HISTORY OF CONSTRUCTION

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Ash Pond 91 CCR Surface Impoundment
Coal Creek Station
Great River Energy

Submitted To: Great River Energy
Coal Creek Station
2875 Third Street SW
Underwood, North Dakota 58576

Submitted By: Golder Associates Inc.
44 Union Boulevard, Suite 300
Lakewood, Colorado 80228

October 13, 2016 **1649586**

Golder Associates

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1.0 INTRODUCTION

1.1 Purpose

Golder Associates Inc. (Golder) has prepared the following History of Construction for the Ash Pond 91 CCR Surface Impoundment (Ash Pond 91) at Great River Energy's (GRE's) Coal Creek Station (CCS). The Environmental Protection Agency's (EPA's) Coal Combustion Residual (CCR) Rule, 40 Code of Federal Regulations (CFR) Part 257, promulgated April 17, 2015 and effective October 19, 2015, requires compilation of the information specified in §257.73(c) to detail the construction history of CCR facilities no later than October 17, 2016 for facilities with either height of 5 feet or more and a storage volume of 20 acre-feet, or a height of more than 20 feet.

1.2 Site Background

Coal Creek Station is located in McLean County, approximately 10 miles northwest of Washburn, North Dakota. The lined Ash Pond 91 footprint compromises approximately 75 acres, and is used as a combined dewatering and storage facility for CCRs including fly ash, bottom ash, and flue-gas desulfurization (FGD) material.

2.0 OWNER, OPERATOR, AND UNIT IDENTIFICATION (§257.73(C)(1)(I))

Coal Creek Station (and Ash Pond 91) is currently owned and operated by Great River Energy (GRE).

Corporate Address:

Great River Energy
12300 Elm Creek Boulevard
Maple Grove, Minnesota 55369

Coal Creek Station Address:

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

The North Dakota Department of Health (NDDH) Division of Waste Management is the environmental regulatory body for the CCR facilities at CCS. Ash Pond 91 is currently permitted with the North Dakota Department of Health (NDDH) under Permit Number 0033.

3.0 HISTORY OF CONSTRUCTION

3.1 Location of Unit (§257.73(c)(1)(ii))

Ash Pond 91 is located in the southwest ¼ of Section 16 and the southeast ¼ of Section 17 of Township 145 North, Range 82 West, in McLean County, North Dakota. Figure 1 shows the location of Ash Pond 91

on the most recent USGS topographic map, and Figure 2 shows the location of Ash Pond 91 on a recent aerial photograph.

3.2 Purpose (§257.73(c)(1)(iii))

Ash Pond 91 is used as a combined dewatering and storage facility for CCRs including fly ash, bottom ash, and flue-gas desulfurization (FGD) material and will be closed with CCR materials in place.

3.3 Watershed Information (§257.73(c)(1)(iv))

The Ash Pond 91 CCR surface impoundment is located within the following Hydrologic Unit (Watershed-Based Performance Management Using Hydrologic Unit, ND 2016) per the Natural Resources Conservation Service (NRCS): Hydrologic Unit 12 Subwatershed 101301010701 Weller Slough-Coal Lake Coulee (40,582 acres).

3.4 Foundation Information (§257.73(c)(1)(v))

The location of Ash Pond 91 was originally characterized by Burns & McDonnell in 1973. A geotechnical investigation was completed by Black & Veatch in 1977 and a hydrogeologic study was performed for CCS by Barr Engineering in 1982. Site geology, soils, and hydrology, including drainage and surface water flow, were examined during these prior studies to determine site suitability for disposal of CCRs. Foundation soils consist of existing natural soils and are generally classified as lean clays, clayey sands, and fat clays. Sandy lean clays dominant the existing natural soils with an effective cohesion of 500 pounds per square foot (psf) and an effective friction angle of 19 degrees (based on shear strength testing).

The foundation soils of Ash Pond 91 consist of native soils (lean clays, clayey sands, and fat clays) and embankment fill materials sourced from nearby native soils (lean clays, clayey sands, and fat clays). Ash Pond 91 was cleaned out, deepened, and relined in 1993 (CPA 1993). According to the 1993 construction report, the foundation materials were compacted in 12-inch lifts to 93% standard Proctor density.

3.5 Materials and Site Preparation (§257.73(c)(1)(vi))

Ash Pond 91 was originally part of the South Ash Pond, which was built in the late 1970s on a foundation of re-compacted site soils (glacial tills) and put into service in 1979. In 1981, the South Ash Pond was taken out of service to reconstruct the clay liner and was put back into service from 1982 until 1987, at which point CCR materials were removed. The South Ash Pond was then divided into Ash Pond 91 and Ash Pond 92 in 1988. Ash Pond 91 was deepened and a new composite liner consisting of a 2-foot thick compacted clay liner underlying a 40-mil high-density polyethylene (HDPE) geomembrane was completed in 1993. The 2-foot thick compacted clay liner was compacted in six-inch loose lifts at 95% of the standard Proctor compaction effort. The liner is overlain with 1 foot of sand, 1 foot of Pit Run gravel, and a drainage system consisting of collection pipes that generally slope to the north side of the facility.

Construction began in 2015 to allow for the vertical containment of CCR materials over the Ash Pond 91 footprint. This included the installation of a composite liner consisting of a geosynthetic clay liner (GCL) overlain with a 60-mil HDPE liner in the areas between Ash Pond 91 and the Upstream Raise CCR Surface Impoundment (Upstream Raise).

It is anticipated that Ash Pond 91 will continue to operate as a surface impoundment receiving sluiced FGD material and dry CCR materials (fly ash and bottom ash) until approximately 2028. After the sluiced FGD material reaches its design height, free liquid in the sluiced FGD material will begin to drain and Ash Pond 91 will only receive dry CCR materials in the construction of a cap/crown until approximately 2031.

During active placement of CCR materials in Ash Pond 91, FGD material will be sluiced directly to Ash Pond 91. Dewatered bottom ash and dry fly ash are hauled by truck to Ash Pond 91. Bottom ash is used as a perimeter drainage layer and fly ash around the perimeter provides an erosion and trafficking surface on the exterior of the facility. Both bottom ash and fly ash are trafficked and spread using dozers. Material properties information of CCR materials used in construction of Ash Pond 91 are presented under separate cover in the Hazard Potential Classification Assessment, Structural Stability Assessment, and Safety Factor Assessment Report (Golder 2016a).

3.6 Detailed Dimensional Drawings (§257.73(c)(1)(vii))

Permit drawings for Ash Pond 91 (CPA/UPA 1992 and Golder 2015a) are included in Appendix A and show facility dimensions, drainage pathways, and facility surroundings.

Ash Pond 91 operates with a minimum freeboard of approximately 3 feet and a design freeboard of approximately 6-feet. A run-on analysis was performed as part of the inflow design flood control system plan (Golder 2016b) indicating that Ash Pond 91 is operated with adequate freeboard to contain the 24-hour, 100-year storm event.

3.7 Instrumentation (§257.73(c)(1)(viii))

There is currently no instrumentation within Ash Pond 91.

3.8 Area-Capacity Curves (§257.73(c)(1)(ix))

Elevation-area-capacity information is shown in Figure 3. Areas were calculated using as-built topography and design grades. Above the elevation of the original soil berms of Ash Pond 91, the area of the facility becomes smaller with increasing elevation. CCR capacities are approximate and were calculated using an average end area method.

3.9 Spillways and Diversion Features (§257.73(c)(1)(x))

There are no spillways associated with Ash Pond 91. Existing controls are in place to monitor water levels in Ash Pond 91 and limit potential overtopping of the impoundment. The only inflow to the facility (besides precipitation) may include hydraulically conveyed coal rejects and FGD material. The design crest of the soil perimeter berms surrounding Ash Pond 91 are at an approximate elevation of 1922 feet, which is approximately 24 feet above surrounding topography, preventing stormwater run-on into Ash Pond 91.

Existing controls in place to monitor the water levels in Ash Pond 91 include weekly observations of water levels by CCS personnel, and daily observations by CCS operations personnel. Additional observations are noted by GRE employees familiar with site CCR units. After large storm events, CCS personnel evaluate site conditions, including impoundment water levels, and are able to adjust operations to maintain water levels below design maximum elevations. Should water levels within Ash Pond 91 reach above desired operating levels during FGD material deposition, GRE has operating procedures to lower gravity drain (decant) pipelines into the water to transfer water to the adjacent Drains Pond CCR Surface Impoundment (Drains Pond System). Contact water in perimeter ditches flows passively from Ash Pond 91 to the Drains Pond System.

3.10 Construction Specifications and Provisions (§257.73(c)(1)(xi))

The following documents contain the specifications, construction quality assurance reports, and provisions for operation of Ash Pond 91.

- The final report for the foundation, liner, and embankment construction completed in 1993 on Ash Pond 91 (CPA 1993).
- The geomembrane quality assurance services documentation performed in 1993 on Ash Pond 91 (Golder 1993).
- The operations plan for Ash Pond 91, Ash Pond 92, and Section 16 (Golder 2015b).
- The geosynthetics material specifications for the liner construction performed on the 2016 Ash Pond 91 Upstream Raise Construction (Golder 2016c).
- The geosynthetics installation specifications for the liner construction performed on the 2016 Ash Pond 91 Upstream Raise Construction (Golder 2016d).
- The construction specifications for the foundation, liner, and embankment construction performed on the 2016 Ash Pond 91 Upstream Raise Construction (Golder 2016e).

3.11 Record of Structural Instability (§257.73(c)(1)(xii))

No record of structural instability has been noted for Ash Pond 91. Weekly Inspections are performed by site personnel and annual inspections are performed by a registered professional engineer.

4.0 CLOSING

Golder Associates Inc. has prepared the above History of Construction for the Ash Pond 91 CCR surface impoundment at Great River Energy's Coal Creek Station. Based on our review of the available information, to the extent feasible, this report provides the information required by 40 CFR §257.73(c)(i) through (xii), as related to the construction of the Ash Pond 91 CCR surface impoundment.

GOLDER ASSOCIATES INC.

Todd Stong, PE
Senior Engineer/Associate

Craig Schuettpelz, PE
Senior Project Engineer

TS/CS/rjg

5.0 REFERENCES

Barr. 1982. *Seepage and Stability Analysis.* Prepared for Cooperative Power Association. February.

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Burns & McDonnell. 1973. *Report on the Environmental Analysis for a North Dakota Power Supply Project*. July.

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Golder. 2016a. *Hazard Potential Classification, Structural Stability, and Safety Factor Assessments, Ash Pond 91 CCR Surface Impoundment*. October.

Golder. 2016b. *Inflow Design Flood Control System Plan, Ash Pond 91 CCR Surface Impoundment*. October.

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Golder. 2016d. *Geosynthetics Installation Specifications for Great River Energy Coal Creek Station 2016 Ash Pond 91 Upstream Raise Construction.* June.

Golder. 2016e. *Construction Specifications for Great River Energy Coal Creek Station 2016 Ash Pond 91 Upstream Raise Construction – Earthworks.* July.

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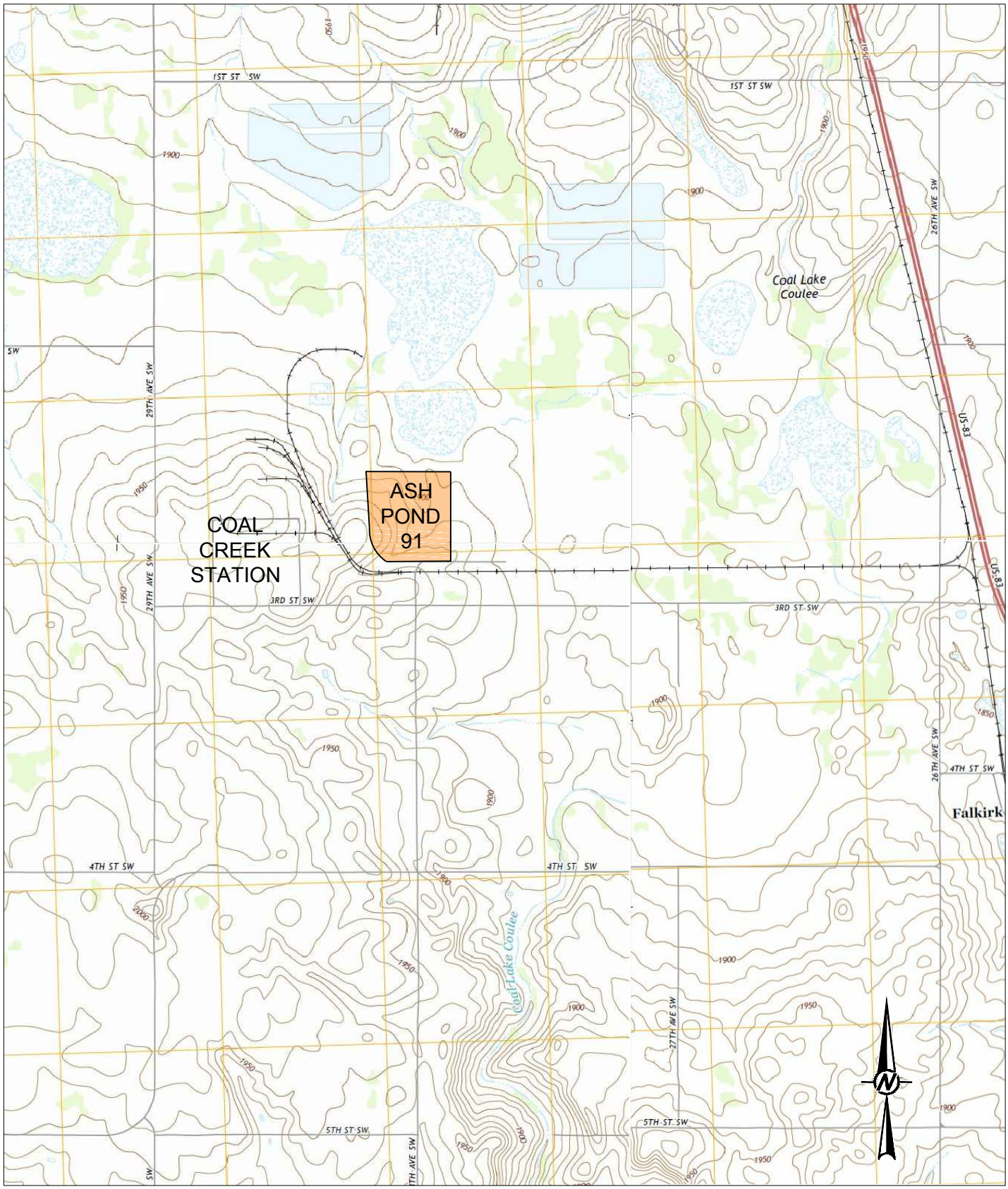
FIGURES



