Report 2 – Evaluation of Location Restrictions

SWEPCO - Flint Creek Primary Bottom Ash Pond
Permit No. 0273-S3N-R2
AFIN: 04-00107

August 2016
Project No. 35157124

Prepared for:
SWEPCO – Flint Creek Power Plant
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ATTACHMENTS

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List of Tables

1.0 Objective

The purpose of this Location Restriction Evaluation Report (LRER) is to evaluate compliance with location restrictions (LR) with the EPA Coal Combustion Residuals (CCR) regulations at the Southwestern Electric Power Company (SWEPCO) – Flint Creek Primary Bottom Ash Pond (Permit No. 0273-S3N-R2).

2.0 Background Information

2.1 Facility Description

The SWEPCO facility consists of an approximately 42.8-acre Primary Bottom Ash Pond along with a 40-acre permitted Class 3N Landfill and various support facilities including entrance roads, leachate and contact water storage ponds, vehicle/equipment facilities, groundwater monitoring facilities, and storm water control systems. The site is located in portions of Section 8, Township 18 North, and Range 33 West in Benton County, Arkansas (**FIGURE 1 & 2**).

2.2 Description of CCR Unit

2.2.1 Embankment Configuration

The Primary Bottom Ash Pond (**See FIGURE 3**) was constructed from 1974 to 1978. The site is situated on a topographically level feature, with a slight slope from northeast to southwest. The surface elevation of the study site is 1100 to 1160 feet above mean sea level (msl). Little Flint Creek enters the subject site along the western portion of the property and flows into the reservoir. The ash pond is divided into two impoundments in series, the Primary Bottom Ash Pond and the Clear Water Pond (non-CCR). The Primary Bottom Ash Pond berm is 820-foot long, the clear water pond is 750-foot long. Surface water runoff from the site is expected to move to the southwest along Little Flint Creek. The primary ash pond embankment is approximately 45 feet deep and the clear water pond embankment is approximately 35 feet deep with a berm crest height of 1155 feet-msl for both. (**Golder Associates Inc., Inspection of the Ash Ponds at Little Flint Creek, November 2015**)[1]

The fill material in the containment berm consists primarily of stiff to very stiff lean clay (CL) or fat clay (CH) with gravel and medium dense clayey gravel (GC) or clayey sand (SC) with gravel overlying native soils which consist primarily of weathered limestone with layers of stiff to hard lean clay (CL) with gravel. The limestone encountered typically consisted of solid layers less than 14 inches thick. The Rock Quality Designation (RQD) of the cores is less than 25%. (**ETTL Engineers and Consultants Inc., Slope Stability Report, Revised August 2010**)[2]

2.2.2 Area/Volume

The Primary Ash Pond is approximately 42.8 acres and Clear Water Pond is approximately 3.7 acres. (**Dewberry & Davis LLC, Coal Combustion Residue Impoundment Round 9 – Dam Assessment Report, December 2011**)[3]

2.2.3 Construction and Operational History

The Primary Bottom Ash Pond was constructed from 1974 to1978. It is used for the management of bottom ash from the coal combustion operations on site. The primary ash pond is approximately 45 feet deep and the clear water pond is approximately 35 feet deep with a berm crest height of 1155 feet-msl for both. The embankment was constructed with 3:1 slopes.

There were no signs of sloughing or slope instability. The crests of both embankments are in good conditions with no obvious depressions in the crest. The riprap on the downstream slope of the Primary pond appears to be in fair conditions, but it is in poor condition along the Secondary Pond due to significant vegetation growth. Two animal burrows were identified on the Primary Pond slope. Sapling trees, 1 to 2-inches in diameter, have established near the shoreline of the Primary Pond embankment, and clusters of 2 to 3-inche diameter trees have established on the slope of the Secondary Pond embankment. No seeps, signs of sloughing, or signs of slope instability were observed. (**Golder Associates Inc., Inspection of the Ash Ponds at Little Flint Creek, November 2015**)[1]

In 2010 a slope stability analysis was conducted on the embankment of the Primary Bottom Ash Pond by ETTL Engineers & Consultants Inc. (ETTL). According to a slope stability analysis performed by ETTL, the site coefficients determined for site class C contained in the IBC, parameters as listed below are recommended by the Code:

Site Coefficients:	Fa = 1.60
	Fv = 2.40
Maximum Earthquake Spectral Response Acceleration Parameters:	SMS = 0.217*
	SM1 = 0.139
Design Spectral Response Acceleration Parameters:	SDS = 0.144
	SD1 = 0.093

*Note: Acceleration used for seismic evaluation.

The minimum factor of safety under static conditions was 1.9, and under seismic conditions was 1.3 (**ETTL Engineers & Consultants Inc., Slope Stability Analysis, August 2010**)[2].

2.2.4 Surface Water Control

Surface Water is controlled by stormwater diversion berms, reinforced letdowns, perimeter ditches (with permanent erosion control matting where necessary), and culverts. A small portion of run-off from the final cover from a southeast portion of the Landfill will flow to the Primary Ash Pond (**Major Modification, Appendix N-I, March 2014 – Rev. 2, Page PN-26, ADEQ Doc ID #65699**)[4].

Discharge

SWEPCO is authorized to discharge through Outfall 101 from ash ponds (bottom ash discharge, low volume wastewater, and stormwater runoff, including coal pile runoff from a facility, treated municipal wastewater from the City of Gentry, and spring water/stormwater) from facility located as follows: approximately 3 miles southwest of Gentry in Benton County, Arkansas to receiving waters named:

Outfall 001: Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.
Outfalls 101 and 401: SWEPCO Reservoir, thence to Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.

The outfalls are located at the following coordinates (NAD 27):

Outfall 001: Latitude: 36° 14' 0.366"; **Longitude:** 94° 33' 05.944"
Outfall 101: Latitude: 36° 14' 59.38"; **Longitude:** 94°31' 34.90"
Outfall 401: Latitude: 36° 15' 29.17"; **Longitude:** 94°31' 33.80"

Discharge shall be in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

2.3 Previous Investigations

- Golder Associates Inc., Inspection of Flint Creek Ash Pond, May 2009
- Dewberry & Davis, LLC, Dam Assessment Report, December 2011
- ETTL Engineers & Consultants Inc., Existing Ash Storage Ponds Embankment Investigations(Revision 2), August 2010.

2.4 Hydrogeologic Setting

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered.

Perched groundwater is occasionally present within the upper unconsolidated soils; however, this perched zone appears discontinuous across the site. Groundwater can occur in both the unconsolidated soils and within the limestone. (**Terracon Well Installation Report, August 2011, pg. 7**)[5]

In the area of the Flint Creek Power Plant, water wells supply rural domestic households. According to state water well records, water wells are typically drilled through the Boone Formation and Chattanooga Shale into the underlying Ordovician age dolomites, due to the low yield of the upper Boone Formation. In general, the total depth of the water wells is approximately 500 feet below ground surface. The water wells are usually cased to allow water production from both the Boone Formation and the Ordovician dolomites. Yields generally range from 2 to 30 gallons per minute (gpm). Some wells within the area have been completed only within the Boone Formation at a typical depth of approximately 200 feet below ground surface. Yields from these wells generally range from 2 to 10 gpm with some wells yielding up to 100 gpm. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[6]

2.4.1 Climate

The Arkansas River Basin lies in a semi-humid region characterized by long summers, relatively short winters, and a wide range of temperatures. Extremes in air temperatures may vary from winter lows around 0°F, usually caused by Canadian air masses to summer highs above 100°F. Extreme temperatures may occur for short periods of time at any location within the study area. The growing season averages 244 days per year.

