REPORT

Annual Inspection

Coal Creek Station - Upstream Raise 91 CCR Surface Impoundment

Submitted to:

Great River Energy
2875 Third Street SW
Underwood, North Dakota 58576

Submitted by:

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FIGURES

APPENDICES

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 25, 2019.

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. The glacial till varies in thickness from 20 feet to several hundred feet in the area of CCS. 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, economizer ash, and fly ash are hauled to the facility. 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. 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. The original soil perimeter berm downstream slopes have grass vegetation. Berm upstream slopes of the original soil perimeter berms have an approximate 3:1 slope 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 2019, continued bottom ash and fly ash placement has occurred to a maximum elevation of approximately 1935 feet amsl.

2.6 Storage Capacity and Volumes

Based on site disposal records, the facility has a remaining CCR capacity of approximately 6,320,000 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 2,020,000 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 average water elevation in Upstream Raise 91 at the time of the inspection was approximately 1925 feet amsl. The elevation of FGD material and other CCR in the facility was variable based on recent deposition. Based on visual observations of areas within Upstream Raise 91 that contained ponded water, the volume of impounded water at the time of the inspection was approximately 25 acre-feet or 8,200,000 gallons.

2.8 Permits

Upstream Raise 91 is currently permitted with the North Dakota Department of Environmental Quality (NDDEQ) 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 2019 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 Inspection

The most recent annual professional engineer inspection of Upstream Raise 91 was performed by Golder in 2018 (Golder 2019). 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, but improved 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 2019 ANNUAL INSPECTION

On September 25, 2019, Craig Schuettpelz, Paul Schlicht, Kayla Moden, 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 2019 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 that are able to convey rejects and economizer ash as needed. 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. This inflow pipe was depositing FGD material in Upstream Raise 92 at the time of the inspection. 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 fair condition at the time of the inspection, as sediment had accumulated at the culvert inlets.

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 the berm upstream slope 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. Some erosion of the fly ash protective cover has exposed geomembrane liner in the southwest corner of the Upstream Raise berm upstream slope. Golder recommends that additional fly ash protective cover be placed on areas of the berm upstream slopes experiencing erosion. 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 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.

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 and then east 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 2019 within Upstream Raise 91. At the time of the inspection, CCR downstream slopes were approximately 10 to 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 6 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, or abnormally thriving vegetation, or settlement during the inspections; however, there was some minor cracking and erosion of the fly ash shell. The cracking was attributed to reactive fly ash placed as a part of the erosion protection “shell” that is observed to

expand/contract as lime within the ash reacts with moisture conditioning water. 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. GRE deposited FGD material in Upstream Raise 92 for a majority of 2019, as noted by the drop in piezometer water levels in late 2018. Fluctuations in water levels, especially in the late summer of 2019 are likely a result of significant rain events and isolation and dewatering of the Drains Pond System east cell for sediment removal.

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 2019.

4.0 SUMMARY AND CONCLUSIONS

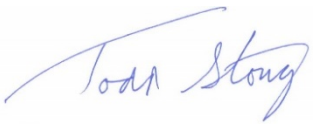
An annual inspection was performed for Upstream Raise 91 at Coal Creek Station on September 25, 2019. The inspection met the requirements for CCR surface impoundments under 40 CFR Part 257.83. Golder observed fair vegetation and good site maintenance and did not identify significant deficiencies such 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 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 Engineer



Todd Stong, PE
Associate and Senior Consultant

CCS/TJS/af

https://golderassociates.sharepoint.com/sites/102406/technical work/a - ccr support/a5 - ccr rule/ccr annual inspections/_final rpts/ur91/19115185_ur91_ccrinspreport_fnl_27jan20.docx

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 2019. Annual Inspection Report – Great River Energy – Coal Creek Station – Upstream Raise 91. January 2019.

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

GOLDER

NOTE(S)

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

GREAT RIVER ENERGY - COAL CREEK STATION
2019 ANNUAL CCR FACILITY INSPECTION REPORT
SITE OVERVIEW

FIGURE 1

Path: \\Denver\acad\GREAT RIVER ENERGY\COAL CREEK\99_PROJECTS\19115185\Annual Inspection\ | File Name: Fig2 - UR91 Site Overview.dwg

