

# ANNUAL INSPECTION BY A QUALIFIED PROFESSIONAL ENGINEER

ALL CCR IMPOUNDMENTS  
*CCR Rule Section 257.83(b)*

## ASBURY POWER PLANT

21133 Uphill Lane  
Asbury, Missouri 64832

January 18, 2017



**SERVICES YOU COUNT ON**

## EMPIRE DISTRICT ELECTRIC COMPANY

Prepared by:



Rachel J. Goeke, P.E.  
MO P.E. 2007020268

January 18, 2017

Empire District Electric Company  
Asbury Power Plant  
21133 Uphill Lane  
Asbury, Missouri 64832

RE: **Annual Inspection by a Qualified Professional Engineer –**  
CCR Rule Section 257.83(b)  
Empire District Electric Company – Asbury Power Plant  
Asbury, Missouri  
PPI Project Number: 231518-2017

To Whom It May Concern:

The attached Report presents the results of Palmerton & Parrish, Inc.'s (PPI's) **Annual Inspection by a Qualified Professional Engineer** at the Empire District Electric Company's (Empire's) CCR Impoundment at the Asbury Power Plant (Asbury CCR Impoundment).

PPI has been involved with several projects at the Asbury Power Plant since 2010, and has been able to observe and study the condition of the existing CCR Impoundment periodically throughout that time. Based upon historical information provided by Empire, PPI's professional training and experience, the results of PPI's studies, and PPI's observations during visual inspection of the CCR Impoundment, the Asbury CCR Impoundments were designed and constructed, and are operated and maintained, in general accordance with recognized and generally accepted engineering standards.

In accordance with Section 257.105(g) of the CCR Rule, a copy of this document should be maintained in Empire's operating records. In accordance with Section 257.107(g), a copy of this document should also be posted to Empire's CCR Compliance website. Notification of the availability of this document should be provided to the State Director, as required in Section 257.106(g).

PALMERTON & PARRISH, INC.

By:



Rachel J. Goeke, P.E.  
MO P.E. 2007020268

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## **ANNUAL INSPECTION BY A QUALIFIED PROFESSIONAL ENGINEER – ALL CCR IMPOUNDMENTS**

### **CCR RULE SECTION 257.83(B)**

#### **EMPIRE DISTRICT ELECTRIC COMPANY – ASBURY POWER PLANT**

#### **ASBURY, MISSOURI**

### **1.0 INTRODUCTION**

*“CCR Rule Section 257.83(b) Annual inspections by a qualified professional engineer. (1) If the existing or new CCR surface impoundment or any lateral expansion of the CCR surface impoundment is subject to the periodic structural stability assessment requirements under Section 257.73(d) or Section 257.74(d), the CCR unit must additionally be inspected on a periodic basis by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards...”*

Section 257.83(b) requires completion of an Annual Inspection of all CCR Impoundments by a qualified professional engineer, including a review of available documentation and previous inspection reports, and a visual inspection of the CCR unit and any hydraulic structures underlying the base of the CCR unit. This Report has been prepared in general accordance with the requirements of Section 257.83(b)(2) Inspection Report.

### **2.0 REVIEW OF AVAILABLE INFORMATION – CCR RULE SECTION 257.83(B)(I)**

PPI has worked on numerous Projects at the Asbury Power Plant throughout the years. Since 2010, PPI has been involved as the Geotechnical Engineer of Record for projects including the Asbury Environmental Retrofit, Asbury Office Building, Asbury Railroad Embankment Repair, and the Asbury Coal Ash Site Structural Assessment. Pertinent to the CCR Rule, PPI assisted Empire with preparation of a weekly inspection report form. PPI transitioned completion of monthly monitoring tasks to Empire’s staff at the end of 2016.

PPI reviewed our internal files pertaining to the Asbury CCR Impoundment as part of this Levee Inspection Report. Information pertaining to the original design and construction of the Asbury CCR Impoundment is summarized in PPI’s Report entitled “Coal Ash Site Structural Assessment Report”, dated December 28, 2012. In general, the Asbury CCR Impoundment is subdivided into three (3) ponds: the Lower Pond, South Pond, and Upper Pond. The Upper Pond is subdivided into two (2) cells, identified as Upper Pond – A and Upper Pond – B.