The average pan evaporation is about 54.9 inches for the Arkansas River Basin. Lake evaporation averages about 69 percent of the class A pan evaporation.

Precipitation is well distributed throughout the year with the driest periods occurring during the late summer and early fall. Mean annual precipitation in the study area ranges from less than 40 inches per year to greater than 52 inches per year (**Arkansas State Water Plan, Arkansas River Basin, pg. 3**)[7].

2.4.2 Regional and Local Geologic Setting

The Site is located in northwest Arkansas in the Springfield Plateau of the Ozark Plateau's Province. The Ozark Plateaus Province covers northern Arkansas and consists of sedimentary rock strata which have undergone massive uplift and which remain relatively horizontal with only minor deformation. Stream erosion has removed much of the original surface rock and typically dissected the area into hills and low mountains. Elevations typically range from 1200 to 1400 feet above mean sea level. Extensive relatively flat areas occur in Benton County (**USCS, Soil Survey of Benton County, Arkansas, January 1977**)[8]. The Site is underlain by the Boone Formation which consists primarily of limestone and chert of Lower Mississippian age. In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as a residual soil overburden. The Boone Formation, in this area, consists of a highly weathered cherty limestone with red to brown clay seams. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[6]

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered. (**FIGURES 4 & 5**)

In the vicinity of the study area, the stratigraphy consists of a weathered residuum of the Boone Formation, overlying the cherty limestone of the Boone Formation (Mississippian). The Boone Formation lies conformably atop the St. Joe Member (Mississippian) and together comprises one hydrostatic unit known as the Boone-St. Joe Aquifer. Unconformably underlying the Boone-St. Joe is the Chattanooga Shale (Devonian), which acts as the upper confining layer of the Sylamore, Clifty, and Everton Aquifers.

In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as residual soil overburden. The Boone residuum is characterized by red (iron-rich) clay, weathered limestone and chert. The thickness of residuum varies from 30 to 50 feet, and the limestone and chert content also varies in lateral extent. The chert is typically the remnant of weathering after the limestone is removed by dissolution in surface and groundwater.

The Boone Formation is a gray, crinoidal limestone abundantly interbedded with gray, black and blue chert. It is massive, well cemented and has a thickness of approximately 280 feet in northwest Arkansas. It is nearly pure calcium carbonate which is soluble, and therefore underground drainage channels, sinkholes, caves and fissures can occur.

The underlying St. Joe Member is typically a light-gray, mud-supported Crinozoan-Bryozoan crystalline limestone, and is easily recognized by its lack of chert. In Northern Arkansas, the formation exhibits a thickness of between 6 to 84 feet, with an average of thickness of 45 feet.

The underlying Chattanooga Shale is a black, fissile and carbonaceous rock with abundant pyrite. It thickens (up to 70 feet) westward and acts as a barrier to vertical groundwater flow (**Nature and Extent Groundwater Monitoring Well Installation Report, Terracon. August 2011**)[9].

2.4.3 Surface Water/Groundwater Interactions

Based on water level elevations, groundwater flow across the pond is to the west. Currently there is not enough data to determine if there is surface water to groundwater communication.

2.4.4 Water Users

A spring and well survey was conducted on November 11, 1991. The area within one-quarter mile of the Site was searched for springs, flowing streams, lakes, ponds, and water wells. **FIGURE 11** includes the results of the survey. A more recent search of an Arkansas USGS water well database provided additional wells

The closest water well was located approximately 1995 feet from the landfill boundary. No springs were located during the spring and well survey. When questioned, plant personnel knew of no springs within the survey area. All streams within the survey area are intermittent and were dry at the time of the survey.

Three large ponds are present within the survey area. The pond located in the SW 1/4 of the NW1/4 of Section 9 contains little water and is used for farming purposes. The plant's bottom ash storage pond is located in the SW1/4 of the NE1/4 of Section 9. The third pond is in the northern portion of the SE1/4 of the SE1/4 of Section 5. Two smaller ponds are also present in the SW1/4 of the SER of Section 5, and in the NW1/4 of the NE1/4 of Section 8. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21**)[10]

3.0 Required Isolation from Uppermost Aquifer

3.1 Aquifer Description and Piezometric Analysis

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered.

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A cross section map (**FIGURE 5**) was constructed based on monitoring well seasonal high water levels, and a potentiometric surface map were constructed (**FIGURE 6**) based on the latest sampling event water levels. The monitoring well water level data from the past five years are illustrated in **TABLE 1**. Groundwater elevation drops gradually to the west across the Primary Bottom Ash Pond. The lowest point of the Primary Bottom Ash Pond is approximately 1110 feet amsl. Based on the potentiometric surface map, the lowest groundwater elevation is 1137 feet amsl and ranges to greater than 1145 feet amsl. Therefore, according to the available data, a five foot separation between the Primary Bottom Ash Pond and the groundwater table has not been established.

3.2 Compliance

Based on the cross sections and potentiometric surface map of the Primary Bottom Ash Pond, the seasonal high water levels are less than five feet below the lowest point of the Primary Bottom Ash Pond and generally rise above the bottom of the pond throughout. The Primary Bottom Ash Pond does not meet the five foot separation requirements set forth by 40 CFR 257 §257.60.

4.0 Wetlands Impact

4.1 Review of Local Wetlands (Based on Available reports, no field work planned)

According to 40 CFR 232 §232.2, *Wetlands* means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. The CCR unit was not identified to be located within any wetland regions according to the National Wetlands Inventory (NWI) (**FIGURE 7)**.

4.2 Compliance (Is/Is Not Located in or Impacting a Wetland, with Rationale)

Since there are no wetlands identified by NWI on the CCR site, the site meets the requirements set by 40 CFR 257 §257.61

5.0 Fault Area

5.1 Description of Regional Geologic Structural Features and Tectonic History

The Site is located in northwest Arkansas in the Springfield Plateau of the Ozark Plateau's Province. The Ozark Plateaus Province covers northern Arkansas and consists of sedimentary rock strata which have undergone massive uplift and which remain relatively horizontal with only minor deformation. Stream erosion has removed much of the original surface rock and typically dissected the area into hills and low mountains. Elevations typically range from 1200 to 1400 feet above mean sea level. Extensive relatively flat areas occur in Benton County (**USCS, Soil Survey of Benton County, Arkansas, January 1977**)[8]. The Site is underlain by the Boone Formation which consists primarily of limestone and chert of Lower Mississippian age. In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as a residual soil overburden. The Boone Formation, in this area, consists of a highly weathered cherty limestone with red to brown clay seams. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[6]

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered.

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St. Joe is the Chattanooga Shale (Devonian), which acts as the upper confining layer of the Sylamore, Clifty, and Everton Aquifers.

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The Boone Formation is a gray, crinoidal limestone abundantly interbedded with gray, black and blue chert. It is massive, well cemented and has a thickness of approximately 280 feet in northwest Arkansas. It is nearly pure calcium carbonate which is soluble, and therefore underground drainage channels, sinkholes, caves and fissures can occur.

The underlying St. Joe Member is typically a light-gray, mud-supported Crinozoan-Bryozoan crystalline limestone, and is easily recognized by its lack of chert. In Northern Arkansas, the formation exhibits a thickness of between 6 to 84 feet, with an average of thickness of 45 feet.