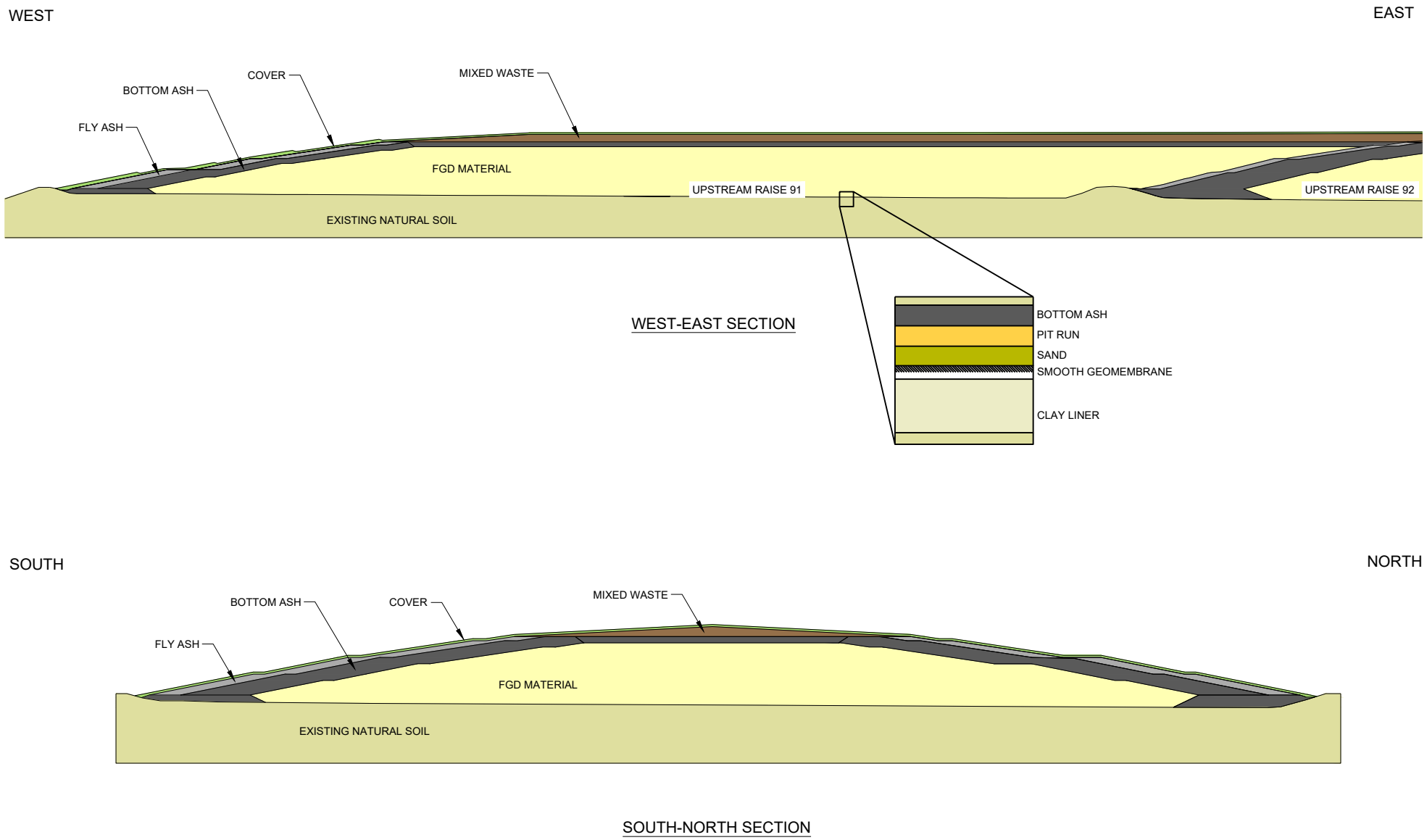
REFERENCE(S)

1. FOREGROUND AERIAL IMAGES FROM GREAT RIVER ENERGY PHOTOGRAPHS TAKEN IN 2019.
2. BACKGROUND AERIAL IMAGE FROM THE UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AERIAL IMAGERY PROGRAM, TAKEN IN 2018.

GOLDER

GREAT RIVER ENERGY - COAL CREEK STATION
2019 ANNUAL CCR FACILITY INSPECTION REPORT
UPSTREAM RAISE 91 - SITE OVERVIEW

FIGURE 2



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GREAT RIVER ENERGY - COAL CREEK STATION
2019 ANNUAL CCR FACILITY INSPECTION REPORT
UPSTREAM RAISE 91 - CROSS SECTIONS

FIGURE 3

Path: \\Denver\acad\GREAT RIVER ENERGY\COAL CREEK\99_PROJECTS\19115185\Annual Inspection\ | File Name: Fig4 - UR91 and UR92 Instrumentation Overview.dwg

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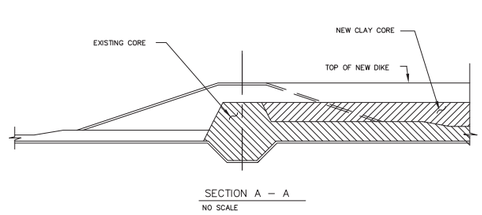
GREAT RIVER ENERGY - COAL CREEK STATION
2019 ANNUAL CCR FACILITY INSPECTION REPORT
UPSTREAM RAISE 91 INSTRUMENTATION OVERVIEW

