



Stantec Consulting Services Inc.
10509 Timberwood Circle, Suite 100, Louisville, KY 40223

October 6, 2016
File: rpt_001_let_175555021
Revision 0

Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402

**RE: Liner Design Demonstration
Bottom Ash Pond
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Cumberland Fossil Plant
Stewart County, Tennessee**

1.0 PURPOSE

This letter documents Stantec's certification of the existing liner assessment for the TVA Cumberland Fossil Plant's Bottom Ash Pond. Based on the assessment, the Bottom Ash Pond is considered an unlined CCR surface impoundment as described in the Final CCR Rule at 40 CFR 257.71(a)(3).

2.0 EXISTING LINER ASSESSMENT

An existing surface impoundment must be evaluated as to whether or not it was constructed with a liner as described in 40 CFR 257.71(a)(1)(i)-(iii).

3.0 SUMMARY OF FINDINGS

The attached report presents the analysis for the existing liner assessment. The report concludes that the Bottom Ash Pond at the Cumberland Fossil Plant was not constructed with a liner that complies with the requirements of §257.71 of the EPA CCR Rule. Therefore, this unit is considered an unlined surface impoundment that is allowed to remain in operation in compliance with the requirements of §257.101(a).

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stephen H. Bickel, being a Professional Engineer in good standing in the State of Tennessee, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of my signature below;
and



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**RE: Liner Design Demonstration
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TVA Cumberland Fossil Plant
Stewart County, Tennessee**

3. that the TVA Cumberland Fossil Plant's Bottom Ash Pond is considered an unlined CCR surface impoundment as described in 40 CFR 257.71(a)(3).

SIGNATURE

DATE

10/6/2016

ADDRESS:

Stantec Consulting Services Inc.
10509 Timberwood Circle, Suite 100
Louisville, KY 40223

TELEPHONE:

(502) 212-5000

ATTACHMENTS:

CUF Bottom Ash Pond Liner Design Demonstration



Liner Design Demonstration

Cumberland Fossil Plant
Bottom Ash Pond
Stewart County, Tennessee



Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:
Stantec Consulting Services Inc.

October 6, 2016
Revision 0

LINER DESIGN DEMONSTRATION

Background
October 6, 2016

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LINER DESIGN DEMONSTRATION

Background
October 6, 2016

1.0 BACKGROUND

1.1 INTRODUCTION

On April 17, 2015, the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule (EPA Final CCR Rule) was published in the Federal Register. The Tennessee Valley Authority (TVA) contracted Stantec Consulting Services Inc. (Stantec) to determine whether the Bottom Ash Pond at Cumberland Fossil Plant (CUF) met the liner design criteria for existing CCR surface impoundments as defined in §257.71 of the EPA Final CCR Rule.

CUF is a coal-fired, electric generating plant located in Stewart County, Tennessee, on the southern bank of the Cumberland River (River Mile 103), which approximately 60 miles northwest of Nashville, Tennessee. Wells Creek flows around the southwest perimeter of CUF. The Bottom Ash Pond is an existing CCR surface impoundment as defined by the EPA Final CCR Rule consisting of approximately 5.3 acres.

This assessment concludes that while this unit is underlain by native clay soils, it is classified as an unlined CCR surface impoundment per the EPA Final CCR Rule. The Bottom Ash Pond consists of the approximate boundary area denoted in Figure 1.



Figure 1 Bottom Ash Pond Approximate Boundary

LINER DESIGN DEMONSTRATION

Background
October 6, 2016

1.2 OBJECTIVE

The objective of this demonstration is to evaluate compliance related to §257.71, specifically whether the Bottom Ash Pond was constructed with one of the following:

- A liner consisting of a minimum of two feet of compacted soil with a hydraulic conductivity of no greater than 1×10^{-7} cm/sec;
- A composite liner that meets the requirements of § 257.70(b); or
- An alternative composite liner that meets the requirements of § 257.70(c).

Based on the EPA presentation dated April 15, 2015 and titled, "Top 20 Questions on EPA's CCR Final Rule", compacted soil means soil that is *mechanically* compacted in lifts.

1.3 SUMMARY OF HISTORICAL INFORMATION

The Bottom Ash Pond was originally part of the Main Ash Pond, which was completed in 1972. In 1976, a divider dike was constructed to form Ash Disposal Area 1 and Ash Disposal Area 2. In 1996, as part of a new Tennessee Department of Environment and Conservation (TDEC) Solid Waste Permit, the Bottom Ash Pond was constructed on the north end of the divider dike that separated the two ash disposal areas. Applicable Record Drawings are included in Appendix A.