The underlying Chattanooga Shale is a black, fissile and carbonaceous rock with abundant pyrite. It thickens (up to 70 feet) westward and acts as a barrier to vertical groundwater flow (**Nature and Extent Groundwater Monitoring Well Installation Report, Terracon. August 2011**)[9].

Based on the Geologic Map of Arkansas, 1993, there are no active faults within the Holocene time period within 200 feet of the CCR site (**FIGURE 8**).

5.2 Compliance (Is/Is Not Located within 200 feet (or alternate distance from Fault Area, with Rationale)

The Primary Bottom Ash Pond is not located within 200 feet from the outermost damage zone of a fault that has had displacement in Holocene time (**FIGURE 8**). The site is in compliance with 40 CFR 257 §257.62.

6.0 Seismic Impact Zone

6.1 Seismic Impact Zone – Definition and Regional Information

Seismic impact zone means an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years as defined by 40 CFR 257 §257.53. The site is not located within a seismic impact zone (**FIGURE 9**).

6.2 Compliance (Is/Is Not Located in a Seismic Impact Zone, with Rationale)

The Primary Bottom Ash Pond is not located in a seismic impact zone. The site is in compliance with 40 CFR 257 §257.53.

7.0 Unstable Areas

7.1 Unstable Areas – Definition and Review of Local Conditions

Unstable area means a location that is susceptible to natural or human induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains as defined by 40 CFR 257 §257.64.

Applicability – Owners or operators of existing or new CCR surface impoundments or any lateral expansion of a CCR unit must not be located in an unstable area. The owner or operator must consider the following factors, at a minimum, when determining whether an area is unstable: (1) On-site or local soil conditions that may result in significant differential settling; (2) On-site or local geologic or geomorphologic features; and (3) On-site or local human-made features or events (both surface and subsurface). The following sections analyze each of these factors as they relate to the surface impoundment.

7.1.1 – On-Site and Local Soil Conditions

The site soil conditions at the Flint Creek facility do not meet the criteria for unstable conditions. Unstable conditions are usually associated with geological conditions such as Karst features. Characteristic physiographic features associated with Karst terrain such as sinkholes, sinking streams, caves, large springs, and blind valleys are not present on the site. **Section 2.3.2** of this document describes the local and regional soil properties. **FIGURE 10** is a soil map of the CCR unit.

7.1.2 – On-Site or Local Geologic or Geomorphic Features

Based on the site specific boring logs, as well as published local and regional geologic and geomorphic information, there are no known on-site or adjacent geologic or geomorphic features which could adversely affect the stability of the surface impoundment as defined by 40 CFR 257 §257.64. Information regarding the hydrogeologic, geologic and geotechnical conditions in the vicinity of the site are described in detail in **Section 2.3.2** of this document.

7.1.3 – On-Site or Local Human-Made Features or Events Affecting Stability

Based on the site specific observations, as well as, published local and regional information, there are no known on-site or local human-made features or events which could adversely affect the stability of the surface impoundment as defined by 40 CFR 257 §257.64.

7.2 Compliance (Is/Is Not Located in Unstable Area, with Rationale)

Looking at previous investigations, including slope stability analysis, hydrogeologic, and geotechnical reports, the site is not located in an unstable area. The site is in compliance with 40 CFR 257 §257.64.

8.0 Summary and PE Certification

8.1 Summary

The Flint Creek Power Plant was constructed from 1974 to 1978 and began disposing of ash from power production in 1978. The facility has a Primary Bottom Ash Pond totaling approximately 42.8 acres that is used for management of bottom ash from the coal combustion operations. The site is underlain by the Boone Formation consisting of primarily limestone and chert. In this area of the Boone Formation there is highly weathered cherty limestone with red to brown clay seams. The Primary Bottom Ash Pond does not meet the five foot separation requirement. There are no wetlands identified by NWI on the site. There are no active faults within 200 feet of the site. The Primary Bottom Ash Pond is not located in a seismic impact zone. The site soil conditions at the Flint Creek facility do not meet the criteria for unstable conditions.

8.2 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.

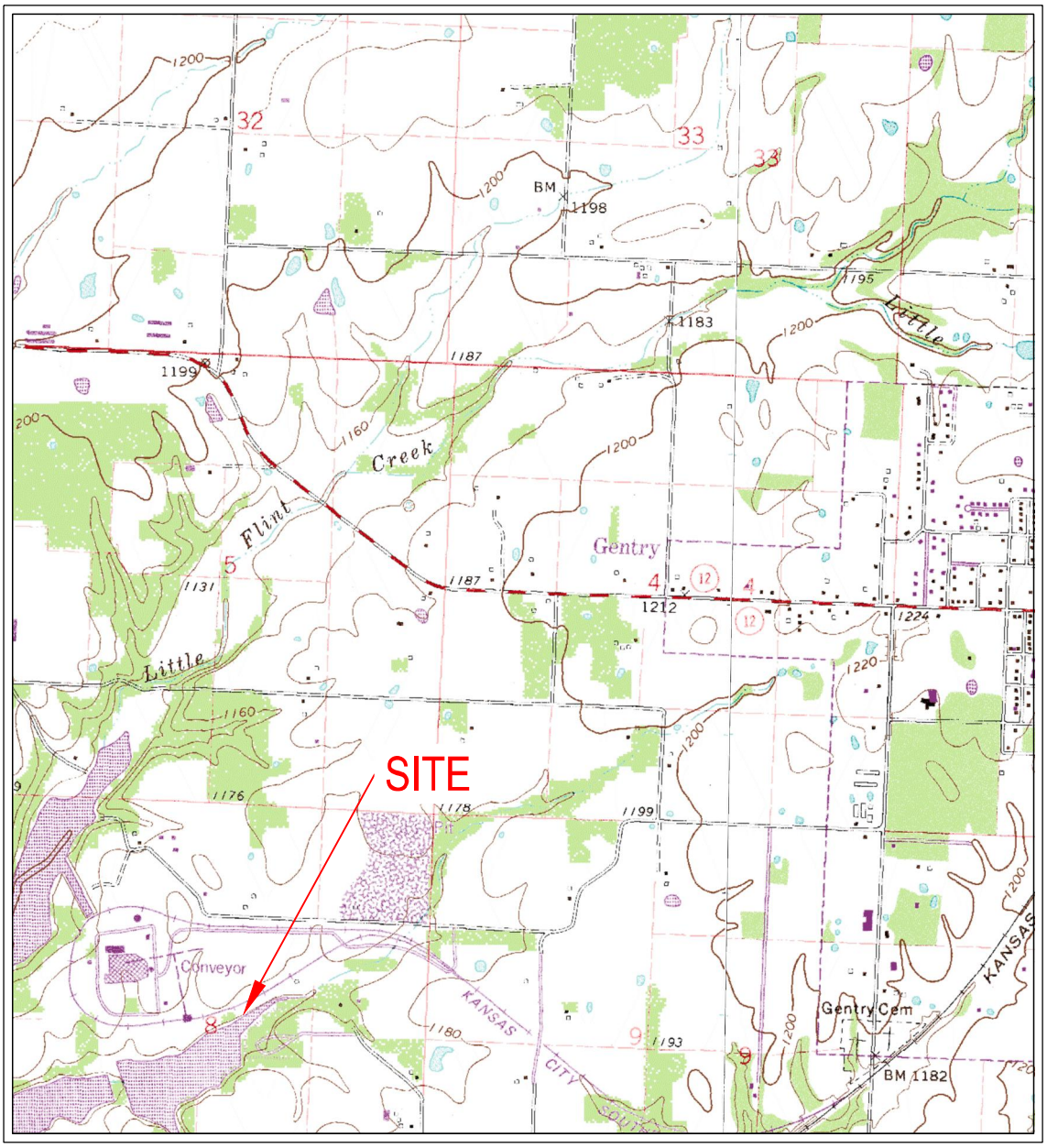
8.3 PE Certification

Name: D. C. McCormick	Date: 8/5/16	
Company: Terracon COA #223	Expiration Date: 12/31/17	Stamp