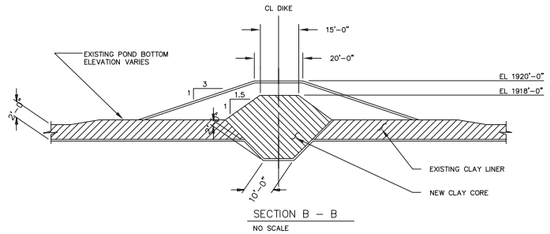
FIGURE 4

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

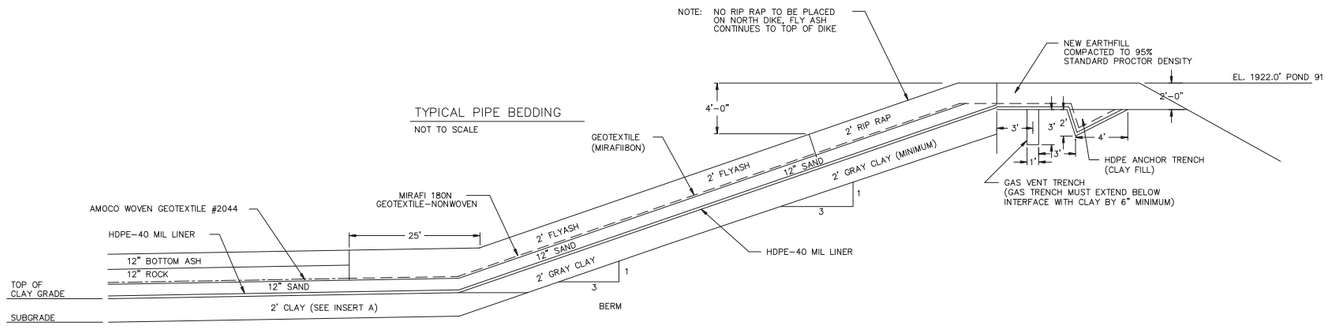
DWN. JJ CHK.
DATE 01/07/91
W/O 91G105

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



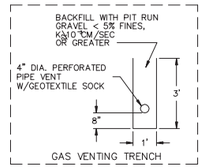
TYPICAL PIPE BEDDING
NOT TO SCALE

INSERT A

6" GRAY CLAY

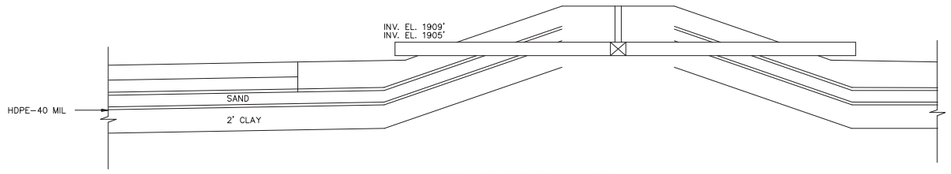
18" BROWN CLAY

