REPORT

Annual Inspection

Coal Creek Station – Upstream Raise 91 CCR Surface Impoundment

Submitted to:

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Submitted by:

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1.0 INTRODUCTION

As part of 40 CFR Part 257 of the Subtitle D solid waste provisions under the Resource Conservation and Recovery Act (RCRA), utilities are required to complete annual inspections for surface impoundments and landfills containing Coal Combustion Residuals (CCR). This report has been prepared by Golder Associates Inc. (Golder) for Great River Energy (GRE) to satisfy the annual inspection requirements for CCR surface impoundments under 40 CFR Part 257.83.

Coal Creek Station (CCS) is located in McLean County, approximately 10 miles northwest of Washburn, North Dakota. There are four facilities located at CCS that fall under the CCR rule requirements (Figure 1):

- Drains Pond System CCR Surface Impoundment (Drains Pond System)
- Upstream Raise 91 CCR Surface Impoundment (Upstream Raise 91)
- Upstream Raise 92 CCR Surface Impoundment (Upstream Raise 92)
- Southeast Section 16 CCR Landfill (Southeast 16)

Upstream Raise 91 and Upstream Raise 92 both operate as impoundments and will be closed with CCR in-place. The Drains Pond System is currently being used to dewater bottom ash and as a process water impoundment to return conveyance water back to the plant. The Southeast 16 landfill operates as a landfill and is used as a storage/disposal facility for CCRs that do not contain free liquid. This report presents a review of available facility information and findings of the inspection of Upstream Raise 91 at CCS performed September 19, 2018.

2.0 REVIEW OF EXISTING INFORMATION

2.1 Geological Conditions

Upstream Raise 91 is generally constructed over a glacial till layer consisting of sandy and silty-clay soils. Glacial till varies in thickness from 20 feet to several hundred feet in the area of Coal Creek Station. Silty-sand and sand lenses are present throughout the glacial till formation, which is underlain by poorly consolidated siltstone/sandstone bedrock (Barr Engineering 1982; CPA and UPA 1989).

2.2 Facility Location and Operation

Upstream Raise 91 (Figure 2) is located in Sections 16 and 17, Township 145N, Range 82W and covers approximately 70 acres. The facility is used as a combined dewatering and storage facility for CCRs including fly ash, bottom ash, economizer ash, and flue gas desulfurization (FGD) material. Bottom ash and fly ash are hauled to the facility. During 2018, economizer ash and associated conveyance water entered Upstream Raise 91 through the 12-inch ash lines. Process water enters Upstream Raise 91 through the drain pipes from Upstream Raise 92. FGD material and hydraulic conveyance water enter Upstream Raise 91 through a high-density polyethylene (HDPE) pipe from the plant to varying locations within the facility. The pipe runs above ground from the northeast corner of the facility to the final discharge location. The on-grade HDPE pipe is periodically moved to different areas of Upstream Raise 91 to achieve an even distribution of FGD material in the facility. A small amount of water may also enter through culverts draining stormwater from the ash pipeline corridor into Upstream Raise 91. Upstream Raise 91 is approximately 300 feet south of Lower Samuelson Slough and 100 feet north of rail lines. The Drains Pond System is adjacent to the northwest side of Upstream Raise 91 and Upstream Raise 92 is adjacent to the east side of Upstream Raise 91. A drainage ditch also exists along the south and west sides of Upstream Raise 91.

2.3 Site History and Liner Systems

Upstream Raise 91 was originally part of the South Ash Pond. The South Ash Pond was constructed with a clay core dike and soil liner. A new clay liner was installed over the South Ash Pond in 1982 and the facility remained in operation until 1987 when ash was excavated from the South Ash Pond and transported to the Section 5 dry CCR landfill. The South Ash Pond was then divided into Ash Pond 91 (Upstream Raise 91) and Ash Pond 92 (west half of Upstream Raise 92). Ash Pond 91 (Upstream Raise 91) was deepened and a new composite liner consisting of a 2-foot thick clay and a 40-mil HDPE liner was completed in 1992. The liner is overlain with 1 foot of sand, 1 foot of gravel, and a drainage system. An additional 7 acres of composite liner was installed in the southeast corner of Upstream Raise 91 and in the area between Upstream Raise 91 and the Upstream Raise 92 in 2016. The liner completes a continuous composite-lined area between Upstream Raise 91 and Upstream Raise 92. The composite liner system installed in 2016 consists of (from bottom to top): Geosynthetic Clay Liner (GCL) and 60-mil HDPE liner.

Selected construction drawings from the 1992 work and 2016 work as well as the current permit drawings are included in Appendix A.

2.4 Site Geometry

The design crest of the original soil berms surrounding Upstream Raise 91 are at a constant elevation of approximately 1922 feet above mean sea level (amsl). This berm surrounding the facility on the north, west, and south sides has a gravel surfaced roadway supporting both light passenger vehicles and heavy construction equipment, such as Caterpillar 777 haul trucks. Based on existing topography, original berm downstream slopes generally have 3:1 slopes to the surrounding grades and perimeter drainage ditches with elevations of 1897 feet amsl on the north side of Upstream Raise 91 and 1898 feet amsl on the south and west sides of Upstream Raise 91. Original soil perimeter berm downstream slopes have grass vegetation. Berm upstream slopes of the original soil perimeter berms have an approximate 3:1 slopes to the base of the facility between elevations 1900 feet amsl and 1914 feet amsl. The top of the HDPE liner is anchored at elevation 1920 feet amsl.

The entire facility is designed with 5:1 final CCR slopes from the perimeter berms to elevation 1974 feet amsl, 15% final CCR grades between elevations 1974 feet amsl and 2004 feet amsl, and a 5% crown to achieve a final CCR elevation of approximately 2018 feet amsl (Figure 3).

2.5 Changes in Geometry

No significant changes to geometry were noted other than the continued placement of CCRs to the design grades. Between January and December of 2018, the bottom ash/fly ash has increased in elevation from approximately 1929 feet amsl to 1935 feet amsl.

2.6 Storage Capacity and Volumes

Based on a comparison between the approximate grades as of the fall of 2018 and the final permitted grades of Upstream Raise 91, the facility has a remaining CCR capacity of approximately 6,420,000 cubic yards (CY). The approximate total CCR capacity of Upstream Raise 91 is approximately 8,340,000 CY. Therefore, the amount of CCR contained in the facility at the time of the inspection is estimated to be approximately 1,920,000 CY.

2.7 Impounded Water

The water level in Upstream Raise 91 varies with time as more CCRs are deposited and as operational variables change (such as gravity drainage pipe elevations). The water elevation at the time of the inspection was approximately 1922 feet amsl. Although not directly measured because of access safety constraints, the average elevation of FGD material in the facility was approximately 1920 feet amsl based on visual observations. An average of approximately 2 feet of water was impounded in Upstream Raise 91 at the time of inspection. Based on an area of impounded water of 36 acres, the volume of impounded water at the time of the inspection was approximately 72 acre-feet or 23,000,000 gallons.

2.8 Permits

Upstream Raise 91 is currently permitted with the North Dakota Department of Health (NDDH) under Permit Number 0033. Previous permit modification documents describe additional historical information about the design of the facility (CPA 1997, CPA and UPA 1989, GRE 2003, GRE 2012, GRE 2015).

2.9 Summary of 2018 Weekly Inspections

Routine weekly inspections of Upstream Raise 91 were performed by GRE as a part of the final CCR Rule. Based on a review of the available inspection forms, the following items were noted:

- Generally good site maintenance.
- No signs of significant seepage, settlement, or cracking of the berm downstream slopes.
- No signs of animal burrows were noted on berm downstream slopes.
- Fugitive dust was actively controlled using a water truck (as required).

2.10 Summary of Previous Inspections

The most recent annual professional engineer inspection of Upstream Raise 91 was performed by Golder in 2017 (Golder 2018). A summary of the observations of that inspection are as follows:

- Generally good vegetation and site maintenance.
- No signs of significant seepage, settlement, or cracking of the berm downstream slopes.
- Sparse vegetation on isolated areas of downstream slopes.
- Inflow structures and perimeter channels in generally good condition.
- Several small animal burrows, but none that were anticipated to cause areas of structural weakness.

3.0 2018 ANNUAL INSPECTION

On September 19, 2018, Craig Schuettpelz, Paul Schlicht and Todd Stong of Golder performed an inspection of Upstream Raise 91 per United States Environmental Protection Agency (USEPA) Regulation 40 CFR Part 257.83(b) requirements. The inspection consisted of visual observations while walking around the facility traversing up and down the perimeter berm and CCR placement areas. An annual inspection checklist used during the inspection is presented in Appendix B. Photographs were taken and are presented in Appendix C. The following presents a summary of the observations made during the 2018 annual inspection.

