Location Restrictions Demonstration Report - Wetlands, Fault Areas, Seismic Impact Zone and Unstable Areas
Bottom Ash Settling Area

Jeffrey Energy Center

Prepared for: Westar Energy
Jeffrey Energy Center
St. Marys, Kansas

Prepared by:
APTIM Environmental & Infrastructure, Inc.

October 2018

TABLE OF CONTENTS

LIST OF FIGURES AND APPENDICES

FIGURES

APPENDICES

1.0 INTRODUCTION AND PURPOSE

The Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule (CCR Rule) 40 CFR §257.60 through §257.64 requires owner/operators of existing CCR surface impoundments to make demonstrations in the event a unit is located in certain areas. The purpose of this report is to demonstrate whether the Bottom Ash Settling Area (Unit) at Westar Energy's (Westar) Jeffrey Energy Center (JEC) is located in any of those areas, and if so, to make certain demonstrations per the CCR Rule that will permit continued CCR disposal/management operations.

The Unit, which is an existing CCR surface impoundment, is located at the JEC near St. Marys, Kansas, as indicated in **Figure 1**.

APTIM Environmental & Infrastructure, Inc. (APTIM) has reviewed available historical reports as provided in **Section 6.0**, and completed a site visit in May 2018 to develop this report. This report provides the demonstrations necessary to document CCR Rule requirements outlined in 40 CFR §257.61 through §257.64 to determine if the Unit is located in an area:

- in wetlands (40 CFR §257.61);
- within 200 feet of the outermost damage zone of a fault which has been displaced in Holocene time (40 CFR §257.62);
- within a seismic impact zone (40 CFR §257.63); and
- in an unstable area (40 CFR §257.64).

A demonstration for the aquifer location restriction (40 CFR §257.60) is provided in a separate report for this Unit by Haley & Aldrich, October, 2018.

The applicable CCR Rule requirement for each of the above is listed in the respective section in italics followed by an explanation of the review and determinations completed by APTIM.

2.0 WETLANDS (§257.61)

§257.61 (a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section."

A Certified Wetland Delineator visited the Unit on August 22, 2018 to determine if any area within the boundary of the Unit is potentially located in an existing wetland area, as defined in 40 CFR §232.2. Details of the area inspected are presented in **Figure 2**. Based on the conclusions during the site visit and wetland inspection, APTIM determined that the Unit is not located within an existing wetland area. Consequently, no additional demonstration is necessary.

3.0 FAULT AREAS (§257.62)

§257.62 (a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

APTIM compared the location of the Unit to the location of faults from the Holocene time, as shown in the United States Geologic Survey (USGS) Quaternary Fault and Fold Database for the United States. The nearest fault area is indicated on **Figure 3**. Based on this review, APTIM determined the Unit is not located within 200 feet of the outermost damage zone of a fault that has had displacement in the Holocene time. Consequently, no additional demonstration is necessary.

4.0 SEISMIC IMPACT ZONE (§257.63)

§257.63 (a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

APTIM compared the location of the Unit to the location of seismic impact zones, as defined in §257.53, using the USGS map "Two Percent Probability of Exceedance in 50 Years Map of Peak Ground Acceleration" shown in **Figure 4**. The location of the Unit in relation to the nearest seismic impact zones (i.e. in areas of at least 0.1 g) is shown on the Figure in light blue. Based on this review, APTIM determined the Unit is not located within a seismic impact zone. Consequently, no additional demonstration is necessary.

5.0 UNSTABLE AREAS (§257.64)

§257.64 (a) An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that

recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

APTIM evaluated the location of the Unit for the presence of on-site or local unstable areas as defined in §257.53. Evaluations of the conditions listed in §257.64(b)(1) through (3) were evaluated and are discussed below. Based on this review, APTIM determined the Unit is not located within an unstable area as defined in §257.53. Consequently, no additional demonstration is necessary.

257.64 (b) The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:

5.1 Unstable Factors Considered: Differential Settling (§257.64(b)(1))

On-site or local soil conditions that may result in significant differential settling;

APTIM has visited the Unit and evaluated site-specific reports detailing the conditions of the on-site and local soils for conditions that could result in significant differential settling. The Unit is located on approximately 10 feet of weathered shale overlying a bedrock composed of alternating shale and limestone (Black & Veatch, 2016). Based on this information, a review of the available geotechnical data for the Unit (Black & Veatch, 2016 and 2009), and a lack of significant overburden material above the bedrock, APTIM's professional opinion is that the Unit should not experience significant differential settlement and is not located within an area that should result in significant differential settlement. Pertinent documents and sections of reports are provided in **Appendix A.1**.

5.2 Unstable Factors Considered: Geologic/Geomorphologic Features (§257.64(b)(2))

On-site or local geologic or geomorphologic features; and

APTIM visited the Unit in May 2018 in addition to evaluating the most recent USGS Topographic Map; and reviewing site-specific reports characterizing the site geology (Black & Veatch, 2016 and Burns & McDonnell, 2009) and structural stability (Haley & Aldrich, 2016) for the presence of on-site or local geologic and geomorphologic features such as karst terrain, steep slopes, and sinkholes. The Unit is underlain by approximately 10 feet of weathered shale, and alternating layers of shale and limestone bedrock ranging in thickness from approximately 10 to 40 feet each. The groundwater flow is predominantly towards the West, with the uppermost aquifer characteristics consisting of limestone approximately 20 to 33 ft in thickness (Burns & McDonnell, 2009). A review of the terrain at or near the Unit indicated no steep slopes, terrain features, or other local geologic or geomorphologic features that could feasibly result in an unstable condition. The visit and references indicated that while the Unit is underlain by limestone, there are no known near surface karst terrain or sinkholes in the area, nor is this area of Kansas known to have near-surface karst terrain or sinkholes. Based on a review of this information and the site visit, APTIM has concluded that there are no steep slopes, terrain features, or other local geologic or geomorphologic features that could feasibly result in an unstable condition. Pertinent documents and sections of documents reviewed are provided in **Appendix A.2**.

5.3 Unstable Factors Considered: Human-made Features or Events (§257.64 (b)(3))

On-site or local human-made features or events (both surface and subsurface).

APTIM visited the Unit in May 2018 as well as evaluated published data and site-specific reports for the presence of on-site or local human-made features or events (both surface and subsurface), including surface and subsurface mining, extensive oil and gas extractions, and sources of rapid groundwater drawdown that could feasibly impact the Unit. Documents and websites reviewed include:

- Kansas Geological Survey, Water Wells Interactive Map
- Kansas Geological Survey, Oil and Gas Wells and Fields Interactive Map
- Kansas Geological Survey, Industrial Minerals – Pottawatomie County
- Haley & Aldrich (2017), CCR Groundwater Monitoring Network Description for the Jeffrey Energy Center

It is noted that there are no records of any surface or subsurface mining, oil and gas extractions and/or groundwater drawdowns near the Unit. Following a review of these documents, APTIM determined that there are no on-site or local human-made features or events (both surface and subsurface) that could feasibly result in an unstable condition at the Unit. Pertinent documents and sections of documents reviewed are provided in **Appendix A.3**, and indicate the location of the Unit in relation to the known on-site or local human-made features or events (both surface and subsurface).

6.0 REFERENCES

Black & Veatch (2009), Bottom Ash Settling Berm Inspection and Engineering Evaluation Report, Jeffrey Energy Center. Referred to in text Per (Black & Veatch 2009).

Black & Veatch (2016), Initial Safety Factor Assessment Report, Bottom Ash Settling Area, Jeffrey Energy Center. Referred to in text Per (Black & Veatch 2016).

Burns & McDonnell Engineering Company, Inc. (2009), Final Phase II Hydrogeologic Investigation and Bottom Ash Pond Characterization, Permit No. 359 Update, Jeffrey Energy Center, Westar Energy, Inc., Pottawatomie, Kansas.

Haley & Aldrich (2017), CCR Groundwater Monitoring Network Description for the Jeffrey Energy Center.

