ALLIANT ENERGY
Interstate Power and Light Company
Ottumwa Generating Station

CCR SURFACE IMPOUNDMENT

STRUCTURAL STABILITY ASSESSMENT

Report Issued: October 5, 2020
Revision 1

HARD HAT SERVICES™
Engineering, Construction and Management Solutions

EXECUTIVE SUMMARY

This Structural Stability Assessment (Report) is prepared in accordance with the requirements of the United States Environmental Protection Agency (USEPA) published Final Rule for Hazardous and Solid Waste Management System – Disposal of Coal Combustion Residual from Electric Utilities (40 CFR Parts 257 and 261, also known as the CCR Rule) published on April 17, 2015 (effective October 19, 2015) and subsequent amendments.

This Report serves as the first periodic review since the initial report dated September 29, 2016. It assesses the structural stability of each CCR unit at Ottumwa Generating Station in Ottumwa, Iowa in accordance with §257.73(b) and §257.73(d) of the CCR Rule. For purposes of this Report, "CCR unit" refers to an existing or inactive CCR surface impoundment.

Primarily, this Report is focused on documenting whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded within each CCR unit.

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1 Introduction

The owner or operator of the Coal Combustion Residual (CCR) unit must conduct an initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. This Report serves as the first periodic review from the initial dates September 29, 2016 and has been prepared in accordance with the requirements of §257.73(b) and §257.73(d) of the CCR Rule.

1.1 CCR Rule Applicability

The CCR Rule requires a periodic structural stability assessment by a qualified professional engineer (PE) for existing CCR surface impoundments with a height of 5 feet or more and a storage volume of 20 acre-feet or more; or the existing CCR surface impoundment has a height of 20 feet or more (§257.73(b)).

1.2 Structural Stability Assessment Applicability

The Ottumwa Generating Station (OGS) in Ottumwa, Iowa (Figure 1) has one existing and one inactive CCR surface impoundments that meet the requirements of §257.73(b)(1) or §257.73(b)(2) of the CCR Rule, which are identified as follows:

- OGS Ash Pond (existing)
- OGS Zero Liquid Discharge Pond (inactive)

2 FACILITY DESCRIPTION

OGS is located approximately ten miles northwest of Ottumwa, Iowa on the western shore of the Des Moines River in Wapello County, at 20775 Power Plant Road, Ottumwa, Iowa (Figure 1). The McNeese Wildlife Area is located to the southeast of OGS. Middle Avery Creek, which flows to the northeast into the Des Moines River, is located to the south and east of OGS.

OGS is a fossil-fueled electric generating station consisting of one steam electric generating unit. Sub-bituminous coal is the primary fuel for producing steam. The burning of coal produces a by-product of CCR. The CCR at OGS is categorized into three types; bottom ash, fly ash, and flue gas desulfurization (scrubber) byproducts. The fly ash also can be subdivided into two types, economizer fly ash and precipitator fly ash.

The majority of precipitator fly ash is collected by the electrostatic precipitators and sent to the on-site storage silo located on the west side of the generating plant. Historically, the precipitator fly ash has then either been transported off-site for beneficial reuse or was placed in the fly ash reclamation processing area adjacent to the coal pile storage area for the purposes of producing hydrated fly ash. In the fly ash reclamation processing area, the fly ash was rolled out, compacted, hydrated, and allowed to dry into a very hard, cement-like material that was stored in this area until transported off-site. Although this fly ash hydrating process has occurred in the past, this process ceased prior to October 19, 2015.

The precipitator fly ash that is not collected by the electrostatic precipitators becomes part of the flue gas desulfurization pollution control process at OGS. Activated carbon is injected into the flue gas stream and binds with mercury. This flue gas stream travels to the spray dry desulfurization towers. From there, a water-based slurry of hydrated (slaked) lime is injected into the spray dry desulfurization towers. The hydrated lime reacts with the sulfur compounds in the flue gas and the water evaporates. A precipitate is left that consists of activated carbon bound to mercury, calcium sulfate, calcium sulfite,

unreacted slaked lime, and some unreacted fly ash. This flue gas stream is directed to the bag house where the particulate matter is removed. A portion of the solids are recycled back to the process and the rest of the scrubber byproducts are sent to the air quality control system byproduct silo. The material from the byproduct silo is mixed with water in a pin mixer to reduce dust, loaded into trucks, and transported to the off-site Ottumwa-Midland CCR landfill for disposal.

The bottom ash and economizer fly ash at OGS were sluiced to a surface impoundment identified as the OGS Ash Pond (Figure 2) until September 2020 when OGS initiated an outage to install a new dry ash handling system. The OGS Ash Pond is located east of the generating plant and is presently the only existing CCR surface impoundment at OGS.

In addition to the OGS Ash Pond, OGS has one inactive CCR surface impoundment identified as the OGS Zero Liquid Discharge (ZLD) Pond. The OGS ZLD Pond is located northeast of the generating plant and north of the OGS Ash Pond. The OGS ZLD Pond, presently, only receives surface water runoff from the surrounding area.

General Facility Information:

- Date of Initial Facility Operations: 1981
- NPDES Permit Number: IA90-001-01
- Latitude / Longitude: 41°5'53"N 92°33'17"W
- Nameplate Ratings: Unit 1 (1981) 725 MW

2.1 OGS Ash Pond

The OGS Ash Pond is located east of the generating plant on the eastern portion of the site. The OGS Ash Pond receives influent flows from the generating plant floor drains, oil/water separator, boiler blow down water, solid contact unit sludge, recirculating media sanitary treatment plant, and surface water runoff from the generating site proper.

Sluiced CCR was discharged into the west end of the OGS Ash Pond until September 2020. The sluiced CCR was discharged into a collection pad area where the majority of CCR was recovered. As of September 2020, a dozer continues to be used to scrape the collection pad and push the CCR into a stockpile for dewatering. Once dewatered, the CCR is then loaded into over-the-road haul trucks for transporting off-site. The sluiced water from the CCR previously drained into a narrow channel that flows into the southwest portion of the OGS Ash Pond. Routine maintenance dredging of the narrow channel occurred as the CCR settled out in the channel. Process water from the OGS Ash Pond is recirculated back into OGS for reuse or discharged as described below.