3.1 Hydraulic Structures

Inflow structures to Upstream Raise 91 consist of drainage pipes from the Upstream Raise 92 facility, an inflow pipe for depositing FGD material, and the ash lines conveying rejects and economizer ash. Some of these pipes are buried or below the water level and could not be observed. The on-grade FGD piping is periodically moved to different areas of Upstream Raise 91 (or Upstream Raise 92) to achieve an even distribution of FGD material in the facilities. The pipes observed appeared to be in good condition with no noticeable settlement, cracking, significant corrosion, or significant erosion.

Additional pipelines and contact water control features (contact water perimeter channels and culverts) inside Upstream Raise 91 convey water to downstream facilities. These include a series of gravity drainage pipes, seepage pipes, and perimeter channels and culverts that transfer CCR conveyance water from the facility to the adjacent Drains Pond System. The gravity drains were constructed at the design elevation and appeared to be free from obstructions and in good working order. Seepage piping was below the elevation of the water and could not be observed. The culverts connecting the contact water perimeter channels were in good condition at the time of the inspection.

The outflow structures from Upstream Raise 91 consist of cross-over pipes directing water to the east cell and center cell of the Drains Pond System. The cross-over pipes were below the water level and could not be observed.

3.2 Perimeter Berm

3.2.1 Berm Upstream Slope

The berm upstream slopes are mostly covered by CCR deposition and/or final cover. A small amount of berm upstream slopes was visible along the north, west, and south sides of the facility. The observed slopes appeared to match the design slopes of 3:1 and are being protected from erosion with a cemented fly ash layer. The berm upstream slopes appeared to be competent with no signs of significant distress.

3.2.2 Berm Crest

The berm crest along the north, west, and south sides of Upstream Raise 91 is surfaced with gravel and used for both light vehicle and heavy construction equipment traffic. The berm crest on the east side of Upstream Raise 91 was not visible during the inspection. The berm crest roads on the west and south sides experience little heavy traffic and are mostly exposed to light vehicle traffic (cars, pickups, etc.). The berm crest road on the north side experiences frequent heavy traffic from large haul trucks and some minor rutting was noted. The road on the berm crest of Upstream Raise 91 appears to be in good condition, with no noticeable cracking or settlement, and appears to be well maintained. A small containment berm on the north side of the berm crest appears to contain and direct runoff from the haul road toward Upstream Raise 91 perimeter ditches. When wet, road surfaces can become rutted and slippery. Ruts that develop should be repaired as soon as possible to maintain access.

3.2.3 Berm Downstream Slope

The berm downstream slopes range from 0 to 20 feet in height. In 2017, erosion rills were repaired and covered with erosion control blankets and several areas on the west and south berm downstream slopes were reseeded. Isolated areas continue to be sparsely vegetated; however, vegetative growth continues to improve and was more established during the 2018 inspection than during the 2017 inspection.

The north berm downstream slope is heavily vegetated with native grasses. Occasional small animal burrows up to approximately two inches in diameter were observed on the north, west, and south berm downstream slopes. Golder did not observe indications of seepage, sloughing, cracking, significant erosion, excessive settlement, or vegetation that seemed to be thriving abnormally. The berm downstream slope appeared to be in good condition.

3.3 Toe

The environment at the toe of slope varies substantially surrounding Upstream Raise 91. Upstream Raise 92 is directly east of Upstream Raise 91 and there is no downstream slope or toe. North of the facility, the toe of the slope is covered in tall grass with no noticeable wet areas. A site surface water drainage ditch exists along the west and south side toes directing flow counterclockwise to the south side of Upstream Raise 91, then eastward away from the site. At the time of inspection, this surface water ditch contained approximately one foot of water. Culverts connecting different areas of this drainage ditch were mostly clear of obstructions at both inlets and outlets. The toes of berm downstream slopes appear to be in good condition.

3.4 CCR Placement

CCR placement above the perimeter berm began in 2017 and continued through 2018 within Upstream Raise 91. At the time of the inspection, CCR downstream slopes were approximately 15 feet tall (up to elevation 1935 feet amsl). With a wide CCR crest constructed of fly ash, bottom ash, and mixed competent CCR materials.

3.4.1 CCR Upstream Slope

The CCR upstream slope is defined as the slope that toes out into the raise pool. The CCR upstream slope of Upstream Raise 91 is constantly changing as bottom ash and FGD material are deposited. Therefore, the CCR upstream slopes are temporary and dependent on the angle of repose of the bottom ash material. The vertical distance from the top of the bottom ash CCR upstream slope to the water/FGD material mixture is approximately 10 to 13 feet in most locations. The CCR upstream slopes appear to be in good condition with no signs of structural weakness.

3.4.2 CCR Crest

The CCR crest along the top of the facility is constructed of bottom ash and fly ash. Fly ash makes up the outer portion of the crest and is a “shell” around Upstream Raise 91 primarily for erosion protection and as a trafficking surface. Bottom ash and fly ash on the CCR crest of the facility is in good condition and is continually worked and compacted with heavy equipment.

3.4.3 CCR Downstream Slope

The area above the original perimeter berm downstream slopes surrounding the north, west, and south sides had an exposed fly ash “shell” at the time of the inspections (CCR downstream slope). The fly ash CCR downstream slope is in good condition and there was no noticeable seepage, sloughing, cracking, or abnormally thriving vegetation, or settlement during the inspections; however, there was some minor erosion of the fly ash shell. The eroded fly ash is collected within the lined footprint in a perimeter ditch and must be periodically cleaned out as required.

3.5 Instrumentation

Three vibrating wire piezometers were installed in Upstream Raise 91 in late 2017. The piezometers were constructed in the center of Upstream Raise 91 where the FGD material is deposited. Communications cables are

routed to the north side of Upstream Raise 91 to a data logger where information from piezometers is downloaded and reviewed monthly by GRE personnel.

Piezometer measurements for the last year are included in Appendix D. In early 2018, GRE began depositing FGD material in the center of Upstream Raise 91, continuing deposition in Upstream Raise 91 until mid-November of 2018. During that time, the pool began to equilibrate with FGD material deposition and process water inflows and varied between approximate elevations of 1922 feet and 1924 feet throughout 2018, as shown by the piezometer readings.

3.6 Signs of Structural Weakness or Other Observations that Could Affect Stability

No signs of structural weakness or other observations that could affect the stability of Upstream Raise 91 were observed during the site inspection in September 2018.

4.0 SUMMARY AND CONCLUSIONS

An annual inspection was performed for Upstream Raise 91 at Coal Creek Station on September 19, 2018. The inspection met the requirements for CCR surface impoundments under 40 CFR Part 257.83. Golder observed fair vegetation and good site maintenance and did not identify significant deficiencies such as seepage, excessive erosion or settlement, or cracking during visual observations of Upstream Raise 91. Overall, the facility appeared to be in good condition at the time of the visual evaluation.

In addition to annual inspections by the professional engineer, trained and qualified site personnel will perform the required weekly facility inspections to look for signs of potential structural weaknesses.

Minor maintenance items that may need to be continually addressed include repairing large animal burrows as they appear, monitoring erosion and vegetative success of the re-configured surface water channel along the west and south toe of the facility, clean-out of collected material in the contact water perimeter channels and maintaining gravity and culvert piping, repairing and re-seeding eroded areas on or adjacent to berm downstream slopes, and removal of any woody vegetation growing on the berm downstream slopes. In addition, the inflow and outflow piping should be monitored regularly and cleared of debris as required to ensure proper conveyance of water to and from the facility.

Golder Associates Inc.

Craig Schuettpelz, PE
Senior Project Engineer

Todd Stong, PE
Associate and Senior Consultant

KAC/PDS/af

5.0 REFERENCES

Barr Engineering. 1982. Coal Creek Station Hydrogeologic Study, June 3, 1982.

Cooperative Power Association. CPA 1997. Application to Renew Permit SU-033 and Combine with Permit SU-118. Eden Prairie, Minnesota, July 30, 1997.

Cooperative Power and United Power Association. CPA and UPA 1989. *Application to Renew Permit to Operate a Special Use Disposal Site, Coal Creek Station, Permit Number SU-033*. Prepared for the North Dakota State Department of Health and Consolidated Laboratories.