Haley & Aldrich (2016), Initial Periodic Structural Stability Assessment Bottom Ash Area 1 Impoundment Jeffrey Energy Center.

U.S. Environmental Protection Agency (2015), Hazardous Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, Federal Register Volume 80, No. 74 40 CFR Parts 257 and 261, April 17, 2015.

7.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION (§257.61(b), 257.62(b), 257.63(b), 257.64(c))

The undersigned registered professional engineer is familiar with the requirements of the CCR Rule and has visited and examined the Unit and/or has supervised examination of the Unit and development of this report by appropriately qualified personnel. I hereby certify based on a review of available information and observations, that this report meets the requirements of paragraphs §257.61(a), 257.62(a), 257.63(a) and 257.64(a).

Name of Professional Engineer: Richard Southorn, P.E., P.G.

Company: APTIM

PE Registration State: Kansas

PE Registration Number: 25201

Professional Engineer Seal:

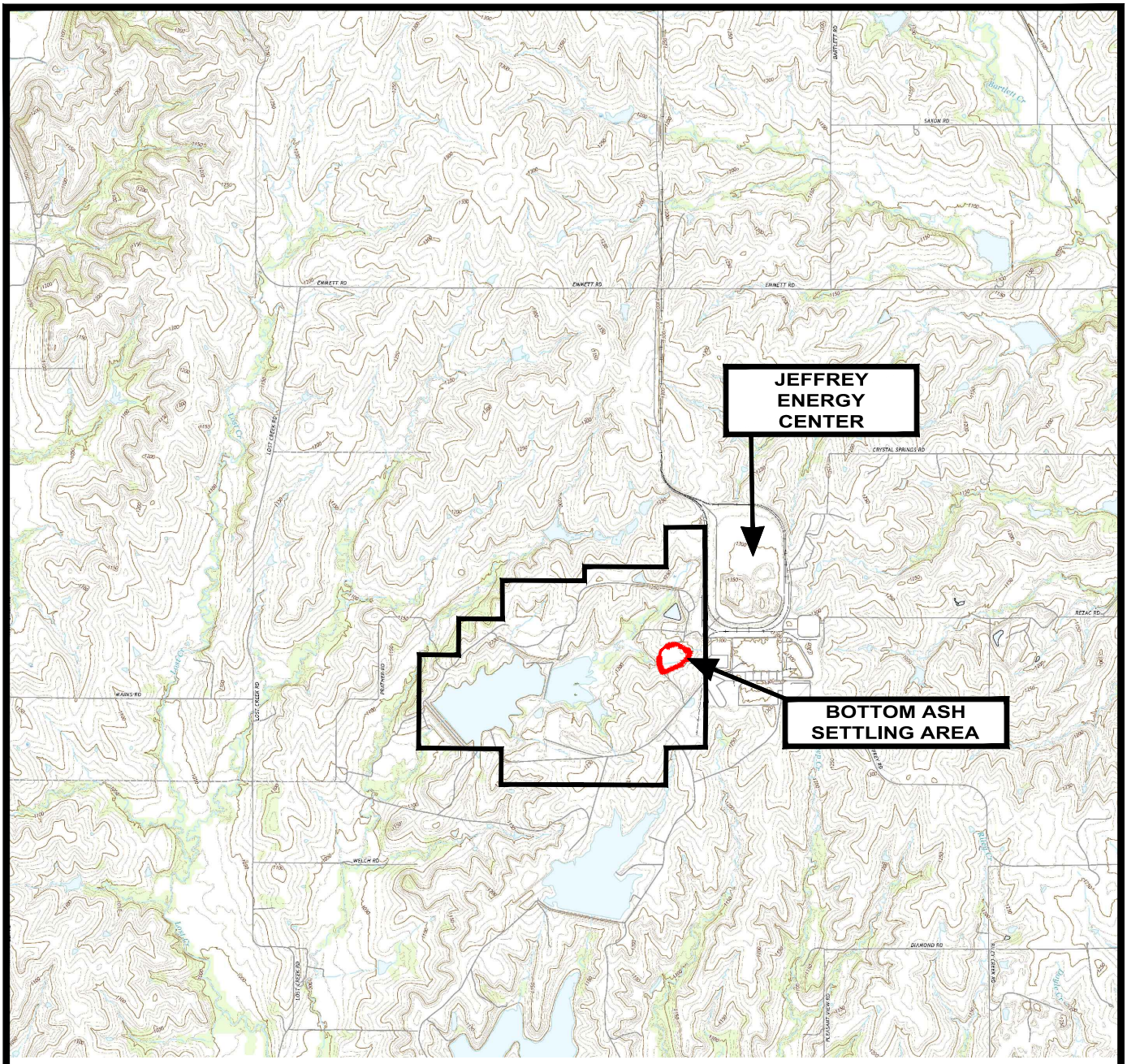
10/15/2018

Richard Southorn

Digitally signed by Richard Southorn
Date: 2018.10.16 16:20:54 -05'00'

APTIM

FIGURES



LEGEND

CCR UNIT BOUNDARY

KDHE-BWM INDUSTRIAL LANDFILL PERMIT NO. 0359 BOUNDARY

N

0 5000'

GRAPHIC SCALE

NOTES

1. AERIAL TOPO OBTAINED FROM USGS 7.5-MINUTE SERIES, EMMETT AND LACLEDE QUADRANGLE, KANSAS, 2014.
2. ALL BOUNDARIES ARE APPROXIMATE.

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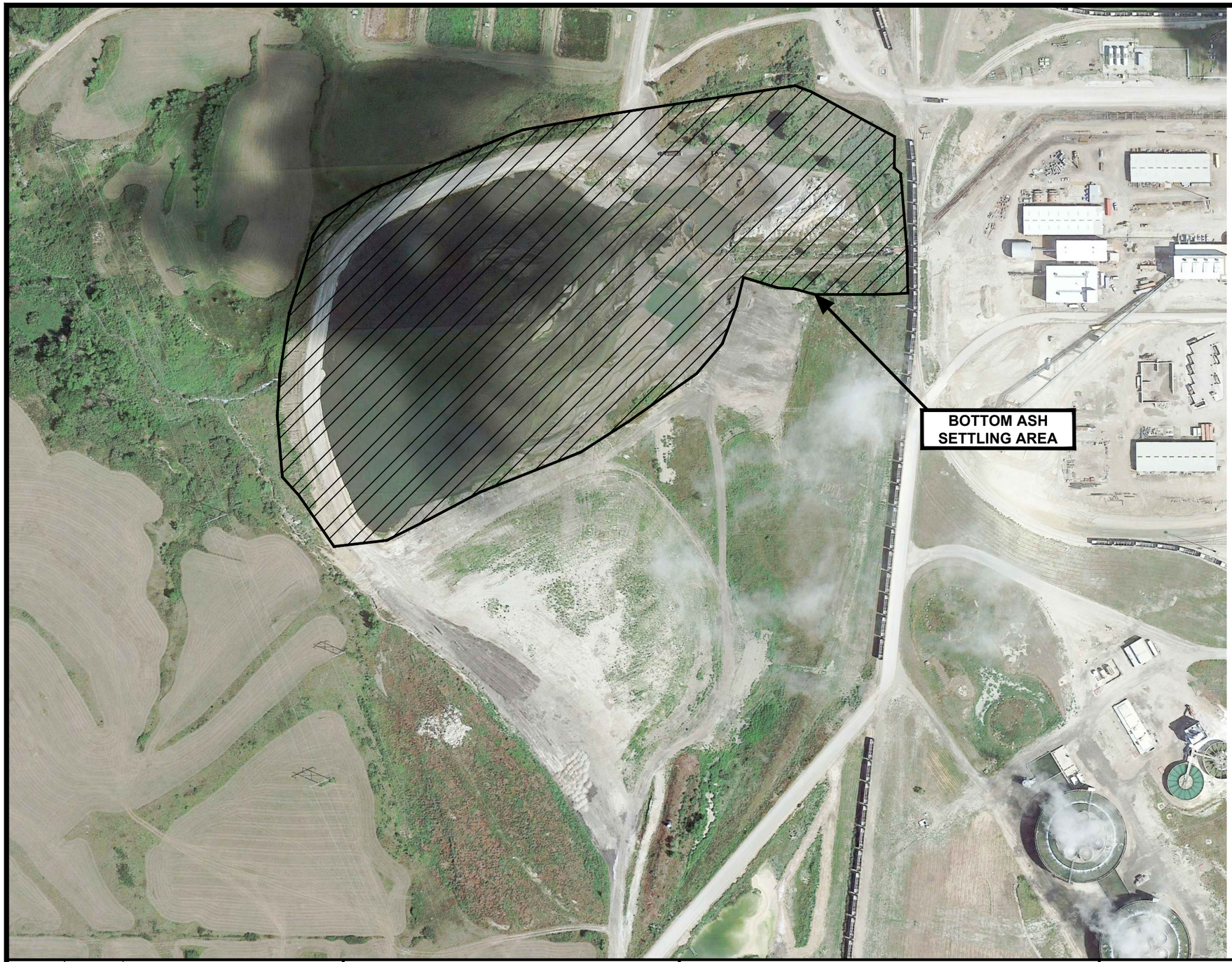
FIGURE 1
SITE LOCATION MAP

