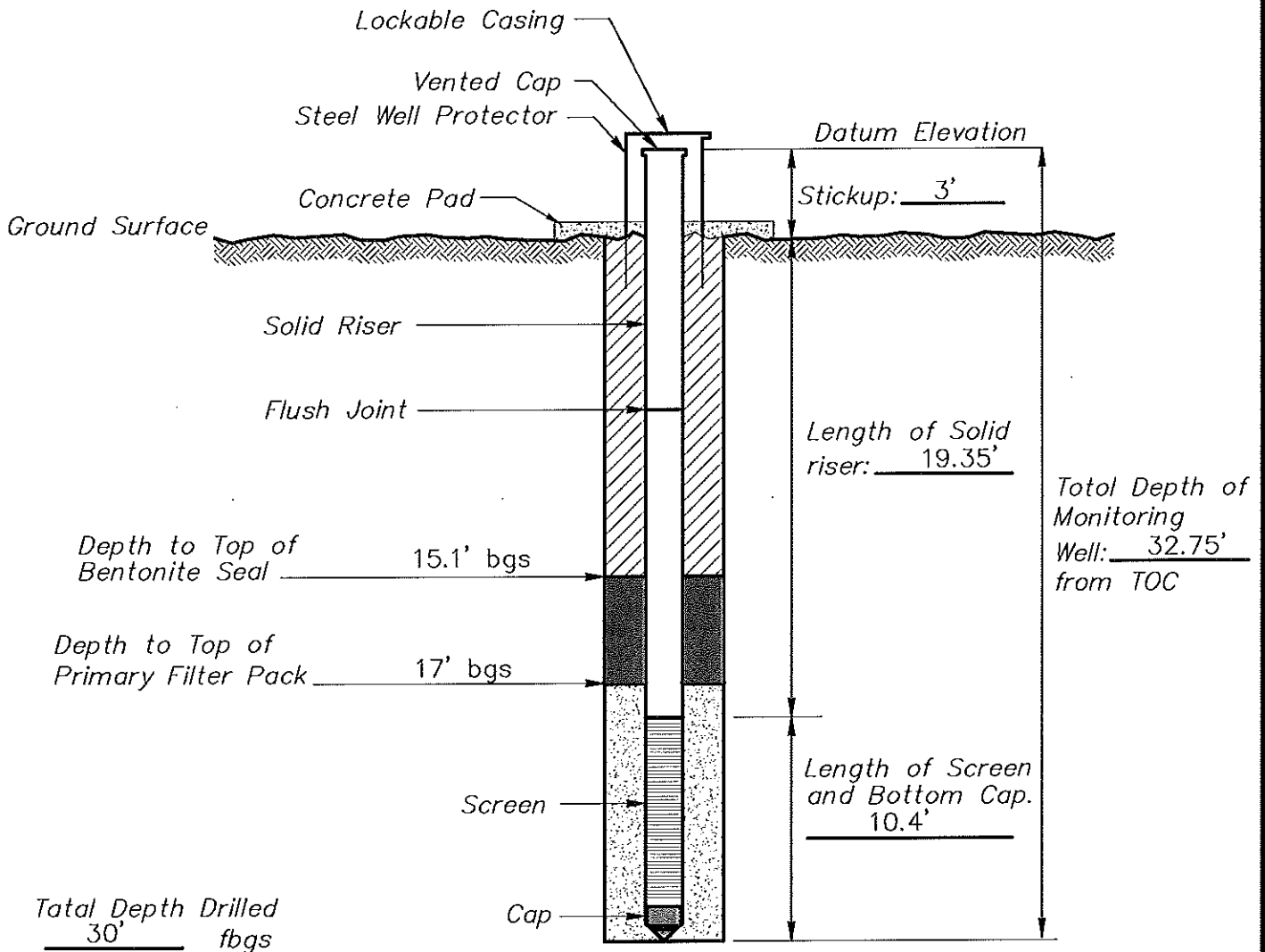
WELL NUMBER: PZ-1 I

DRAWING NUMBER: 003

CHECKED BY: JBA

PIEZOMETER INSTALLATION RECORD

Job Name JOHN W. TURK JR. POWERPLANT - FULTON, AR. Well Number PZ-2 I
 Job Number 35087014 Installation Date 2/26/08 Location PROPOSED CLASS 3N LANDFILL
 Datum Elevation 302.66' Surface Elevation 299.59'
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.020"
 Riser Diameter & Material 2" PVC Borehole Diameter 8.25"
 Granular Backfill Material 20-40 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