Operating conditions at the Asbury Power Plant have changed considerably since PPI’s 2012 Report, as Empire transitioned to a dry hauling system when the Asbury Environmental Retrofit Project was commissioned in November 2014. The amount of impounded water has decreased significantly since 2012, and the volume of stored CCR has increased in correlation to the volume of CCR byproduct that has been produced and stored in the CCR Impoundment since that time.

### **3.0 VISUAL INSPECTION – CCR RULE SECTIONS 257.83(b)(ii) AND (iii)**

PPI completed a visual inspection of the CCR levee impoundments and hydraulic structures in general accordance with the requirements of CCR Rule Sections 257.83(b)(ii) and 257.83(b)(iii). The completed Levee Inspection Form is included in Appendix I. The levee inspection was completed on January 11, 2017 by Ms. Rachel Goeke, P.E.

### **4.0 CCR RULE SECTION 257.83 (2) INSPECTION REPORT**

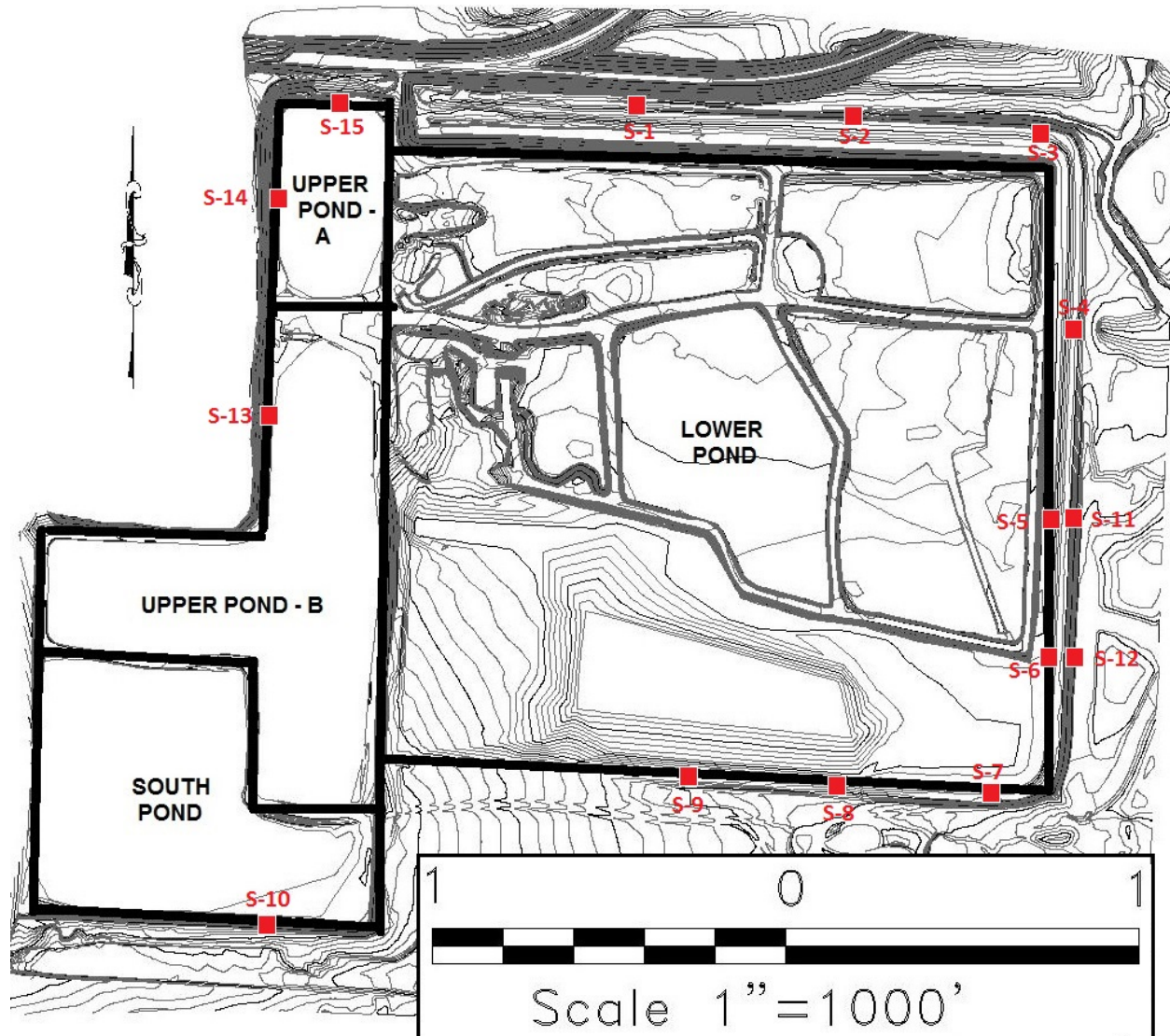
Section 257.83(2) lists specific information that is required in the Inspection Report. This entire Report document, including Appendix I constitutes the “Inspection Report” for the purposes of the CCR Rule. The requirements of Section 257.83(2) are summarized in the list below, along with supplemental information as appropriate.