REFERENCES

1. TOPOGRAPHIC MAP WAS COMPILED FROM THE FOLLOWING USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES:
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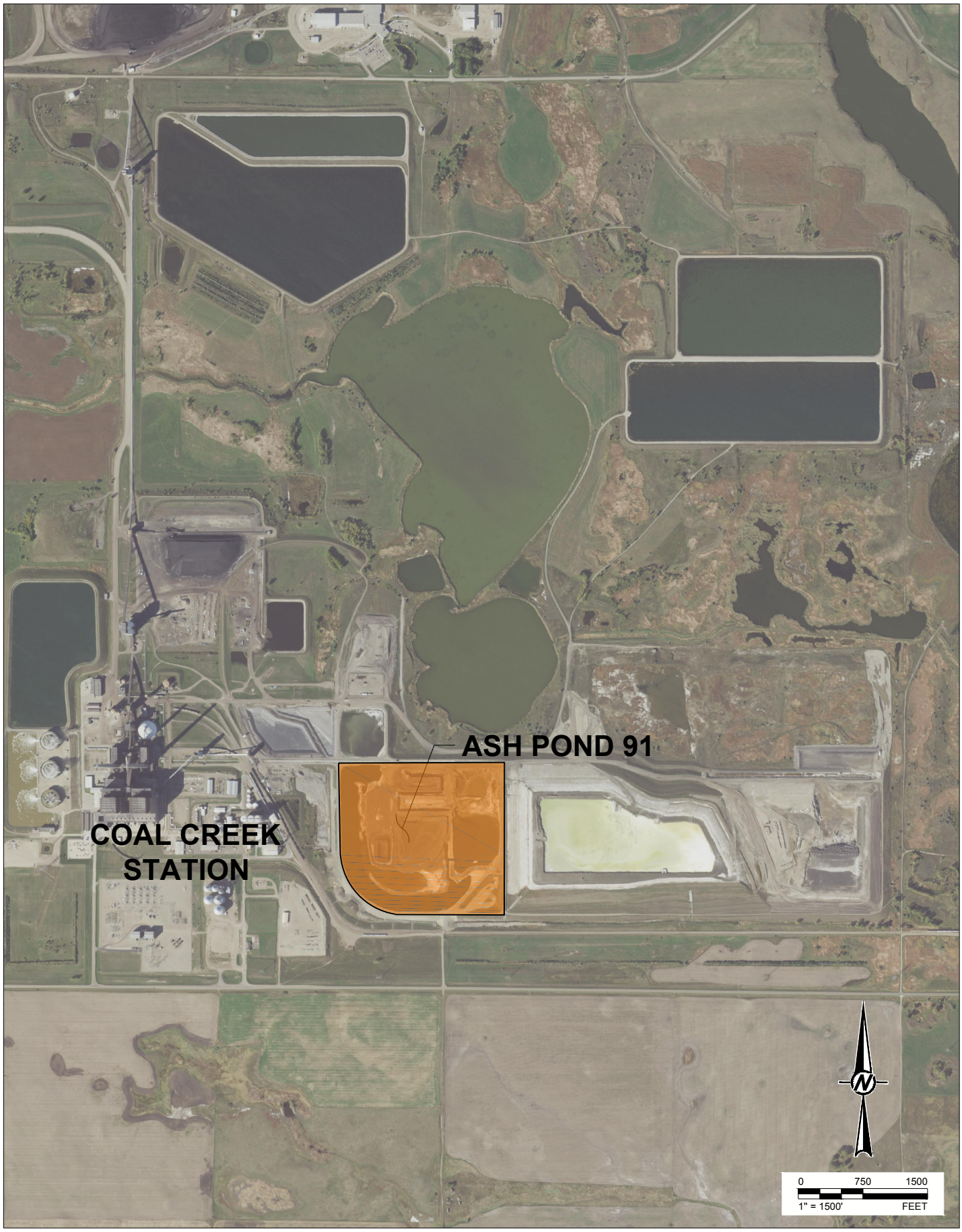
   WASHBURN NE, NORTH DAKOTA (2014)
   WASHBURN, NORTH DAKOTA (2014)
   WASHBURN SW, NORTH DAKOTA (2014)

GREAT RIVER ENERGY
ASH POND 91 SITE LOCATION (USGS TOPOGRAPHIC MAPS)

FIGURE 1

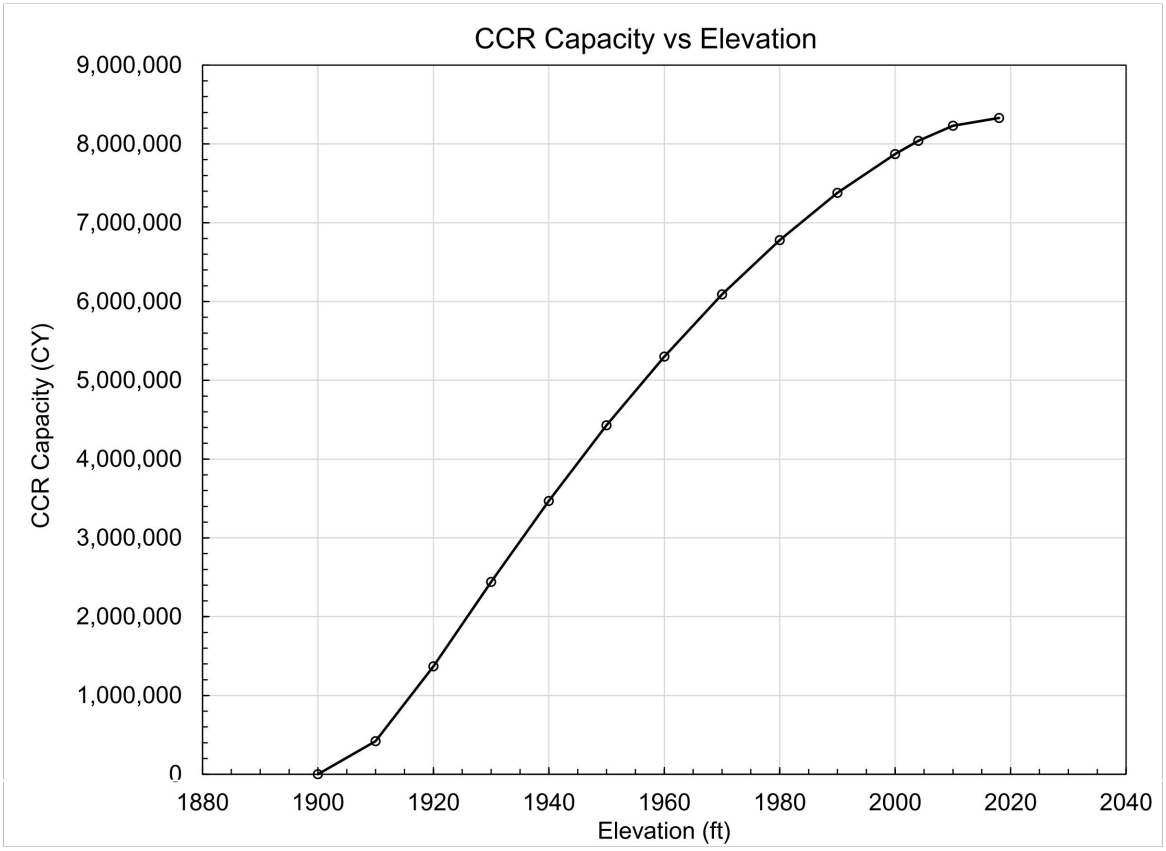
Golder Associates

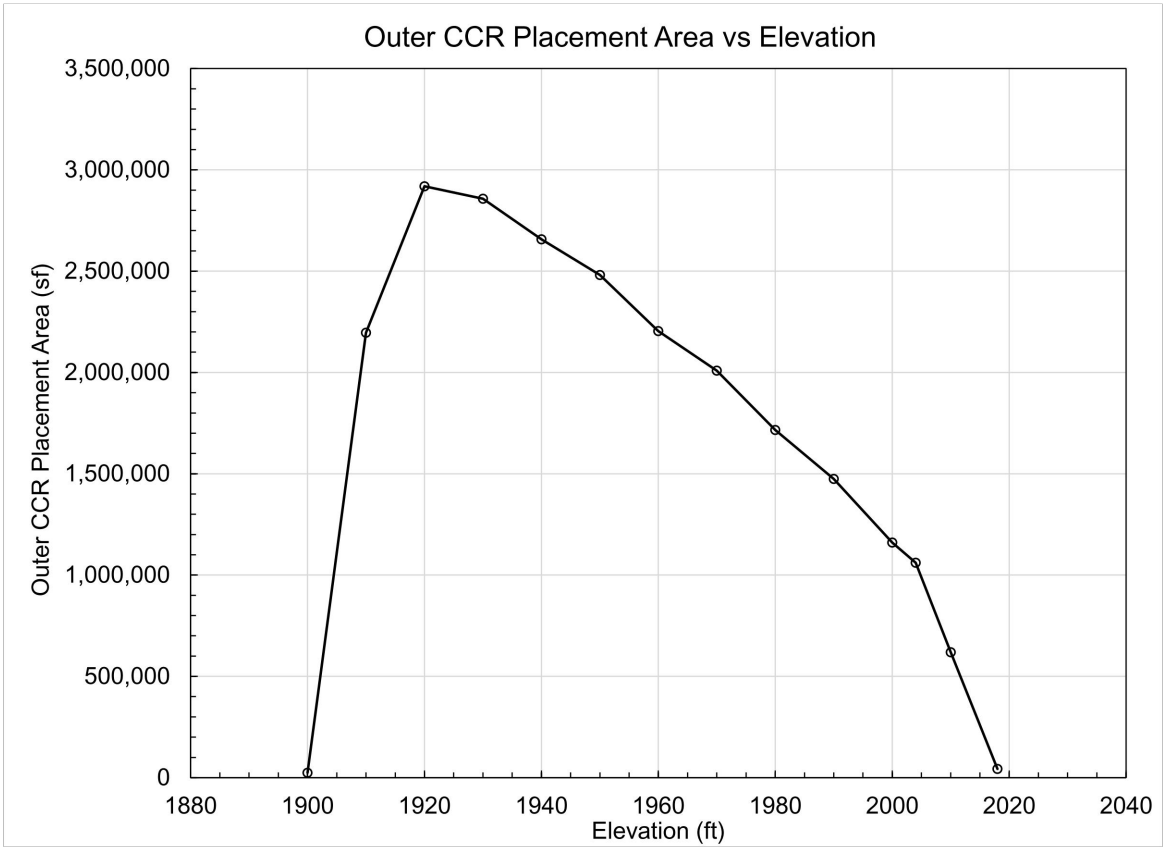


GREAT RIVER ENERGY
ASH POND 91 SITE LOCATION (AERIAL PHOTOGRAPH)

FIGURE 2

Golder Associates





GREAT RIVER ENERGY
ASH POND 91 AREA-CAPACITY INFORMATION

FIGURE 3

Golder Associates

APPENDIX A
DESIGN DRAWINGS

APPENDIX A-1
ASH POND 91 DESIGN DRAWINGS (CPA/UPA 1992)