The water in the OGS Ash Pond from other sources flows to the east and discharges through the facility's National Pollution Discharge Elimination System (NPDES) Outfall 001, located in the northeast corner of the OGS Ash Pond. NPDES Outfall 001 consists of a concrete discharge structure with a six-foot-wide overflow weir and includes a Parshall flume and instrumentation to measure the flow of the discharged water. The water flows through the NPDES Outfall 001 and discharges into an unnamed creek at an average rate of 1.54 MGD. The water flows through the NPDES Outfall 001 and discharges into an unnamed creek. The unnamed creek flows into the Des Moines River downstream of the water intake structure and before the confluence of Middle Avery Creek.

The surface area of the OGS Ash Pond is approximately 18 acres and has an embankment height of approximately 25 feet from the crest to the toe of the downstream slope. The interior storage depth of the OGS Ash Pond is approximately 20 feet. Currently, the total volume of impounded CCR and water within the OGS Ash Pond is approximately 556,000 cubic yards.

2.2 OGS Zero Liquid Discharge Pond

The OGS Zero Liquid Discharge (ZLD) Pond is located northeast of the generating plant on the eastern portion of the site and north of the OGS Ash Pond. The OGS ZLD Pond historically received influent flows from the generating plant that consisted of boiler

wash water, air heater wash, turbine chemical cleaning water, and boiler chemical cleaning water. Presently, the OGS ZLD Pond only receives storm water runoff from the surrounding area, which includes the inactive hydrated fly ash area located west of the surface impoundment, as well as occasional excess storm water runoff from the coal pile storage area. One 24-inch diameter high-density polyethylene culvert connects the coal pile runoff pond to the OGS ZLD Pond. The culvert is used as an emergency overflow to route storm water from the coal pile runoff pond into the OGS ZLD Pond.

The OGS ZLD Pond does not currently discharge. Two 48-inch diameter concrete culverts, located along the south embankment, previously connected the OGS ZLD Pond to the OGS Ash Pond prior to being permanently sealed off with concrete.

The OGS ZLD Pond covers a surface area of approximately 19 acres and has an embankment height of approximately 29 feet from crest to toe of the downstream slope. The interior storage depth of the OGS ZLD Pond is approximately 25 feet. Based on readily available information, the OGS ZLD Pond has a total storage capacity of approximately 515,000 cubic yards.

3 STRUCTURAL STABILITY ASSESSMENT- §257.73(d)

This Report documents whether the design, construction, operation, and maintenance of each CCR unit is consistent with recognized and generally accepted good engineering practices for maximum volume of CCR and CCR wastewater which can be impounded.

3.1 OGS Ash Pond

The OGS Ash Pond was constructed as part of the initial plant sometime between 1977 and 1981 using native clay from onsite for construction of embankments for the impoundment. The embankments were constructed on the native clay. The impoundment is subject to water loss mainly from evaporation and the discharge of water that is not reused for sluicing.

Borings for the installation of monitoring wells were installed through the embankment in April of 2016 and form the current understanding of embankment and foundation soils for the OGS Ash Pond, Appendix A.

The outfall structure for the OGS Ash Pond is a concrete weir box with six-foot-wide overflow weir and a Parshall flume for flow monitoring. The weir box discharges under the embankment through two 66-inch diameter reinforced concrete pipes, Appendix B.

Based on the annual inspections conducted by Hard Hat Services since Revision 0 of this Report, there have been no significant changes regarding settlement, instability, or reconfiguration of the OGS Ash Pond.

3.1.1 CCR Unit Foundation and Abutments - §257.73(d)(1)(i)

The foundation soil is a medium stiff to stiff low plasticity clay (CL) with an unconfined compressive strength of 2,000 psf. The clay is underlain by a deposit of very dense sand (SP) over rock at an elevation of approximately 625 feet. The foundation soils are adequate for the support of the approximately 24-foot-high embankment with acceptable safety factors as shown in the OGS Safety Factor Assessment Report, Revision 1.

3.1.2 Slope Protection - §257.73(d)(1)(ii)

The impoundment is incised on the portions of the north side and all the west side. The crest of the embankments is approximately 20 feet wide and the downstream slope of the embankment is approximately a 3:1 vegetated slope. The east and portion of the north sides also have an embankment crest of 20 feet and consist of a 3:1 vegetated slope.

Well established and managed vegetation will minimize surface erosion on both the upstream and downstream slopes. Additionally, storm water runoff is limited to the crest and downstream slope of the embankment, which limits the erosive force. Therefore, the impoundment configuration protects against surface erosion. Additionally, erosion due to wave action will have minimal impacts to the embankments.

Sudden drawdown is addressed in Section 3.1.7.

3.1.3 CCR Embankment Density- §257.73(d)(1)(iii)

The embankment is constructed of compacted low plasticity clay. The borings shown in Appendix A indicate an unconfined compressive strength of 3,200 psf. The strength of the clay indicates that the clay was compacted at optimum moisture during construction of the embankments and that the density of the embankments are adequate. Analysis of the slope safety factor in the OGS Safety Factor Assessment Report, Revision 1 indicate the foundation soils control the minimum safety factors for the slope.

3.1.4 Vegetation Management - §257.73(d)(1)(iv)

Historically, vegetation management has been conducted on a periodic basis. Annual inspections have been completed since the Revision 0 of this Report. Based on those inspections, the facility has continued to routinely manage vegetation, minimizing animal activity and deep rooting vegetation. The vegetation management has been maintained with recognized and generally accepted good engineering practices.

3.1.5 Spillway Management - §257.73(d)(1)(v)

The OGS Ash Pond is equipped with two side-by-side 66-inch diameter reinforced concrete pipes to drain process water and storm water from the concrete box structure in

east corner of the impoundment, Figure 2. The culverts and drainage structure are constructed of non-erodible material and designed to carry sustained flows.

The culverts are checked for malfunction (e.g., blockages, deformations) during the weekly inspections by the facility personnel and have been inspected during the annual inspections.