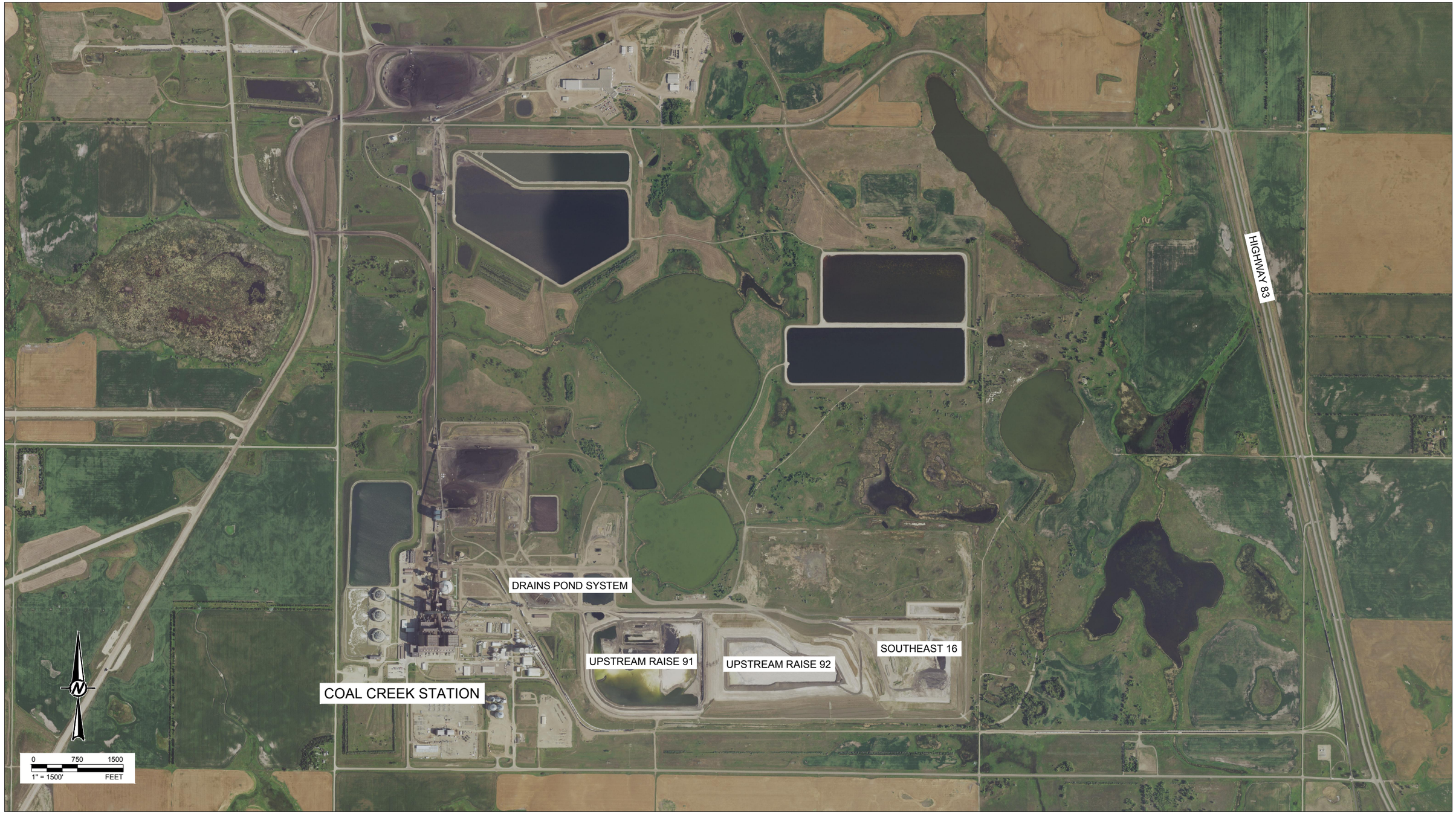
Golder Associates Inc. Golder 2018. Annual Inspection Report – Great River Energy – Coal Creek Station – Upstream Raise 91. January 2018.

Great River Energy – Coal Creek Station. GRE 2003. Permit Modification Document, Permit No. SP-033. Original Permit Modification submitted September 30, 2003. Revised Permit Modification submitted to NDDH on July 8, 2004.

Great River Energy – Coal Creek Station. GRE 2012. Permit Modification Document, Permit No. SP-033. Original Permit Modification dated December 12, 2012.

Great River Energy – Coal Creek Station. GRE 2015. Permit Modification Document, Permit No. SP-033. Original Permit Modification dated February, 2015.

FIGURES



REFERENCES

1. AERIAL IMAGE FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, PUBLISHED IN 2018.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-03
DESIGNED	KAC
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2018 ANNUAL CCR FACILITY INSPECTION REPORT

TITLE
COAL CREEK STATION - SITE OVERVIEW

PROJECT NO.	REV.	FIGURE
1893823	B	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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REFERENCES

1. FOREGROUND AERIAL IMAGE FROM GREAT RIVER ENERGY PHOTOGRAPH TAKEN MAY 2018.
2. BACKGROUND AERIAL IMAGE FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, PUBLISHED IN 2018.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

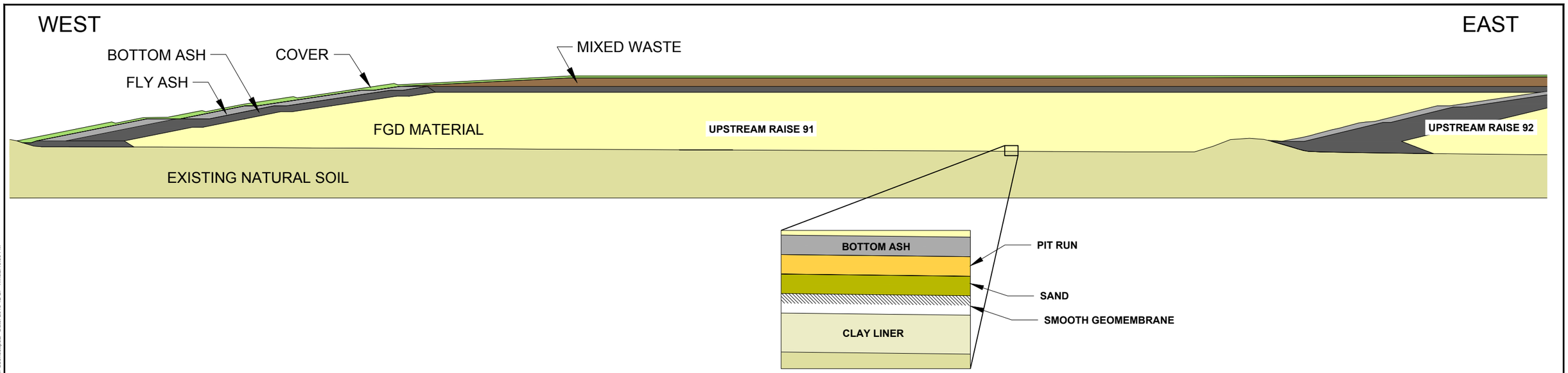
CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-03
DESIGNED	KAC
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

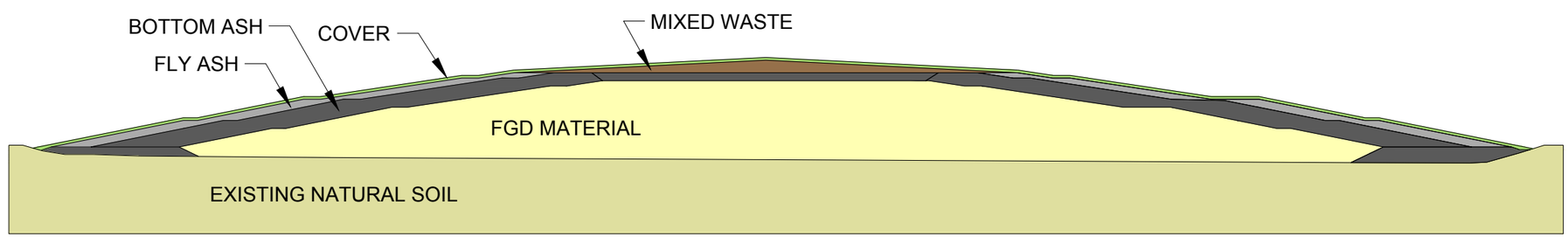
PROJECT
2018 ANNUAL CCR FACILITY INSPECTION REPORT

TITLE
UPSTREAM RAISE 91
SITE OVERVIEW

PROJECT NO.	REV.	FIGURE
1893823	B	2



WEST-EAST SECTION



SOUTH-NORTH SECTION

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
GOLDER

YYYY-MM-DD	2018-12-27
DESIGNED	CCS
PREPARED	CCS
REVIEWED	TJS
APPROVED	TJS

PROJECT
2018 ANNUAL CCR FACILITY INSPECTION REPORT

TITLE
UPSTREAM RAISE 91
CROSS SECTIONS

PROJECT NO.	REV.	FIGURE
1893823	A	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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REFERENCES

1. FOREGROUND AERIAL IMAGE FROM GREAT RIVER ENERGY PHOTOGRAPH TAKEN MAY 2018.
2. BACKGROUND AERIAL IMAGE FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, PUBLISHED IN 2018.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-03
DESIGNED	CCS
PREPARED	CCS
REVIEWED	TJS
APPROVED	TJS

PROJECT
2018 ANNUAL CCR FACILITY INSPECTION REPORT

TITLE
UPSTREAM RAISE 91
PIEZOMETERS OVERVIEW

PROJECT NO.	REV.	FIGURE
1893823	B	4

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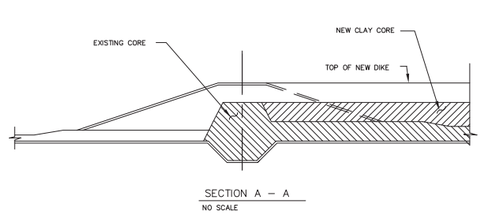
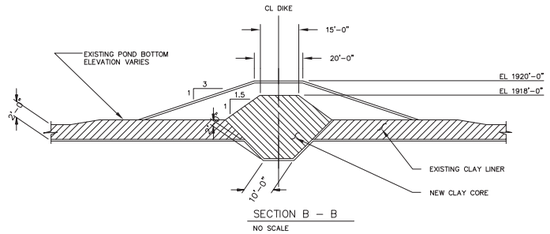
APPENDIX A