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

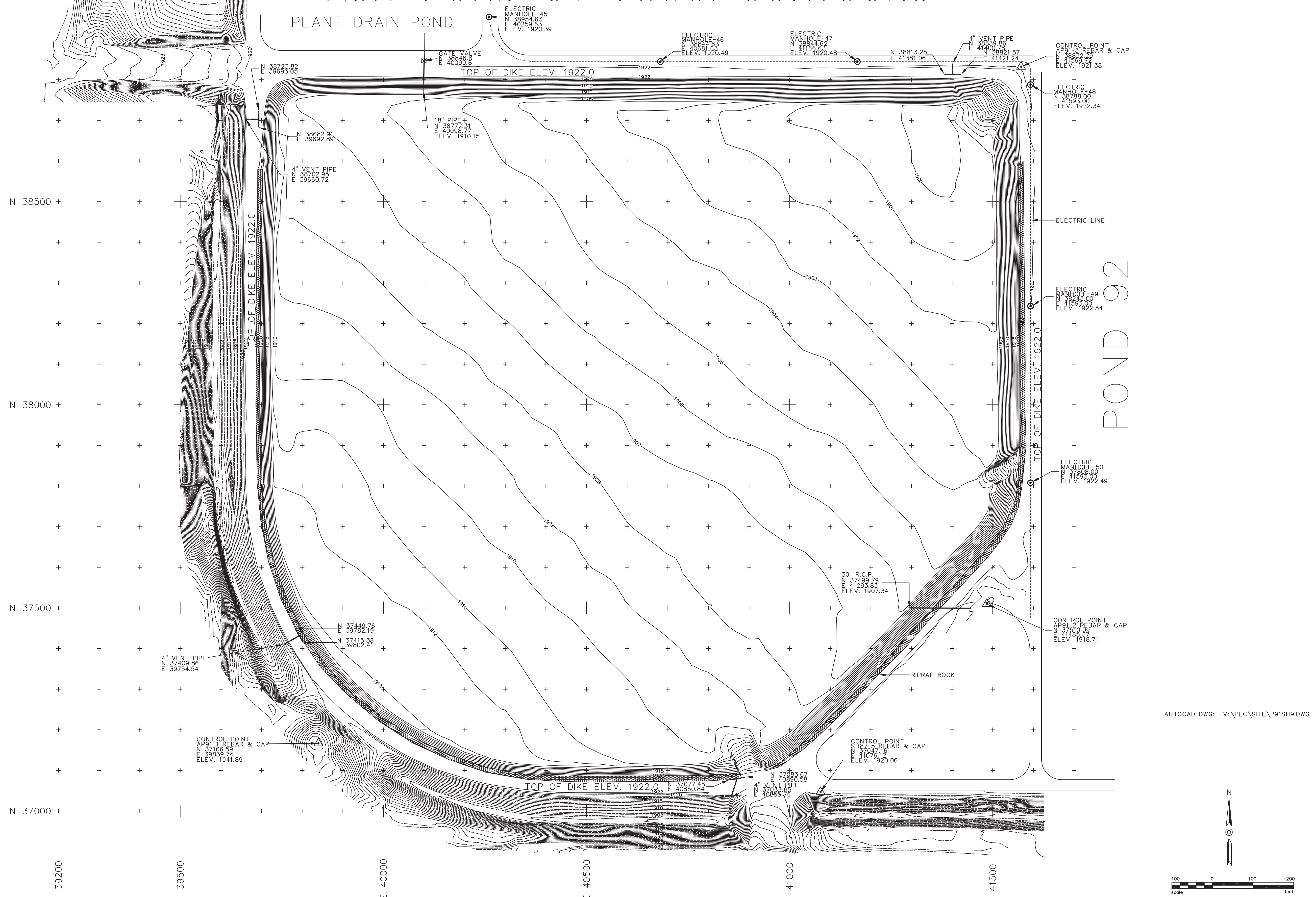
TYPICAL SECTIONS AND DETAILS

1992 ASH DISPOSAL

DRAWING NO. 92G213-17

COOPERATIVE Association POWER

ASH POND 91 FINAL CONTOURS



Revision No.	Date	By	Description

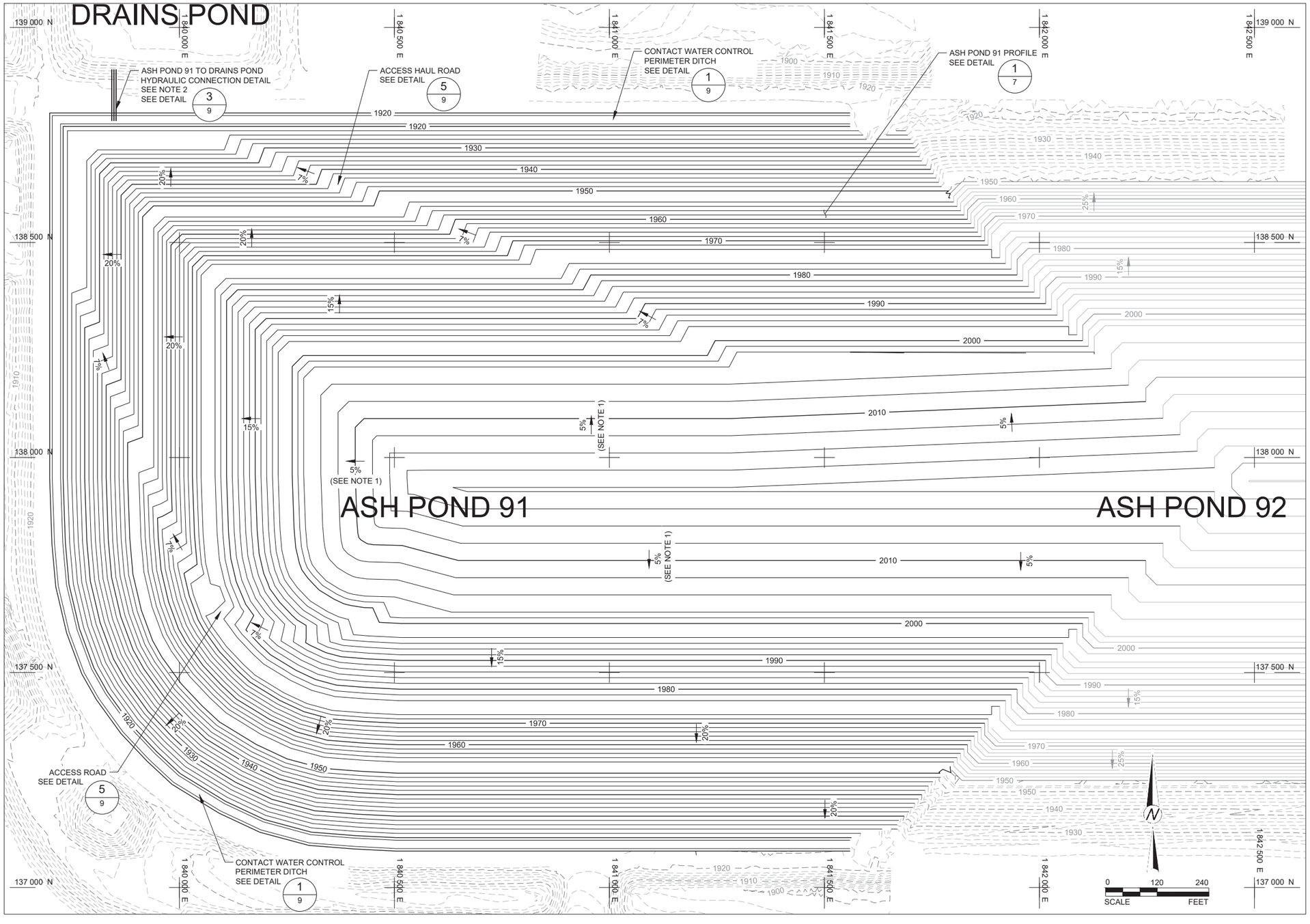
COOPERATIVE POWER ASSOCIATION
UNDERWOOD, NORTH DAKOTA

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.