This impoundment currently has a hazard potential classification of "Low," which in turn requires an evaluation of the impacts of a 100-year rainfall event. The Inflow Flood Control Plan, which is a separate document developed to comply with §257.82, shows that the precipitation from this event will drain through the culverts without overtopping the embankments of the impoundment.

3.1.6 Hydraulic Structures - §257.73(d)(1)(vi)

The two 66-inch diameter outlet pipes under the embankment provide adequate discharge capacity that is independent of the flood stage in Middle Avery Creek. On June 20, 2016, the pipes were inspected using remote camera video inspection. The inspection showed that there was minimal deterioration, deformation, distortion, sedimentation, debris, and no bedding deficiencies were observed. Additionally, the pipes were visually inspected on September 24, 2020 by Hard Hat Services and found no changes since the 2016 remote camera video inspection.

3.1.7 Sudden Drawdown - §257.73(d)(1)(vii)

The toe of the embankment could be flooded if the Des Moines River exceeds flood elevation of 656 feet. The embankments and the foundation soils are clay and there will be no sudden drawdown seepage pressure from the short-term impacts from floodwaters receding.

3.2 OGS Zero Liquid Discharge Pond

The OGS ZLD Pond was constructed as part of the initial plant sometime between 1977 and 1981 using native clay from the site for construction of embankments for the impoundment. The embankments were constructed on the native clay and the

impoundment is subject to water loss from evaporation. The impoundment presently does not discharge water and the former discharge pipes to the OGS Ash Pond are permanently sealed. The OGS ZLD Pond could accept water from the coal pile runoff pond under certain severe storm events.

Borings for the installation of monitoring wells were installed through the embankment in April of 2016 and form the current understanding of embankment and foundation soils for the impoundment, Appendix A.

Based on the annual inspections conducted by Hard Hat Services since Revision 0 of this Report, there have been no significant changes regarding settlement, instability, or reconfiguration of the OGS ZLD Pond.

3.2.1 CCR Unit Foundation and Abutments - §257.73(d)(1)(i)

The foundation soil is a medium stiff to stiff low plasticity clay (CL) with an unconfined compressive strength of 2,000 psf. The clay is underlain by a deposit of very dense sand (SP) over rock at an elevation of approximately 625 feet. The foundation soils are adequate for the support of the approximately 30-foot-high embankment with acceptable safety factors as shown in the OGS Safety Factor Assessment Report, Revision 1.

3.2.2 Slope Protection - §257.73(d)(1)(ii)

The impoundment is incised on the west side. The south, east and north crest of the embankments is approximately 20 feet wide and the downstream slope of the embankment is approximately a 3:1 vegetated slope.

Well established and managed vegetation will minimize surface erosion on both the upstream and downstream slopes. Additionally, storm water runoff is limited to the crest and downstream slope of the embankment, which limits the erosive force. Therefore, the impoundment configuration protects against surface erosion. Additionally, erosion due to wave action will have minimal impacts to the embankments.

Sudden drawdown is addressed in Section 3.2.7.

3.2.3 CCR Embankment Density- §257.73(d)(1)(iii)

The embankment is constructed of compacted low plasticity clay. The borings shown in Appendix A indicate an unconfined compressive strength of 3,200 psf. The strength of the clay indicates that the clay was compacted at optimum moisture during construction of the embankments and that the density of the embankments are adequate. Analysis of the slope safety factor in the OGS Safety Factor Assessment Report, Revision 1 indicate the foundation soils control the minimum safety factors for the slope.

3.2.4 Vegetation Management - §257.73(d)(1)(iv)

Historically, vegetation management has been conducted on a periodic basis. Annual inspections have been completed since the Revision 0 of this Report. Based on those inspections, the facility has continued to routinely manage vegetation, minimizing animal activity and deep rooting vegetation. The vegetation management has been maintained with recognized and generally accepted good engineering practices.

3.2.5 Spillway Management - §257.73(d)(1)(v)

The OGS ZLD Pond is a zero liquid discharge impoundment. The former spillway, which consisted of two 48-inch RCP pipes are permanently sealed. The storm water that collects within the OGS ZLD Pond exfiltrates and evaporates, Figure 2.

This impoundment currently has a hazard potential classification of "Low," which in turn requires an evaluation of the impacts of a 100-year rainfall event. The Inflow Flood Control Plan, which is a separate document developed to comply with §257.82, shows that the precipitation from this event will be contained within the limits of the impoundment without overtopping the embankments.

3.2.6 Hydraulic Structures - §257.73(d)(1)(vi)

No active hydraulic structures are associated with this OGS ZLD Pond. The abandoned discharge pipes are filled with concrete. The pipes were visually inspected on September 24, 2020 by Hard Hat Services and found no changes since the 2016 remote camera video inspection.

3.2.7 Sudden Drawdown - §257.73(d)(1)(vii)

The toe of the embankment could be flooded if the Des Moines River exceeds flood elevation of 652 feet. The embankments and the foundation soils are both clay and there will be no sudden drawdown seepage pressure from the short-term impacts of toe flooding.

4 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

To meet the requirements of 40 CFR 257.73(d)(3), I Mark W. Loerop hereby certify that I am a licensed professional engineer in the State of Iowa; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in 40 CFR 257.73(b) and 40 CFR 257.73(d).