Selected Construction Drawings and Permit Drawings



SECTION A – A
NO SCALE



SECTION B – B
NO SCALE

GENERAL NOTES

DRAWING NO.	REVISION	REFERENCE DRAWINGS

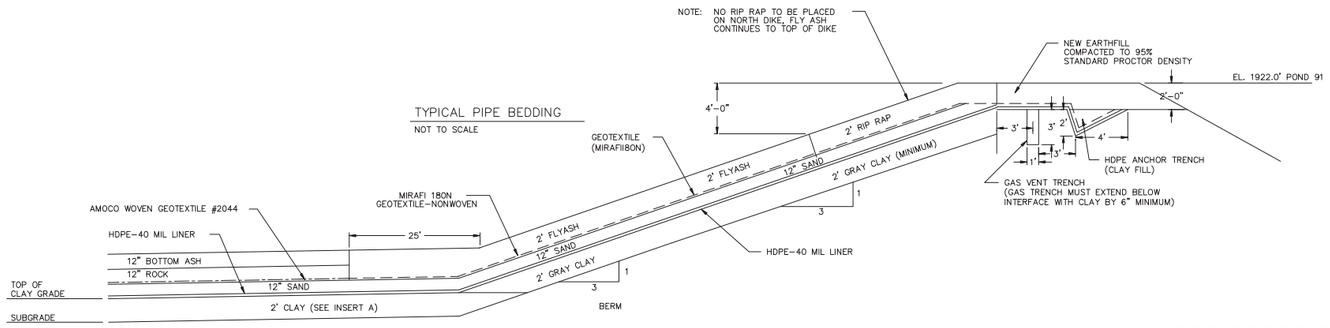
DWN. JJ CHK.
DATE 01/07/91
W/O 91G105

SOUTH ASH POND–
SECTIONS AND ELEVS
1991 ASH DISPOSAL

DRAWING NO.
91G105-26

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP
02/27/91	ISSUED FOR CONSTRUCTION	1	RR	AS	
01/18/91	ISSUED FOR BID	0	JJ	AS	

COOPERATIVE Association POWER



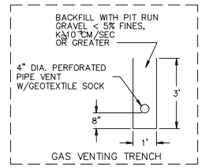
TYPICAL PIPE BEDDING
NOT TO SCALE

INSERT A

6" GRAY CLAY

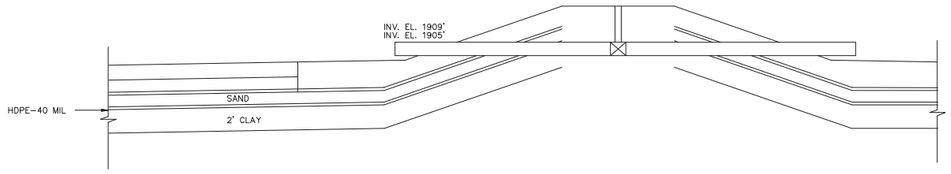
18" BROWN CLAY

BERM & BOTTOM SECTION
ASH POND 91
(1/17) NOT TO SCALE



GAS VENTING TRENCH

NOTE:
1. PROVIDE PERFORATED PIPE VENTS (PVC-SHED40), EACH APPROX. 120' LONG AND 4" DIA. IN THE GAS VENTING TRENCHES. THE EXACT LENGTHES TO BE DETERMINED BY SITE REPRESENTATIVE.
2. THE EXPOSED ENDS OF 4" DIA. GAS VENTING PIPE SHALL BE PROTECTED WITH BOTH A 1/2" STAINLESS STEEL SCREEN AND REGULAR SCREENING MATERIALS.



PIPE PENETRATION - BERM
ASH POND 91 AND DRAIN POND 91
(2/17) NOT TO SCALE

VALVE LIST

ITEM NO.	SYSTEM TAG	DESCRIPTION	B & V FILE NO.	SIZE IN.	PRESS TEMP	PRESS CLASS	TYPE	BODY MAT	END PREP	MFGR NO.	SHOP NO.	REMARKS
	WC08-VL9168	ASH POND 91-PLANT DRAIN POND		18	100	150	GA	CI				UNDERGROUND VALVE WITH VALVE BOX
	WC08-VL9169	PLANT DRAIN POND DISCHARGE		18	100	150	GA	CI				UNDERGROUND VALVE WITH VALVE BOX

GENERAL NOTES

DRAWING NO.	REVISION	REFERENCE DRAWINGS

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP
03-18-92	ISSUED FOR CONSTRUCTION	1	BK	AS	AS
01/09/92	ISSUED FOR BID	0	BK	AS	AS

DWN. BAK CHK.
DATE 12/26/91
W/O 92G213

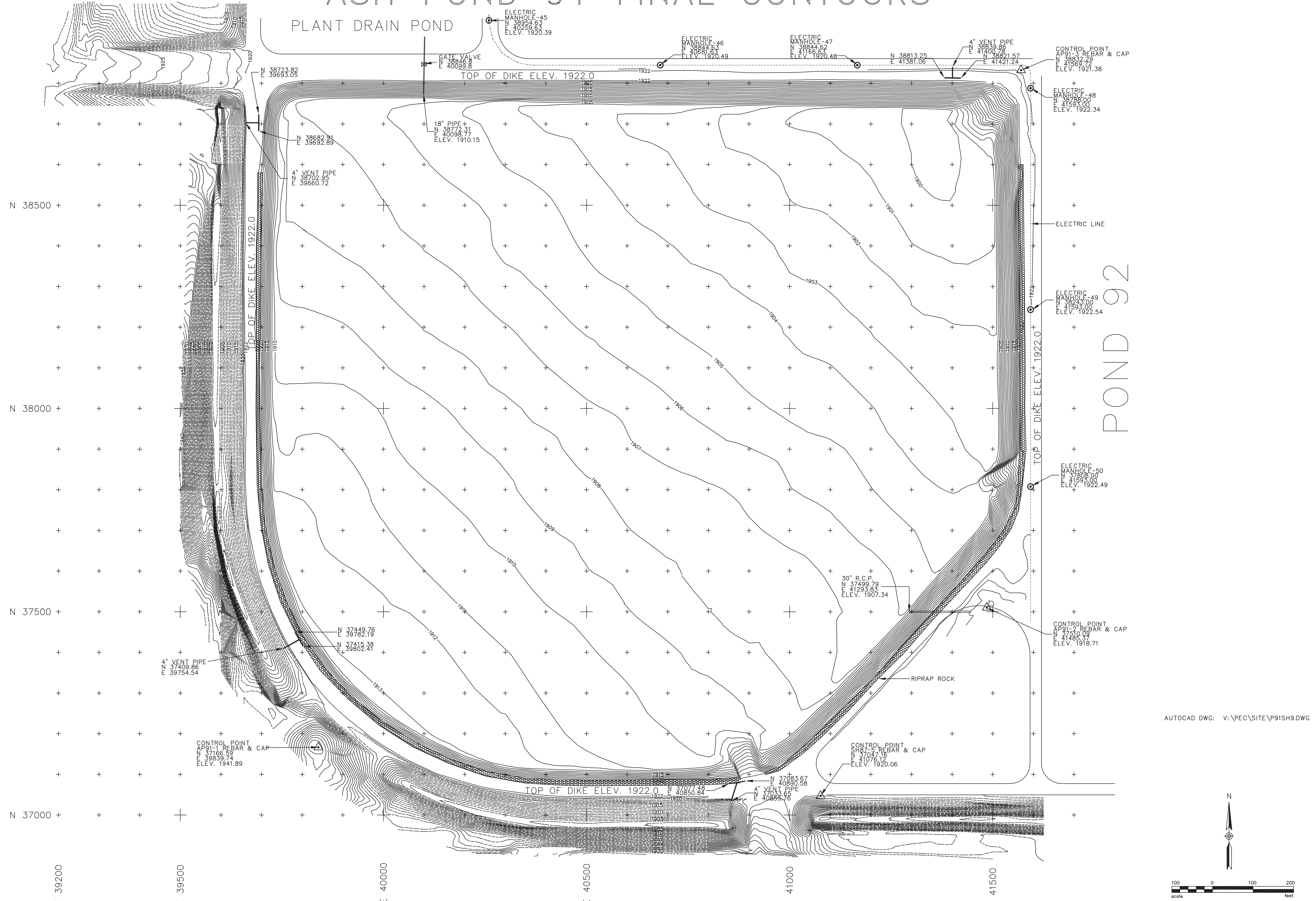
TYPICAL SECTIONS AND DETAILS

1992 ASH DISPOSAL

DRAWING NO. 92G213-17

COOPERATIVE Association POWER

ASH POND 91 FINAL CONTOURS



Revision No.	Date	By	Description

COOPERATIVE POWER ASSOCIATION
UNDERWOOD, NORTH DAKOTA

ASH POND 91 FINAL CONTOURS

Drawn By D.B.J. | Project No. B92-17-02

Checked By L.H.K | Date 1/25/94

interstate engineering, inc.