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 — NORTH DAKOTA

CLIENT

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

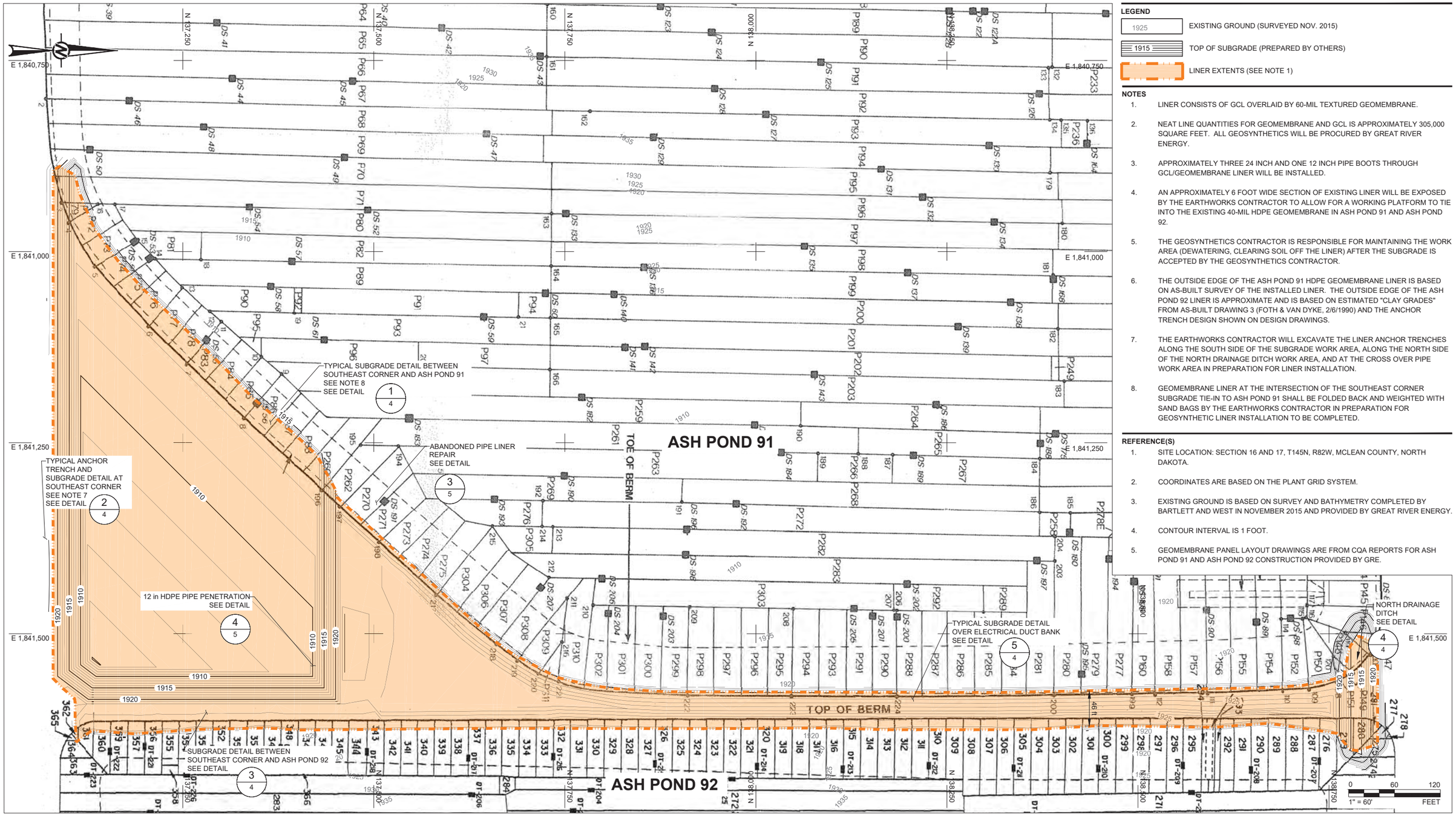
CONSULTANT

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-6144 — NORTH DAKOTA

CLIENT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

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www.golder.com

PROJECT
ASH POND 91 UPSTREAM RAISE CONSTRUCTION
GEOSYNTHETICS INSTALLATION

TITLE
GEOSYNTHETICS INSTALLATION PLAN VIEW

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

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

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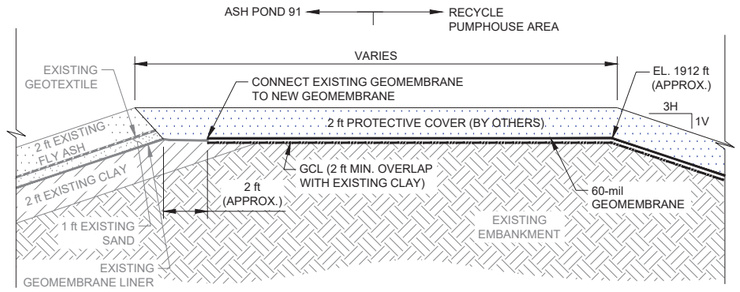
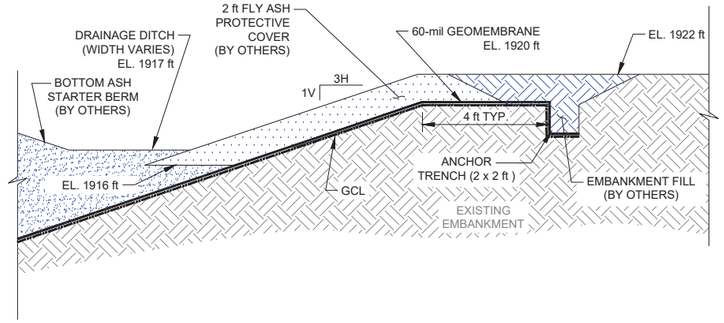
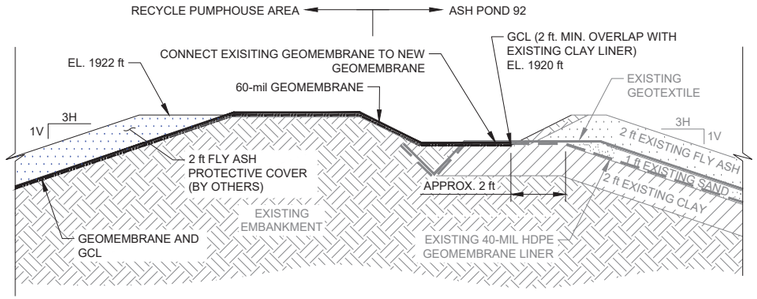


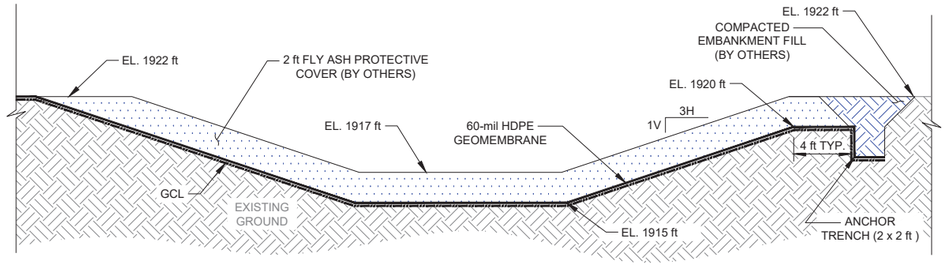