By: _____

Name: MARK LOEROP

Date: OCTOBER 5, 2020

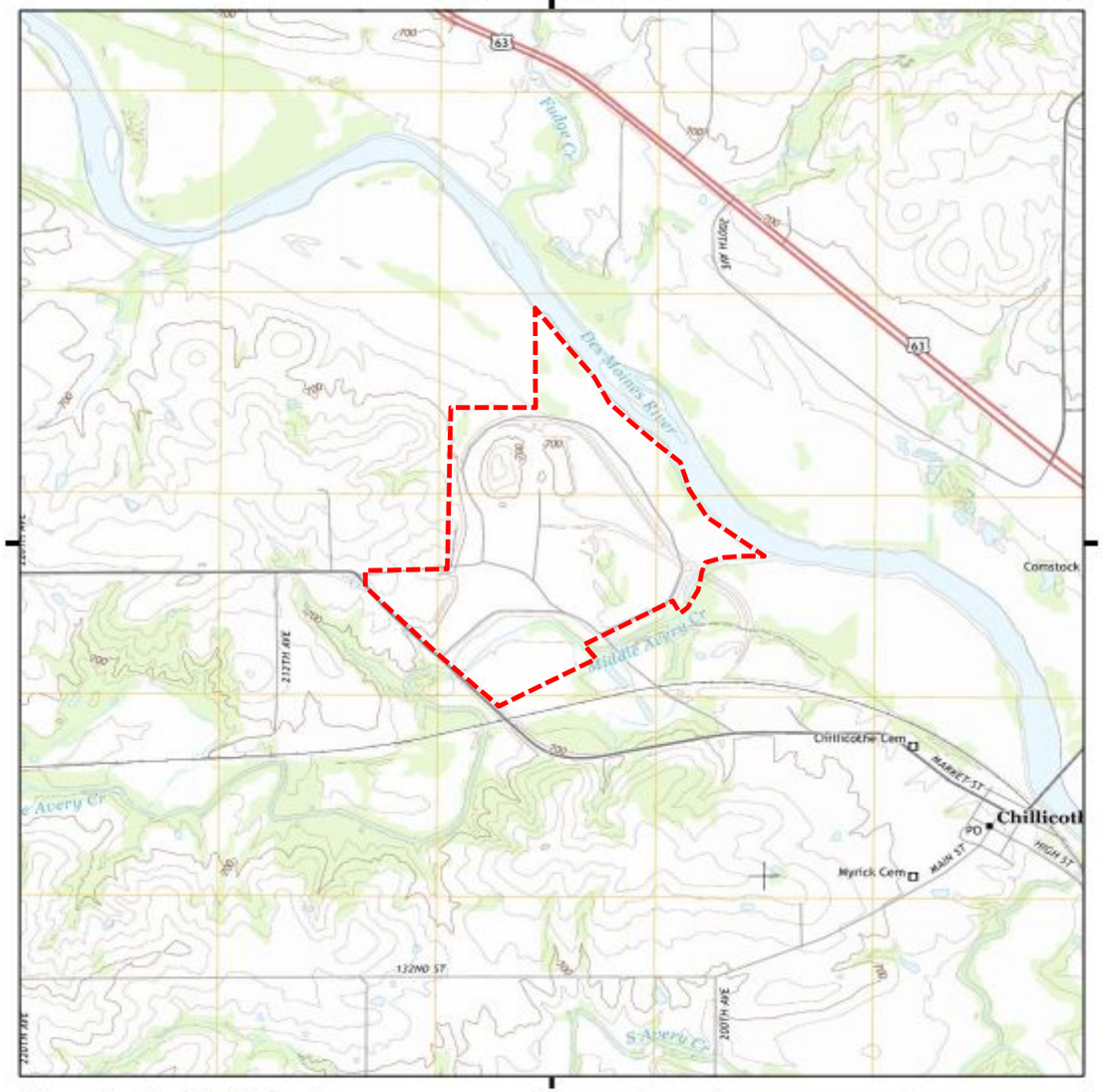
FIGURES

Alliant Energy
Interstate Power and Light Company
Ottumwa Generating Station
Ottumwa, Iowa