Bibliography

1 Golder Associates Inc., Inspection of Flint Creek Ash Pond, May 2009
2 ETTL Engineers and Consultants Inc., Slope Stability Report, Revised August 2010
3 Dewberry & Davis LLC, Coal Combustion Residue Impoundment Round 9 – Dam Assessment Report, December 2011
4 Major Modification, Appendix N-I, March 2014 - Rev2, page N-I, ADEQ Doc ID# 65699
5 Terracon Well Installation Report, August 2011, pg. 7
6 Burns & McDonnel Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20
7 Arkansas State Water Plan, Arkansas River Basin, pg. 3
8 USCS, Soil Survey of Benton County, Arkansas, January 1977
9 Nature and Extent Groundwater Monitoring Well Installation Report, Terracon. August 2011
10 Burns & McDonnel Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21

UNITED STATES – DEPARTMENT OF THE INTERIOR – GEOLOGICAL SURVEY



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CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

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CHEROKEE CITY QUADRANGLE 1982 7.5 MINUTE SERIES (TOPOGRAPHIC)

Project Mngr: DCM Drawn By: TLB Checked By: DCM Approved By: DCM	Project No. 216-001-35157124 Scale: AS SHOWN File No. 001 Date: 5-25-2016	Terracon Consulting Engineers and Scientists 25809 I-30 SOUTH BRYANT, AR 72022 PH. (501) 847-9292 FAX. (501) 847-9210	SITE LOCATION MAP LOCATION RESTRICTION EVALUATION AMERICAN ELECTRIC POWER SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND GENTRY ARKANSAS	FIG. No. 1

FIGURE 2

DESIGNED BY:	TLB
DRAWN BY:	TLB
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	5-25-2016
JOB NO.	216-001-35157124
ACAD NO.	002
SHEET NO.:	2 OF 11

PLANT AND CCR UNIT LOCATION MAP

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
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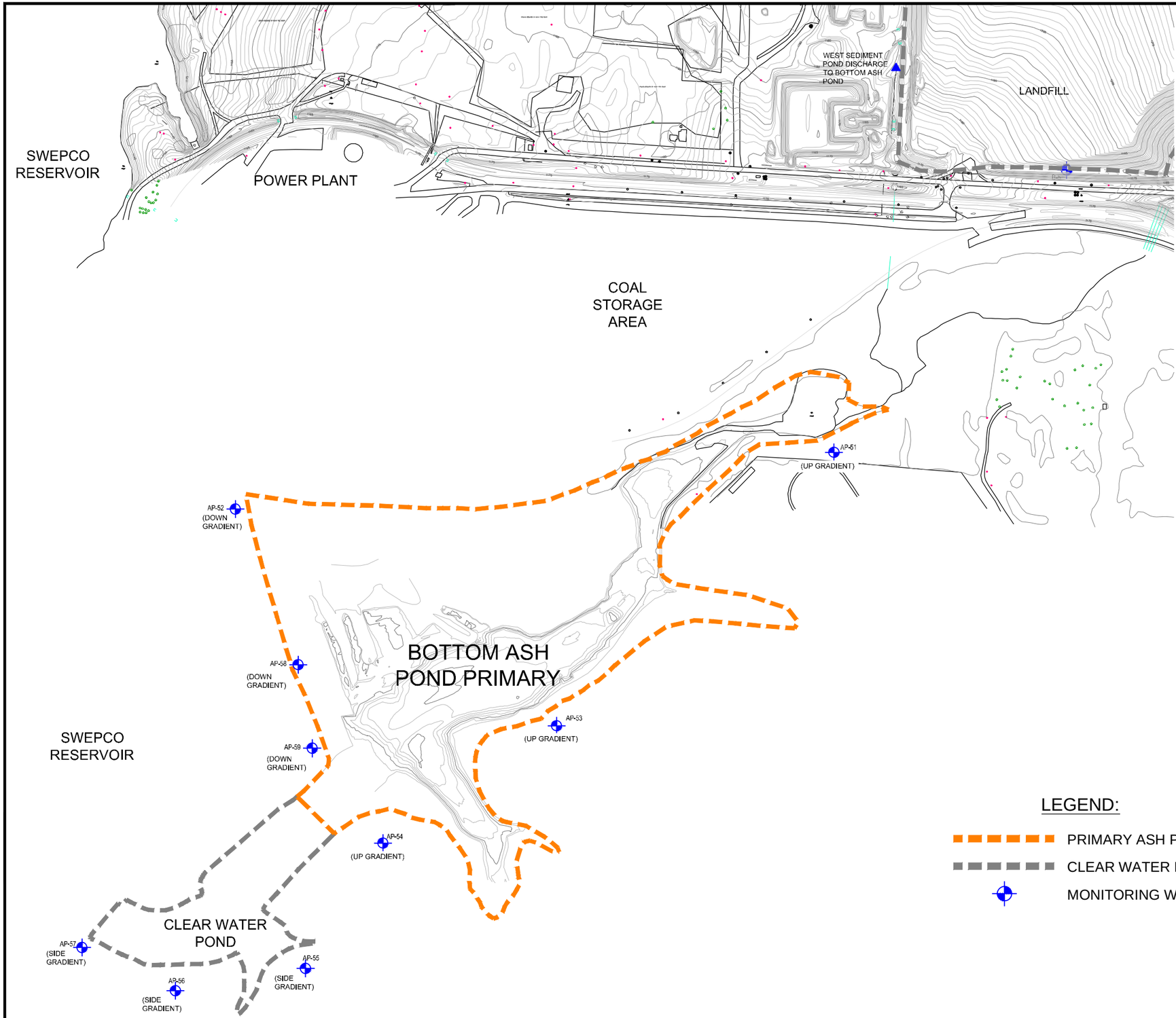
REV.	DATE	BY	DESCRIPTION



LEGEND:

- PRIMARY ASH POND BOUNDARY (THIS REPORT)
- CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
- MONITORING WELL

FIGURE 3

DESIGNED BY:	TLB
DRAWN BY:	TLB
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	5-25-2016
JOB NO.	216-001-38157124
ACAD NO.	003
SHEET NO.:	3 OF 11