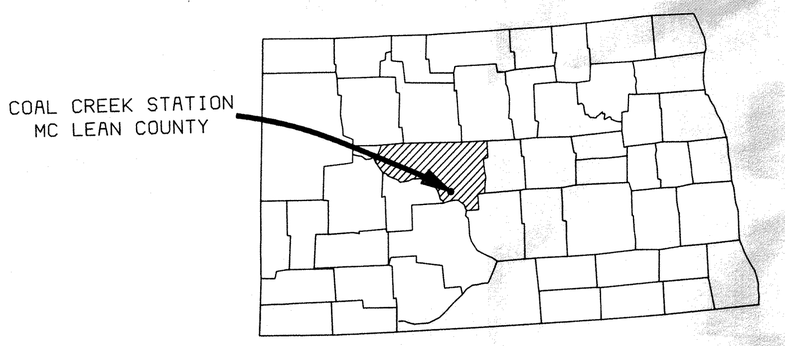
COOPERATIVE POWER ASSOCIATION

UNITED POWER ASSOCIATION

COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

COOPERATIVE POWER ASSOCIATION
14615 LONE OAK ROAD
EDEN PRAIRIE, MINNESOTA 55344

UNITED POWER ASSOCIATION
HIGHWAY 10
ELK RIVER, MINNESOTA 55330



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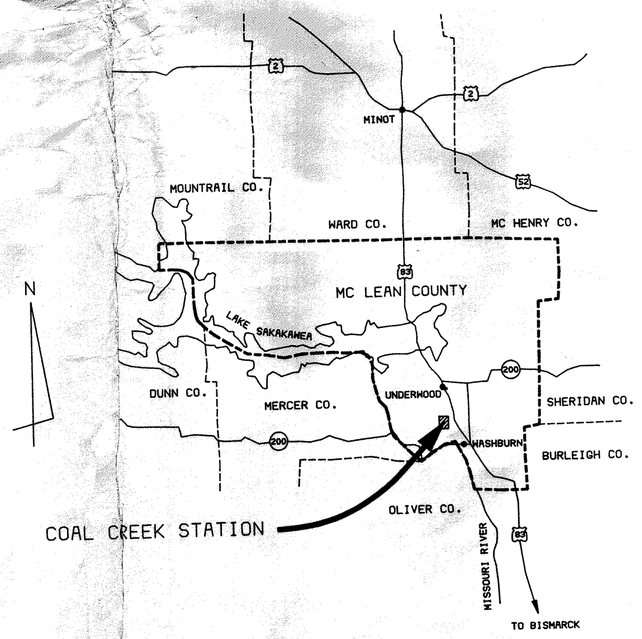


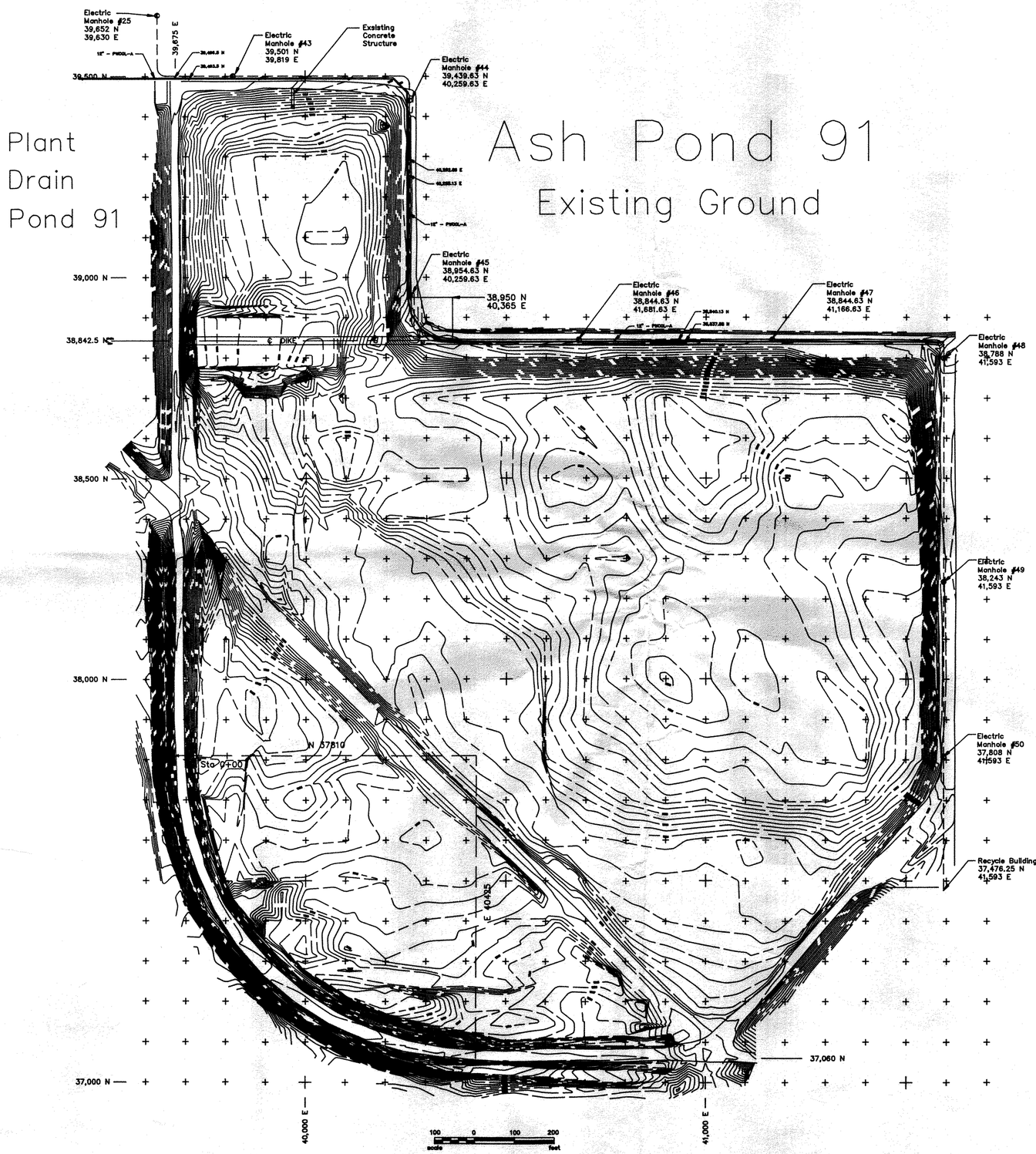
SITE LOCATION MAP

DRAWING NO.	DRAWING TITLE
92G213-1	EXISTING GROUND EVAPORATION POND 93
92G213-2	LAYOUT - TOP OF SUBGRADE EVAPORATION POND 93
92G213-3	LAYOUT - TOP OF BROWN CLAY EVAPORATION POND 93
92G213-4	LAYOUT - TOP OF GRAY CLAY EVAPORATION POND 93
92G213-5	LAYOUT - TOP OF SAND EVAPORATION POND 93
92G213-6	LAYOUT - TOP OF BOTTOM ASH EVAPORATION POND 93
92G213-7	EXISTING GROUND ASH POND 91
92G213-8	LAYOUT - TOP OF SUBGRADE ASH POND 91
92G213-9	LAYOUT - TOP OF BROWN CLAY ASH POND 91
92G213-10	LAYOUT - TOP OF GRAY CLAY ASH POND 91
92G213-11	LAYOUT - TOP OF SAND ASH POND 91
92G213-12	LAYOUT - TOP OF ROCK ASH POND 91
92G213-13	LAYOUT - TOP OF BOTTOM ASH ASH POND 91
92G213-14	LAYOUT - DRAIN SYSTEM ASH POND 91
92G213-15	PIPE ROUTING ALONG POND 94 TO POND 93
92G213-16	TYPICAL SECTIONS AND DETAILS
92G213-17	TYPICAL SECTIONS AND DETAILS
92G213-18	PLAN VIEW-EVAP. POND 92 OUTLET & SEWAGE LINE DETAIL
92G213-19	DETAILS MISCELLANEOUS
92G213-20	DEWATERING, PERFORATED PIPE DETAILS

FOR BID ONLY

PROJECT TITLE:
1992 ASH DISPOSAL

WORKORDER NO.:
92G213



2 12,000 C.Y. OF RIP RAP IS STOCKPILED AT APPROXIMATELY 39,000 E AND 39,000 N.

1 EXISTING ASH IN POND 91 TO BE REMOVED UNDER AN EXISTING CONTRACT. AFTER REMOVAL IS COMPLETE, A SURVEY OF GROUND CONDITIONS WILL BE COMPLETED PRIOR TO CONSTRUCTION OF LINER SYSTEM.

GENERAL NOTES

FOR BID ONLY

DRAWING NO. | REVISION | REFERENCE DRAWINGS

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

DWN. BAK CHK.
DATE 12/30/91
W/O 92G213

COOPERATIVE POWER

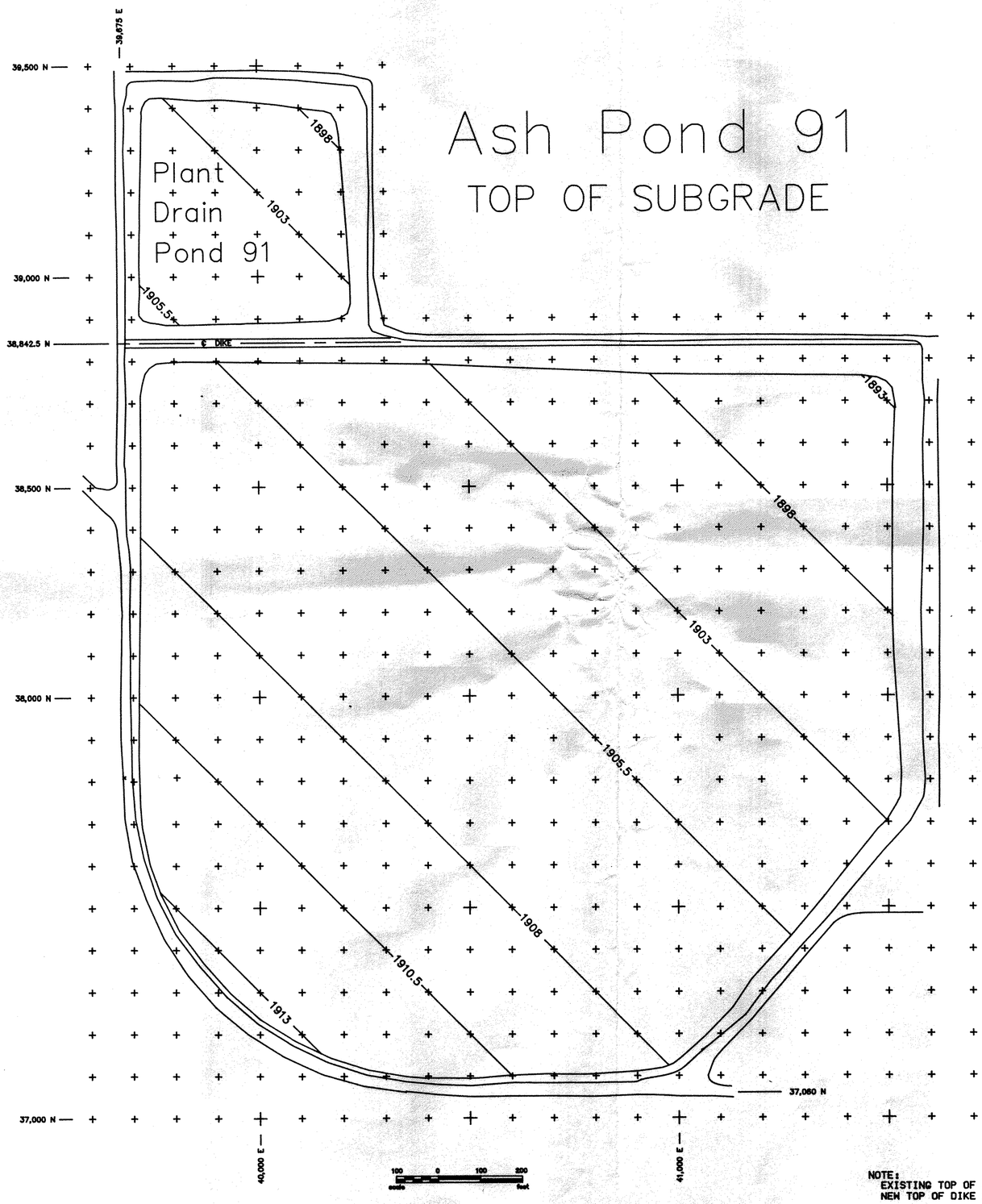
EXISTING GROUND
ASH POND 91

1992 ASH DISPOSAL

DRAWING NO. 92G213-7

Ash Pond 91

TOP OF SUBGRADE



NOTE:
EXISTING TOP OF DIKE 1920'
NEW TOP OF DIKE 1922'