Structural Stability Assessment

Historical Topo Map

2013



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

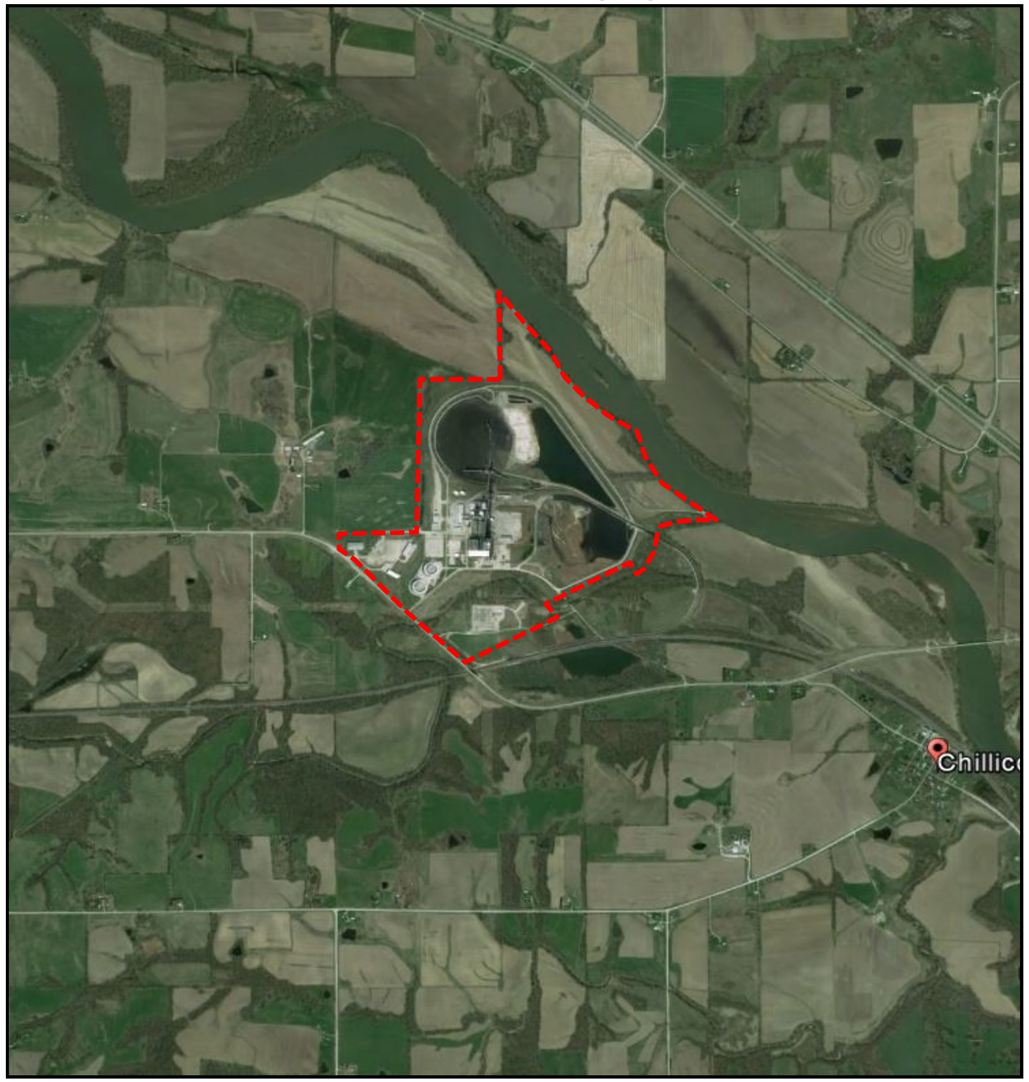
NW N NE
W E
SW S SE

TP, Chillicothe, 2013, 7.5-minute

SITE NAME: Ottumwa Generating Station
ADDRESS: 20775 Power Plant Road
Ottumwa, IA 52501
CLIENT: Environmental Site Assessors

N

Historical Aerial Photo 4/13/2016



Approximate Property Boundary

HARD HAT SERVICES™
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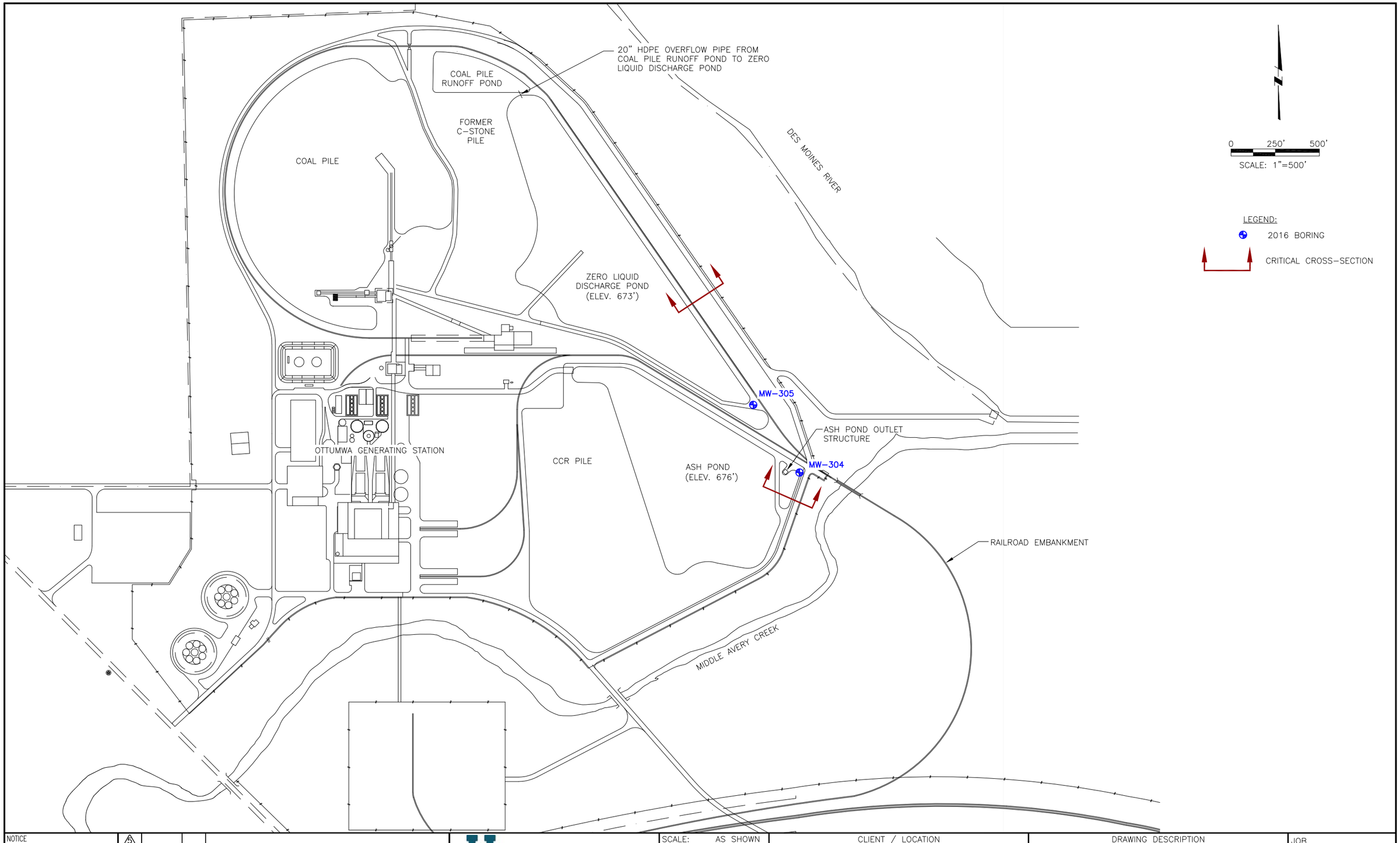
Site Location
Ottumwa Generating Station
Intersate Power and Light Company

Drawing: Figure 1
Date: 7/12/2016



REV	DATE	BY	DESCRIPTION
5			
4			
3			
2			
1			

hard hat SERVICES
solutions and action

SCALE:	AS SHOWN
DATE:	8-29-16
DRAWN BY:	JFD
CHKD BY:	THJ
APRVD BY:	MWL

CLIENT / LOCATION

INTERSTATE POWER AND LIGHT (IPL)
OTTUMWA GENERATING STATION
OTTUMWA, IA

DRAWING DESCRIPTION

SAFETY FACTOR ASSESSMENT
CRITICAL CROSS-SECTION LOCATION

JOB 154.018.002.003
SHT. FIGURE 2
DWG. 154.018.002.003-D2

APPENDIX A – 2016 Boring Logs

Alliant Energy
Interstate Power and Light Company
Ottumwa Generating Station
Ottumwa, Iowa