The following geotechnical reports have been reviewed:

- Law Engineering. 1992. Report of Subsurface and Stability Analysis. Prepared for Tennessee Valley Authority. January 27, 1992.
- Stantec Consulting Services Inc. 2010. Report of Geotechnical Exploration, Cumberland Fossil Plant – Dry Fly Ash Stack and Gypsum Disposal Complex. June 11, 2010.

These reports included soil borings drill near the Bottom Ash Pond. The boring logs indicated natural clay foundation soils were encountered and these materials range in thickness from 10 to 16 feet. Review of the Record Drawings and geotechnical reports could not conclude whether a mechanically compacted clay liner was placed across the extent of the Bottom Ash Pond.

LINER DESIGN DEMONSTRATION

Field Exploration
October 6, 2016

2.0 FIELD EXPLORATION

The "Report of Geotechnical Exploration, Cumberland Fossil Plant, Bottom Ash Pond," prepared for Tennessee Valley Authority by Stantec dated September 30, 2016 documents a recent study. The boring logs indicated natural clay foundation soils underlie the impoundment, and these materials range in thickness from 13 to 19 feet. Review of this report could not conclude whether a mechanically compacted clay liner was placed across the extent of the Bottom Ash Pond.

LINER DESIGN DEMONSTRATION

Conclusion
October 6, 2016

3.0 CONCLUSION

Based on a review of existing geotechnical reports, the Bottom Ash Pond at Cumberland Fossil Plant was not constructed with a liner that complies with the requirements of §257.71 of the EPA Final CCR Rule. Therefore, this unit is considered an unlined surface impoundment in accordance to the EPA Final CCR Rule and is allowed to remain in operation in compliance with the requirements of §257.101 (a).

LINER DESIGN DEMONSTRATION

References
October 6, 2016

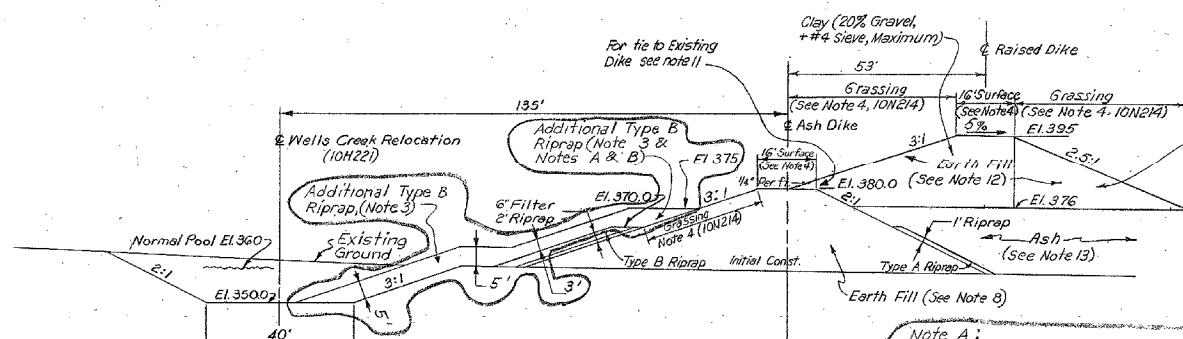
4.0 REFERENCES

Law Engineering. 1992. Report of Subsurface and Stability Analysis. Prepared for Tennessee Valley Authority. January 27, 1992.

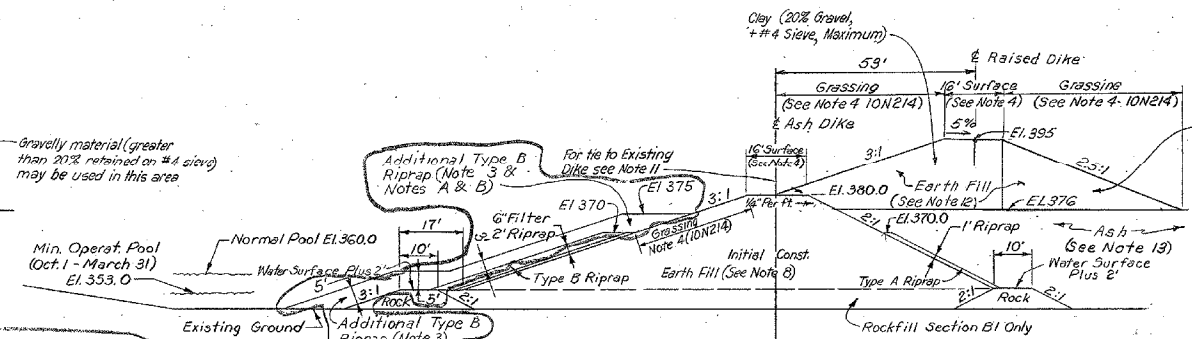
Stantec Consulting Services Inc. 2010. Report of Geotechnical Exploration – Cumberland Fossil Plant – Dry Fly Ash Stack and Gypsum Disposal Complex. June 11, 2010.