APPROVED BY: RDS	PROJ. NO.: 631236340	DATE: SEPT. 2018



N

0 250'

GRAPHIC SCALE

LEGEND

AREAS FOUND NOT TO INCLUDE WETLANDS BASED ON INSPECTION

NOTES

1. GOOGLE EARTH IMAGE DATED AUGUST 2014.
2. ALL BOUNDARY LOCATIONS ARE APPROXIMATE.
3. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.

REV. NO.	DATE	DESCRIPTION

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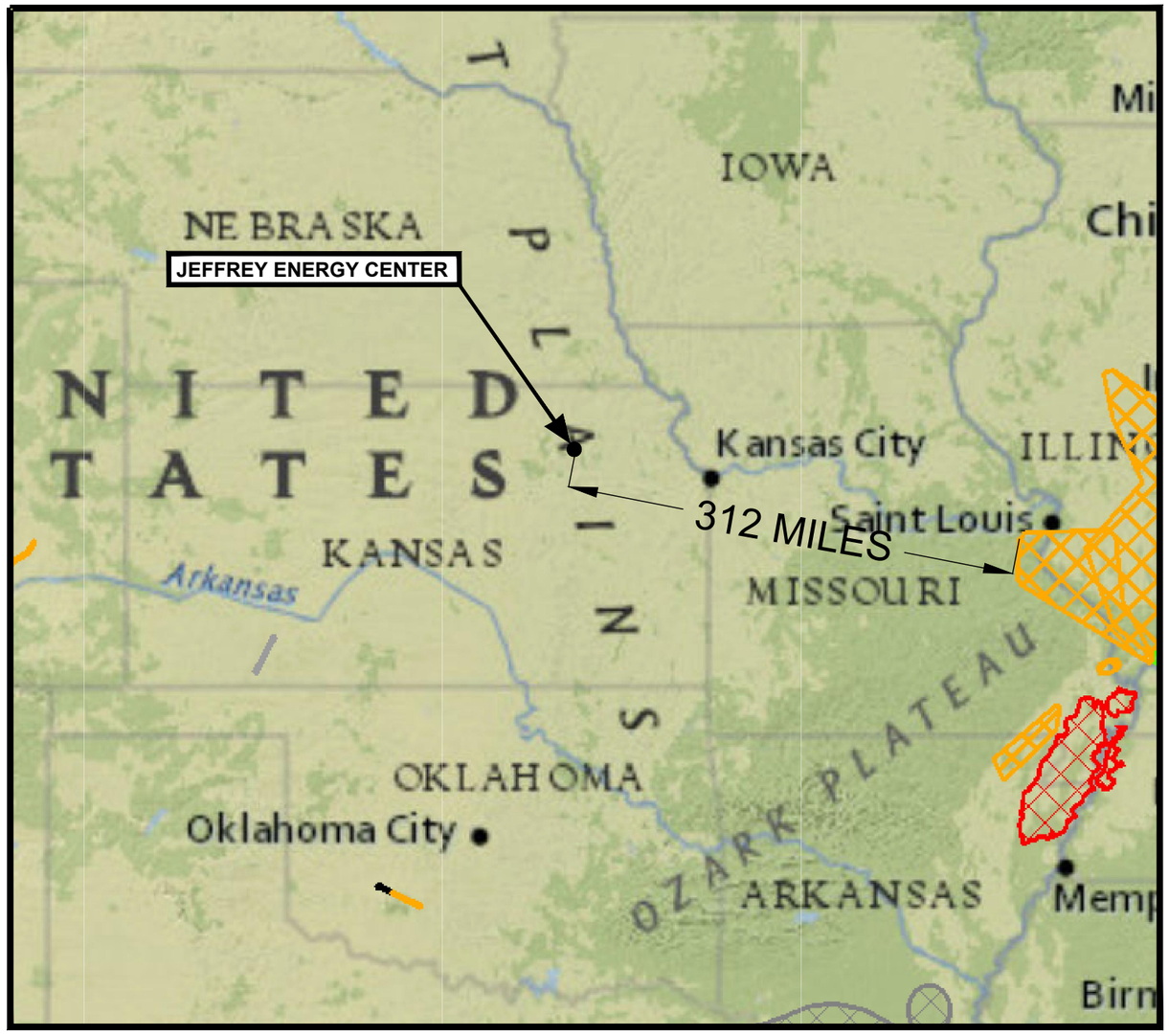
FIGURE 2
MAP OF WETLANDS INSPECTION AREA

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	631236340	DATE:	OCTOBER 2018

T:\AutoCAD\Projects\Westar Energy\Jeffrey\Compliance Reports\Bottom Ash Settling Area\Location Demonstration\FIGURE 2 - WETLANDS.dwg, 10/15/2018 8:16:11 AM, _AutoCAD PDF (General Documentation).pc3

USGS QUATERNARY FAULTS AND FOLDS DATABASE



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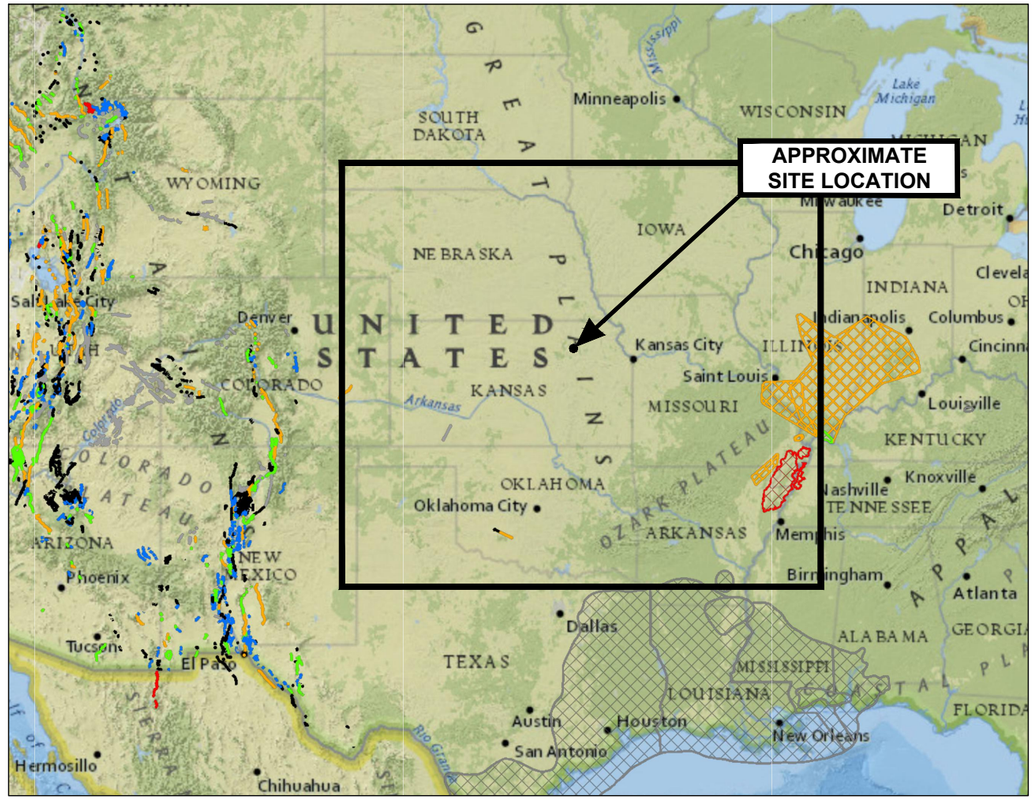
GRAPHIC SCALE