Structural Stability Assessment

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/11/2015	11/11/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-304	Feet	680.1 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,152 N, 1,903,287 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL.	TOPSOIL									
			2	FAT CLAY, black (10YR 2/1).										
			3											
			4											
			5											
			6											
			7		CH									
			8											
			9											
			10											
S1	23	4 5 4 5	11							M				
			12											
			13	FAT CLAY, yellowish brown (10YR 5/4).										
S2	19.5	4 4 5 5	14		CH					M				
			15	FAT CLAY, yellowish brown (10YR 3/4).										
			16		CH									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature for Kyle Kramer

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53718

Tel: (608) 224-2830
Fax:

Boring Number MW-304 Page 2 of 3

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S3	12	3 3 4 5	17	FAT CLAY, yellowish brown (10YR 3/4). *(continued)*						M				
S4	22	4 3 7 12	18 19 20							M				
S5	23	2 7 8 9	21 22							M				
S6	23	3 4 8 6	23 24 25							M				
S7	23	5 11 15 11	26 27		CH					M				
S8	15	4 4 5 6	28 29 30							M				
S9	18	4 6 9 9	31 32							M				
S10	24	4 6 7 6	33 34 35							M				
S11	16	2 2 4 6	36 37	FAT CLAY, DARK OLIVE BROWN (2.5Y 3/3).						M				
S12	24	4 3 5 5	38 39 40		CH					M				
S13	18	2 3 3 3	41 42							M				

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			43	FAT CLAY, DARK OLIVE BROWN (2.5Y 3/3). *(continued)*	CH									
S14	24	3 4 9 14	44	SANDY SILT, very dark gray.	ML					W				
			45	POORLY GRADED SAND, medium grained, gray (5Y 6/1), (weathered bedrock).										
S16	15	30 50/.4	46							W				
			47											
S17	5	33 50/.2	48		SP					W				
			49											
			50											
S18		50/.4	51							W				
			52	End of Boring at 52 feet bgs.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL- Ottumwa Generating Station SCS#: 25215135.40		MW-305

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	12/7/2015	12/8/2015	4-1/4 hollow stem auger

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-305	Feet	681.5 Feet	8.5 in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 401,473 N, 1,903,023 E S/C/N
SE 1/4 of NE 1/4 of Section 26, T 73 N, R 15 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL	TOPSOIL									
				GRAVEL	GP									
			2	FAT CLAY										
			3											
			4											
			5											
			6											
			7											
			8											
			9		CH									
			10	FAT CLAY, very dark grayish brown (10YR 3/2).										
S1	18	3 6 9 11	11							W				
			12											
			13	same as above except, brown (10YR 4/3).										
S2	22	3 7 14 22	14							W				
			15											
			16											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: for Kyle Kramer

Firm: SCS Engineers
2830 Dairy Drive Madison, WI 53718
Tel: (608) 224-2830
Fax:

Boring Number MW-305

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S3	22	5 15 14 15	17	FAT CLAY *(continued)*										
S4	20	3 5 13 15	18 19 20		CH									
S5	24	4 5 7 11	21 22	FAT CLAY WITH SILT, dark gray (10YR 4/1).						M				
S6	20	7 11 15 20	23 24	same as above except, very dark brown (10YR 2/2).						M				
S7	24	4 8 11 12	25 26 27	same as above except, very dark gray (10YR 3/1).	CH					M				
S8	24	8 12 16 21	28 29							M				
S9	13	4 4 7 12	30 31 32							M				
S10	24	5 6 9	33 34	LEAN CLAY, very dark brown (10YR 2/2).						W				
S11	24	4 4 5 7	35 36 37		CL					W				
S12	22	2 2 3 5	38 39 40	same as above except, very dark grayish brown (10YR 3/2).						W				
S13	6	3 9 11	41 42	POORLY GRADED SANDY GRAVEL, fine, brown (10YR 4/3).	GPS					W				water @ 41.0 ft bgs.