Engineering – Surveying – Planning

9

SHEET NO.

DRAINS POND

ASH POND 91 TO DRAINS POND HYDRAULIC CONNECTION DETAIL SEE NOTE 2 SEE DETAIL 3/9

ACCESS HAUL ROAD SEE DETAIL 5/9

CONTACT WATER CONTROL PERIMETER DITCH SEE DETAIL 1/9

ASH POND 91 PROFILE SEE DETAIL 1/7

ACCESS ROAD SEE DETAIL 5/9

CONTACT WATER CONTROL PERIMETER DITCH SEE DETAIL 1/9

ASH POND 91

ASH POND 92

139 000 N
138 500 N
138 000 N
137 500 N
137 000 N
1 840 000 E
1 840 500 E
1 841 000 E
1 841 500 E
1 842 000 E
1 842 500 E

SCALE 0 120 240 FEET

LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCE 2)
- DESIGN TOP OF CCP GRADES (ASH POND 92 AND SW SECTION 16 UPSTREAM RAISE)
- PROPOSED TOP OF CCP GRADES (ASH POND 91 UPSTREAM RAISE)
- CROSS-OVER PIPING

NOTES

1. CROWN OF CCP GRADES ARE SHOWN AT FIVE PERCENT, BUT MAY BE CONSTRUCTED BETWEEN THREE PERCENT AND FIVE PERCENT.
2. CONTACT WATER IS COLLECTED IN THE PERIMETER DITCH AROUND ASH POND 91. WATER IS DIRECTED THROUGH CROSS-OVER PIPES TO THE DRAINS POND OR DOWNWARD INTO THE UPSTREAM RAISE.

REFERENCES

1. SITE LOCATION: SECTIONS 16 AND 17, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.
2. EXISTING GROUND TOPOGRAPHY WAS PROVIDED BY GREAT RIVER ENERGY. THE SURVEYS WERE PERFORMED BETWEEN 1996 AND 2011 EXCEPT DRAINS POND AS-BUILT TOP OF LINER SYSTEM GRADES, WHICH WERE SURVEYED BY INTERSTATE ENGINEERING, INC. AND ARE REFERENCED FROM A SURVEY DRAWING PROVIDED BY GREAT RIVER ENERGY, DATED JANUARY 10, 1994.
3. COORDINATES ARE BASED ON THE PLANT GRID SYSTEM.
4. THE CONTOUR INTERVAL IS TWO FEET.
5. ALL PROPERTY SHOWN ON THIS MAP IS OWNED BY GREAT RIVER ENERGY.

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-02-11	ISSUED FOR PERMIT MODIFICATION	CCS	CCS	TJS	RRJ
A	2014-11-10	ISSUED FOR CLIENT REVIEW	CCS	CCS	TJS	RRJ

SEAL

REGISTERED PROFESSIONAL ENGINEER — TODD J. STONG — PE-6144 — DATE 2/11/2015 — NORTH DAKOTA

CLIENT

GREAT RIVER ENERGY

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

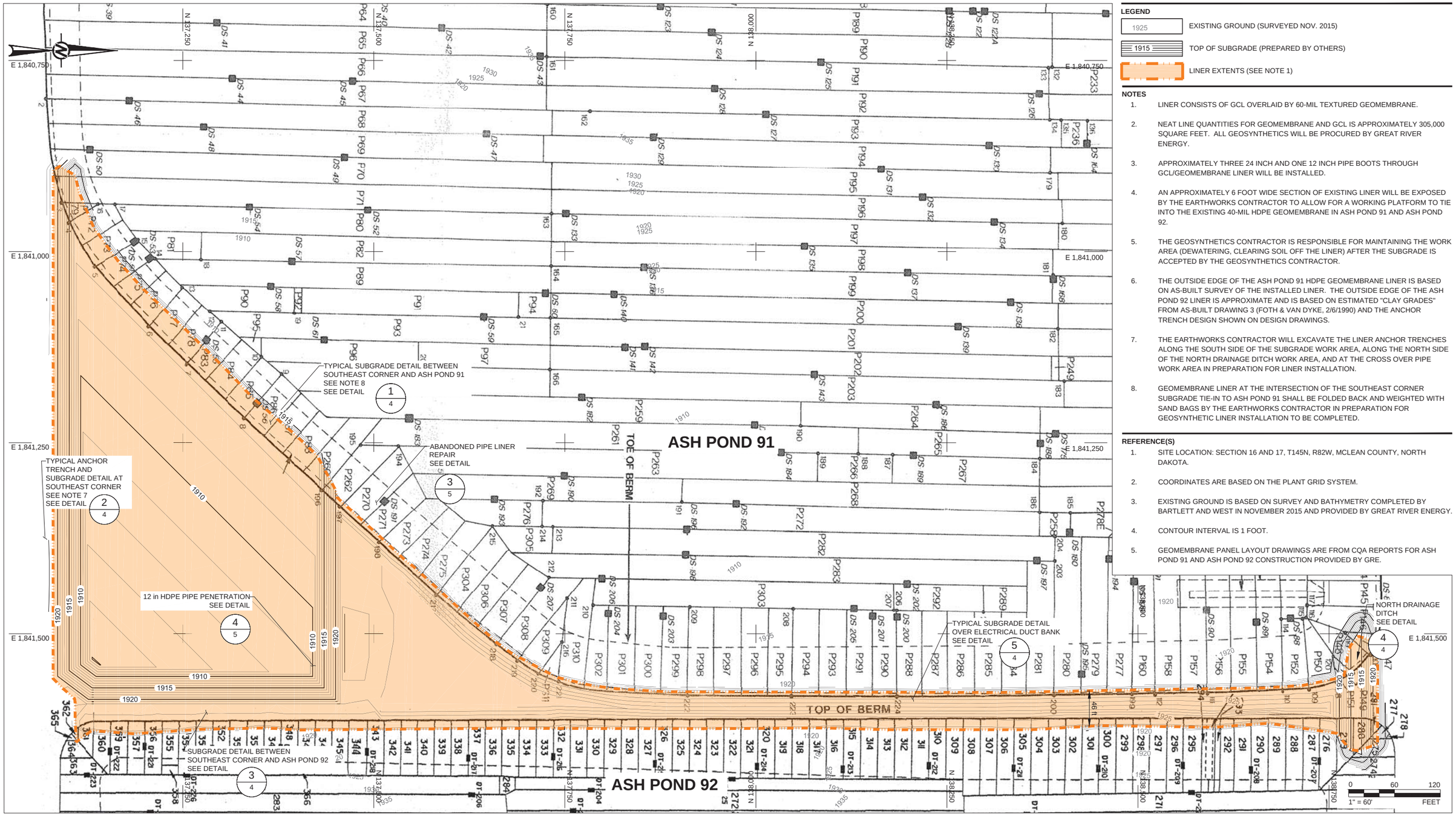
CONSULTANT

GOLDER ASSOCIATES INC.
44 UNION BLVD. SUITE 300
LAKEWOOD, COLORADO
USA
(303) 980-0540
www.golder.com

PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
PROPOSED FINAL CCP GRADES

PROJECT No. 1400644 | Rev. B | 4 of 10 | SHEET 4



LEGEND

- 1925 — EXISTING GROUND (SURVEYED NOV. 2015)
- 1915 — TOP OF SUBGRADE (PREPARED BY OTHERS)
- LINER EXTENTS (SEE NOTE 1)