0 250 MILES

GRAPHIC SCALE

Quaternary Faults

- historical (<150 years), well constrained location
- historical (<150 years), moderately constrained location
- historical (<150 years), inferred location
- latest Quaternary (<15,000 years), well constrained location
- latest Quaternary (<15,000 years), moderately constrained location

N

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

NOTES

1. SOURCE: UNITED STATES GEOLOGIC SERVICE (USGS) U.S. QUATERNARY FAULTS AND FOLDS DATABASE, 2014.

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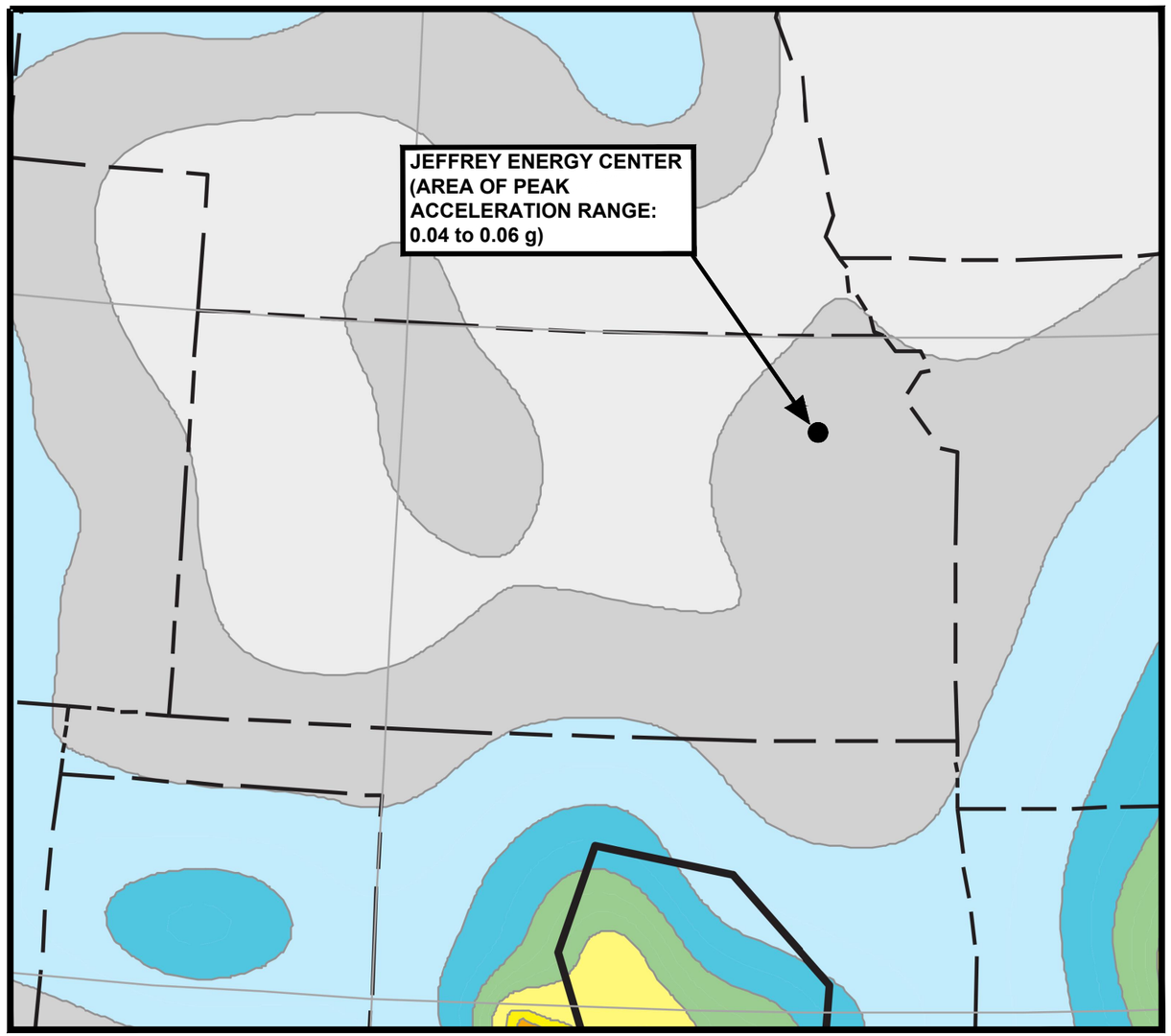
FIGURE 3
MAP OF FAULT AREAS

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	63123640	DATE:	SEPTEMBER 2018

TWO-PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS MAP OF PEAK GROUND ACCELERATION



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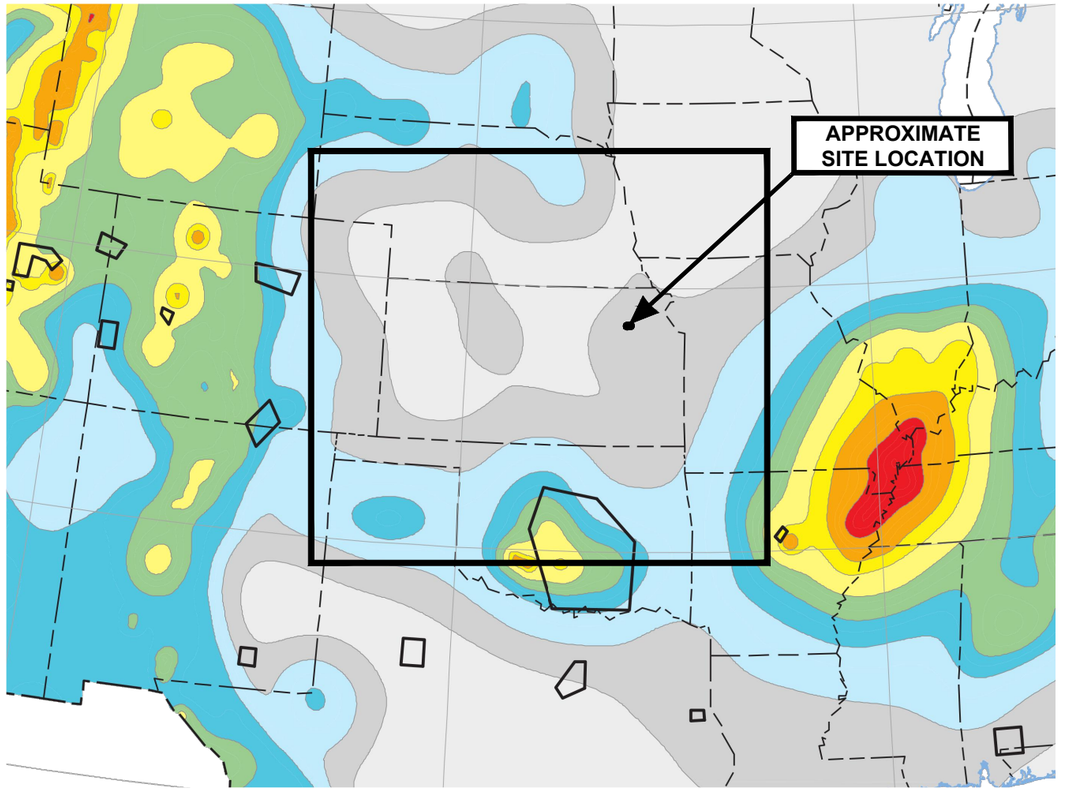
GRAPHIC SCALE



0 200 MILES

GRAPHIC SCALE

EXPLANATION

Peak acceleration, expressed as a fraction of standard gravity (g)

- 0.8
- 0.4
- 0.3
- 0.2
- 0.14
- 0.1
- 0.06
- 0.04
- 0.02
- 0

NOTES

1. SOURCE: UNITED STATES GEOLOGIC SERVICE (USGS) WEBSITE, 2014.
2. AREAS WITH SUSPECTED NONTECTONIC EARTHQUAKES ARE NOT INCLUDED.