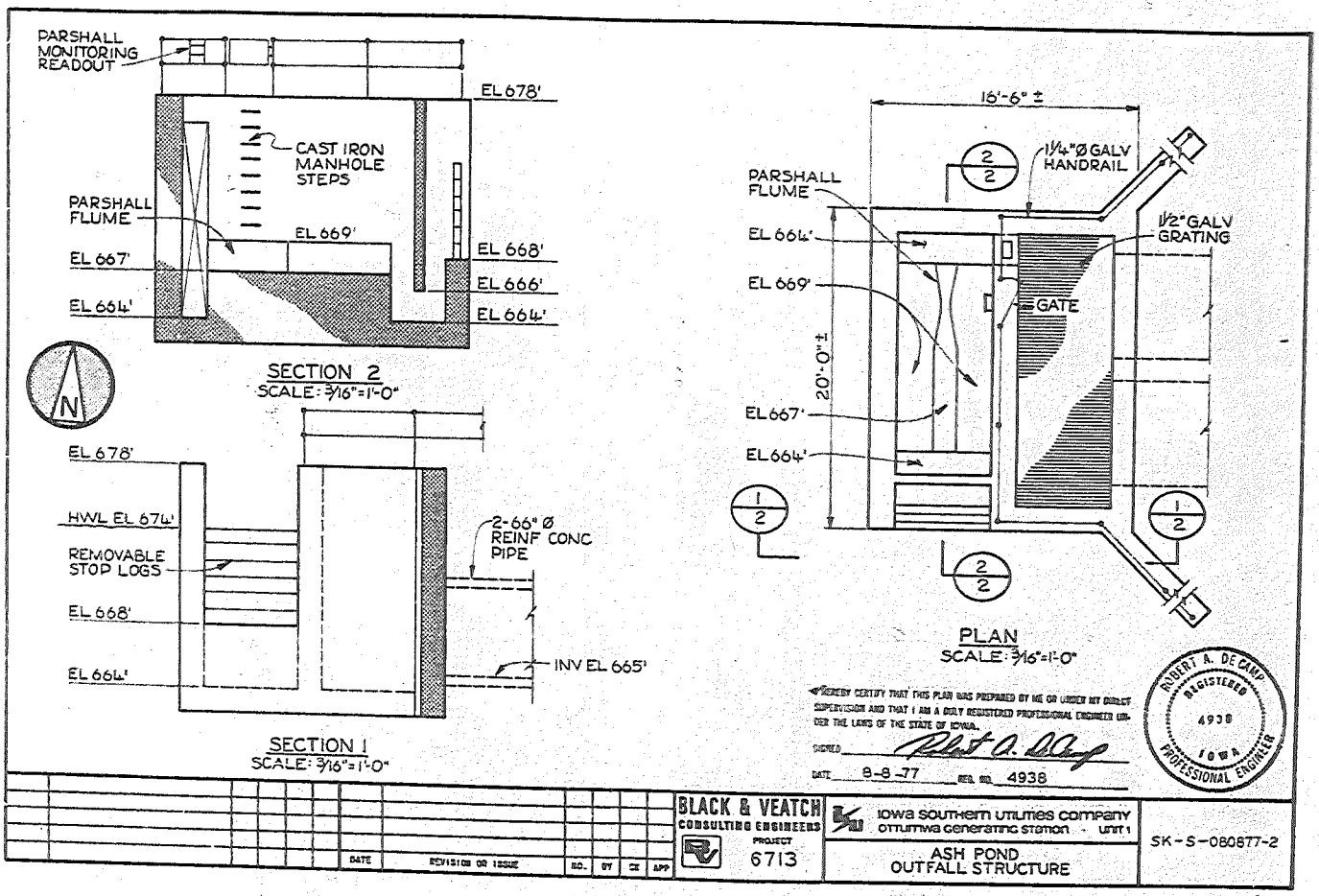
Boring Number MW-305 Page 3 of 3

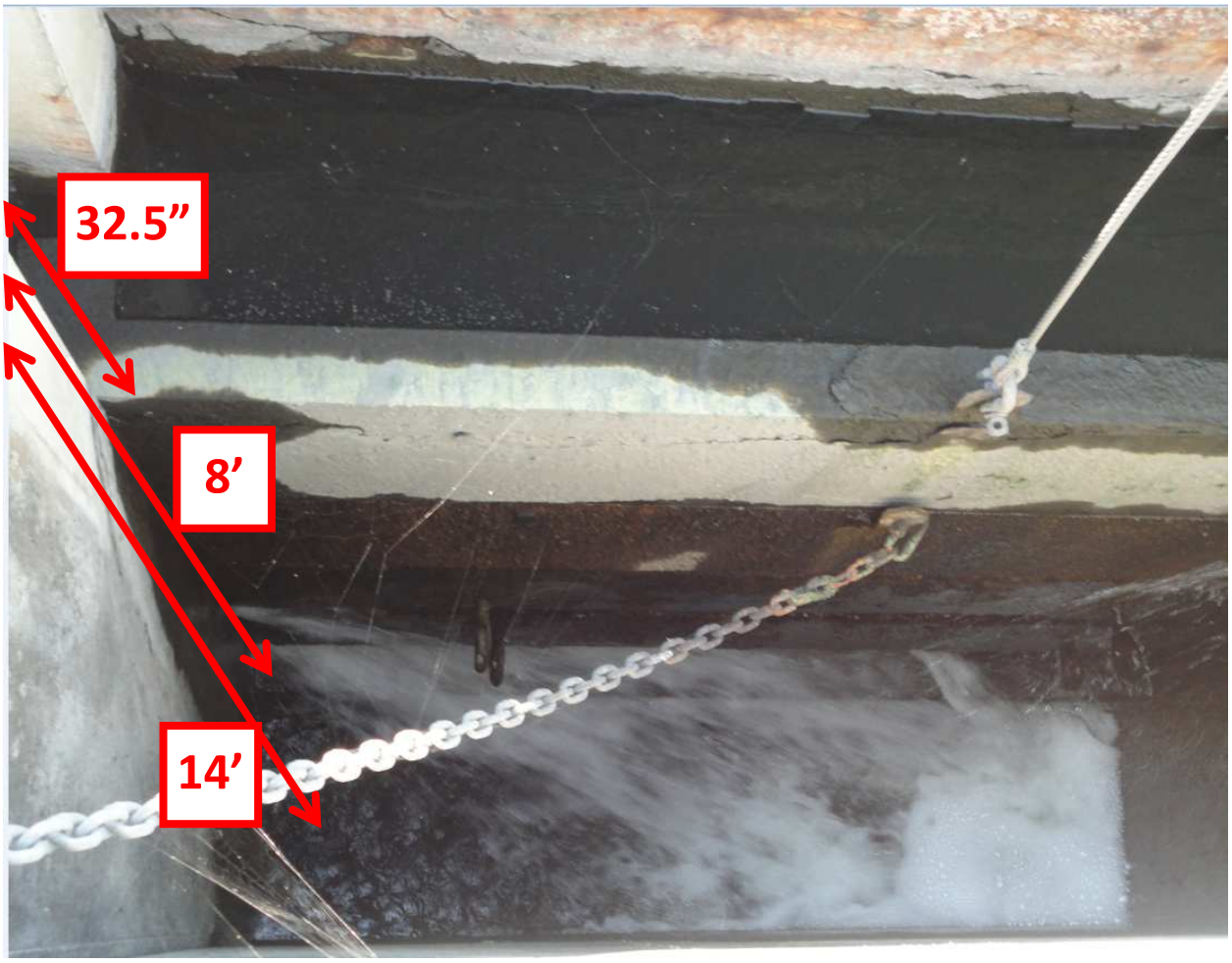
Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S14	22	23 50	43	POORLY GRADED SAND, medium grained, yellowish brown (10YR 5/4), (weathered bedrock). *(continued)*	SP					S				
			44											
			45											
S15	6	5 10 50	46		SP					S				
			47											
			48											
S16	6	50	49							S				
			50	End of Boring at 50 ft bgs.										