NOTES

1. LINER CONSISTS OF GCL OVERLAID BY 60-MIL TEXTURED GEOMEMBRANE.
2. NEAT LINE QUANTITIES FOR GEOMEMBRANE AND GCL IS APPROXIMATELY 305,000 SQUARE FEET. ALL GEOSYNTHETICS WILL BE PROCURED BY GREAT RIVER ENERGY.
3. APPROXIMATELY THREE 24 INCH AND ONE 12 INCH PIPE BOOTS THROUGH GCL/GEOMEMBRANE LINER WILL BE INSTALLED.
4. AN APPROXIMATELY 6 FOOT WIDE SECTION OF EXISTING LINER WILL BE EXPOSED BY THE EARTHWORKS CONTRACTOR TO ALLOW FOR A WORKING PLATFORM TO TIE INTO THE EXISTING 40-MIL HDPE GEOMEMBRANE IN ASH POND 91 AND ASH POND 92.
5. THE GEOSYNTHETICS CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE WORK AREA (DEWATERING, CLEARING SOIL OFF THE LINER) AFTER THE SUBGRADE IS ACCEPTED BY THE GEOSYNTHETICS CONTRACTOR.
6. THE OUTSIDE EDGE OF THE ASH POND 91 HDPE GEOMEMBRANE LINER IS BASED ON AS-BUILT SURVEY OF THE INSTALLED LINER. THE OUTSIDE EDGE OF THE ASH POND 92 LINER IS APPROXIMATE AND IS BASED ON ESTIMATED "CLAY GRADES" FROM AS-BUILT DRAWING 3 (FOTH & VAN DYKE, 2/6/1990) AND THE ANCHOR TRENCH DESIGN SHOWN ON DESIGN DRAWINGS.
7. THE EARTHWORKS CONTRACTOR WILL EXCAVATE THE LINER ANCHOR TRENCHES ALONG THE SOUTH SIDE OF THE SUBGRADE WORK AREA, ALONG THE NORTH SIDE OF THE NORTH DRAINAGE DITCH WORK AREA, AND AT THE CROSS OVER PIPE WORK AREA IN PREPARATION FOR LINER INSTALLATION.
8. GEOMEMBRANE LINER AT THE INTERSECTION OF THE SOUTHEAST CORNER SUBGRADE TIE-IN TO ASH POND 91 SHALL BE FOLDED BACK AND WEIGHTED WITH SAND BAGS BY THE EARTHWORKS CONTRACTOR IN PREPARATION FOR GEOSYNTHETIC LINER INSTALLATION TO BE COMPLETED.

REFERENCE(S)

1. SITE LOCATION: SECTION 16 AND 17, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.
2. COORDINATES ARE BASED ON THE PLANT GRID SYSTEM.
3. EXISTING GROUND IS BASED ON SURVEY AND BATHYMETRY COMPLETED BY BARTLETT AND WEST IN NOVEMBER 2015 AND PROVIDED BY GREAT RIVER ENERGY.
4. CONTOUR INTERVAL IS 1 FOOT.
5. GEOMEMBRANE PANEL LAYOUT DRAWINGS ARE FROM CQA REPORTS FOR ASH POND 91 AND ASH POND 92 CONSTRUCTION PROVIDED BY GRE.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-08-25	ISSUED FOR CONSTRUCTION	RFS	RFS	CCS	TJS
B	2016-08-01	ISSUED FOR CONTRACTOR INFORMATION	RFS	RFS	CCS	TJS
A	2016-06-28	ISSUED FOR BID	RFS	RFS	CCS	TJS

SEAL

REGISTERED PROFESSIONAL ENGINEER — TODD J. STONG — PE-8144 — DATE 8/25/16 — NORTH DAKOTA

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
GOLDER ASSOCIATES, INC.
44 UNION BLVD, SUITE 300
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USA
[+1] (303) 980-0540
www.golder.com

PROJECT
ASH POND 91 UPSTREAM RAISE CONSTRUCTION
GEOSYNTHETICS INSTALLATION

TITLE
GEOSYNTHETICS INSTALLATION PLAN VIEW

PROJECT NO. 1658202 | REV. 0 | 3 of 5 | DRAWING 3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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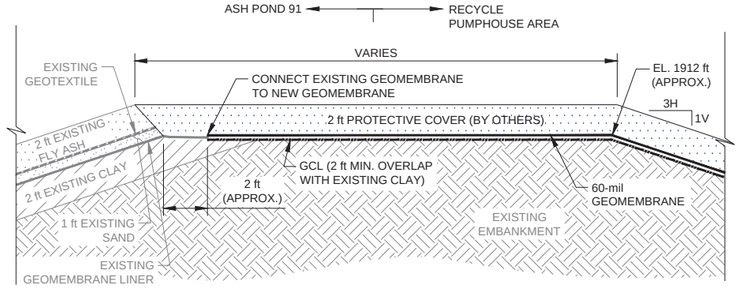
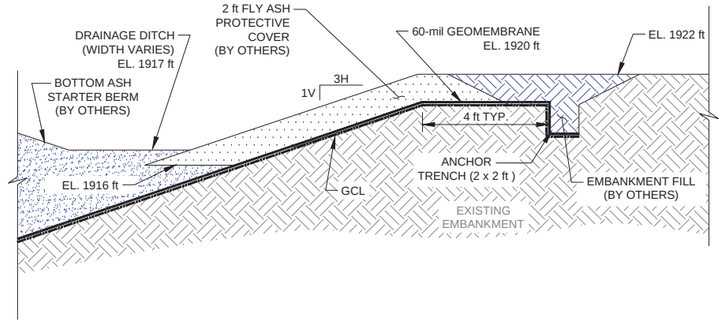
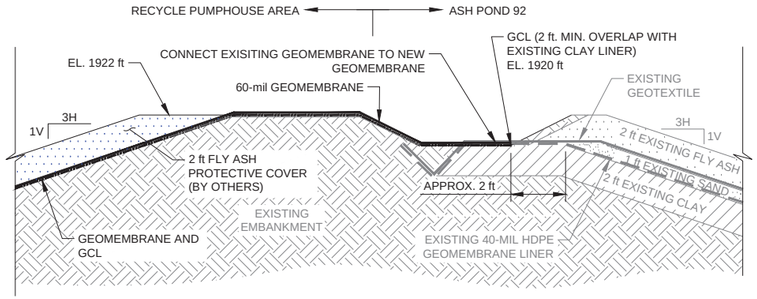


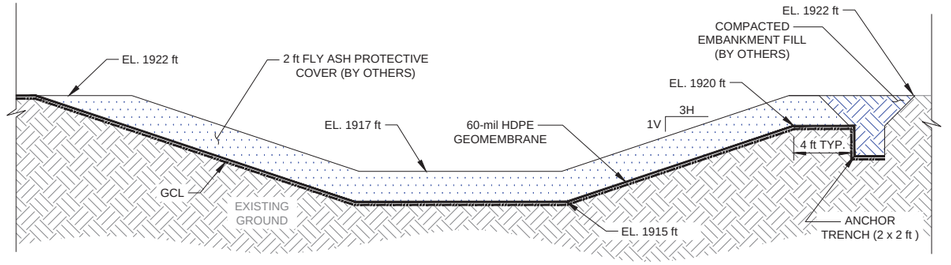
N.T.S. 1/4 ASH POND 91 TO SOUTHEAST CORNER SUBGRADE DETAIL



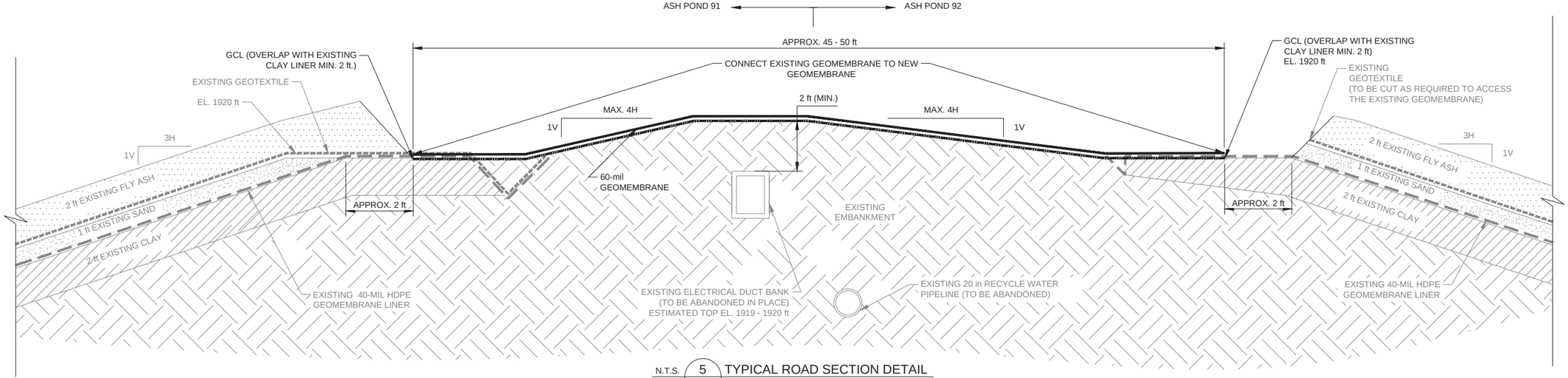
N.T.S. 2/4 SOUTHEAST CORNER ANCHOR TRENCH DETAIL



N.T.S. 3/4 SOUTHEAST CORNER TO ASH POND 92 LINER DETAIL



N.T.S. 4/4 NORTH DRAINAGE DITCH DETAIL



N.T.S. 5/4 TYPICAL ROAD SECTION DETAIL

NOTES

1. LINER CONSISTS OF GCL OVERLAID BY 60-MIL DOUBLE-SIDED TEXTURED GEOMEMBRANE.
2. NEAT LINE QUANTITIES FOR GEOMEMBRANE AND GCL IS APPROXIMATELY 305,000 SQUARE FEET. ALL GEOSYNTHETICS WILL BE PROCURED BY GREAT RIVER ENERGY.
3. THREE 24 INCH PIPE BOOTS THROUGH CLAY/GEOMEMBRANE LINER WILL BE INSTALLED. ONE 12 INCH PIPE BOOT THROUGH GCL/GEOMEMBRANE LINER WILL ALSO BE INSTALLED.
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5. THE GEOSYNTHETICS CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE WORK AREA (DEWATERING, CLEARING SOIL OFF THE LINER) AFTER THE SUBGRADE IS ACCEPTED BY THE GEOSYNTHETICS CONTRACTOR.
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8. GEOMEMBRANE LINER AT THE INTERSECTION OF THE SOUTHEAST CORNER SUBGRADE TIE-IN TO ASH POND 91 SHALL BE FOLDED BACK AND WEIGHTED WITH SAND BAGS BY THE EARTHWORKS CONTRACTOR IN PREPARATION FOR GEOSYNTHETIC LINER INSTALLATION TO BE COMPLETED.