1. Changes in impoundment structure geometry since the previous annual inspection: The last formal inspection of the CCR Impoundments, by a licensed third-party Professional Engineer, was completed by Palmerton & Parrish, Inc. (PPI) in 2016, with a formal Inspection Report dated January 18, 2016. Since that time, the geometry of the perimeter levee impoundment embankments is essentially unchanged. Additional CCR has been placed within portions of the Lower Pond, typically resulting in decreased interior embankment height and more gradual side slopes for the interior embankments.

2. Locations and type of any existing instrumentation and the maximum recorded readings of each instrument since the previous annual inspection: As of the date of the 2017 inspection, there are twelve (12) settlement monuments and fifteen (15) vertical deflection monuments in place at the Asbury CCR Impoundment.

The twelve (12) settlement monuments were originally installed as part of the Site Structural Assessment Project in March 2012. The twelve (12) original settlement monuments were surveyed using traditional level loop survey methods by Allgeier, Martin & Associates (AMA) periodically from March 2012 to October 2015, when the CCR Rule went into effect. The settlement monuments were surveyed monthly from October 2015 through August 2016, at which time monthly monitoring transitioned to the vertical deflection monuments. The fifteen (15) vertical deflection monuments were installed in July 2016 and have been monitored monthly in accordance with Section 257.83(a) since that time. The twelve (12) settlement monuments will be maintained and will remain available for future surveying.

The general location of the vertical deflection monuments is shown on the Site Plan below. The vertical deflection monuments are identified as S-1 through S-15. Vertical deflection monuments S-1 through S-12 are located in close proximity to the twelve (12) settlement monuments.



The five (5) piezometers that were installed from February 27 to March 2, 2012 as part of the Site Structural Stability Assessment Project were closed from July 18 to 20, 2016. PPI prepared a Piezometer Closure Plan, and submitted Piezometer Closure Records to MDNR on July 28, 2016. This instrumentation no longer exists at the site as of the date of this Report.

Table 4.0-1 summarizes the Settlement Monument Readings by AMA from May 25, 2012, May 13, 2014, and all of the measurements from 2016.

<b>Table 4.0-1: Settlement Monument Readings, by AMA</b>										
<b>Settlement Monument</b>	<b>Elevation (ft.), on Surveyed Date</b>									
	5/25/12	5/13/14	1/29/16	2/26/16	4/5/16	4/28/16	5/31/16	6/30/16	7/29/16	8/31/16
SM-1	929.17	929.26	929.20	929.26	929.25	929.27	929.25	929.28	929.29	929.30
SM-2	929.13	929.16	929.14	929.16	929.15	929.16	929.14	929.17	929.19	929.19
SM-3	927.39	927.44	927.42	927.44	927.43	927.44	927.42	927.46	927.45	927.46
SM-4	930.65	930.69	930.66	930.68	930.67	930.68	930.64	930.68	930.68	930.69
SM-5	930.91	930.94	930.91	930.93	930.92	930.93	930.93	930.94	930.93	930.94
SM-6	931.05	931.05	931.02	931.05	931.05	931.05	931.06	931.06	931.05	931.05
SM-7	931.95	931.95	931.93	931.95	931.95	931.95	931.95	931.95	931.94	931.95
SM-8	931.77	931.75	931.74	931.76	931.76	931.75	931.76	931.76	931.74	931.75
SM-9	933.86	933.89	933.85	933.86	933.86	933.86	933.86	933.86	933.85	933.85
SM-10	956.38	956.39	956.41	956.40	956.41	956.40	956.41	956.40	956.41	956.38
SM-11	926.33	926.36	926.34	926.36	926.36	926.36	926.37	926.37	926.37	926.37
SM-12	926.69	926.67	926.65	926.67	926.67	926.67	926.68	926.68	926.68	926.68

\* SM-1 was disturbed by truck traffic shortly after installation.