N

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FIGURE 4
MAP OF HORIZONTAL ACCELERATION

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	63123640	DATE:	SEPTEMBER 2018

T:\AutoCAD\Projects\Westar Energy\Jeffrey\Compliance Reports\Bottom Ash Settling Area\Location Demonstrations\Geotech - Horizontal Acceleration.dwg, 9/27/2018 10:13:22 AM, _AutoCAD PDF (General Documentation).pc3

APPENDIX A

Unstable Areas

APPENDIX A.1

Differential Settling

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Based on the 2014 topographic and bathymetric survey, upstream of the berm in the impoundment, bottom ash appears to have settled from the slurry water and has collected along the bottom of the impoundment and upstream toe of the berm. No samples of this material were collected during the 2009 B&V study. This material was considered to have no strength only a unit weight. Since this material is on the upstream portion of the berm, the material does not affect the stability of the berm.

The berm fill rests directly on a weathered bedrock profile composed of shale and limestone. Based on the three 2009 borings, the top of the profile is a grayish green shale that is weathered to residual soil. The material properties for the weathered shale were developed based on the results from the 2009 B&V report. Drained or effective stress strength parameters were developed based on published correlations. The design values for the weathered shale are presented in Table 3-2.

Below the weathered shale, the bedrock is composed of shale and limestone. Unconfined compression testing indicated the strength of the intact rock varied between approximately 400 and 9,000 pounds per square inch. The design properties listed in Table 3-2 were based on the lowest strength and average unit weights from the laboratory testing.

TABLE 3-2
STABILITY ANALYSIS PARAMETERS

LAYER	BERM MATERIAL		BOTTOM ASH	WEATHERED SHALE	BEDROCK
	UPPER	LOWER			
Total Unit Weight	125	125	115	125	140
Total Stress (Undrained) Parameters					
Cohesion (c) (psf)	330	1300	0	2000	30,000
Angle of Internal Friction (ϕ) (degrees)	33	38	0	0	0
Effective Stress (Drained) Parameters					
Cohesion (c') (psf)	330	1300	0	0	30,000
Angle of Internal Friction (ϕ') (degrees)	33	38	0	28	0

3.5 DESIGN GROUNDWATER CONDITIONS

No long term field measurements of the pore pressures have been collected within the berm. For the static and seismic analysis, it was assumed that the water elevation on the upstream side would be at the elevation of the outlet invert (1239.5 feet). Water level measurements were noted on the piezometer logs from the 2009 Investigation. The water depths at B-1 and B-2 were reported at 19.1 feet deep (elevation 1225.9 feet) and 12.1 feet (elevation 1226.9 feet), respectively with an average value of elevation 1226.4 feet. These two measurements were made with the pool elevation lower than current; therefore, an adjustment was made based on the change in the normal pool elevation between the 2009 and 2015 Reports. According to the two reports, the outlet invert pipe elevation was raised from 1231.72 to 1239.5 feet; therefore, the average phreatic surface (upper boundary of the water saturated zone) at the centerline of the berm was increased 7.8 feet to elevation 1234.2 feet.

Based on the observation of seepage in the 2015 and 2016 inspections, the phreatic surface within the slope was shown to intercept the downstream face of the berm. According to the 2016 B&V inspection, the seepage was occurring approximately 50 feet downslope from the berm crest which was approximately elevation 1222 feet. Groundwater elevations measured at the monitoring wells located along the western toe of the berm in April 2016 indicated the groundwater elevation was approximately 1211 to 1212 feet. These groundwater elevations are higher than the lowest surface elevation at the berms toe; therefore, the phreatic surface at the toe of the berm was modelled at the surface.

APPENDIX A.2

Geologic/Geomorphologic Features Documentation

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Based on the 2014 topographic and bathymetric survey, upstream of the berm in the impoundment, bottom ash appears to have settled from the slurry water and has collected along the bottom of the impoundment and upstream toe of the berm. No samples of this material were collected during the 2009 B&V study. This material was considered to have no strength only a unit weight. Since this material is on the upstream portion of the berm, the material does not affect the stability of the berm.

The berm fill rests directly on a weathered bedrock profile composed of shale and limestone. Based on the three 2009 borings, the top of the profile is a grayish green shale that is weathered to residual soil. The material properties for the weathered shale were developed based on the results from the 2009 B&V report. Drained or effective stress strength parameters were developed based on published correlations. The design values for the weathered shale are presented in Table 3-2.

Below the weathered shale, the bedrock is composed of shale and limestone. Unconfined compression testing indicated the strength of the intact rock varied between approximately 400 and 9,000 pounds per square inch. The design properties listed in Table 3-2 were based on the lowest strength and average unit weights from the laboratory testing.

Range 12E are occurring based on an understanding, with KDHE and Westar Energy, that these areas will be legally defined and included in the permit update requested under the Special Conditions issued under Permit No. 359 on April 2, 2004. The permitted boundary depicted on Figure 1 is the approximate proposed boundary for the ongoing permit update. The permitted boundary is shown in relation to the JEC Power Plant on Figure 1.

1.5 SOILS, TOPOGRAPHY, AND SURFACE DRAINAGE

The JEC is covered with mostly silty clay loam, which has low to high plasticity (NRCS Soil Survey, 1987). The topsoil at the Permitted Landfill Site consists of terrace alluvium, glaciolacustrine deposits, and the Sandborn formation. The thickness varies over the JEC based on location in regards to hilltops and fill operations. The approximate thickness of topsoil is one to 16 feet below ground surface (bgs).

The natural highest soil elevation within the permitted landfill boundary, located along the northeast portion of the boundary, is approximately 1300 feet above msl. The lowest natural elevation within the permitted landfill boundary, located along the southwest portion of the boundary, is approximately 1100 feet above msl (See Figure 1).

Several small streams have their headwaters on the slopes surrounding the JEC property. Those to the north and east are tributaries of Bartlett and Cross Creeks, while those to the south merge to form Deep Creek, and streams to the west join either Lost Creek or Vermillion Creek. The tributaries within the permitted landfill boundary join with Lost Creek. At lower elevations around the streams, the grades are uniform with generally well developed alluvial flood plains and meanders. The upper elevations of the streams are generally youthful with small benches across limestone and deep V-shaped valleys incised into the shales and glacial deposits.

1.6 CLIMATE

The coldest month occurs in January where the average daily temperature is 32.2 degrees Fahrenheit (°F) and the warmest month occurs in July where the average daily temperature is 77.6 °F. Based on the precipitation record in Wamego, Kansas, for the years of 1951-1976, two years in ten will experience annual precipitation less than 16.45 inches. The average total annual precipitation is 33 inches, and of this, approximately 23.8 inches, or about 72 percent, of the annual precipitation falls during the period April through September. The average annual snowfall is 21.5 inches. The heaviest 24-hour rainfall event was 6.93 inches at Wamego on

1.7.2 Site Geology

Permian shale makes up approximately 70 percent of the stratigraphy below the JEC. The remainder of the stratigraphy consists of limestone beds and topsoil. In the area of the Permitted Landfill Site (shown in Figure 3) the following formations in the stratigraphic column (from youngest to oldest) were encountered during drilling: Blue Rapids shale, Crouse limestone, Easly Creek shale, Bader limestone, Stearns shale, Beattie limestone, Eskridge shale, Grenola limestone, Roca shale, Red Eagle limestone, Johnson shale, Foraker limestone, an the Janesville shale.