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
0	2016-08-25	ISSUED FOR CONSTRUCTION	RFS	RFS	CCS	TJS
A	2016-06-28	ISSUED FOR BID	RFS	RFS	CCS	TJS

SEAL

REGISTERED PROFESSIONAL ENGINEER — TODD J. STONG — PE-6144 — DATE 8/25/16 — NORTH DAKOTA

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
GOLDER ASSOCIATES, INC.
44 UNION BLVD, SUITE 300
LAKEWOOD, COLORADO
USA
[+1] (303) 980-0540
www.golder.com

PROJECT
ASH POND 91 UPSTREAM RAISE CONSTRUCTION
GEOSYNTHETICS INSTALLATION

TITLE
GEOSYNTHETICS DETAILS 1 OF 2

PROJECT No. 1658202 | Rev. 0 | 4 of 5 | DRAWING 4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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APPENDIX B

Visual Observations Checklist

IMPOUNDMENT INSPECTION CHECKLIST

Facility Name: ***Upstream Raise 91***

Owner and Address: Great River Energy – Coal Creek Station

Purpose of Facility: CCR Containment

Legal: Sections 16 and 17 ***Township:*** 145N ***Range:*** 82W

County: McLean

Inspected By: Todd Stong/Craig Schuettpelz/Paul Schlicht ***Inspection Date:*** September 19, 2018

Weather: Cloudy, 45°F - 65°F, No Precipitation

ITEM		Y	N	N/A	REMARKS
1.	Water Levels				
	a. High water mark			X	
	b. Current water level	X			Approximate elevation 1922 feet
2.	Inflow Structure				Flue gas desulfurization piping
	a. Settlement		X		
	b. Cracking		X		
	c. Corrosion		X		
	d. Obstacles in inlet		X		
	e. Riprap/erosion control		X		
3.	Outflow Structure				Drains to Drains Pond (not able to be observed)
	a. Settlement			X	
	b. Cracking			X	
	c. Corrosion			X	
	d. Obstacles in outlet			X	
	e. Riprap/erosion control			X	
4.	CCR Placement Areas				
	a. CCR Upstream Slope erosion		X		
	b. CCR Upstream Slope cracks/settlement		X		
	c. CCR Crest exposed to heavy traffic	X			Cat 777
	d. CCR Crest damage from vehicles/machinery		X		
	e. CCR Crest cracks/settlement		X		
	f. CCR Downstream slope erosion	X			Minor erosion of fly ash
	g. CCR Downstream slope cracks/settlement		X		
5.	Covered Downstream Slopes				No cover currently constructed
	a. Downstream Slope erosion			X	
	b. Downstream Slope rodent burrows			X	
	c. Downstream Slope vegetation			X	
	d. Downstream Slope seepage/sloughs/cracks/settlement			X	
6.	Perimeter Berm				
	a. Upstream Slope erosion (exposed liner)		X		
	b. Upstream Slope rodent burrows		X		
	c. Upstream Slope vegetation		X		
	d. Upstream Slope cracks/settlement		X		
	e. Upstream Slope riprap/other erosion protection	X			Fly ash protective cover in perimeter ditches
	f. Crest exposed to heavy traffic	X			North side haul road (Cat 777)
	g. Crest damage from vehicles/machinery		X		
	h. Crest comparable to design width	X			
	i. Crest rodent burrows		X		
	j. Downstream Slope erosion	X			Minor erosion rills
	k. Downstream Slope rodent burrows	X			Mostly small burrows
	l. Downstream Slope vegetation	X			Healthy grass and reeds on north side, fair to good vegetative growth and south and west sides
	m. Downstream Slope seepage/sloughs/cracks/settlement		X		Minor over-steepening of slope near toe as a result of re-grading of the south drainage channel
7.	Toe				
	a. Vegetation	X			Healthy grass and reeds
	b. Rodent burrows	X			Mostly small burrows on south side
	c. Seepage/sloughs/cracks/settlement		X		
	d. Drainage conditions	X			Some standing water

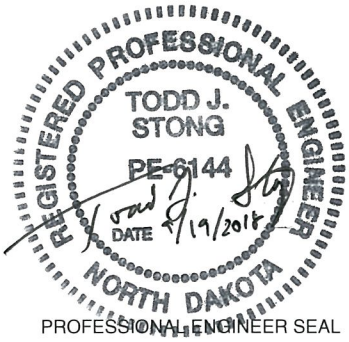
General Remarks: No significant issues. Minor maintenance includes addressing small burrows, maintaining fly ash protective cover, maintaining inflow and outflow piping, and addressing erosion as observed.

Name of Engineer: Todd Stong

Date: 9/19/2018

Engineering Firm: Golder Associates Inc.

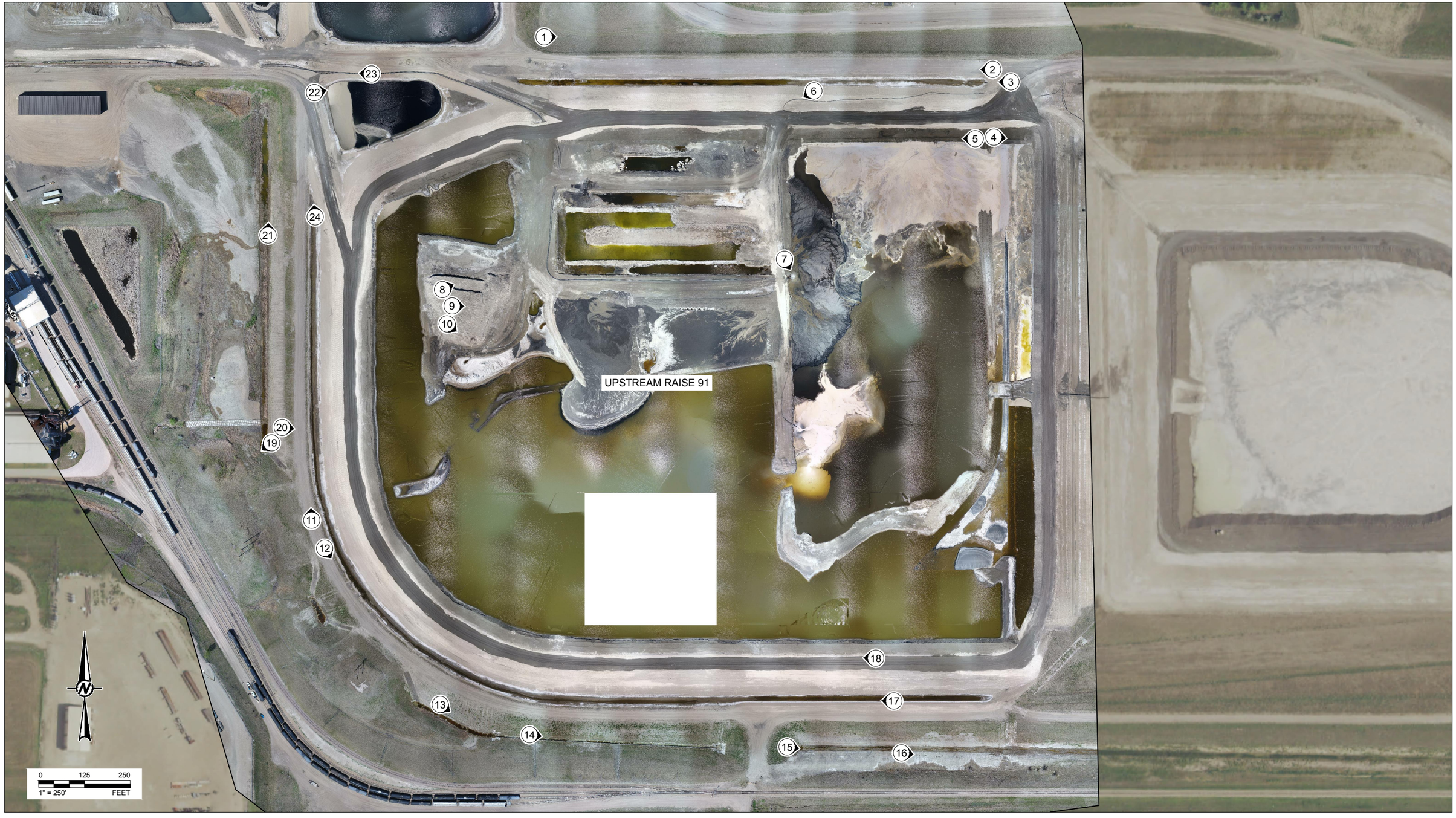
Signature: Todd Stong



PROFESSIONAL ENGINEER SEAL

APPENDIX C

Photographs



LEGEND

(#) PHOTOGRAPH NUMBER AND DIRECTION

REFERENCES

1. FOREGROUND AERIAL IMAGE FROM GREAT RIVER ENERGY DRONE PHOTOGRAPH TAKEN MAY 2018.
2. BACKGROUND AERIAL IMAGE FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, PUBLISHED IN 2018.