GENERAL NOTES

FOR BID ONLY

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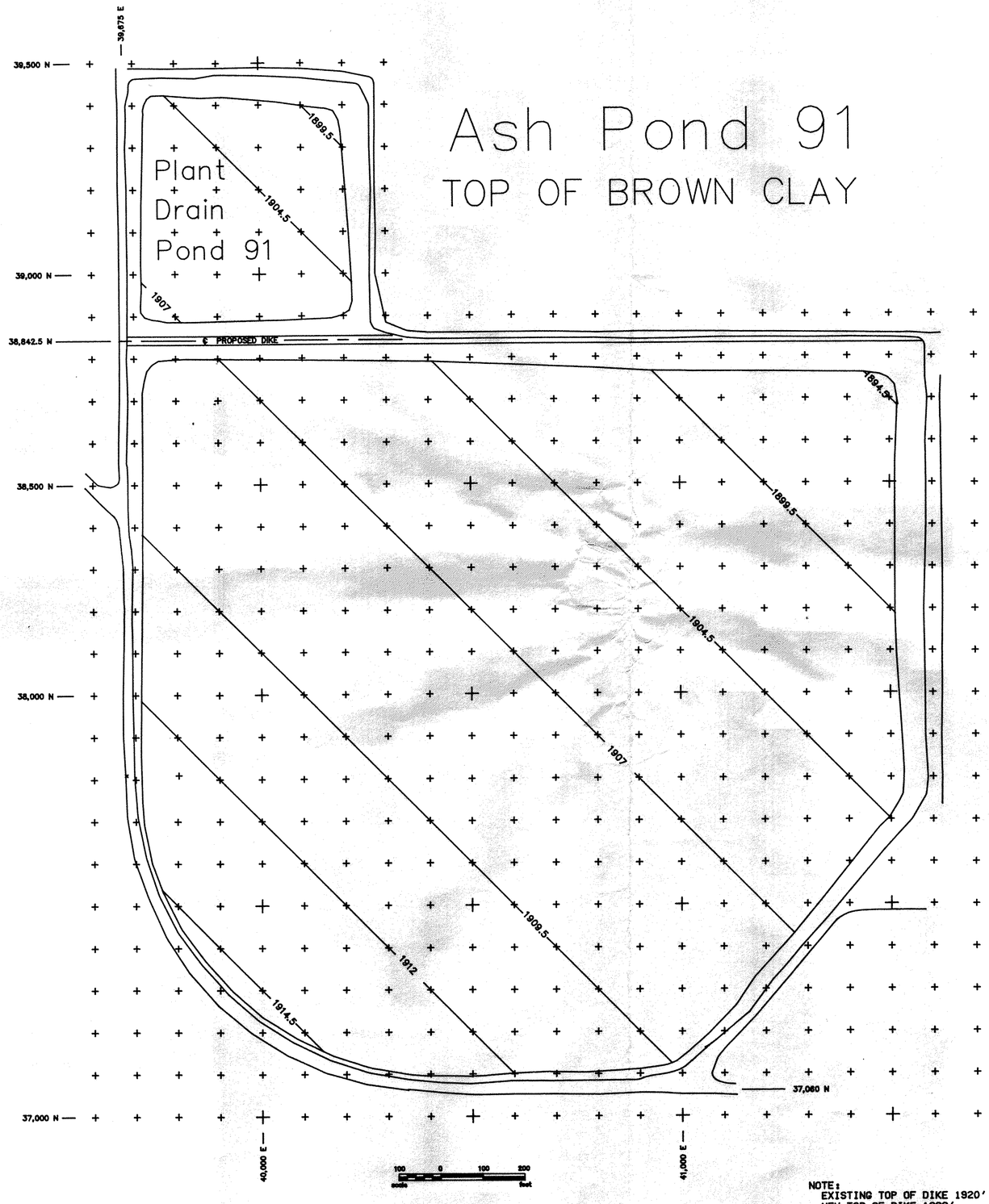
01/08/92	ISSUED FOR BID	0	BK	AS	AS

DWN. BAK CHK.
DATE 12/30/91
W/O 920213

LAYOUT - TOP OF SUBGRADE
ASH POND 91

1992 ASH DISPOSAL

DRAWING NO.
92G213-8



Ash Pond 91

TOP OF BROWN CLAY

NOTE:
EXISTING TOP OF DIKE 1920'
NEW TOP OF DIKE 1922'

GENERAL NOTES

FOR BID ONLY

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NO.	DATE	REVISIONS AND RECORD OF ISSUE	BK	AS	AS
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DWN. BAK CHK.
DATE 12/30/91
W/O 92G213

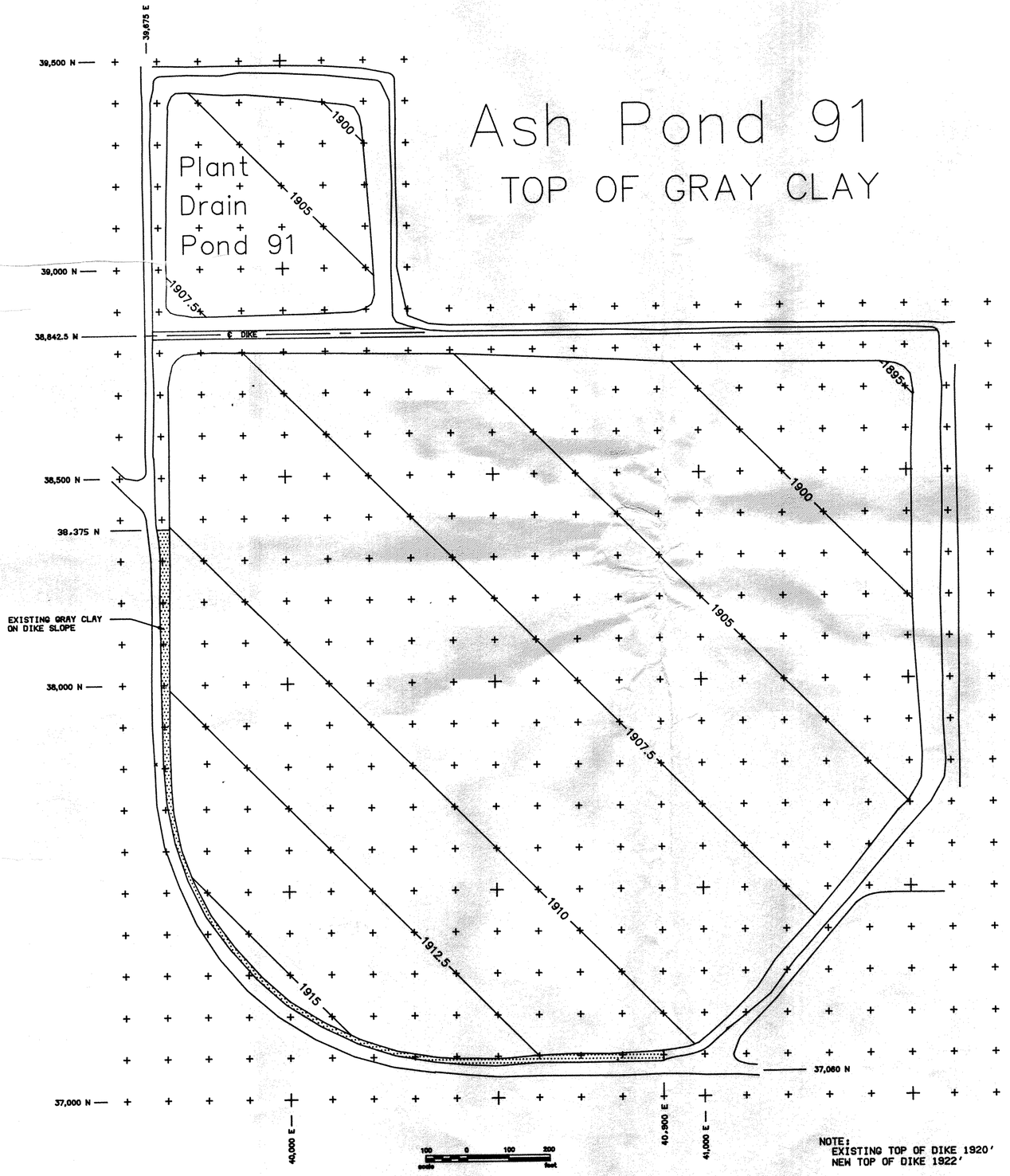
LAYOUT - TOP OF BROWN CLAY
ASH POND 91

1992 ASH DISPOSAL

DRAWING NO. 92G213-9

Ash Pond 91

TOP OF GRAY CLAY



NOTE:
EXISTING TOP OF DIKE 1920'
NEW TOP OF DIKE 1922'

GENERAL NOTES

FOR BID ONLY

DRAWING NO.	REVISION	REFERENCE DRAWINGS

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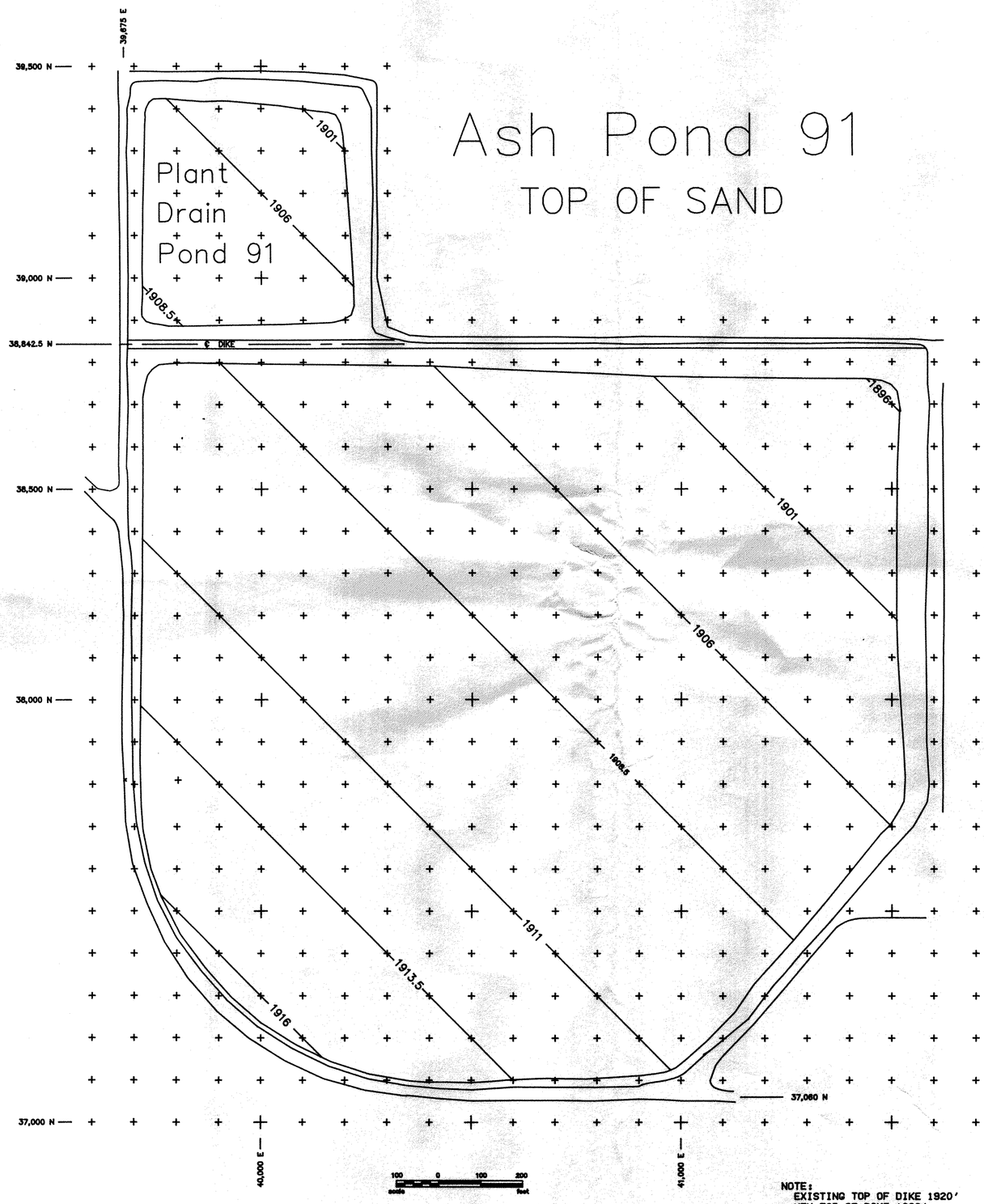
DWN. BAK CHK.
DATE 12/30/91
W/O 920213

LAYOUT - TOP OF GRAY CLAY
ASH POND 91

1992 ASH DISPOSAL

DRAWING NO.
92G213-10

COOPERATIVE POWER



Ash Pond 91

TOP OF SAND

NOTE:
EXISTING TOP OF DIKE 1920'
NEW TOP OF DIKE 1922'

GENERAL NOTES

FOR BID ONLY

DRAWING NO.	REVISION	REFERENCE DRAWINGS

NO.	BY	CK.	APP	DATE	REVISIONS AND RECORD OF ISSUE
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DWN. BAK CHK.
DATE 12/30/91
W/O 92G213