N.T.S. 1/4 ASH POND 91 TO SOUTHEAST CORNER SUBGRADE DETAIL



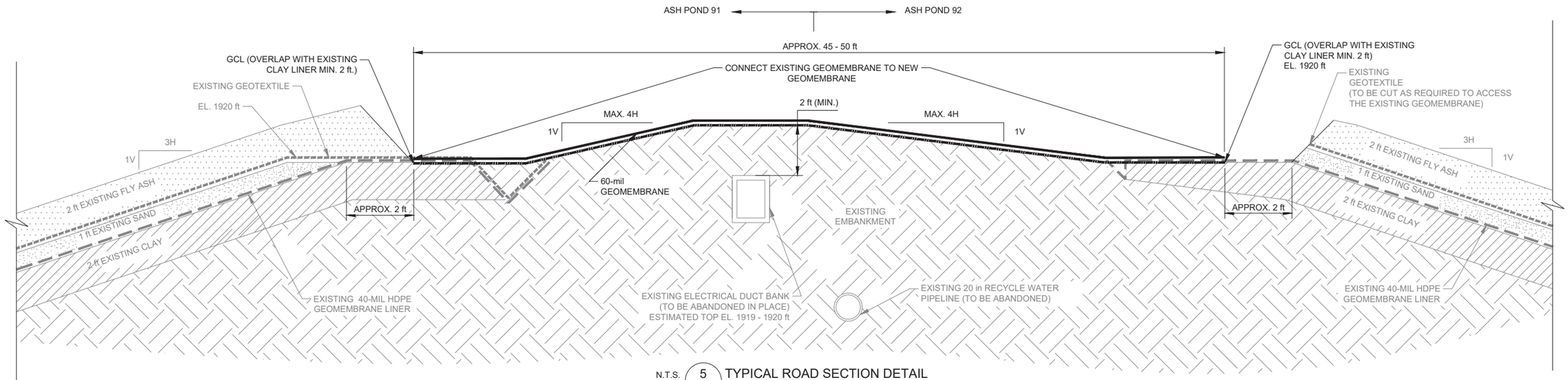
N.T.S. 2/4 SOUTHEAST CORNER ANCHOR TRENCH DETAIL



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.
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.
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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 — STATE OF NORTH DAKOTA

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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

INSPECTION CHECKLIST

Facility Name: Upstream Raise 91

Owner and Address: Great River Energy – Coal Creek Station

Purpose of Facility: CCR Containment

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

County: McLean

Inspected By: Todd Stong/Craig Schuettpelz/Paul Schlicht/ Kayla Moden **Inspection Date:** September 25, 2019

Weather: Clear Skies, 46ºF, no precipitation.