- Grout
- Bentonite Plug
- Granular Backfill

(Not to Scale)

Ground Surface Elevation: 299.59
 Northing: 34644.95
 Easting: 28449.62

Terracon

Consulting Engineers and Scientists

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BRYANT, AR 72022
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PIEZOMETER INSTALLATION RECORD

PROJECT NUMBER: 216-002-35087014

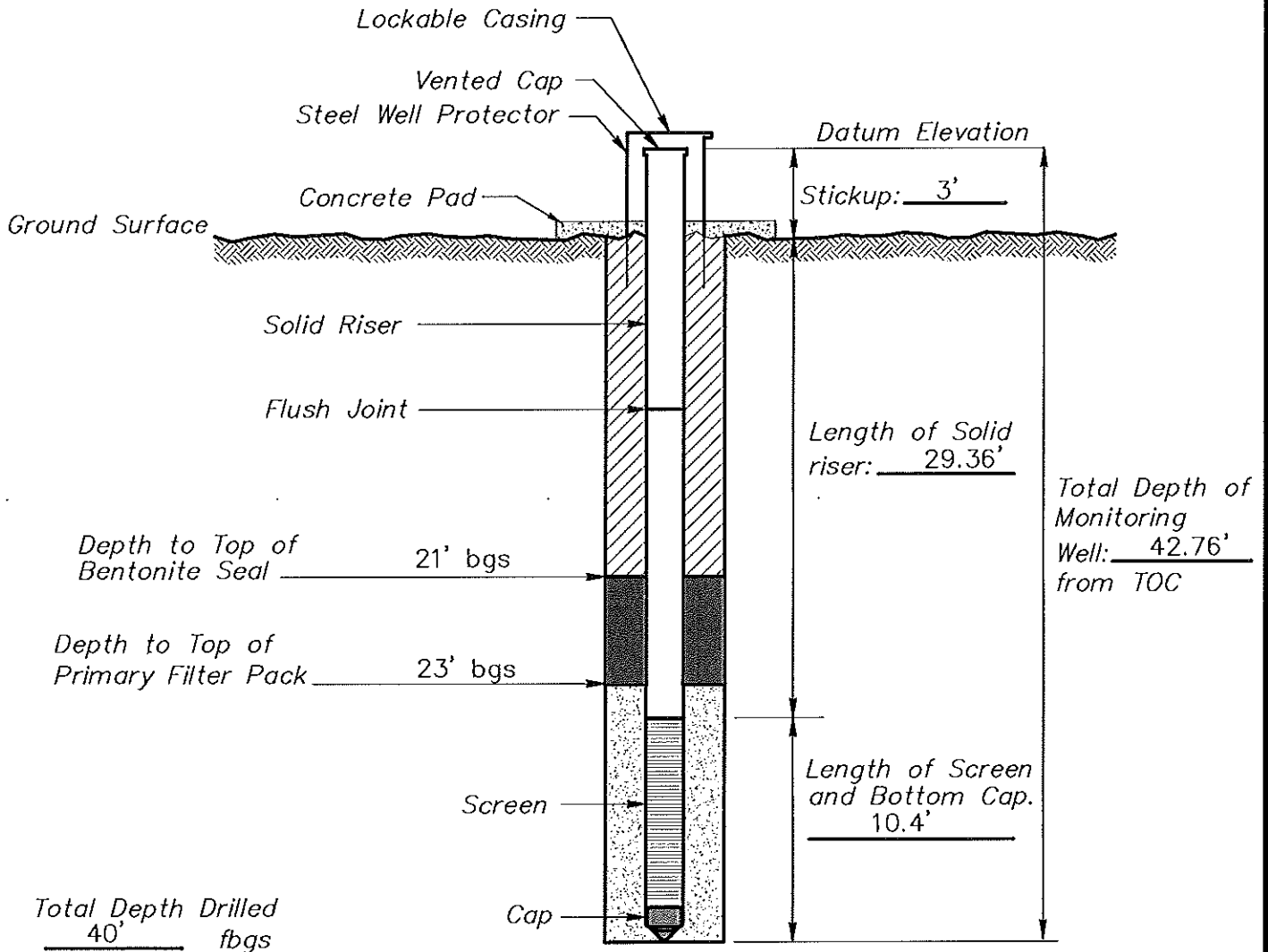
WELL NUMBER: PZ-2 I




DRAWING NUMBER: 006

CHECKED BY: JBA

PIEZOMETER INSTALLATION RECORD

Job Name JOHN W. TURK JR. POWERPLANT – FULTON, AR. Well Number PZ-3 1
 Job Number 35087014 Installation Date 3/4/08 Location PROPOSED CLASS 3N LANDFILL
 Datum Elevation 303.46' Surface Elevation 300.38'
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.020"
 Riser Diameter & Material 2" PVC Borehole Diameter 8.25"
 Granular Backfill Material 20-40 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



-  Grout
-  Bentonite Plug
-  Granular Backfill

(Not to Scale)

Ground Surface Elevation: 300.38
 Northing: 35220.75
 Easting: 29125.72

Terracon
 Consulting Engineers and Scientists

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PIEZOMETER INSTALLATION RECORD