CCR UNIT AND WELL LOCATIONS

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

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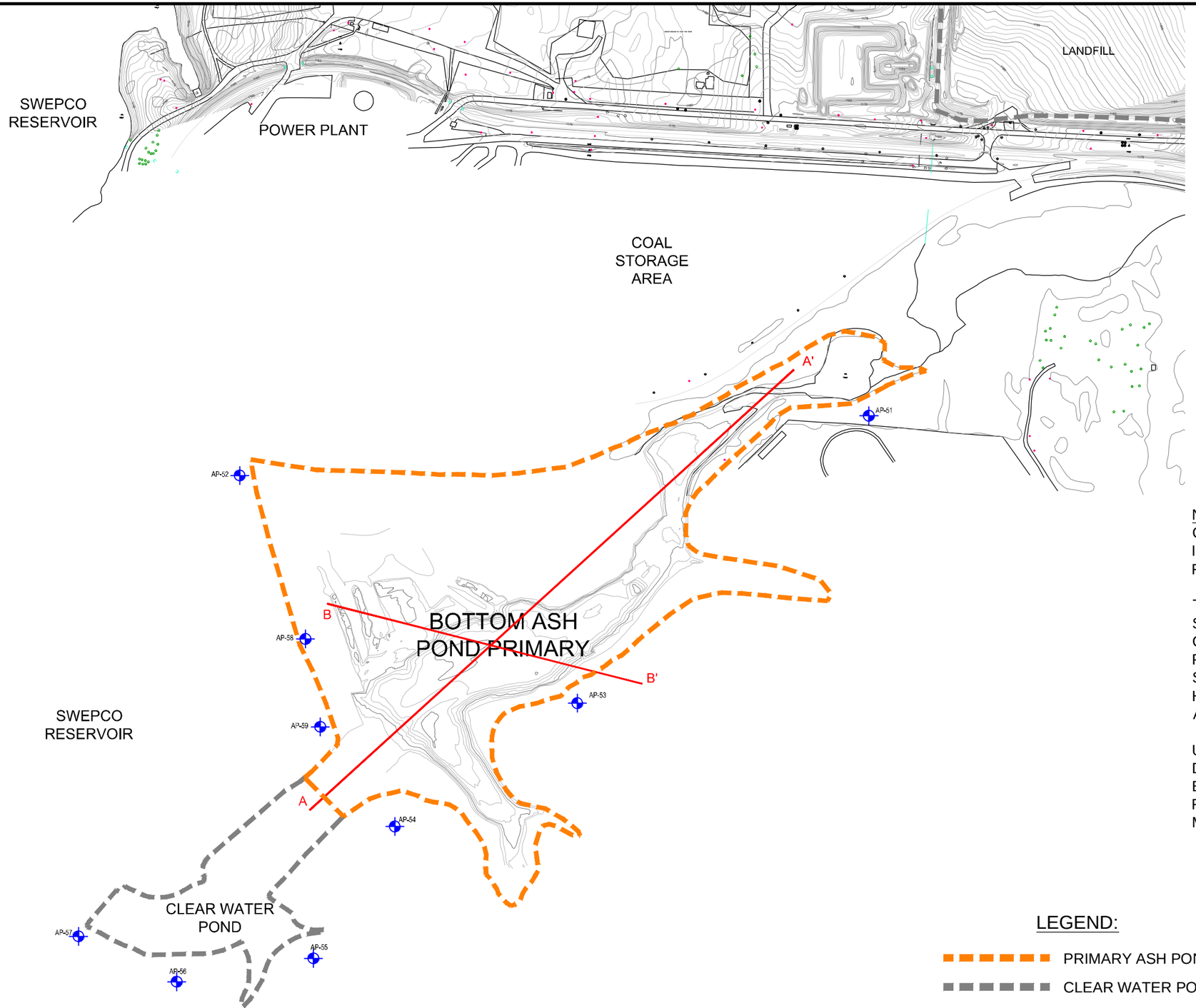
REV.	DATE	BY	DESCRIPTION



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SCALE IN FEET

NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE 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 APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

LEGEND:

- PRIMARY ASH POND BOUNDARY (THIS REPORT)
- CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
- CROSS SECTION LOCATION
- MONITORING WELL

FIGURE 4

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	5-25-2016
JOB NO.	216-001-38157124
ACAD NO.	004
SHEET NO.:	4 OF 11

CROSS SECTION LOCATION MAP

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY
ARKANSAS

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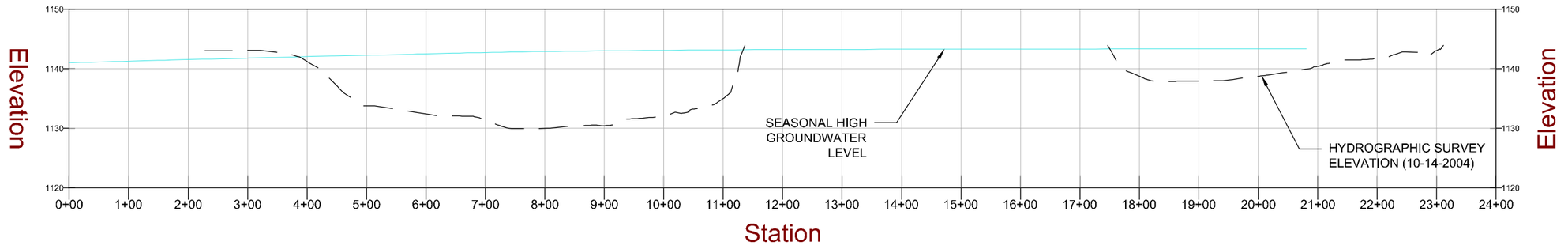
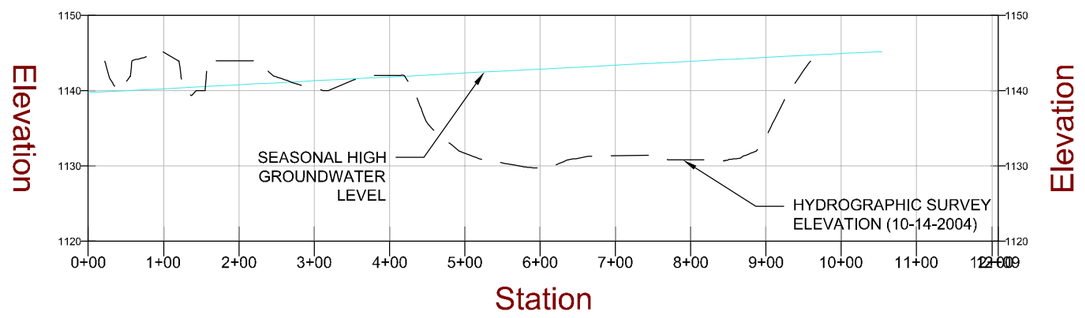
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

SECTION A-A'



SECTION B-B'



NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE 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 APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15,2016.

FIGURE 5

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JOB NO.	216-001-38157124
ACAD NO.	005
SHEET NO.:	5 OF 11