The shale formations are generally known to be medium to moderately hard, thin to very thin bedded, calcareous, widely jointed shale (Scott, Glenn R., 1959 and Shannon and Wilson, 1974). The limestone formations are generally known to be divided into alternating limestone and shale members. The limestone members can generally be described as hard, slightly weathered, sometimes exhibiting vugs and fracturing. The limestone formations become more massive with increasing depth and age. The limestone members are fairly individual in weathering pattern, with some members exhibiting blocky features while others have cavernous or cellular characteristics (Shannon and Wilson, 1974).

1.7.3 Regional Hydrogeology

Regionally, the groundwater occurs in the bedrock strata, but the shale units are so impermeable that there is little or no movement of groundwater. Some of the limestone units transmit small quantities of water that discharge in many small springs in the valleys of the intermittent creeks. The numerous small springs in the stream valleys discharge from 0.1 gallons per minute (gpm) to 10 gpm (Shannon and Wilson, 1974). Local recharge to the limestone aquifers is likely to come from snow drifts or other local concentrations of infiltrations. The low permeability of the limestone and shales in the region makes it difficult to identify a horizontally continuous saturated unit. Regionally, groundwater is supplied through alluvial and glacial outwash materials underlying the plains of the main valley floors of Vermillion Creek (five miles west of the JEC) and the Kansas River, located seven miles south of the JEC (Shannon and Wilson, 1974). Eleven domestic wells are within a three mile radius of the permitted landfill site and listed with the Kansas Geological Survey (KGS). All eleven wells are located upgradient from the permitted landfill site, within Sections 19 and 30, Township 9 South, Range 10 East. The wells range in estimated yield from 20 to 70 gpm and the depths range from 58 feet to 110 feet below ground surface (bgs). The majority of the wells are screened through alluvium and a few

APPENDIX A.3

Human-made Features or Events Documentation

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Forest City Coal Gas Area--Oil and Gas Production

Additional information on this field is available in the Digital Petroleum Atlas
Discovery currently listed:

Operator:
Lease: , Well
Location: S-W:
Discovery Date: 01/01/1873
Producing zone: Forest City coal gas

Counties: Anderson, Atchison, Brown, Coffey, Doniphan, Douglas, Franklin, Jackson, Jefferson, Johnson, Leavenworth, Linn, Lyon, Miami, Morris, Nemaha, Osage, Pottawatomie, Shawnee, Wabaunsee, Wyandotte
View Field Boundary
Leases and Wells: View Production by Lease for this Field || View Wells Assigned to this Field
Producing Formations

Name	Depth (ft.)	Thickness (ft.)	Oil Grav	Produces	Temperature
COAL	-	-	-	Gas	-

Field Map (opens in new window): View Field Map
Production Bubble Map (opens in new window, requires Java): View Bubble Map

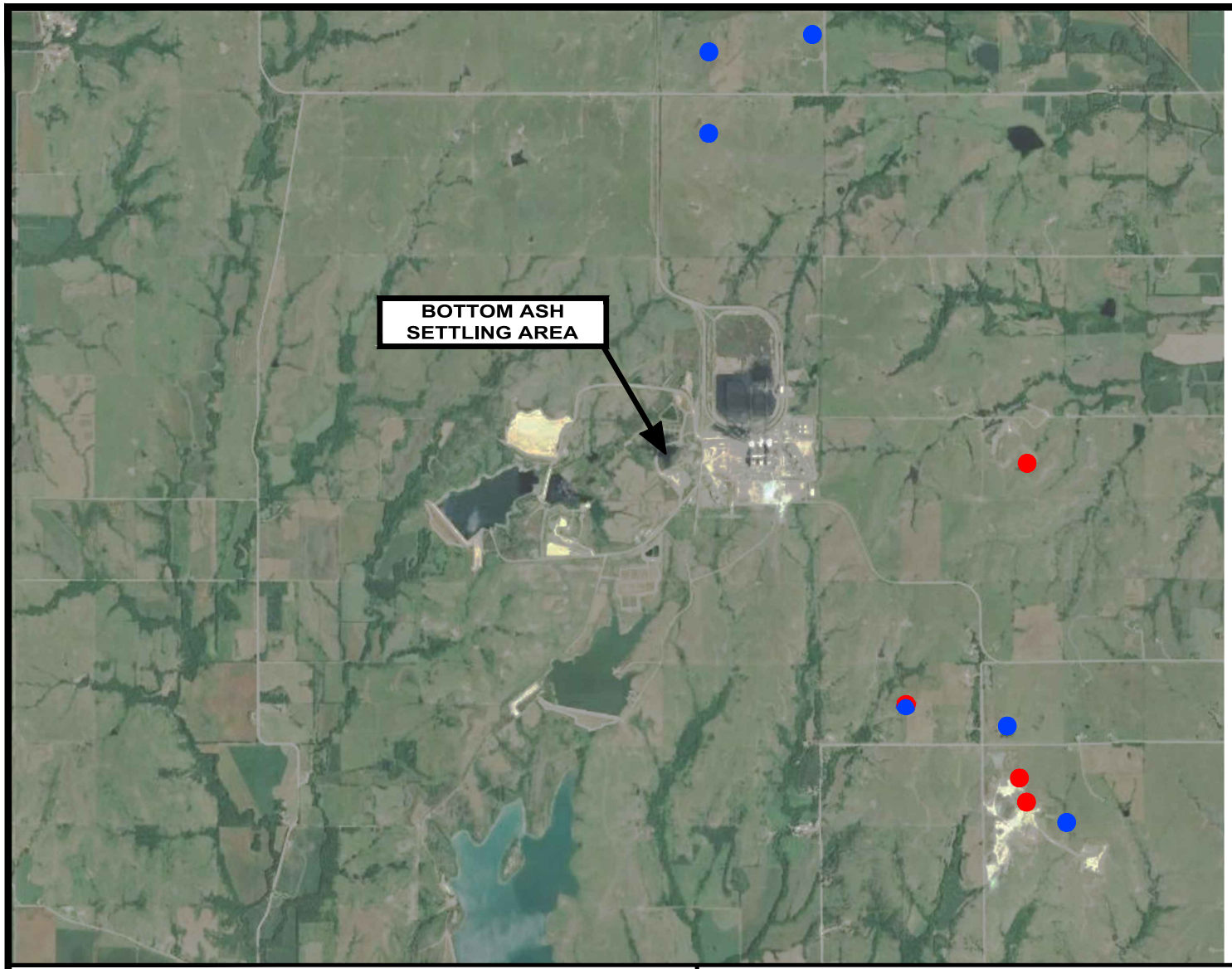
Production Charts
View Flash chart
Java Chart

	Oil			Gas		
Year	Production (bbls)	Wells	Cumulative (bbls)	Production (mcf)	Wells	Cumulative (mcf)
1998	-	-	0	-	2	3,749
1999	-	-	0	2,344	2	6,093
2000	-	-	0	84,782	22	90,875
2001	-	-	0	95,402	24	186,277
2002	-	-	0	121,446	28	307,723
2003	-	-	0	158,593	47	466,316
2004	138	2	138	253,889	51	720,205
2005	251	6	389	273,126	68	993,331
2006	345	5	734	392,871	181	1,386,202
2007	2,242	10	2,976	417,663	237	1,803,865

2008	836	5	3,812	497,569	329	2,301,434
2009	424	12	4,236	353,341	282	2,654,775
2010	424	4	4,660	252,193	253	2,906,968
2011	286	4	4,946	161,384	232	3,068,352
2012	153	4	5,099	25,356	35	3,093,708
2013	184	6	5,283	1,047	1	3,094,755
2014	112	5	5,395	699	1	3,095,454
2015	254	3	5,649	762	1	3,096,216
2016	42	3	5,691	38,340	21	3,134,556
2017	-	-	5,691	131,786	33	3,266,342
2018	-	-	5,691	28,667	31	3,295,009

Updated through 4-2018.
Note: bbls is barrels; mcf is 1000 cubic feet.