Stantec Consulting Services Inc. 2016. Report of Geotechnical Exploration – Cumberland Fossil Plant, Bottom Ash Pond. Prepared for Tennessee Valley Authority, September 30, 2016.

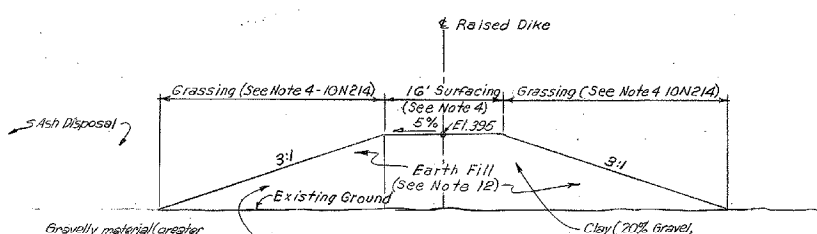
APPENDIX HISTORICAL DRAWINGS



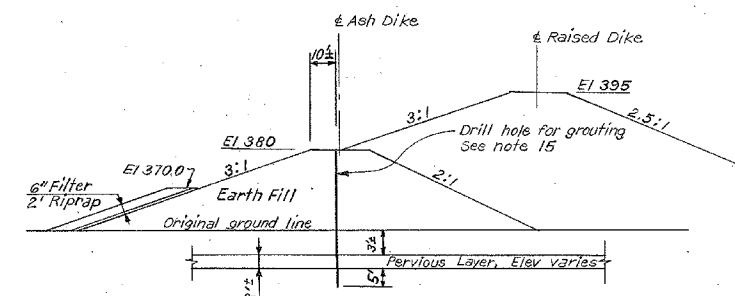
SECTION A
Dike where Exist. Ground is above water surface.
Scale: 1" = 20'



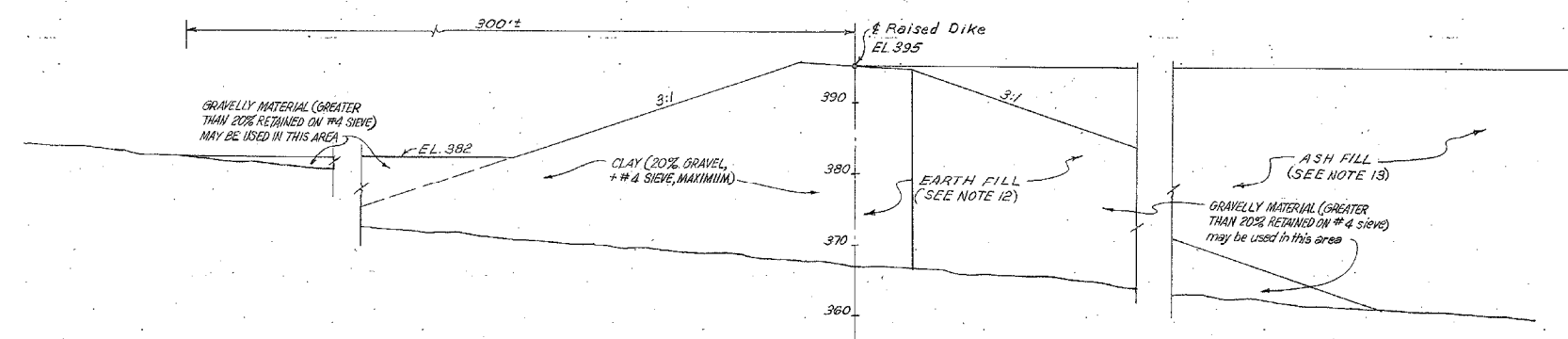
SECTION B & B1
Dike where Exist. Ground is below water surface.
Scale: 1" = 20'



SECTION C-C
Scale: 1" = 10'-0"
(ION212)



TYP. GROUTING SECTION
NTS



SECTION E-E
SCALE: 1" = 10'
(ION212)