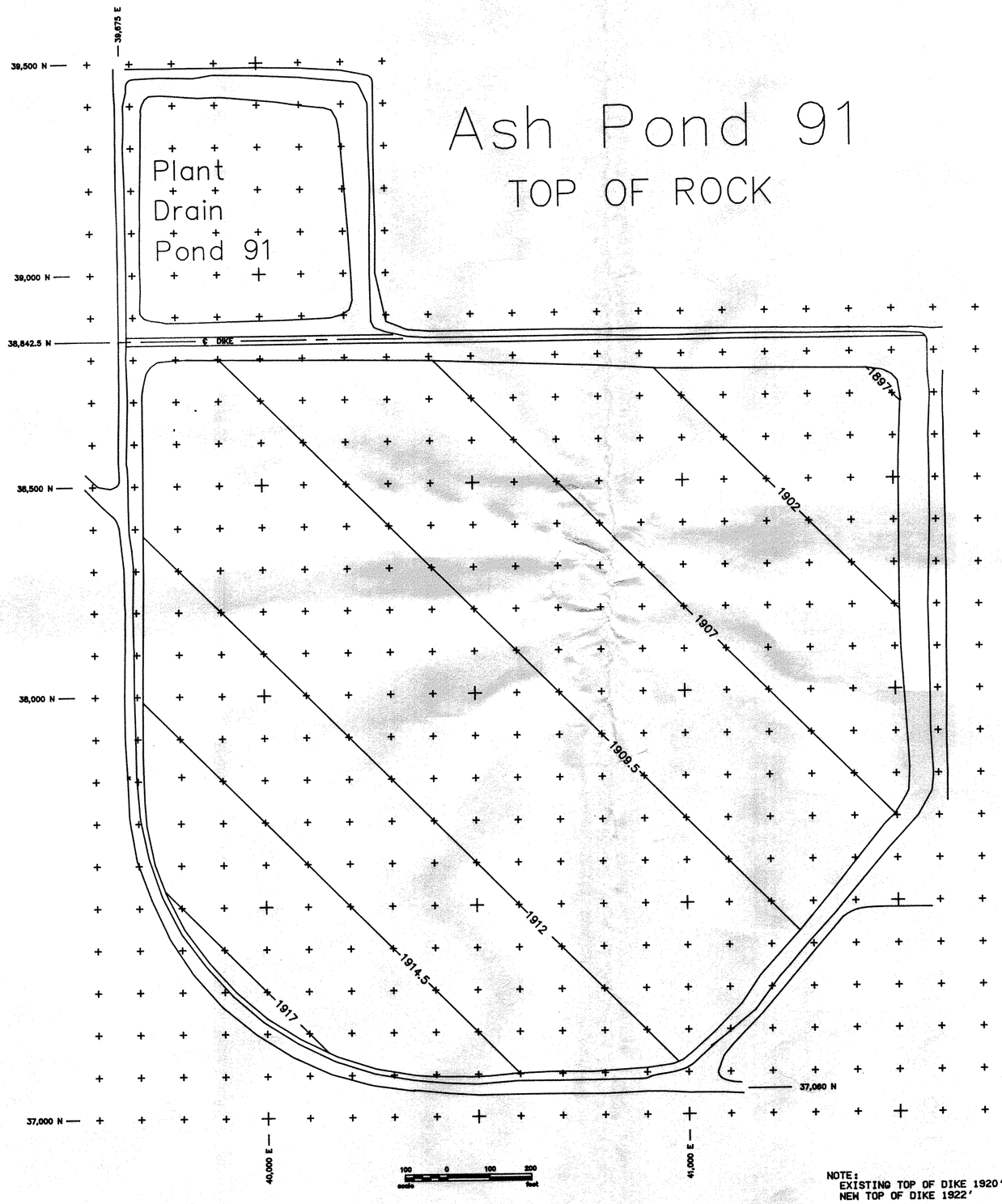
LAYOUT - TOP OF SAND
ASH POND 91

1992 ASH DISPOSAL

DRAWING NO.
92G213-11

Ash Pond 91

TOP OF ROCK



NOTE:
EXISTING TOP OF DIKE 1920'
NEW TOP OF DIKE 1922'

GENERAL NOTES

FOR BID ONLY

DRAWING NO.	REVISION	REFERENCE DRAWINGS

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DATE 12/30/91	LAYOUT - TOP OF ROCK ASH POND 91
W/O 92G213	1992 ASH DISPOSAL
COOPERATIVE POWER	DRAWING NO. 92G213-12

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP
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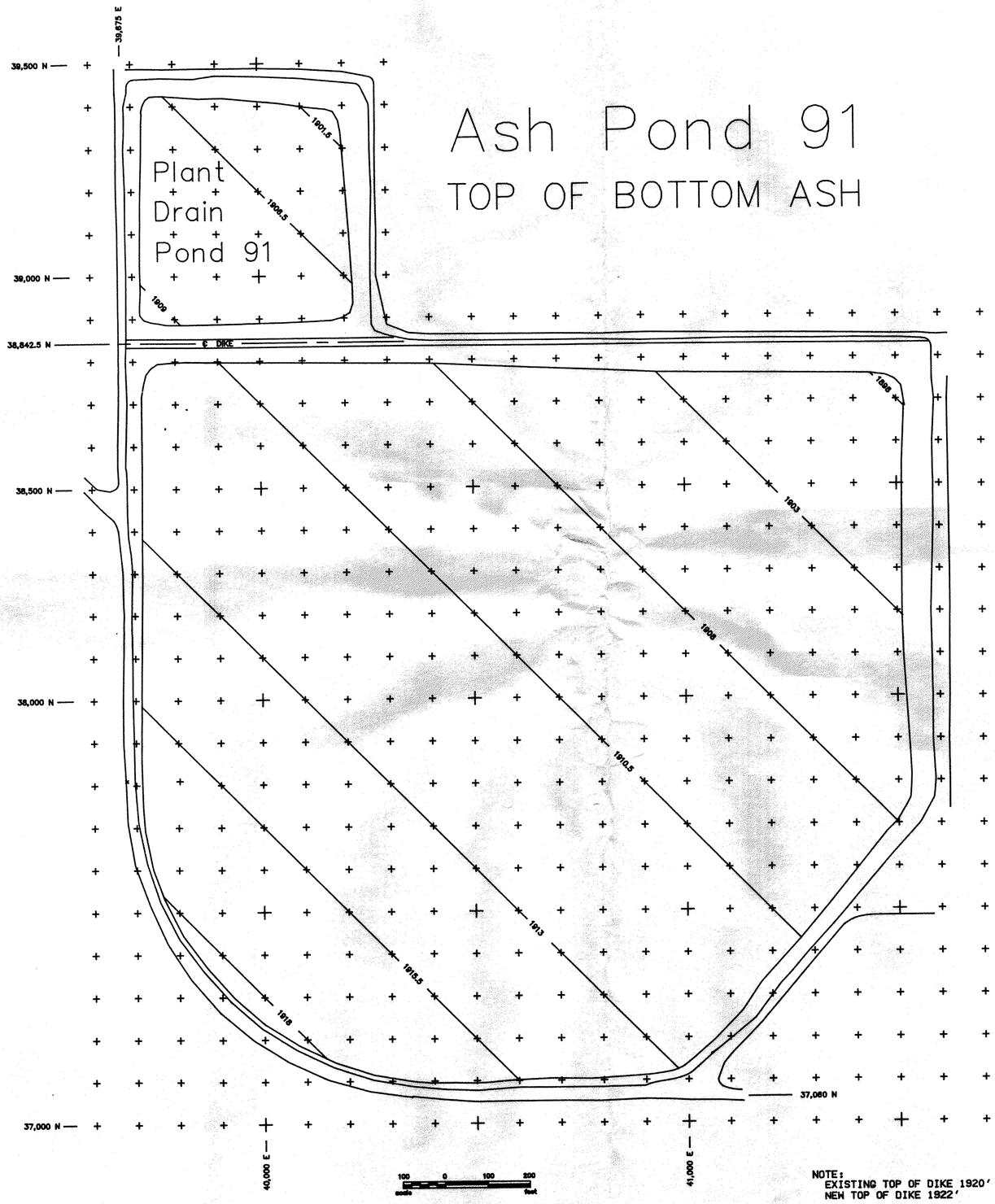

GENERAL NOTES

FOR BID ONLY

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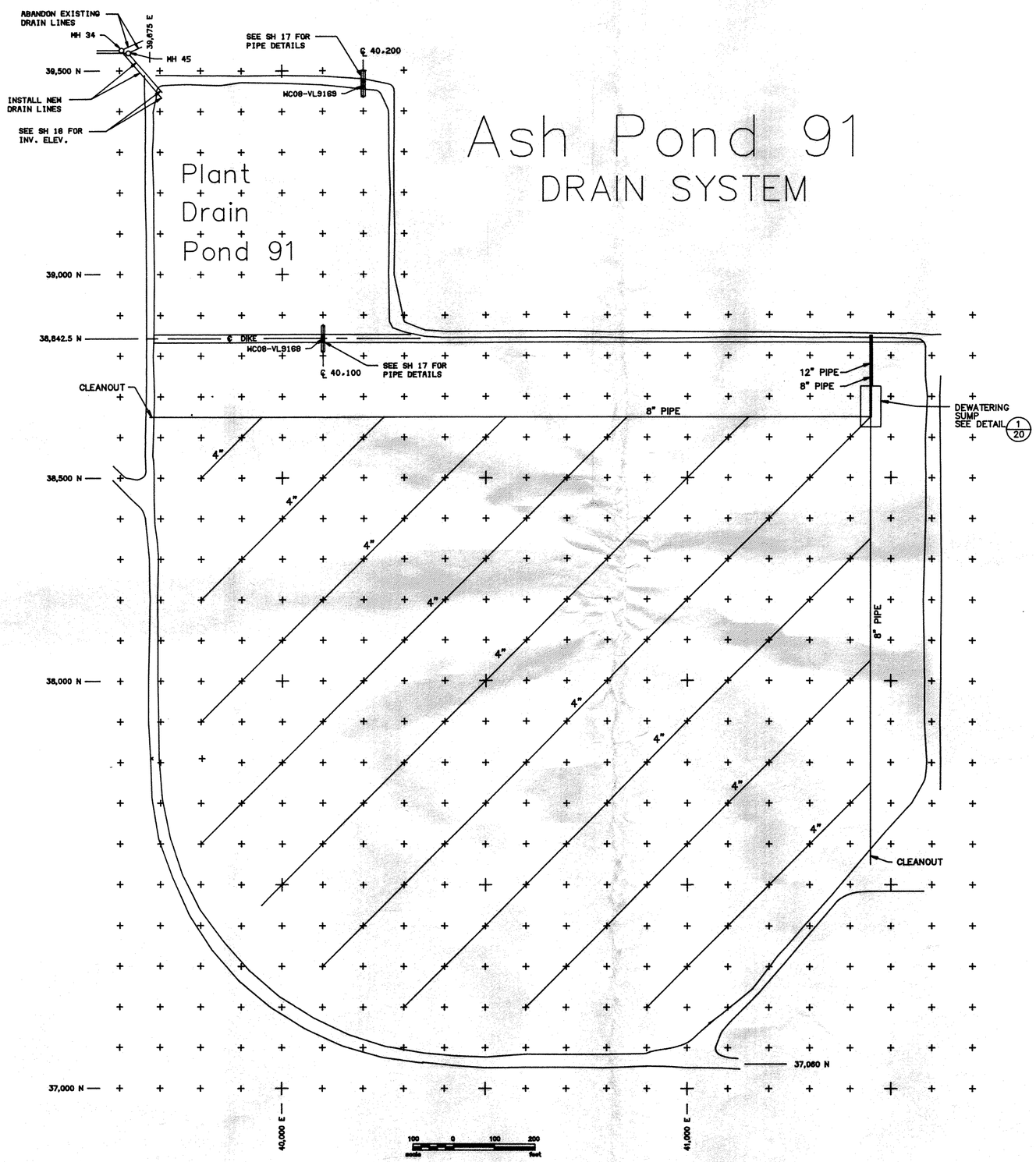
DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP

DWN. BAK CHK.
DATE 12/30/91
W/O 92G213

LAYOUT - TOP OF BOTTOM ASH
ASH POND 91
1992 ASH DISPOSAL
DRAWING NO.
92G213-13



GENERAL NOTES

FOR BID ONLY

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DATE 12/30/91		
W/O 92G213		1992 ASH DISPOSAL
COOPERATIVE POWER		DRAWING NO. 92G213-14

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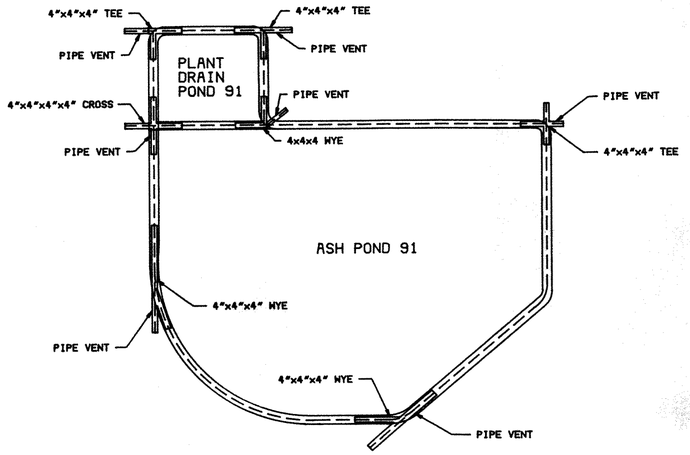