Kansas Geological Survey
Comments to webadmin@kgs.ku.edu
URL=http://www.kgs.ku.edu/Magellan/Field/index.html
Programs Updated Aug. 28, 2014.
Data from Kansas Dept. of Revenue files monthly.



N

0 1 MILES

GRAPHIC SCALE

LEGEND

- ACTIVE
- ABANDONED

NOTES

1. AERIAL PHOTO FROM GOOGLE EARTH, AUGUST 2014.
2. QUARRY LOCATIONS ARE APPROXIMATE.
3. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.

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25905 JEFFREY RD., ST. MARYS, KS

QUARRIES NEAR BOTTOM ASH SETTLING AREA

DRAWN BY:	ORC	APPROVED BY:	RDS	PROJ. NO.:	631236340	DATE:	SEPTEMBER 2018

Industrial Minerals--Pottawatomie County; Active Quarries

18 records returned. **You may also choose to save this data to a file.**
Active Quarries Shown || Show Abandoned Quarries || Show Abandoned and Active Quarries

Building Limestone

Company	Type	Location
Bayer Stone Inc 120 N 6th Street St Marys, Ks 66536-1509 785-437-2781	Surface Active	T9S, R12E, Sec. 26, N2SE Long: -96.03993, Lat: 39.23648

Limestone

Company	Type	Location
Bayer Construction Company, Inc. 120 Deep Creek Road P.O.Box 889 Manhattan, Kansas 66502 785-776-8839	Surface Active	T9S, R9E, Sec. 18, SW Long: -96.45882, Lat: 39.26541
Bayer Stone, Inc. 120 N. 6th St. Marys, Kansas 66536 913-437-2781	Surface Active	T7S, R12E, Sec. 22, Long: -96.06284, Lat: 39.42738
N.R. Hamm Quarries, Inc. P. O. Box 17 One Perry Plaza Perry, KS 66073-0017 785-597-5111	Surface Active	T7S, R7E, Sec. 11, SE SW SW Long: -96.62188, Lat: 39.45105
	Surface Active	T7S, R7E, Sec. 11, SW NW SW Long: -96.62427, Lat: 39.45467
	Surface Active	T7S, R10E, Sec. 3, SE Long: -96.28137, Lat: 39.46783
	Surface Active	T7S, R10E, Sec. 10, NE Long: -96.28131, Lat: 39.46049
	Surface Active	T9S, R12E, Sec. 9, NW Long: -96.08667, Lat: 39.28567
	Surface Active	T9S, R12E, Sec. 9, NW Long: -96.08667, Lat: 39.28567
	Surface Active	T9S, R12E, Sec. 17, S2 Long: -96.10076, Lat: 39.26383

	Surface Active	T9S, R12E, Sec. 21, NW Long: -96.0867, Lat: 39.25661
	Surface Active	T9S, R12E, Sec. 21, SWN2 Long: -96.0867, Lat: 39.25479

Sand & Gravel

Company	Type	Location
Roberts And Hale Westmoreland, Kansas 66549 913-457-3365	Surface Active	TS, R, Sec. , Long: , Lat:
Wamego Sand Company, Inc. P. O. Box 119 Wamego, Kansas 66547 785-456-9888	Pit or Lake Dredge Active	T10S, R10E, Sec. 10, SW SE NW Long: -96.28984, Lat: 39.19683
	Active	T10S, R12E, Sec. 7, SW Long: -96.12404, Lat: 39.19151
Bayer Construction Company, Inc. 120 Deep Creek Road P.O. Box 889 Manhattan, KS 66502 785-776-8839	Active	T7S, R9E, Sec. 19, Long: -96.45411, Lat: 39.42849
Ebert Construction Co. P.O. Box 198 Wamego, KS 66547 785-456-2455	Surface Active	T10S, R9E, Sec. 8, NW Long: -96.44003, Lat: 39.1995
Marten, Kenneth Rt. #2 Onaga, Kansas 66521 913-889-4854	Pit or Lake Dredge Active	TS, R, Sec. , Long: , Lat:

Kansas Geological Survey
Comments or questions to webadmin@kgs.ku.edu
URL=http://www.kgs.ku.edu/Magellan/Minerals/index.html
Display Programs Updated Aug. 12, 2003
Data added periodically.

Industrial Minerals--Pottawatomie County; Abandoned Quarries

89 records returned. **You may also choose to save this data to a file.**
Show Active Quarries || **Abandoned Quarries Shown** || Show Abandoned and Active Quarries

Coal

Company	Type	Location
Name Unknown	Abandoned	T9S, R9E, Sec. 4, SE Long: -96.41219, Lat: 39.29369

Limestone

Company	Type	Location
George Oxandale	Abandoned	T6S, R12E, Sec. 34, SW Long: -96.0679, Lat: 39.48181
	Abandoned	T7S, R11E, Sec. 14, NW Long: -96.1603, Lat: 39.44625
____	Abandoned	T8S, R12E, Sec. 22, SE Long: -96.05782, Lat: 39.33632
Hallett Construction	Abandoned	T7S, R7E, Sec. 10, SE SE SE Long: -96.6261, Lat: 39.45096
	Abandoned	T7S, R7E, Sec. 29, NE Long: -96.66727, Lat: 39.419035
Anderson Oxandale	Abandoned	T6S, R10E, Sec. 7, Long: -96.34173, Lat: 39.544
	Abandoned	T8S, R9E, Sec. 10, SE Long: -96.39361, Lat: 39.36624
(Roy Lasswell)	Abandoned	T7S, R12E, Sec. 27, SW Long: -96.06734, Lat: 39.40903

Bayer Construction Company, Inc. 120 Deep Creek Road P.O. Box 889 Manhattan, KS 66502 785-776-8839	Abandoned	T8S, R7E, Sec. 4, SW NE SW Long: -96.65524, Lat: 39.38125
	Abandoned	T9S, R8E, Sec. 18, Long: -96.57277, Lat: 39.26941
(E.A.Johnson)	Abandoned	T8S, R12E, Sec. 30, SW Long: -96.12314, Lat: 39.32185
(Jennie Nightwine)	Abandoned	T8S, R12E, Sec. 31, NW Long: -96.12322, Lat: 39.31461
Ebert Construction Co. P. O. Box 198 Wamego, Kansas 66547 785-456-2455	Surface Abandoned	T10S, R9E, Sec. 12, S2SW,W2SE Long: -96.35869, Lat: 39.1918
	Surface Abandoned	T10S, R9E, Sec. 13, NW NE Long: -96.35849, Lat: 39.18637
	Surface Abandoned	T10S, R10E, Sec. 7, SE SE SW Long: -96.34361, Lat: 39.18912
	Surface Abandoned	T10S, R10E, Sec. 18, NE NW Long: -96.34479, Lat: 39.18639
Bayer Stone, Inc. 120 N. 6th St. Marys, Kansas 66536 785-437-2781	Abandoned	T6S, R10E, Sec. 12, SW Long: -96.25331, Lat: 39.54043
	Surface Abandoned	T7S, R12E, Sec. 15, SE SE SW Long: -96.06399, Lat: 39.43552
	Abandoned	T7S, R12E, Sec. 22, Long: -96.06284, Lat: 39.42738
Name Unknown	Abandoned	T6S, R7E, Sec. 26, NESW Long: -96.61819, Lat: 39.49883
	Abandoned	T6S, R10E, Sec. 16, SE Long: -96.29991, Lat: 39.52582
	Abandoned	T6S, R10E, Sec. 22, SW Long: -96.29059, Lat: 39.51132
	Abandoned	T6S, R10E, Sec. 27, NE Long: -96.28138, Lat: 39.5041
	Abandoned	T6S, R10E, Sec. 36, SESE Long: -96.24161, Lat: 39.48071
	Abandoned	T6S, R11E, Sec. 34, NESE Long: -96.16727, Lat: 39.48426
	Abandoned	T7S, R7E, Sec. 13, SW Long: -96.60204, Lat: 39.43922
	Abandoned	T7S, R7E, Sec. 26, NE Long: -96.61137, Lat: 39.41749