ITEM	Y	N	N/A	REMARKS
1. Water levels				
a. High water mark			X	El: N/A
b. Current water level	X			Approximate elevation 1925 ft.
2. Inflow structure (*UR92 cross-over piping)*				
a. Settlement		X		
b. Cracking		X		
c. Corrosion		X		
d. Obstacles in inlet		X		
e. Riprap/erosion control		X		
3. Outflow structure (*not visible at time of inspection)*				
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 vegetation		X		
g. Downstream slope seepage/sloughs/cracks/settlement		X		Minor erosion of fly ash.
5. Covered downstream slopes				
a. Erosion			X	
b. Vegetation			X	
c. Rodent burrows			X	
d. Seepage/sloughs/cracks/settlement			X	
e. Damage from vehicles/machinery			X	
6. Perimeter berm				
a. Upstream slope erosion (exposed liner)	X			Minor erosion of fly ash protective cover with geomembrane liner exposed in southwest corner.
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.
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			Small burrows.
l. Downstream slope vegetation	X			Healthy grass on north side, fair to good vegetation growth on south and west sides.
m. Downstream slope seepage/sloughing/cracks/settlement		X		Minor oversteepening 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			Small burrows on south and west sides.
c. Settlement		X		
d. Drainage conditions	X			Some standing water in channels.

General Remarks: No significant issues. Minor maintenance includes addressing small burrows, replacing and maintaining fly ash protective cover (especially in areas noted to have exposed geomembrane), maintaining and removing sediment from inflow and outflow piping, and addressing erosion as observed.

Name of Engineer (Engineer Firm):
Todd Stong, PE (Golder Associates, Inc.)
Date: 9/25/2019
Signature:

APPENDIX C

Photographs

Path: \\Denver\acad\GREAT RIVER ENERGY\COAL CREEK\99_PROJECTS\19115185\Annual Inspection\ | File Name: PhotoLog - UR91 Locations.dwg

GOLDER

LEGEND

1 PHOTOGRAPH ID AND LOCATION

NOTE(S)

1. FOREGROUND AERIAL IMAGES FROM GREAT RIVER ENERGY PHOTOGRAPHS TAKEN IN 2019.
2. BACKGROUND AERIAL IMAGE FROM THE UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AGRICULTURE AERIAL IMAGERY PROGRAM, TAKEN IN 2018.

GREAT RIVER ENERGY - COAL CREEK STATION
2019 ANNUAL CCR FACILITY INSPECTION REPORT
UPSTREAM RAISE 91 - PHOTOGRAPH LOCATIONS

FIGURE 1

Upstream Raise 91

Photograph 1 (South berm downstream slope)
Large erosion rill on vegetated slope (PDS UR91 (5).JPG)

Photograph 2 (Southwest toe and ditch)
Inlet side of surface water drainage culvert, algae on trash guard limiting full flow (PDS UR91 (15).JPG)

Upstream Raise 91

Photograph 3 (Northwest internal berm crest)
Northwest pool (panoramic view, 1 of 2) (IMGP6970.JPG)

Photograph 4 (Northwest internal berm crest)
Northwest pool (panoramic view, 2 of 2) (IMGP6971.JPG)

Upstream Raise 91

Photograph 5 (West CCR downstream slope)
Perimeter channel and CCR downstream slope saturated to approximately elevation 1919 feet (IMGP6978.JPG)

Photograph 6 (Southwest CCR berm crest)
Upstream Raise 91 interior and CCR upstream slope (IMGP6979.JPG)

Upstream Raise 91

Photograph 7 (Southwest berm upstream slope)
Erosion of fly ash protective cover and exposed geomembrane (PDS UR91 (2).jpg)

Photograph 8 (Southwest CCR downstream slope)
Minor cracking of reactive fly ash on the CCR downstream slope (IMGP6982.JPG)

Upstream Raise 91

Photograph 9 (South CCR downstream slope)
Perimeter channel and downstream CCR slope saturated to approximately elevation 1919 feet (IMGP6988.JPG)

Photograph 10 (South CCR upstream slope and berm crest)
CCR berm crest, CCR upstream slope and Flue Gas Desulfurization (FGD) pool (IMGP6992.JPG)

Upstream Raise 91

Photograph 11 (Southeast corner)
Upstream Raise 91 and Upstream Raise 92 shared CCR berm (IMGP6994.JPG)

Photograph 12 (North downstream slope and toe)
Well-vegetated downstream slope and toe (2.JPG)

Upstream Raise 91

Photograph 13 (North perimter ditch)
North berm upstream slope fly ash protective cover and perimeter channel (7.JPG)

Photograph 14 (North downstream slope and toe)
Irregular slope geometry on the north downstream slope, well-vegetated (11.JPG)

Upstream Raise 91

Photograph 15 (Northwest berm crest)
Erosion of berm upstream fly ash slope near the northwest contact water pool of Upstream Raise 91 (18.JPG)

Photograph 16 (West downstream slope)
Berm crest and downstream slope, well-vegetated (24.JPG)