1/16 GAS PIPING AND TRENCH LAYOUT ASH POND 91
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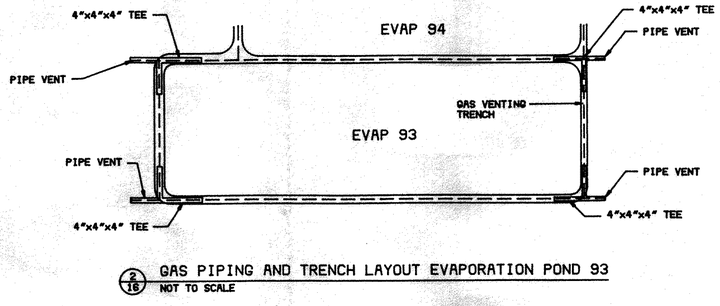

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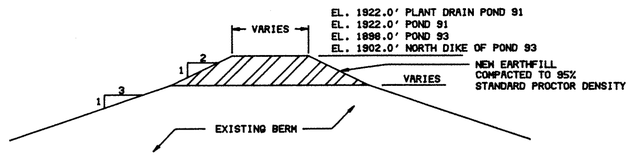

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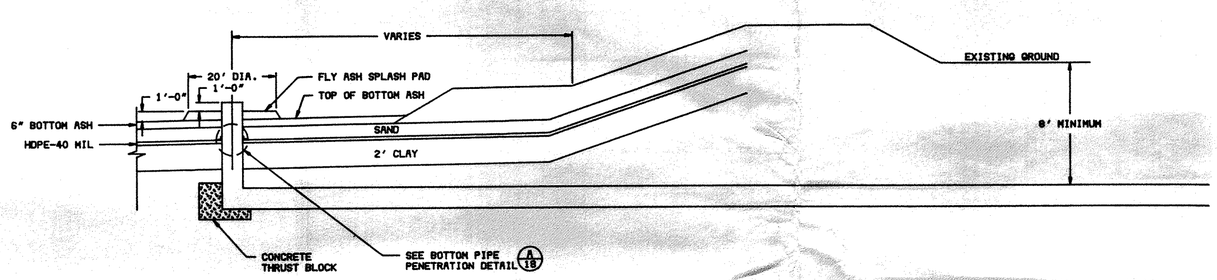

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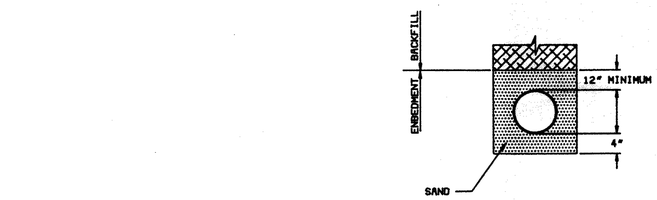

TYPICAL PIPE BEDDING
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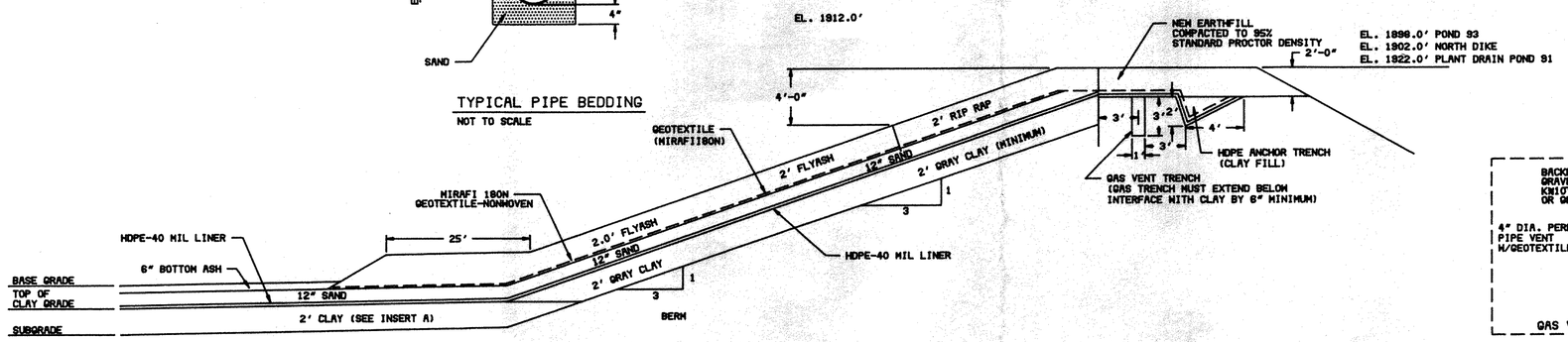
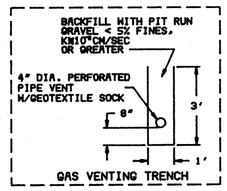


INSERT A

6" GRAY CLAY
18" BROWN CLAY

TYPICAL BERM & BOTTOM SECTION
EVAPORATION POND 93 AND PLANT DRAIN POND 91
5/16 NOT TO SCALE



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.

GENERAL NOTES

FOR BID ONLY

DRAWING NO.	REVISION	REFERENCE DRAWINGS

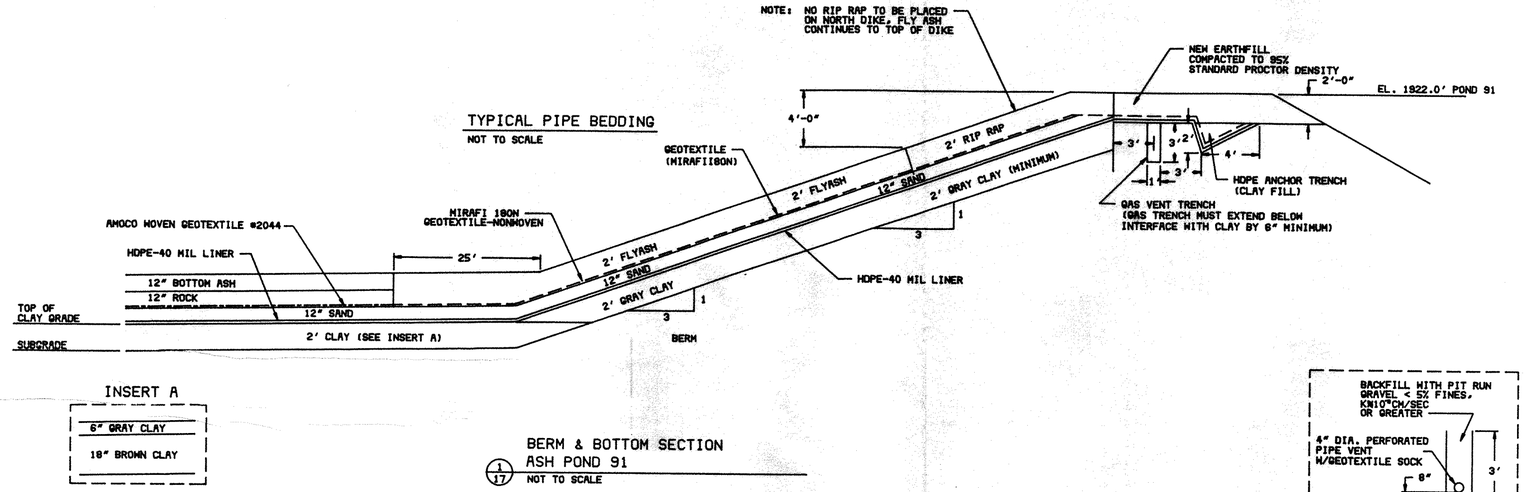
DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK.	APP
01/09/92	ISSUED FOR BID	0	BK	AS	AS

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

TYPICAL SECTIONS AND DETAILS

1992 ASH DISPOSAL

DRAWING NO. 92G213-16

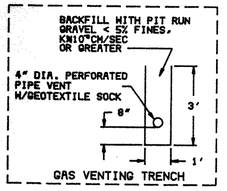


TYPICAL PIPE BEDDING
NOT TO SCALE

INSERT A

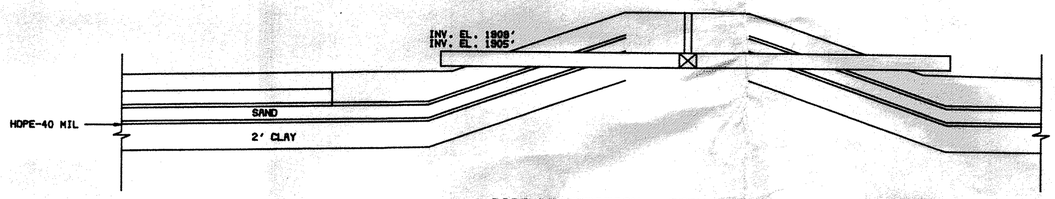
6" GRAY CLAY
18" BROWN CLAY

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
	MC09-VL9168	ASH POND 91-PLANT DRAIN POND		18	100	150	GA	CI				UNDERGROUND VALVE WITH VALVE BOX
	MC09-VL9169	PLANT DRAIN POND DISCHARGE		18	100	150	GA	CI				UNDERGROUND VALVE WITH VALVE BOX

GENERAL NOTES

FOR BID ONLY

NO.	BY	CK	AS	AS
0				

01/09/92 ISSUED FOR BID
DATE REVISIONS AND RECORD OF ISSUE

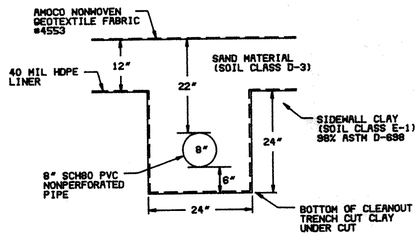
DRAWING NO. | REVISION | REFERENCE DRAWINGS

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

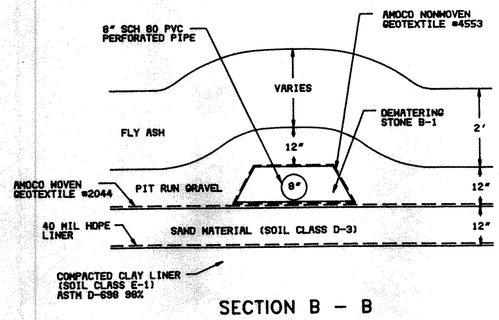
TYPICAL SECTIONS AND DETAILS

1992 ASH DISPOSAL

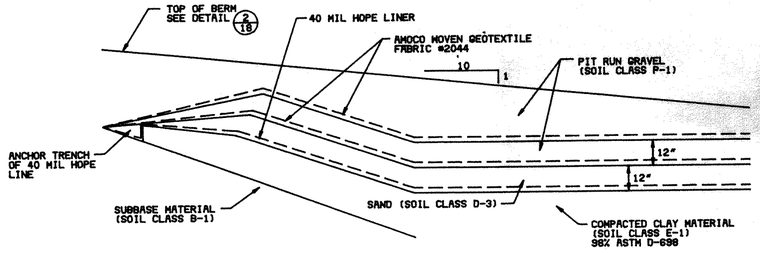
DRAWING NO. 92G213-17



SECTION A – A



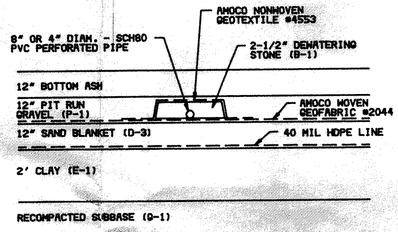
SECTION B – B



PERMANENT HEAVY EQUIPMENT ENTRANCE RAMP DETAIL
(SOUTHEAST CORNER OF POND)

1/19

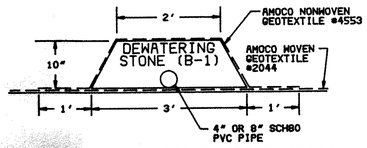
NOT TO SCALE



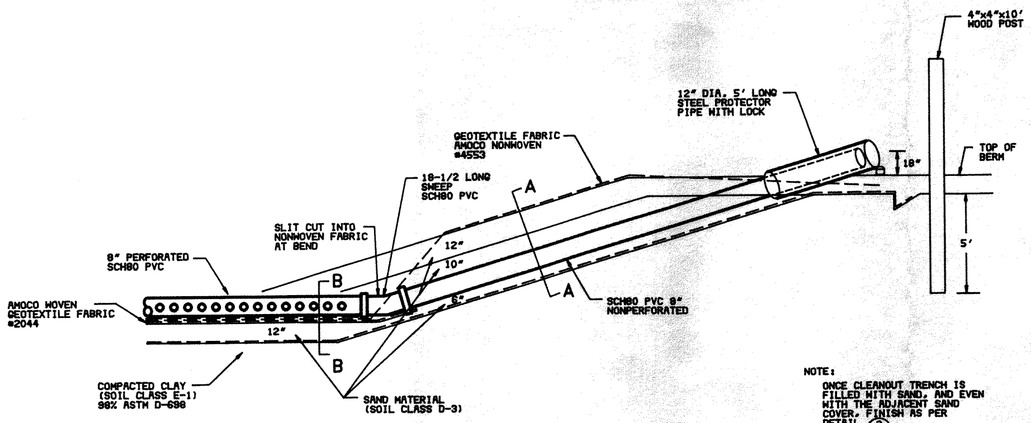
TYPICAL DEWATERING AND HEADER TRENCH DETAIL
WITH DETAIL OF THE BEDDING AROUND THE
PERFORATED PIPE