The vertical deflection monuments, S-1 through S-15 have not moved more than 0.2 degrees since installation with the exception of S-7 which was disturbed during site maintenance activities.

3. Approximate minimum, maximum, and present elevation of impounded water and CCR since the previous annual inspection: Empire typically maintains the impounded water elevation within the Upper Pond at approximately 953 feet. Historically, the surface elevation of the South Pond has also been maintained at approximately 953 feet. Empire lowered the operating level of the South Pond to approximately pond bottom elevation in the summer of 2016.

The maximum impounded water elevation in the Lower Pond is controlled by the spillway elevation, which is 930.35 feet. Normal pool elevation of the Lower Pond is maintained around 928.8 feet, and maximum pool during overflow is 931.5 feet.

The CCR elevation within the Lower Pond is variable, as the interior dike embankments are typically constructed of CCR. The maximum elevation of the interior dikes is on the order of 950 feet near the north end of the Lower Pond. The maximum elevation in the areas where Empire is actively filling is approximately 946 feet.

CCR elevations are largely unchanged since the 2016 Inspection Report, with the exception of the additional CCR that has been placed within the active filling area of the Lower Pond. Filling of this area has resulted in increased buttressing of interior CCR dikes, and generally flatter conditions.

4. The storage capacity of the impounding structure at the time of the inspection: Conservatively, the remaining storage capacity at the Asbury CCR Impoundments is estimated to be approximately 850,000 cubic yards. This storage capacity estimate is based upon topographic survey data collected during 2012; baseline computations made in 2012; and periodic estimates of CCR production and placement volumes provided by Empire. The computation of storage capacity is based upon the following assumptions: (1) no CCR is placed in the Upper Pond, South Pond, or standing water portion of the Lower Pond; and (2) the maximum fill line, or finished ground surface elevation, was assumed to be approximate elevation 959.25 feet.

5. The approximate volume of impounded water and CCR at the time of the inspection: The approximate volume of impounded CCR is 2,180,000 cubic yards. This volume was computed using data from PPI's 2012 studies and the approximate volume of CCR placed since that time.

Estimation of the volume of impounded water is difficult. Empire does not have good topographic survey information pertaining to the bottom elevations of the Upper Pond and Lower Pond. The majority of the impounded water has been removed from the South Pond as of the date of this Report and the volume is considered incidental for the purposes of this computation.

As a generalized estimate only, PPI computed the approximately volume of impounded water as:

- The surface area of the Upper Pond (approximately 700,000 square feet mid-interior slope) multiplied by an approximated average depth of water (Elev. 953.5 ft. minus 930 ft. = 23.5 ft.) equals 16,450,000 cubic feet;
- Plus the surface area of the impounded water portion Lower Pond (approximately 164,000 square feet mid-interior slope) multiplied by an approximated average depth of water (Elev. 930 ft. – Elev. 926 ft. = 4 ft.) equals approximately 656,000 cubic feet.

The resultant computed volume of impounded water is approximately 17,106,000 cubic feet.

6. Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit and appurtenant structures: Evidence of structural weakness was not observed at the time of the inspection.



7 Any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection: The condition of the Asbury CCR Impoundment is largely unchanged since PPI's 2012 studies and the 2016 Annual Inspection Report. There are a few locations in the levee crest, particularly on the south perimeter of the South Pond, where wheel ruts are present and need to be remediated. There are also a few locations where supplemental vegetation should be re-established, as has been discussed with Empire. Compared to previous years, there is less impounded water and more solid CCR in place, which should be a benefit to the overall stability of the CCR Impoundments.

## **5.0 REPORT LIMITATIONS**

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. (PPI) observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. PPI's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.