CROSS SECTIONS

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

Terracon
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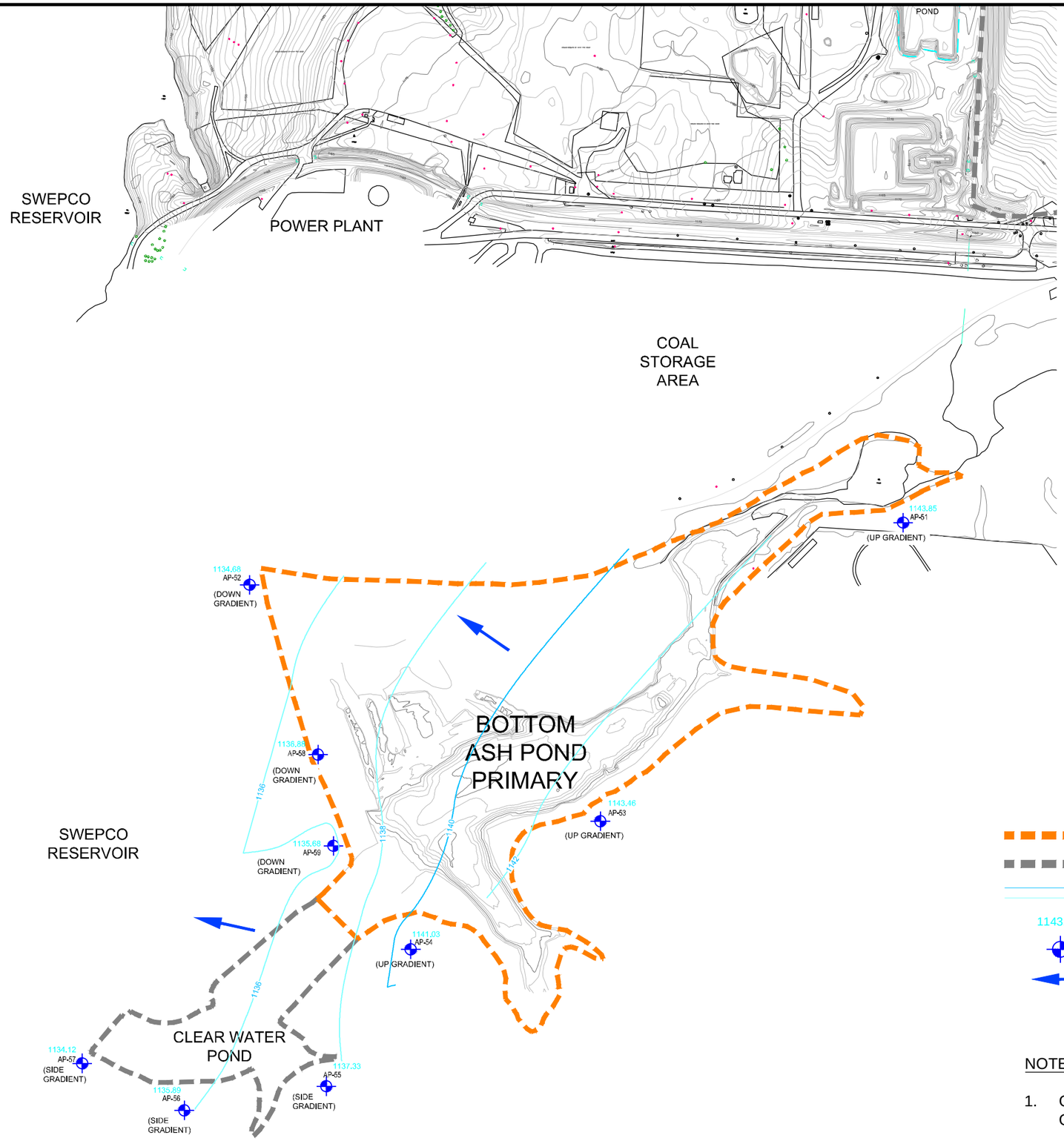
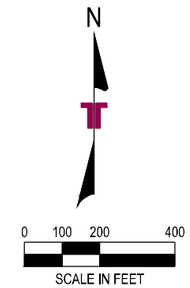
REV.	DATE	BY	DESCRIPTION





LEGEND:

- PRIMARY ASH POND BOUNDARY (THIS REPORT)
- CLEAR WATER POND/LANDFILL BOUNDARY (OTHERS NEARBY)
- GROUNDWATER CONTOURS
- 1143.46 GROUNDWATER ELEVATION
- MONITORING WELL
- GROUNDWATER FLOW DIRECTION

NOTE:

1. GROUNDWATER ELEVATIONS TAKEN FROM SAMPLING EVENT ON MARCH 15, 2016.

FIGURE 6

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ACAD NO.	006
SHEET NO.:	6 OF 11

POTENTIOMETRIC SURFACE MAP - UPPERMOST AQUIFER

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

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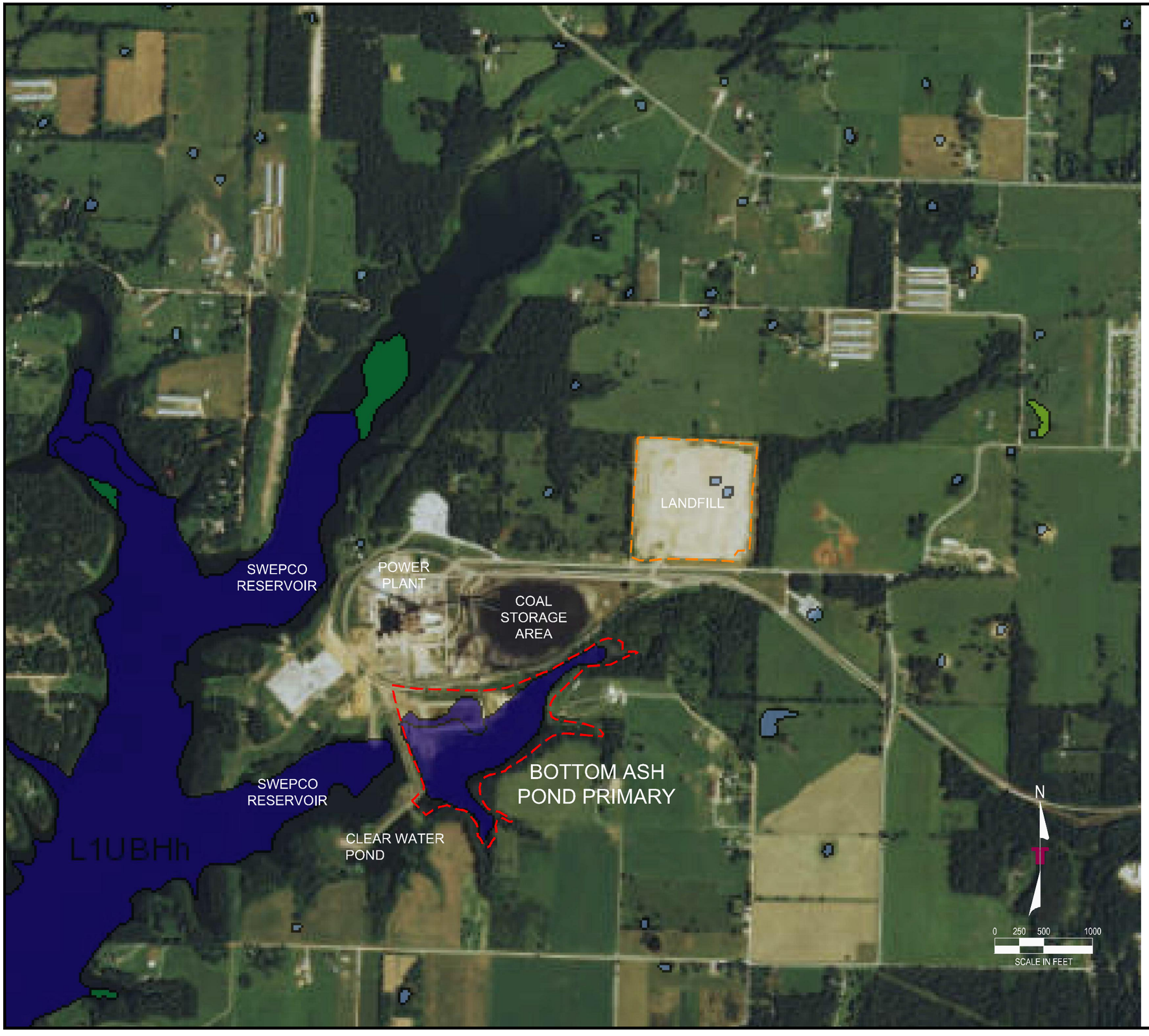

Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

FIGURE 7

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NEARBY WETLANDS MAP

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT LANDFILL

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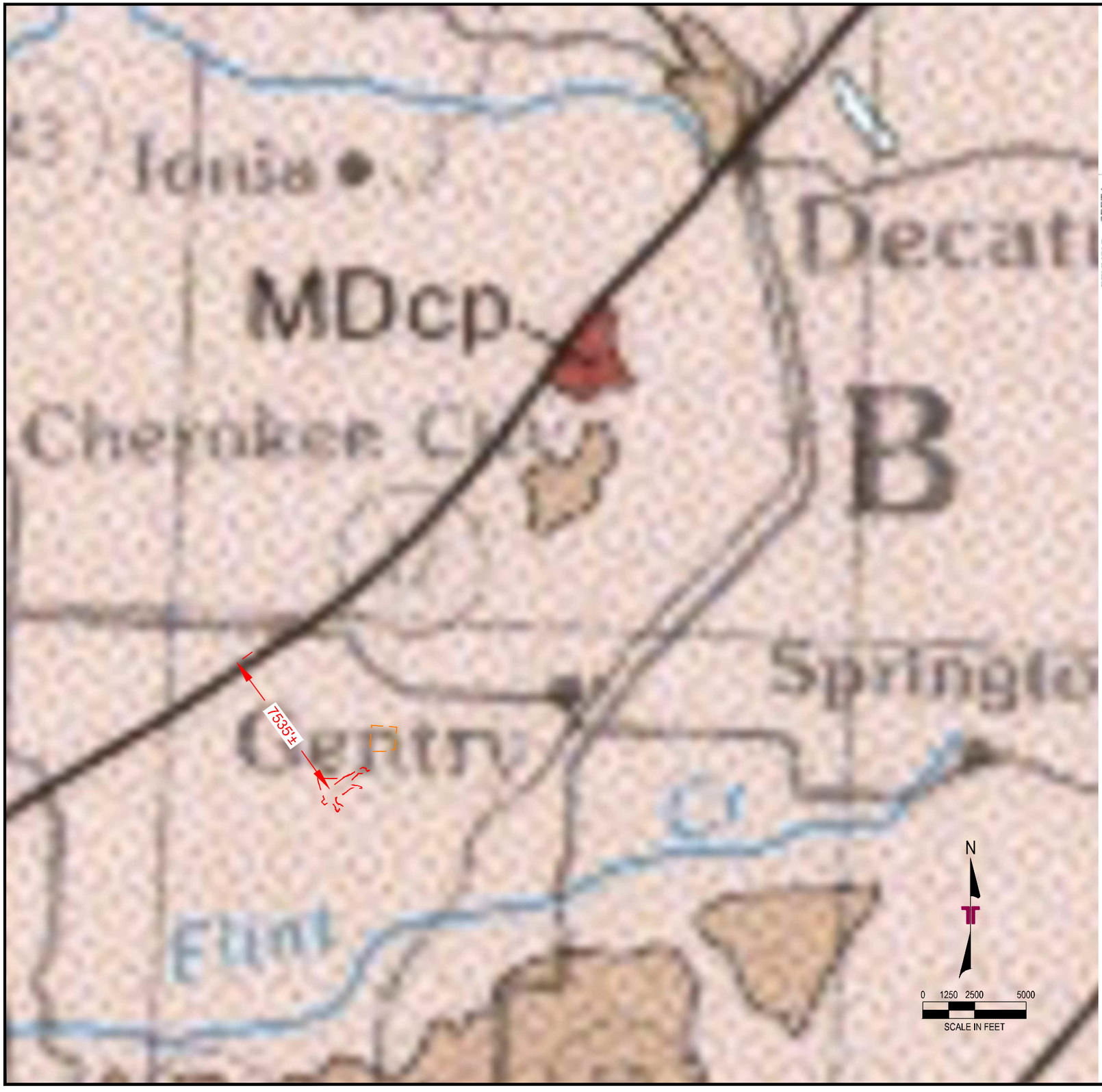
REV.	DATE	BY	DESCRIPTION



OZARK REGION

QUATERNARY		Qat	**Alluvium and terrace deposits**—Alluvial deposits of present streams and on one or more terrace levels
TERTIARY	Pleistocene and Holocene	Tg	**Gravel**—Gravel on isolated hills within 40 miles (64 km) of the Mississippi Embayment. Many small deposits to the west not shown
CRETACEOUS	Upper Cretaceous	Ksc	**Sand and clay**
		Kr	**Cretaceous rocks**
PENNSYLVANIAN	Atokan	Pa	**Atoka Formation**
	Morrowan	Pbh	**Bloyd Shale, and Prairie Grove Member of the Hale Formation**
		Phc	**Cane Hill Member of the Hale Formation**
MISSISSIPPIAN	Chesterian	Mpfb	**Pitkin Limestone, Fayetteville Shale (including the Wedington Sandstone Member), and Batesville Sandstone (including the Hindsville Limestone Member)**
	Meramecian	Mr	**Ruddell Shale**
		Mm	**Moorefield Formation**
		Mb	**Boone Formation**
DEVONIAN	Osagean	MDcp	**Chattanooga Shale (Lower Mississippian and Upper Devonian), Clifty Limestone (Middle Devonian), and Penters Chert (Lower Devonian)**
SILURIAN		Slsb	**Lafferty, St. Clair, and Brassfield Limestones**
ORDOVICIAN		Ocj	**Cason Shale and Fernvale Limestone (Upper Ordovician) and Kimmswick Limestone, Plattin Limestone, and Joachim Dolomite (Middle Ordovician)**
		Ose	**St. Peter Sandstone and Everton Formation (Middle Ordovician)**
	Lower Ordovician	Op	**Powell Dolomite**
		Ocjc	**Cotter and Jefferson City Dolomites**

SYMBOLS

Contact

Normal Fault

Thrust fault—Also cross fault in some areas, dashed under Lake Ouachita to show continuity

PREPARED COOPERATIVELY BY THE
ARKANSAS GEOLOGICAL COMMISSION
NORMAN F. WILLIAMS, DIRECTOR
AND THE
UNITED STATES GEOLOGICAL SURVEY
DALLAS A. PECK, DIRECTOR

GEOLOGIC MAP OF ARKANSAS

By

Boyd R. Haley, U.S. Geological Survey

Assisted by Ernest E. Glick, U.S. Geological Survey
and William V. Bush, Benjamin F. Clardy, Charles G. Stone,
Mac B. Woodward, and Doy L. Zachry, Arkansas Geological Commission

1993
(Revised from the 1976 edition)