PROJECT NUMBER: 216-002-35087014

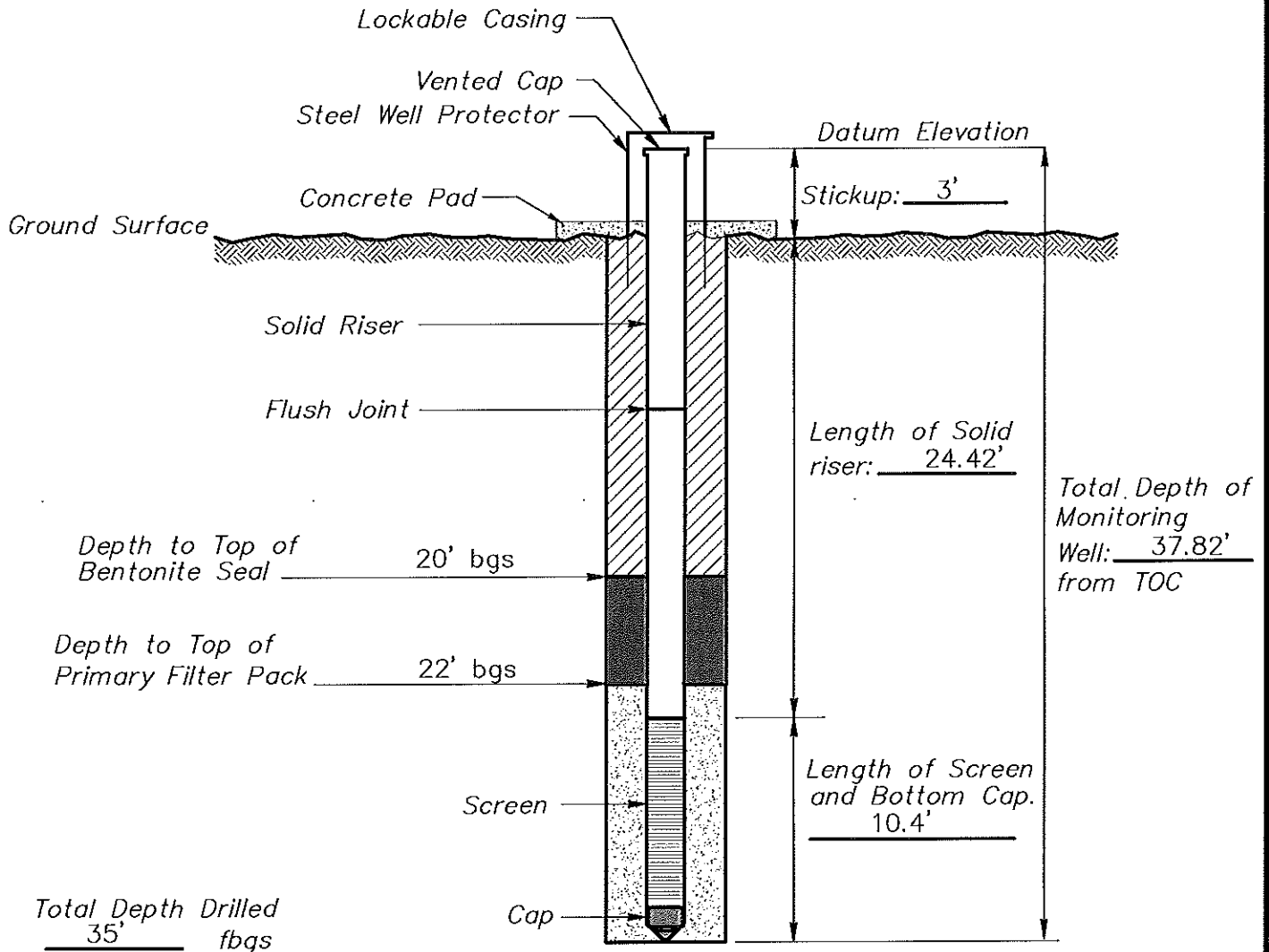
WELL NUMBER: PZ-3 1




DRAWING NUMBER: 008

CHECKED BY: JBA

PIEZOMETER INSTALLATION RECORD

Job Name JOHN W. TURK JR. POWERPLANT – FULTON, AR. Well Number PZ-4 I
 Job Number 35087014 Installation Date 2/25/08 Location PROPOSED CLASS 3N LANDFILL
 Datum Elevation 301.39' Surface Elevation 298.30'
 Datum for Water Level Measurement T.O.C.
 Screen Diameter & Material 2" PVC Slot Size 0.020"
 Riser Diameter & Material 2" PVC Borehole Diameter 8.25"
 Granular Backfill Material 20-40 SAND Terracon Representative JODY ADAMS
 Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



-  Grout
-  Bentonite Plug
-  Granular Backfill

(Not to Scale)

Ground Surface Elevation: 298.30
 Northing: 35219.89
 Easting: 29865.03

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PIEZOMETER INSTALLATION RECORD