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-03
DESIGNED	KAC
PREPARED	KAC
REVIEWED	CCS
APPROVED	TJS

PROJECT
2018 ANNUAL CCR FACILITY INSPECTION REPORT

TITLE
UPSTREAM RAISE 91
PHOTOGRAPH LOCATIONS

PROJECT NO.	REV.	FIGURE
1893823	B	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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Upstream Raise 91

Photograph 1 (NW corner, downstream slope)
Grass vegetation on downstream slope (IMGP6353.JPG)

Photograph 2 (North haul road)
Gravel haul road surface (IMGP6359.JPG)

Upstream Raise 91

Photograph 3 (North upstream slope)
North perimeter ditch (looking west) (IMGP6362.JPG)

Photograph 4 (CCR placement)
Flue Gas Desulfurization (FGD) inflow pipe (IMGP6366.JPG)

Upstream Raise 91

Photograph 5 (CCR upstream slope)
CCR upstream slope (IMGP6367.JPG)

Photograph 6 (CCR downstream slope)
Vibrating Wire Piezometer (VWP) datalogger box (IMGP6369.JPG)

Upstream Raise 91

Photograph 7 (CCR placement)
Rejects and economizer ash inflow pipe (IMGP6370.JPG)

Photograph 8 (CCR placement from west side)
Upstream Raise 91 interior and CCR placement panorama (1 of 3) (IMGP6373.JPG)

Upstream Raise 91

Photograph 9 (CCR placement from west side)
Upstream Raise 91 interior and CCR placement panorama (2 of 3) (IMGP6374.JPG)

Photograph 10 (CCR placement from west side)
Upstream Raise 91 interior and CCR placement panorama (3 of 3) (IMGP6375.JPG)

Upstream Raise 91

Photograph 11 (SW berm upstream slope)
Perimeter berm upstream slope and channel (5ccs.JPG)

Photograph 12 (SW berm upstream slope)
Perimeter berm upstream slope and channel (6ccs.JPG)

Upstream Raise 91

Photograph 13 (SW downstream slope)
Southwest downstream slope and surface water channel (<1 foot water) (9ccs.JPG)

Photograph 14 (South toe)
Approximately 1 foot of water in concrete surface water drainage (15ccs.JPG)

Upstream Raise 91

Photograph 15 (South toe)
South downstream slope and surface water ditch (18ccs.JPG)

Photograph 16 (South toe)
Sparse vegetation on south downstream slope near the toe (21ccs.JPG)

Upstream Raise 91

Photograph 17 (South berm upstream slope)
Perimeter berm upstream slope, channel, and CCR downstream slope (24ccs.JPG)

Photograph 18 (South CCR upstream slope)
CCR crest and Upstream Raise 91 interior (25ccs.JPG)

Upstream Raise 91

Photograph 19 (West toe and ditch)
Inlet side of surface water drainage culvert on west side of Upstream Raise 91 (2PDS.JPG)

Photograph 20 (West downstream slope)
Minor erosion and sparse vegetation on west downstream slope (5PDS.JPG)

Upstream Raise 91

Photograph 21 (West downstream slope)
Minor erosion and sparse vegetation on west downstream slope (10PDS.JPG)

Photograph 22 (NW crest and pond)
Minor erosion of fly ash shell near northwest corner of Upstream Raise 91 (12PDS.JPG)

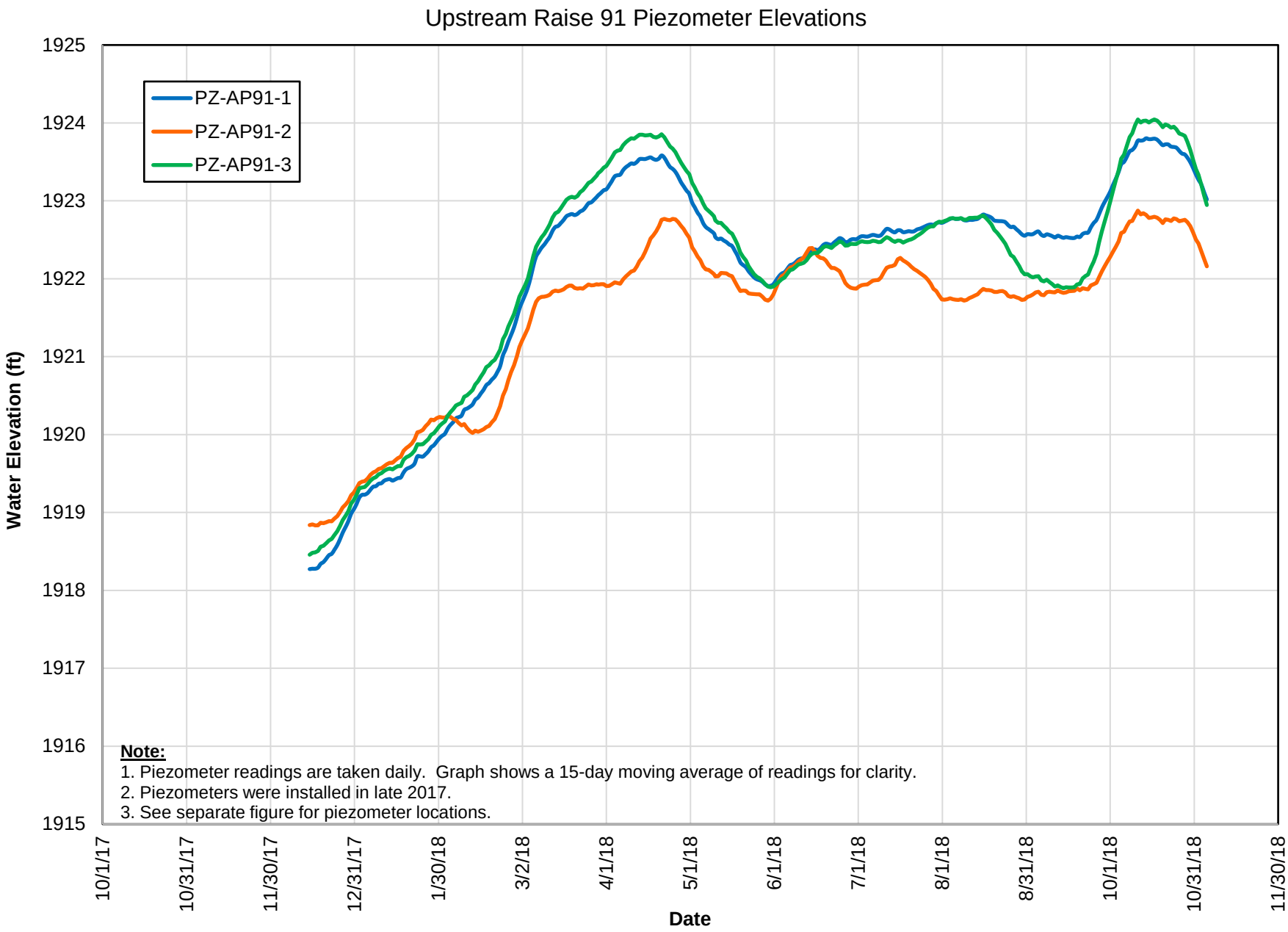
Upstream Raise 91

Photograph 23 (North berm upstream slope)
Cleanouts and valve controls for Upstream Raise 91 to Drains Pond System cross-over pipes (14PDS.JPG)

Photograph 24 (West upstream slope)
Perimeter channel contact water culverts (20PDS.JPG)

APPENDIX D

Piezometer Elevations


Upstream Raise 91 Piezometer Elevations
PZ-AP91-1
PZ-AP91-2
PZ-AP91-3
Water Elevation (ft)
1925
1924
1923
1922
1921
1920
1919
1918
1917
1916
1915
10/1/17
10/31/17
11/30/17
12/31/17
1/30/18
3/2/18
4/1/18
5/1/18
6/1/18
7/1/18
8/1/18
8/31/18
10/1/18
10/31/18
11/30/18
Date
Note:
1. Piezometer readings are taken daily. Graph shows a 15-day moving average of readings for clarity.
2. Piezometers were installed in late 2017.
3. See separate figure for piezometer locations.

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