FIGURE 8

NEARBY FAULT LOCATIONS MAP

LOCATION RESTRICTION EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

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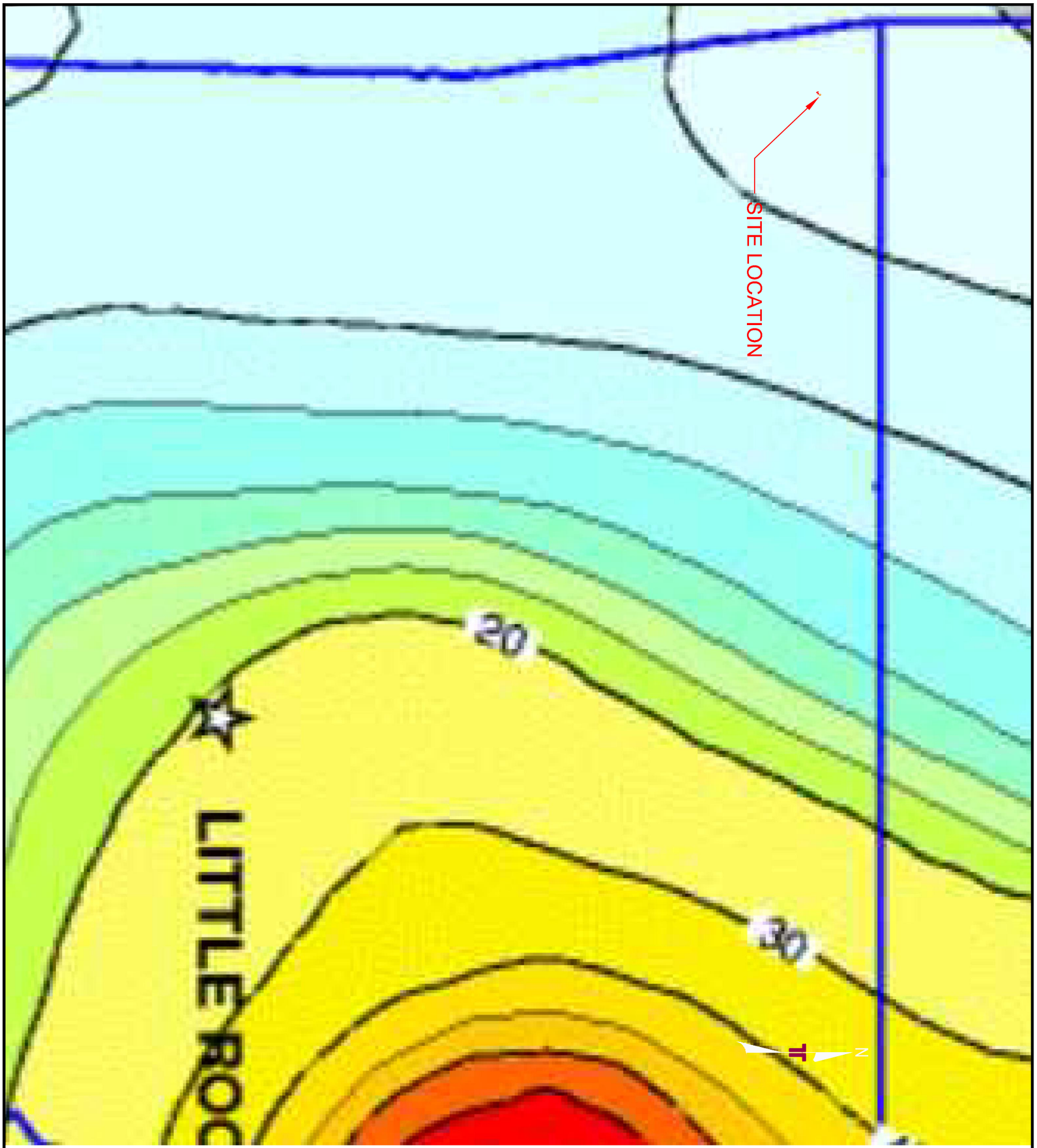

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NEARBY SEISMIC IMPACT ZONES

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

FIGURE 9

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DATE:	5-25-2016
JOB NO.	216-001-35157124
ACAD NO.	009
SHEET NO.:	9 OF 11

JERALD SHEA RD.

Jerald Shae

SWEPCO PLANT RD.

COUNTY RD. 486

TAYLOR ORCHARD RD

POWER PLANT

LANDFILL

NORTH SEDIMENT POND

WEST SEDIMENT POND

SWEPCO RESERVOIR

SWEPCO RESERVOIR

COAL STORAGE AREA

BOTTOM ASH POND PRIMARY

CLEAR WATER POND

N

0 150 300 600

SCALE IN FEET

Benton County, A	
Map Unit Symbol	**Map Unit Name**
BtC	Britwater gravelly silt loam, 3 to 8 percent slopes
CnB	Captina silt loam, 1 to 3 percent slopes
Cs	Cherokee silt loam
CvF	Clarksville extremely gravelly silt loam, 12 to 50 percent slopes
Eg	Elsah soils, occasionally and frequently flooded
Hf	Healing silt loam, occasionally flooded
LrC	Linker fine sandy loam, 3 to 8 percent slopes
NfC	Nixa very gravelly silt loam, 3 to 8 percent slopes
NfD	Nixa very gravelly silt loam, 8 to 12 percent slopes
NoD	Noark very gravelly silt loam, 8 to 12 percent slopes
PeC	Peridge silt loam, 3 to 8 percent slopes
Se	Secesh gravelly silt loam, occasionally flooded
TsC	Tonti gravelly silt loam, 3 to 8 percent slopes

FIGURE 10

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SHEET NO.:	10 OF 11

NEARBY UNSTABLE AREAS

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

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REV.	DATE	BY	DESCRIPTION

NEAREST DOMESTIC WELL LOCATION

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

FIGURE 11

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REV.	DATE	BY	DESCRIPTION

TABLE 1
AEP – Flint Creek
Primary Bottom Ash Pond
Groundwater Elevations (FMSL)

Well	AP-51	AP-52	AP-53	AP-54	AP-55	AP-56	AP-57	AP-58	AP-59
Date									
7/20/2011	1144.38	1134.59	1145.13	1142.71	1139.16	1136.90	1134.72		
10/26/2011	1143.72	1131.70	1142.57	1140.03	1136.80	1133.71	1131.37		
1/24/2012	1144.41	1134.85	1145.28	1141.57	1139.01	1136.53	1134.95		
4/25/2012	1144.23	1137.08	1142.88	1140.79	1138.74	1087.86	1137.24		
7/31/2012	1143.60	1133.35	1143.19	1140.75	1136.59	1134.94	1133.27		
10/24/2012	1142.56	1131.67	1141.35	1137.99	1135.18	1132.36	1130.20		
1/29/2013	1141.08	(dry)	1139.86	1136.43	1133.83	1130.78	1129.74		
4/23/2013	1145.20	1136.01	1143.28	1141.11	1140.83	1139.10	1136.30		
8/13/2013	1143.67	1133.40	1143.29	1140.59	1138.25	1137.03	1135.92		
10/21/2013	1143.48	1134.74	1144.49	1142.07	1137.29	1135.89	1134.96		
1/29/2014	1144.12	1134.68	1143.69	1141.30	1138.76	1137.30	1135.80		
4/30/2014	1142.45	1135.04	1140.98	1137.81	1135.77	1135.72	1135.25		
7/23/2014	1144.04	1134.64	1143.57	1140.99	1138.56	1137.23	1135.71		
10/16/2014	1143.87	(dry)	1144.42	1142.71	1142.13	1138.36	1135.32		
1/20/2015	1143.45	(dry)	1144.19	1142.82	1141.87	1137.80	1134.75		
4/28/2015	1144.27	(dry)	1142.73	1140.23	1138.55	1137.23	1136.50		
7/22/2015	1145.15	1138.77	1143.23	1140.90	1139.87	1138.75	1137.35		
10/20/2015	1140.13	(dry	1143.70	1141.39	1136.91	1135.73	1133.83		
3/15/2016	1143.85	1134.68	1143.46	1141.03	1137.33	1135.89	1134.12	1136.88	1135.68
Seasonal High	1145.20	1138.77	1145.28	1142.82	1142.13	1139.10	1137.35	1136.88	1135.68