- NOTES:**
- All work on the construction of these dikes shall be in accordance with the T-1 Specifications unless otherwise noted.
 - Embankments shall be compacted with sheepfoot rollers. Two density tests per day shall be made to insure achievement of 95% of standard proctor maximum density. Fill moisture shall be controlled to obtain optimum compaction (initial cost).
 - Riprap shall consist of sound, durable limestone, section 575. Filter shall be crushed stone conforming to section 570. (a) Type A Riprap shall be 12 inches thick and at least 50% of the stone shall weigh 85 lb. or more. Riprap laid without filter. (b) Type B Riprap shall be 24 inches thick and at least 50% of the stone shall weigh 150 lb. or more. Filter blanket shall be 6 inches thick.
 - Crushed stone surfacing, 4 inches thick, shall be applied for the full width of the top of the dike in accordance with section 305.
 - Rock fill shall be sound, durable stone in accordance with section 124 and chocked with fines.
 - Where practical borrow shall be obtained from inside disposal areas.
 -
 - Initial ash dikes to be built by construction of earth to elevation shown on sections.
 - The results of the soil investigation for the raising of the dikes at the ash disposal area no. 2 are reported in a memorandum from Gene Farmer to G.L. Buchanan dated Nov. 20, 1978 Cumberland Steam Plant Ash Disposal Area Dikes Soils Investigation.
 - The minimum factor of safety for all loading conditions on ash disposal area dikes is 1.60.
 - When connecting the new dike to the old dike extreme care shall be used to insure an impervious and stable connection. The existing dikes shall be stripped of all vegetation, riprap, gravel, crushed stone, coarse ash and other pervious material on top of dike and above elevation 376 on inside slope. Benched and scarified to a minimum depth of 6 inches and compacted to form a bond with the new earth fill. The utmost caution shall be used in benching the existing dike slopes so as not to create an unstable condition. Small benches of minimum depth shall be used.
 - Earth fill for raised dikes shall be placed in accordance with all applicable sections of general construction specification G-9 for Rolled Earth Fill for Dams and Power Plants. Earth fill shall be obtained from designated borrow areas. The earth fill moisture content shall not exceed 3.0% above optimum moisture content and shall be placed and compacted to be at least 95% maximum dry density as determined by the TVA Materials Laboratory. At least one moisture-density assurance test shall be made on each 5000 cu. yd. of fill placed.
 - Placement of the underwater ash fill shall be by end dumping along the length of the dike. The top surface of the underwater dike just above the water shall be thoroughly compacted and scarified before placing the overlying ash fill. Bottom ash for that portion of the divider dike above water shall be placed in not more than 9 inch layers, and well compacted with rubber tired hauling equipment.
 - Dike foundation shall have all weak surface soils removed to material that will easily bear the weight of loaded rubber tired earth hauling equipment.
 - Refer to the memorandum J.H. Coulson to R.G. Haynes dated Nov. 20, 1930 (B65901120029), for specifications for grouting Ash Pond seep repair.

Scale: As Noted

SUMMARY OF QUANTITIES												
Area	Item No. Location	123		305		580		582		600 Class III		
		Ash Fill Cu. Yd.	Earth Bon. Cu. Yd.	Surfacing Ton	Seeding Sq. Yd.	Mulching Sq. Yd.	Reinf. Conc. Pipe - Lin. Ft.	Filter Blanket 18"	36"	48"	575 Riprap - Cu. Yd. Type A	Rock Fill Cu. Yd.
Ash Disposal Dike (Initial Const.)	A-B	54,900	310									
	B-C	75,900	310									
	C-D	14,9,500	920									
	D-E	104,850	580									
	E-F	140,150	640									
	F-G	28,850	440									
	G-H	3,000	200									
Ash Disposal Dikes (Raising to EL 395)	H-I	12,050	440									
	I-J	40,450	840									
Total		95,300	310,200	3000	47,300	47,300	272			8280	10,905	24,485
Dike Stability												31,000

CAPACITY OF DISPOSAL AREAS			
ACCUMULATION OF UNIT YEARS			
AREA NO. 1 Elevations	Unit Yrs.*	AREA NO. 2 Elevations	
		Unit Yrs.*	Unit Yrs.*
345	0.2		
350	0.6		
355	1.5		
360	3.4	360	0.6
365	5.9	365	2.0
370	8.8	370	3.8
375	11.9	375	5.9
380	15.3	380	8.5
385	18.6	385	11.3
390	22.3	390	14.2

* Based on 1,300,000 KW unit, 80% Capacity.