Upstream Raise 91

Photograph 17 (North CCR upstream slope)
Upstream Raise 91 interior and CCR placement (DSCF0540.JPG)

Photograph 18 (North perimter ditch)
Inlet perimeter ditch culverts to northwest contact water pool (DSCF0542.JPG)

Upstream Raise 91

Photograph 19 (Upstream Raise interior)
Upstream Raise 91 interior and FGD inflow pipe (DSCF0544.JPG)

Photograph 20 (North perimeter ditch)
Culvert and drainage from Upstream Raise 92 in perimeter ditch (DSCF0546.JPG)

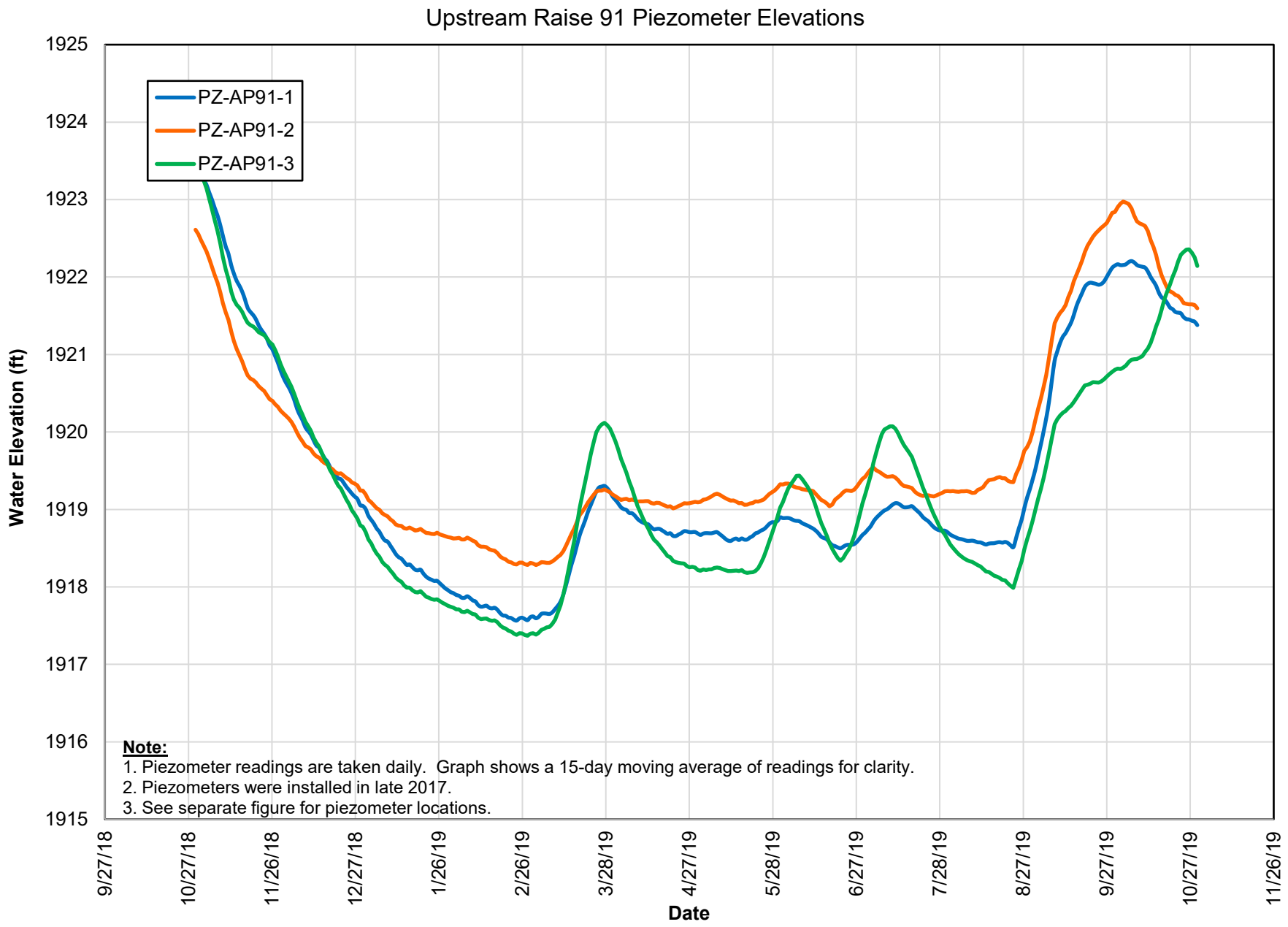
Upstream Raise 91

Photograph 21 (East CCR berm crest and upstream slope)
CCR material deposition on east side of Upstream Raise 91 (DSCF0548.JPG)

Photograph 22 (East CCR berm crest and upstream slope)
Inflow piping from Upstream Raise 92 (DSCF0549.JPG)

APPENDIX D

Piezometer Information


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
9/27/18
10/27/18
11/26/18
12/27/18
1/26/19
2/26/19
3/28/19
4/27/19
5/28/19
6/27/19
7/28/19
8/27/19
9/27/19
10/27/19
11/26/19
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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