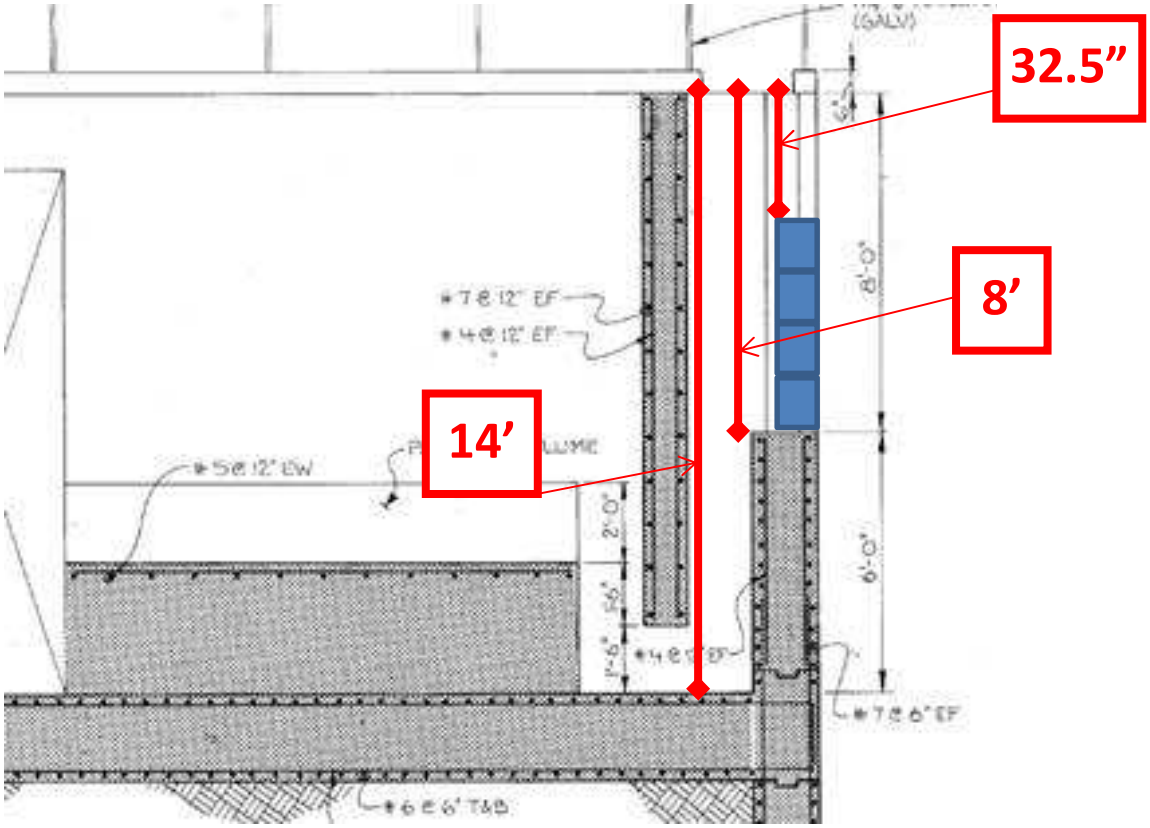
APPENDIX B – Impoundment Outfall Details

Alliant Energy
Interstate Power and Light Company
Ottumwa Generating Station
Ottumwa, Iowa

Structural Stability Assessment



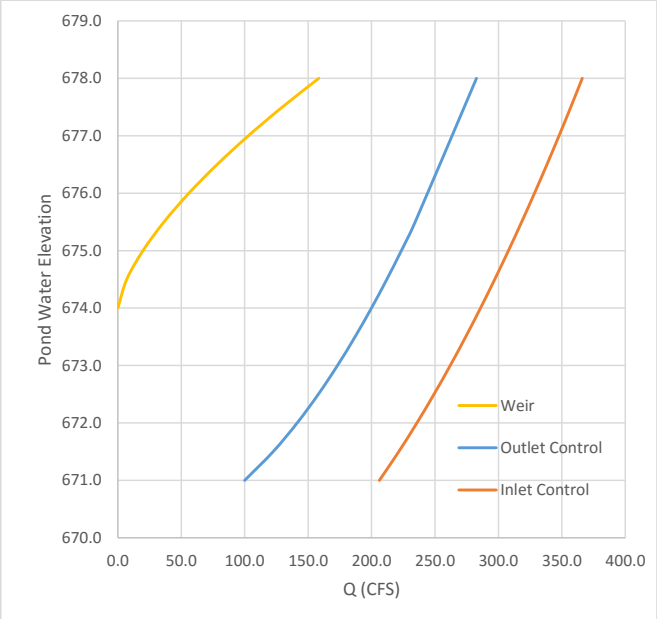

32.5”
8’
14’


32.5”
8’
14’
8'-0"
6'-0"
2'-0"

OSG - Slag Pond Outlet Discharge Curve

SINGLE OUTLET PIPE !!!!!
SUMMERGED OUTLET

5.5	FT = Pipe Diameter Steel
1.375	FT = Hydraulic Radius
3.636	k in Q outlet control equation
665	FT = Pipe Inlet Invert Elevation
180	FT = Length
0.025	= n for RCP
0.6	= Co for Inlet Control
670	FT = Tail Water Elevation
6	FT = Weir Width
3.3	= Weir Coefficient



OUTLET CONTROL / BARROW CONTROL

Q CFS	Elevation	Head Ft
99.947	671.0	1.0
122.41	671.5	1.5
141.35	672.0	2.0
158.03	672.5	2.5
173.11	673.0	3.0
186.98	673.5	3.5
199.89	674.0	4.0
212.02	674.5	4.5
223.49	675.0	5.0
234.4	675.5	5.5
282.69	678.0	8.0

INLET CONTROL

Q CFS	Elevation	Head (to pipe middle) Ft
206.15	671.0	3.25
221.44	671.5	3.75
235.74	672.0	4.25
249.22	672.5	4.75
262.01	673.0	5.25
274.2	673.5	5.75
285.87	674.0	6.25
297.09	674.5	6.75
307.9	675.0	7.25
318.34	675.5	7.75
328.44	676.0	8.25
338.25	676.5	8.75
347.78	677.0	9.25
357.06	677.5	9.75
366.1	678.0	10.25

Weir Equation
Q = Cw * L * H^1.5

H Ft	Q CFS
674.0	0.0
674.5	7.0
675.0	19.8
675.5	36.4
676.0	56.0
676.5	78.3
677.0	102.9
677.5	129.6
678.0	158.4

The two Wier outlet pipes can easily handle high flows even if one pipe is plugged and the outlet submerged (15' + above the flood plain).