DESIGN: R.D.R. SUPPLY: R.B.B.
 DRAWN: E.S.M. INSP: J.W.S.
 CHECK: R.D.R.
 TRACED: R.D.R.
 COMP: E.E. Bennett
 DATE: 1-13-69

COMPANION DRAWINGS: 10N212, 214, 10N221-229, 256

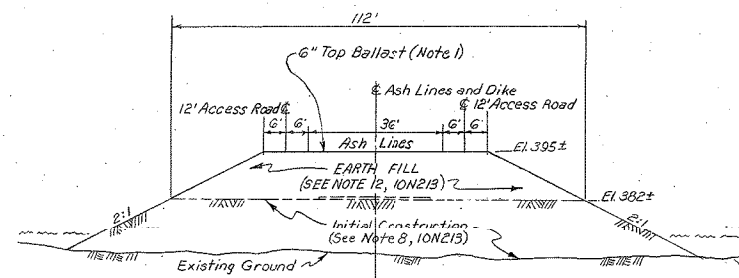
MAIN PLANT
ASH DISPOSAL AREAS
SHEET NO. 2

CUMBERLAND STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

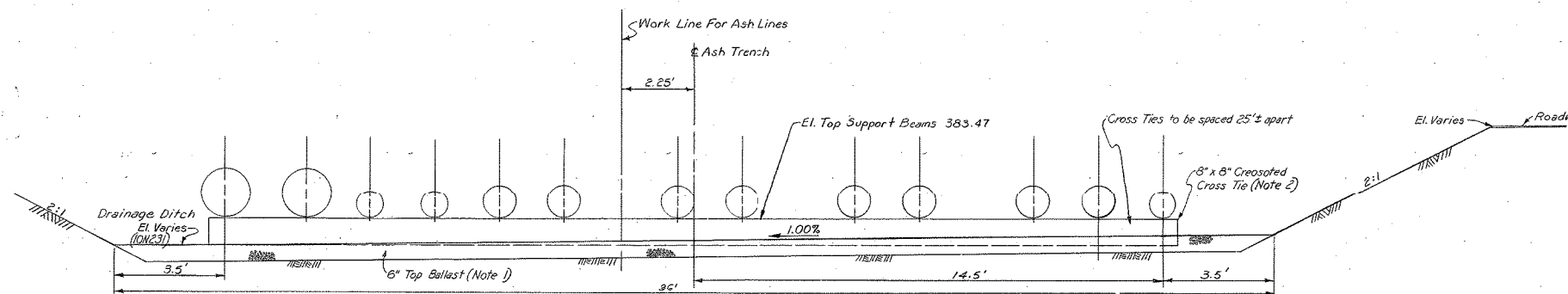
SUBMITTED	RECOMMENDED	APPROVED
J.M. [Signature]	[Signature]	[Signature]
KNOXVILLE	1-13-69	46 C 4 ION213 R6

SUMMARY OF QUANTITIES

Item No.	Description	Quantities
	8"x8" Creosoted Cross Ties	1440 LF
1071	Top Ballast	1000 CY



SECTION H-H
Scale: 1"=20'
(ION212)



SECTION G-G
Scale: 1"=2'

NOTES:

- Top ballast shall be size No. 5 and shall conform in quality and gradation to Section 1071.
- Timbers shall be creosoted cross ties 8" x 8". Any length from 7' to 10' may be used and roared to obtain required 30' length per support. They shall be red oak, gum, or timber of similar texture, fiber, and treating conditions in accordance with current AREA Specification for cross ties. Treatment shall be in accordance with current AREA Specification for Wood Preservation, Rimping process, grade A or grade C, for solution, with initial air pressure of usually 60 psi and 80 psi for red oak ties and gum ties respectively with minimum retention of 6 pounds for red oak and 8 pounds for gum per cubic foot. White oak shall be treated to refusal.

4. For additional Notes see Dwg. 10N213.

Scale: As Noted

MAIN PLANT			
ASH DISPOSAL AREAS			
SHEET NO. 3			
CUMBERLAND STEAM PLANT TENNESSEE VALLEY AUTHORITY DIVISION OF ENGINEERING DESIGN			
SUBMITTED	RECOMMENDED	APPROVED	
<i>J.M. Johnston</i>	<i>W.M. Caldwell</i>	<i>F.P. Jacey</i>	
KNOXVILLE	1-13-69	46 C 4	ION218r2

COMPANION DRAWINGS: 10N212, 213

REV	DATE	MADE	CHKD	SUPV	INSP	SUBM	REC'D	APPR	PPR
0558	ADD			ADD					
0559	ADD			ADD					
0560	ADD			ADD					