	Abandoned	T7S, R9E, Sec. 32, SESE Long: -96.42846, Lat: 39.39386
	Abandoned	T7S, R10E, Sec. 19, NENW Long: -96.34426, Lat: 39.43317
	Abandoned	T7S, R11E, Sec. 3, NENW Long: -96.17661, Lat: 39.47697
	Abandoned	T8S, R9E, Sec. 27, SE Long: -96.39379, Lat: 39.32275
	Abandoned	T8S, R9E, Sec. 30, SE Long: -96.44965, Lat: 39.32321
	Abandoned	T8S, R10E, Sec. 27, NESW Long: -96.28903, Lat: 39.32438
	Abandoned	T8S, R12E, Sec. 19, NW Long: -96.12297, Lat: 39.34361
	Abandoned	T8S, R12E, Sec. 30, NESE Long: -96.11163, Lat: 39.32358
	Abandoned	T9S, R7E, Sec. 1, SE Long: -96.59309, Lat: 39.29461
	Abandoned	T9S, R7E, Sec. 14, NE Long: -96.61173, Lat: 39.27284
	Abandoned	T9S, R8E, Sec. 13, SW Long: -96.47766, Lat: 39.26563
	Abandoned	T9S, R9E, Sec. 19, SENE Long: -96.44714, Lat: 39.25621
	Abandoned	T9S, R9E, Sec. 20, NW Long: -96.44018, Lat: 39.25791
	Abandoned	T9S, R10E, Sec. 28, SE Long: -96.30052, Lat: 39.23528
	Abandoned	T9S, R12E, Sec. 3, SWSE Long: -96.06074, Lat: 39.29111
	Abandoned	T10S, R9E, Sec. 15, NW Long: -96.40277, Lat: 39.18466
(Ed Miller)	Abandoned	T7S, R12E, Sec. 21, NW Long: -96.08621, Lat: 39.43124
N.R. Hamm Quarries, Inc. P. O. Box 17 One Perry Plaza Perry, KS 66073-0017 785-597-5111	Surface Abandoned	T6S, R10E, Sec. 34, SE Long: -96.28145, Lat: 39.48236
	Abandoned	T7S, R10E, Sec. 10, Long: -96.28597, Lat: 39.45692
	Surface Abandoned	T9S, R12E, Sec. 16, SW SW Long: -96.08911, Lat: 39.26204

	Abandoned	T9S, R12E, Sec. 17, S2 Long: -96.10076, Lat: 39.26383
	Surface Abandoned	T9S, R12E, Sec. 21, Long: -96.08202, Lat: 39.25301
	Abandoned	T10S, R9E, Sec. 8, NW Long: -96.44003, Lat: 39.1995
(A.D.Dodd)	Abandoned	T6S, R12E, Sec. 18, SW Long: -96.12338, Lat: 39.52588
Concrete Materials	Abandoned	T10S, R9E, Sec. 15, NW Long: -96.40277, Lat: 39.18466
	Abandoned	T10S, R9E, Sec. 15, NE Long: -96.39349, Lat: 39.18467
Reno Construction Co.	Abandoned	T7S, R8E, Sec. 28, NE Long: -96.52437, Lat: 39.41767
(Mary A Snyder)	Abandoned	T7S, R9E, Sec. 32, NW Long: -96.44019, Lat: 39.40304

Sand & Gravel

Company	Type	Location
George Oxandale	Abandoned	T8S, R12E, Sec. 35, SE Long: -96.03929, Lat: 39.30736
(Louis Smith)	Abandoned	T6S, R12E, Sec. 9, NE Long: -96.07789, Lat: 39.54698
Bayer Construction Company, Inc. 120 Deep Creek Road P.O. Box 889 Manhattan, KS 66502 785-776-8839	Abandoned	T7S, R9E, Sec. 19, Long: -96.45411, Lat: 39.42849
Geo. Machin	Abandoned	T7S, R11E, Sec. 20, NW Long: -96.21637, Lat: 39.4316

Anderson Oxandale	Abandoned	T9S, R10E, Sec. 9, SW Long: -96.30956, Lat: 39.27868
(W. Shields)	Abandoned	T6S, R12E, Sec. 8, SE Long: -96.09654, Lat: 39.54005
Wamego Sand Co.	Abandoned	T10S, R10E, Sec. 9, NE Long: -96.30008, Lat: 39.19942
	Abandoned	T10S, R10E, Sec. 10, NESW Long: -96.28873, Lat: 39.19393
	Abandoned	T10S, R10E, Sec. 15, NE Long: -96.28204, Lat: 39.18467
	Abandoned	T10S, R12E, Sec. 7, SW Long: -96.12404, Lat: 39.19151
Name Unknown	Abandoned	T6S, R8E, Sec. 8, SE Long: -96.54295, Lat: 39.54084
	Abandoned	T6S, R12E, Sec. 3, NE Long: -96.05894, Lat: 39.56215
	Abandoned	T6S, R12E, Sec. 10, Long: -96.06366, Lat: 39.54324
	Abandoned	T6S, R12E, Sec. 15, NW Long: -96.06831, Lat: 39.53244
	Abandoned	T6S, R12E, Sec. 18, SW Long: -96.12338, Lat: 39.52588
	Abandoned	T7S, R6E, Sec. 25, NW Long: -96.7132, Lat: 39.41774
	Abandoned	T7S, R7E, Sec. 8, NW Long: -96.67685, Lat: 39.46078
	Abandoned	T7S, R8E, Sec. 1, SW Long: -96.47749, Lat: 39.46832
	Abandoned	

		T7S, R8E, Sec. 9, W2 Long: -96.53381, Lat: 39.45763
	Abandoned	T7S, R9E, Sec. 27, NE Long: -96.39326, Lat: 39.41766
	Abandoned	T7S, R9E, Sec. 27, SW Long: -96.40259, Lat: 39.41029
	Abandoned	T7S, R9E, Sec. 28, SE Long: -96.41195, Lat: 39.41028
	Abandoned	T8S, R9E, Sec. 1, SE Long: -96.35606, Lat: 39.38057
	Abandoned	T8S, R9E, Sec. 11, NE Long: -96.37476, Lat: 39.37328
	Abandoned	T8S, R9E, Sec. 16, SW Long: -96.42187, Lat: 39.35203
	Abandoned	T8S, R9E, Sec. 20, Long: -96.43578, Lat: 39.34124
	Abandoned	T8S, R9E, Sec. 28, SW Long: -96.42181, Lat: 39.32298
	Abandoned	T9S, R9E, Sec. 19, NW Long: -96.45882, Lat: 39.25816
	Abandoned	T10S, R9E, Sec. 3, SENE Long: -96.39128, Lat: 39.212
	Abandoned	T10S, R10E, Sec. 5, NW Long: -96.32889, Lat: 39.21369
Ebert Construction Co. P.O. Box 198 Wamego, KS 66547 785-456-2455	Abandoned	T10S, R9E, Sec. 8, NW Long: -96.44003, Lat: 39.1995
Pottawatomie County	Abandoned	T6S, R12E, Sec. 15, SW Long: -96.06825, Lat: 39.52521
(V.Budenbender)	Abandoned	

		T6S, R8E, Sec. 8, NE Long: -96.54298, Lat: 39.54808

Kansas Geological Survey
Comments or questions to webadmin@kgs.ku.edu
URL=http://www.kgs.ku.edu/Magellan/Minerals/index.html
Display Programs Updated Aug. 12, 2003
Data added periodically.