2/19

NOT TO SCALE



TYPICAL DEWATERING STONE DETAIL



NOTE:
ONCE CLEANOUT TRENCH IS FILLED WITH SAND, AND EVEN WITH THE ADJACENT SAND COVER, FINISH AS PER DETAIL 2/10

TYPICAL CLEAN-OUT RISERS
EAST AND WEST SLOPES

3/19

NOT TO SCALE

GENERAL NOTES

FOR BID ONLY

DRAWING NO.	REVISION	REFERENCE DRAWINGS

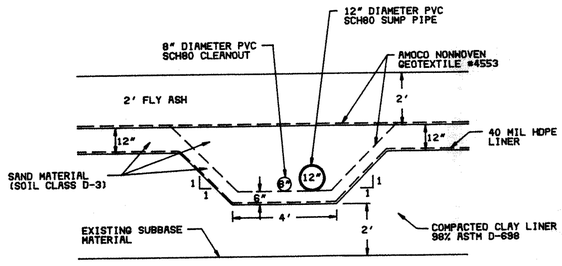
DWN. BAK	CHK.
DATE 01/02/92	
W/O 92G213	

DETAILS
MISCELLANEOUS

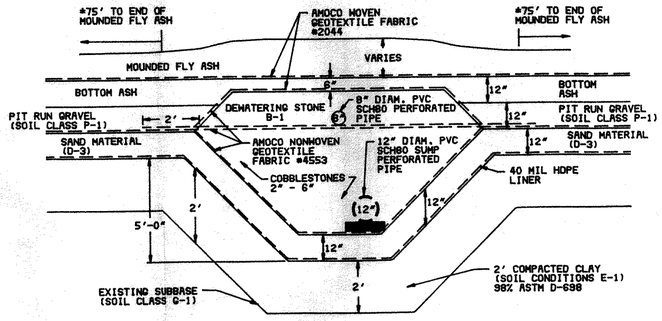
1992 ASH DISPOSAL

DRAWING NO. 92G213-19

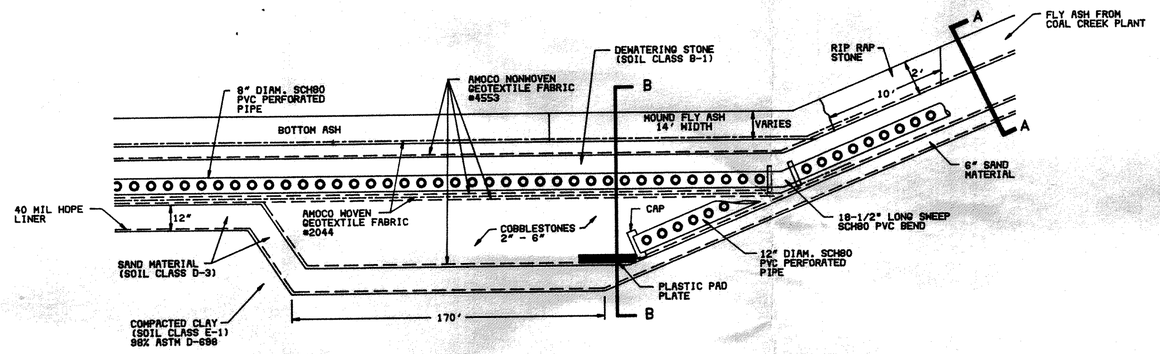
NO.	DATE	REVISIONS AND RECORD OF ISSUE	BY	CK.	APP
0	01/09/92	ISSUED FOR BID	BK	AS	AS



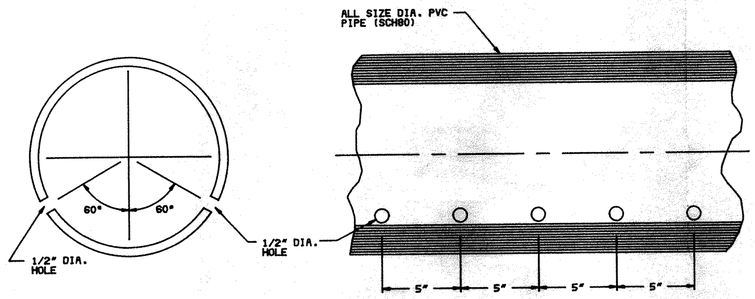
SECTION A – A



SECTION B – B



1/20 DEWATERING SUMP DETAIL
NOT TO SCALE



2/20 PERFORATED PIPE DETAIL (ALL SIZES)
NOT TO SCALE

GENERAL NOTES

DRAWING NO.	REVISION	REFERENCE DRAWINGS

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

DWN. bak | CHK.
DATE 01/03/92
W/O 920213

DEWATERING, PERFORATED PIPE DETAILS

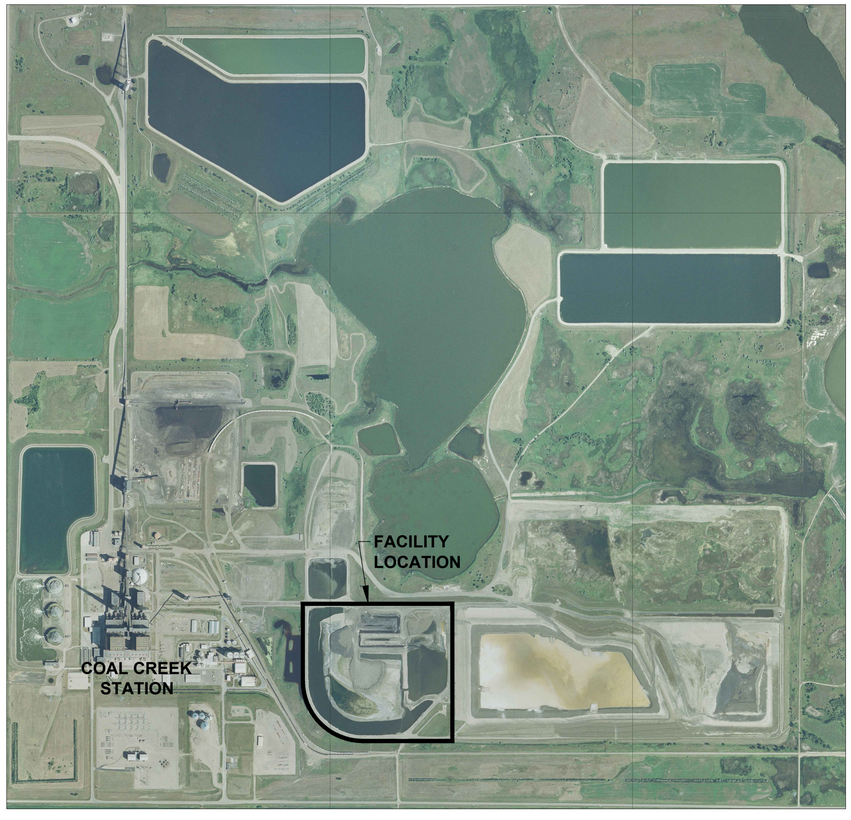
COOPERATIVE POWER

1992 ASH DISPOSAL

DRAWING NO. 92G213-20

APPENDIX A-2
ASH POND 91 PERMIT DRAWINGS (GOLDER 2015A)

GREAT RIVER ENERGY
PERMIT NO. 033 MODIFICATION
ASH POND 91



Prepared for:

GREAT RIVER ENERGY®
A Touchstone Energy® Cooperative

Coal Creek Station
Underwood, North Dakota

Prepared by:

Golder Associates

Golder Associates Inc.
44 Union Boulevard, Suite 300
Lakewood, Colorado USA 80228

DRAWING LIST

DRAWING NO.	TITLE	REVISION
1	TITLE SHEET	B
2	EXISTING CONDITIONS	B
3	PROPOSED TOP OF LINER	B
4	PROPOSED FINAL CCP GRADES	B
5	FINAL COVER GRADES AND SURFACE WATER PLAN	B
6	CROSS SECTIONS	B
7	SECTION DETAILS	B
8	LINER DETAILS	B
9	HYDRAULIC DETAILS	B
10	COVER DETAILS	B

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
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
TITLE SHEET

PROJECT No. 1400644 | Rev. B | 1 of 10 | SHEET 1

DRAINS POND

ASH POND 91

ASH POND 92

INVERT EL. ~1909.5 FT

TWO 18" HDPE CROSS-OVER DRAINAGE PIPES INVERT EL. ~1912 FT

18" HDPE CROSS-OVER DRAINAGE PIPE INVERT EL. ~1910 FT

EXISTING DRAINAGE SYSTEM CLEANOUT PIPE

EXISTING DRAINAGE SYSTEM CLEANOUT PIPE AND SUMP RISER PIPE

CONTROL POINT
AP91-3 REBAR & CAP
N 138832.29
E 1841569.72
ELEV. 1921.38

DEWATERING SUMP

EXISTING DRAINAGE SYSTEM CLEANOUT PIPE

RECYCLE PUMPHOUSE

30" REINFORCED CONCRETE PIPE
N 137499.79
E 1841293.83
INVERT ELEV. 1907.34

30" REINFORCED CONCRETE PIPE
N 137495.64
E 1841676.13
INVERT ELEV. 1906.72

CONTROL POINT
AP91-2 REBAR & CAP
N 137510.09
E 1841485.37
ELEV. 1918.71

CONTROL POINT
AP91-1 REBAR & CAP
N 137166.59
E 1839839.74
ELEV. 1941.89

CONTROL POINT
SH87-5 REBAR & CAP
N 137047.16
E 1841076.12
ELEV. 1920.06

139 000 N
138 500 N
138 000 N
137 500 N
137 000 N
1 839 500 E
1 840 000 E
1 840 500 E
1 841 000 E
1 841 500 E
1 842 000 E

0 120 240
SCALE FEET

LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCE 2)
- AS-BUILT TOP OF LINER GRADES (SEE REFERENCES 3 AND 4)
- ASH POND 91 FACILITY BOUNDARY
- CROSS-OVER DRAINAGE PIPING
- SURVEY CONTROL POINT
- EXISTING 4-INCH DIA. PERFORATED DRAINAGE PIPE
- EXISTING 8-INCH DIA. PERFORATED DRAINAGE/CLEANOUT PIPE
- EXISTING 12-INCH DIA. SUMP RISER PIPE

NOTES

1. THE PROPOSED FACILITY BOUNDARY IS APPROXIMATE.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS, PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33-20-04.1-09.
2. OPERATE THE ASH POND 91 UPSTREAM RAISE (SURFACE IMPOUNDMENT) TO HAVE A FREEBOARD OF AT LEAST TWO FEET, PER SUBDIVISION D OF SUBSECTION 2 OF NDAC SECTION 33-20-08.1-01.
3. MINIMIZE EROSION OF FINAL COVER, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
4. MAXIMUM FINAL SLOPES NOT LESS THAN THREE PERCENT, NOR MORE THAN TWENTY-FIVE PERCENT, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
5. EVALUATE SLOPES STEEPER THAN FIFTEEN PERCENT TO ENSURE STABILITY, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
6. CONTROL OF SURFACE WATER DRAINAGE FROM FINAL SLOPES, PER SUBDIVISIONS B2-B4 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.
7. COMPOSITE LINER, PER SUBDIVISION B OF SUBSECTION 2 OF NDAC SECTION 33-20-08.1-01.
8. APPROPRIATE ENGINEERED FINAL COVER DESIGN, PER NDAC SECTION 33-20-07.1-02.
9. ALL OTHER APPLICABLE RULES FROM NDCC CHAPTER 23-29 AND NDAC ARTICLE 33-20.