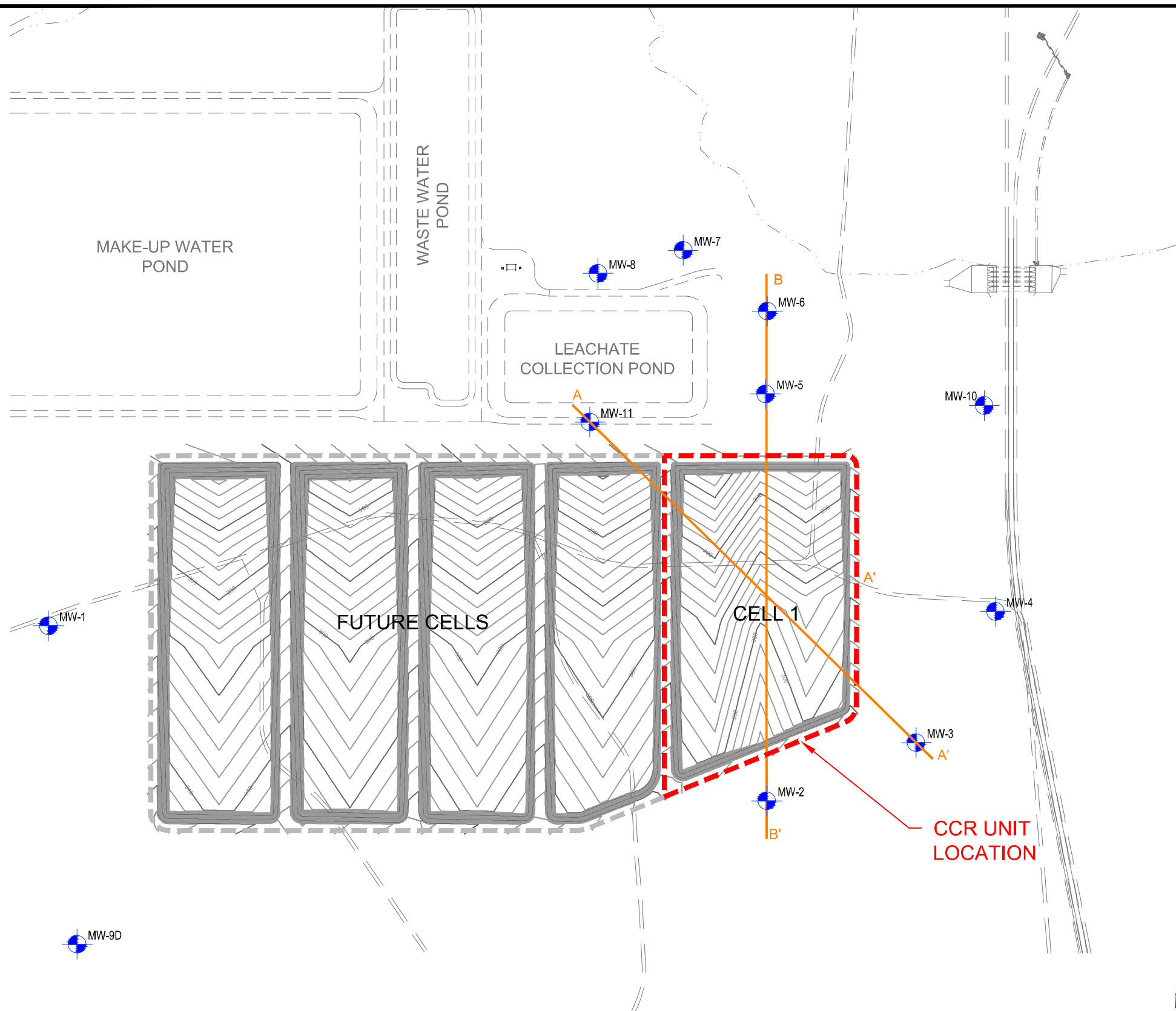
PROJECT NUMBER: 216-002-35087014

WELL NUMBER: PZ-4 I

DRAWING NUMBER: 010

CHECKED BY: JBA

APPENDIX 2
Geologic Cross Sections



- LEGEND:**
- PROPERTY BOUNDARY
 - CCR UNIT BOUNDARY
 - FUTURE CELL BOUNDARY
 - MONITORING WELL

NOTE:
FUTURE CELLS ARE NOT PART OF THE CURRENT CCR UNIT.

SHEET 1	
DESIGNED BY: TLB	DRAWN BY: SRE
APPROVED BY: DCM	SCALE: SEE BARSCALE
DATE: 08-19-16	JOB NO.: 216-002-35157126
ACAD NO.: R-1/201	SHEET NO.: 1 OF 3

GEOLOGICAL CROSS SECTION LOCATION MAP
GROUNDWATER MONITORING NETWORK
AMERICAN ELECTRIC POWER
 JOHN W. TURK, JR. POWER PLANT
 FULTON ARKANSAS

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REV.	DATE	BY	DESCRIPTION