**APPENDIX I**  
**LEEVE INSPECTION FORM**

**LEVEE INSPECTION FORM**

**Date:** 1/11/17

**Inspection By:** Rachel Goeke, P.E., PPI

**Dam Name:** Asbury Power Plant

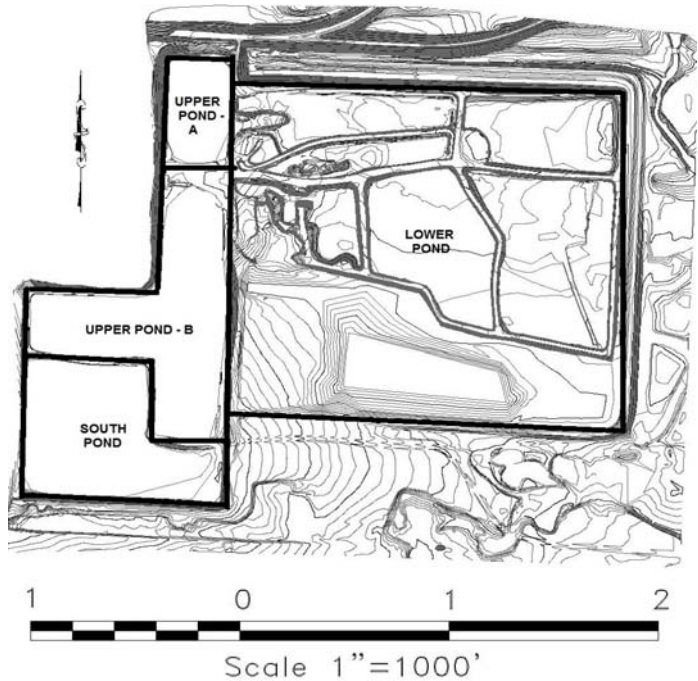
CCR Impoundment Levees

**Dam Location:** Asbury Missouri

Jasper County

**Weather:** Sunny

**Temperature:** 67 deg



**Notes / Instructions:** Reference previous Annual Levee Inspection prior to commencement of field work. Observe entire perimeter levee of East and West Ponds. Use a separate checklist form for each Pond and/or levee embankment length as appropriate.

Summarize Overall Condition of Levee Embankments: The overall condition of the perimeter levee embankments is good. Evidence of sloughing or seepage was not observed during the inspection. Empire had plumbing work on-going at the northwest corner of the Upper Pond as of the date of the Inspection.

Summarize Areas of Concern / Recommended Action Items: The plumbing work on the northwest side of the Upper Pond needs to be completed as soon as possible. The pipes need to be properly backfilled with controlled fill, and vegetation needs to be re-established. Rutting on the levee crest, specifically on the south side of the South Pond, needs to be remediated to avoid ponding water. Empire should review the overall condition and health of the vegetation on the levee embankments and over-seed areas as necessary. Animal burrow holes were not observed during the inspection, but Empire should monitor for and repair burrow holes as needed.

**LEEVE INSPECTION FORM**

ITEM	YES	NO	REMARKS
1. CREST			Rutting due to vehicles should be repaired.
a. Any visual Settlement?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. INTERIOR LEEVE SLOPES			
a. Adequate grass cover?	X		
b. Any erosion?		X	
c. Trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate rip rap protection?	X		
g. Visual depressions or bulges?		X	
h. Visual Settlements?		X	
j. Debris or trash present?		X	
3. EXTERIOR LEEVE SLOPES			
a. Adequate grass cover?	X		Some areas should be over-seeded.
b. Any erosion?		X	
c. Trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Visual depressions or bulges?		X	
g. Visual Settlements?		X	
h. Debris or trash present?		X	
i. Boils or seepage at toe?		X	
j. Seepage on slope face?		X	
k. Soft or spongy zones?		X	

**LEEVE INSPECTION FORM**

ITEM	YES	NO	REMARKS
4 SPILLWAY OUTLET			
a. Is the conduit concrete?	X		
b. Do concrete surfaces show:			
(1.) Spalling?		X	
(2.) Cracking?		X	
(3.) Erosion?		X	
(4.) Scaling?		X	
(5.) Exposed Reinforcement?		X	
(6.) Other?		X	
c. Do the joints show:			
(1.) Displacement or offset?		X	
(2.) Loss of joint material?		X	
(3.) Leakage?		X	
d. Is the conduit metal?		X	
(1.) Corrosion present?		X	
(2.) Protective coatings adequate?		X	
(3.) Leakage?		X	
e. Seepage around the conduit?		X	
5 DITCHES / SITE DRAINAGE			
a. Describe ditch function:			Drainage channels around Impoundment perimeter.
b. Are ditches free of debris?	X		
c. Is adequate erosion protection present at the toe of slope around the perimeter?	X		
6 PHOTOGRAPHS TAKEN:	X		
7 INSTRUMENTATION IN TACT:	X		