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 SURVEY WAS PERFORMED BETWEEN 1996 AND 2011.
3. ASH POND 91 AS-BUILT TOP OF LINER SYSTEM GRADES REPRESENT THE TOP OF THE PROTECTIVE COVER AND WERE SURVEYED BY INTERSTATE ENGINEERING, INC. THE GRADES ARE REFERENCED FROM A SURVEY DRAWING PROVIDED BY GREAT RIVER ENERGY, DATED JANUARY 25, 1994.
4. DRAINS POND AS-BUILT TOP OF LINER SYSTEM GRADES REPRESENT THE TOP OF PROTECTIVE COVER AND WERE SURVEYED BY INTERSTATE ENGINEERING, INC. THE GRADES ARE REFERENCED FROM A SURVEY DRAWING PROVIDED BY GREAT RIVER ENERGY, DATED JANUARY 10, 1994.
5. DRAINAGE SYSTEM PIPE AND SUMP LOCATIONS ARE FROM DRAWINGS DATED JANUARY 9, 1992 PROVIDED BY GREAT RIVER ENERGY.
6. COORDINATES ARE BASED ON THE PLANT GRID SYSTEM.
7. THE CONTOUR INTERVAL IS TWO FEET.
8. 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
EXISTING CONDITIONS

PROJECT No. 1400644 | Rev. B | 2 of 10 | SHEET 2

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

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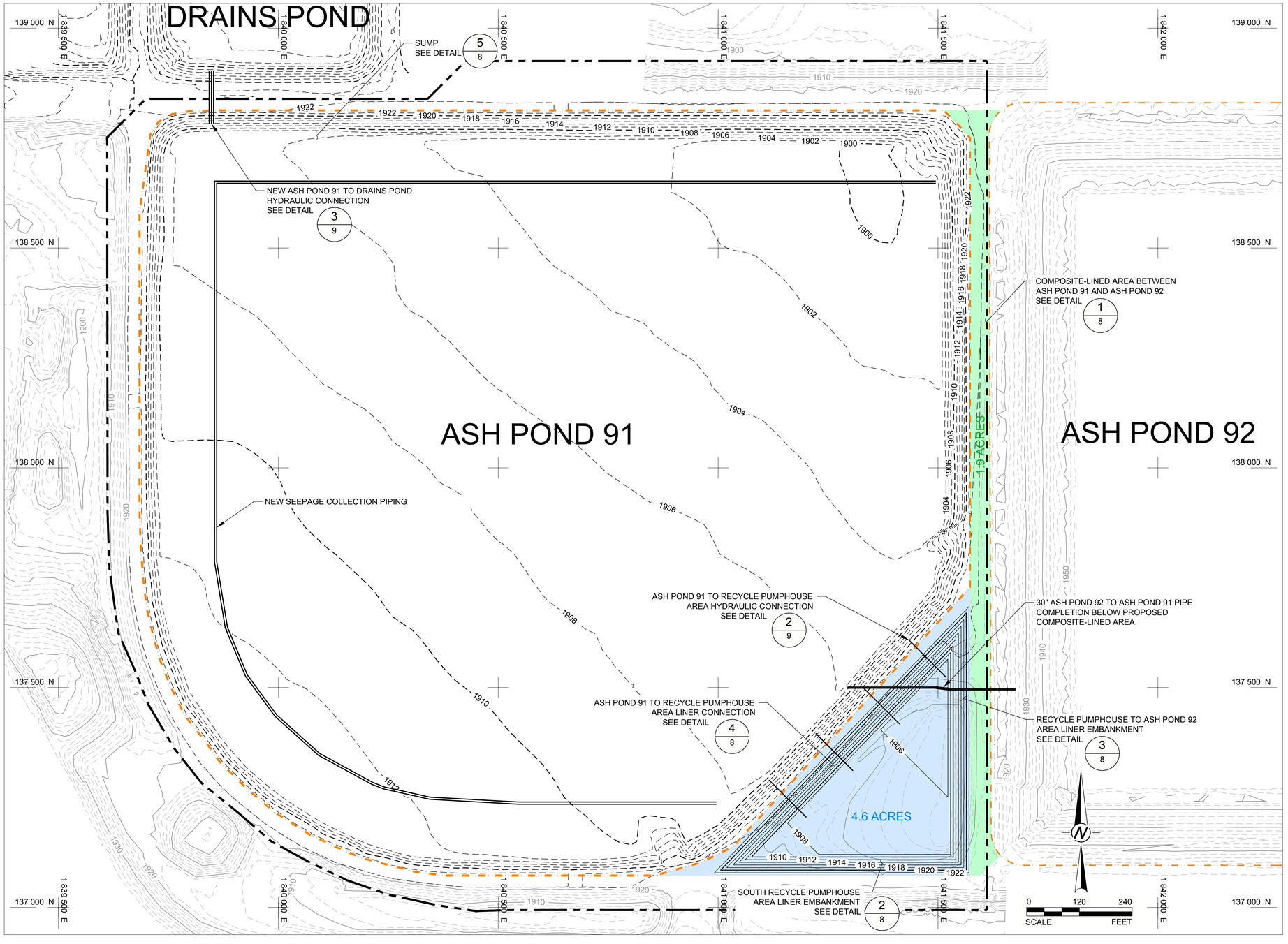

LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCE 2)
- AS-BUILT TOP OF LINER SYSTEM GRADES (SEE REFERENCES 3 AND 4)
- PROPOSED TOP OF LINER SYSTEM GRADES
- PROPOSED COMPOSITE-LINED AREA (GEOMEMBRANE PLUS TWO FEET OF LOW PERMEABILITY SOIL)
- PROPOSED COMPOSITE-LINED AREA (GEOMEMBRANE PLUS GEOCOMPOSITE CLAY LINER)
- ASH POND 91 FACILITY BOUNDARY
- EXTENT OF EXISTING COMPOSITE LINER (APPROXIMATE)
- CROSS-OVER PIPING

NOTES

1. THE PROPOSED FACILITY BOUNDARY IS APPROXIMATE.
2. EXISTING FLOOR AND CROSS-OVER PIPING NOT SHOWN FOR CLARITY.

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 SURVEY WAS PERFORMED BETWEEN 1996 AND 2011.
3. ASH POND 91 AS-BUILT TOP OF LINER SYSTEM GRADES REPRESENT THE TOP OF THE PROTECTIVE COVER AND WERE SURVEYED BY INTERSTATE ENGINEERING, INC. THE GRADES ARE REFERENCED FROM A SURVEY DRAWING PROVIDED BY GREAT RIVER ENERGY, DATED JANUARY 25, 1994.
4. DRAINS POND AS-BUILT TOP OF LINER SYSTEM GRADES REPRESENT THE TOP OF PROTECTIVE COVER AND WERE SURVEYED BY INTERSTATE ENGINEERING, INC. THE GRADES ARE REFERENCED FROM A SURVEY DRAWING PROVIDED BY GREAT RIVER ENERGY, DATED JANUARY 10, 1994.
5. COORDINATES ARE BASED ON THE PLANT GRID SYSTEM.
6. THE CONTOUR INTERVAL IS TWO FEET.
7. ALL PROPERTY SHOWN ON THIS MAP IS OWNED BY GREAT RIVER ENERGY.

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
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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
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT

GOLDER ASSOCIATES INC.
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(303) 980-0540
www.golder.com

PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
PROPOSED TOP OF LINER

PROJECT No. 1400644 | Rev. B | SHEET 3 of 10

DRAINS POND

ASH POND 91

ASH POND 92

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

5% (SEE NOTE 1)

0 120 240 SCALE 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
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

CONSULTANT

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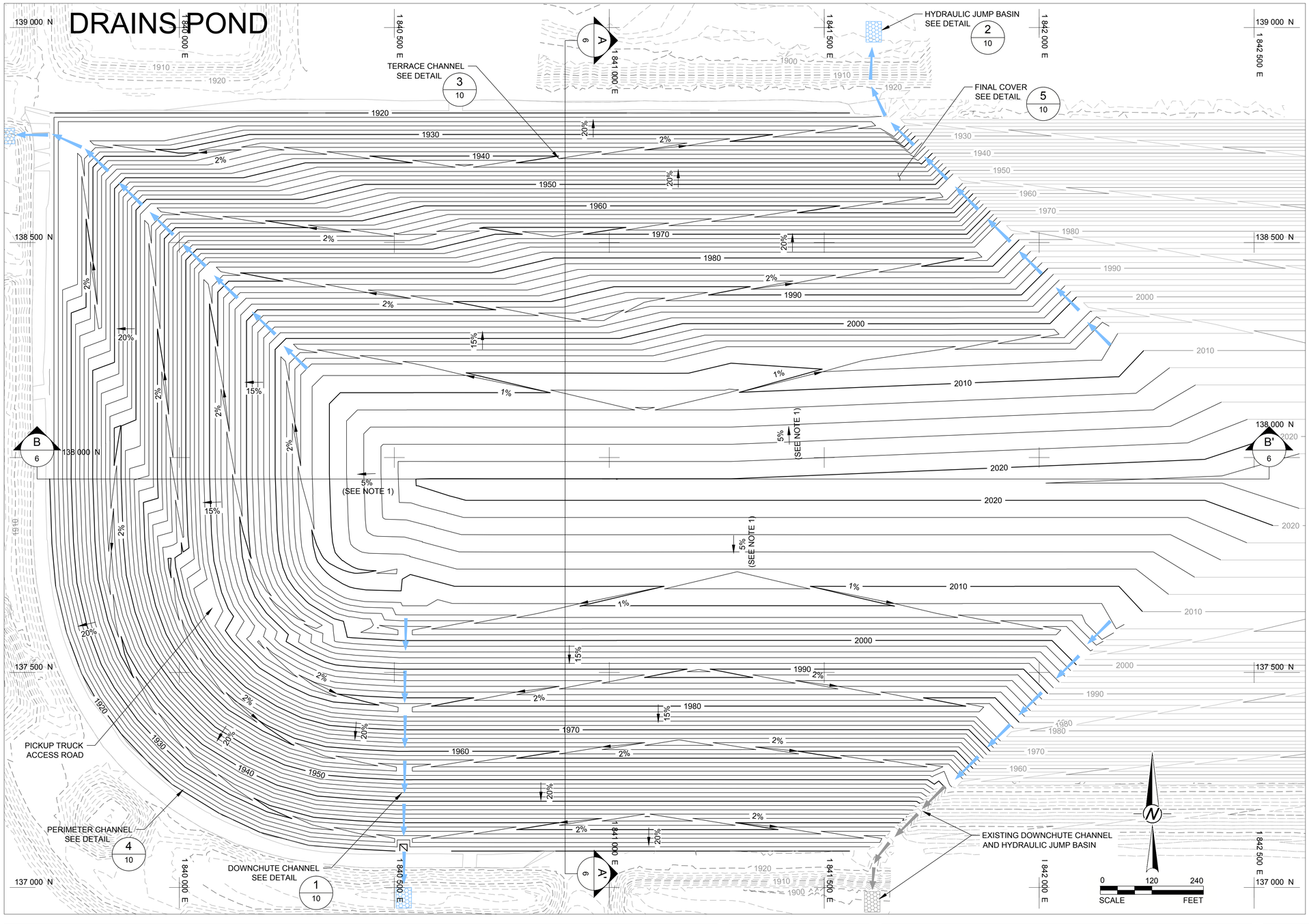
USA
(303) 980-0540
www.golder.com

PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
PROPOSED FINAL CCP GRADES

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

DRAINS POND



LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCE 2)
- DESIGN TOP OF FINAL COVER GRADES (ASH POND 92 AND SW SECTION 16 UPSTREAM RAISE)
- PROPOSED TOP OF FINAL COVER GRADES (ASH POND 91 UPSTREAM RAISE)
- DOWNCHUTE/OUTLET CHANNEL
- HYDRAULIC JUMP BASIN

NOTES

1. GRADES OF THE CROWN OF THE FACILITY ARE SHOWN AT FIVE PERCENT, BUT MAY BE CONSTRUCTED BETWEEN THREE PERCENT AND FIVE PERCENT.
2. SEE THE SURFACE WATER ENGINEERING WORKSHEET FOR FURTHER DETAILS CONCERNING THE SURFACE WATER CONTROL PLAN.

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

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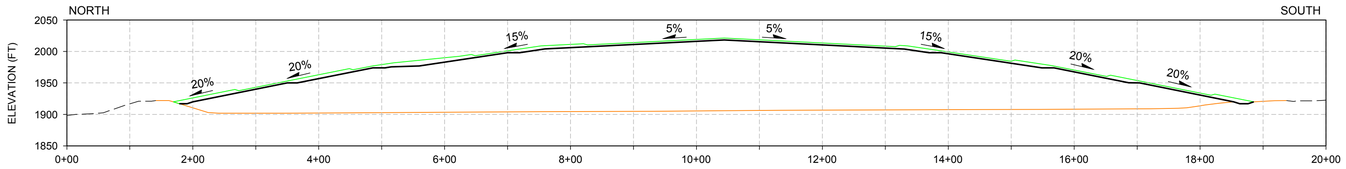
PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
FINAL COVER GRADES AND SURFACE WATER PLAN

PROJECT No. 1400644 | Rev. B | 5 of 10 | SHEET 5

LEGEND

- ASH POND 92/SW SECTION 16 DESIGN TOP OF CCP
- EXISTING GROUND TOPOGRAPHY
- PROPOSED TOP OF COVER
- PROPOSED ASH POND 91 TOP OF CCP
- APPROXIMATE LINER/FLOOR TOPOGRAPHY

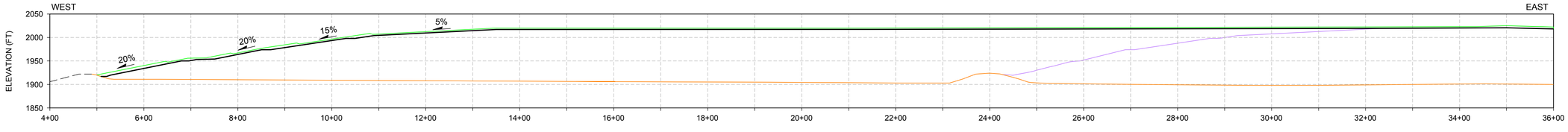


A SECTION A - A'

NO VERTICAL EXAGGERATION 6

0 120 240

SCALE FEET



DISTANCE (FT)

B SECTION B - B'

NO VERTICAL EXAGGERATION 6

0 120 240

SCALE FEET

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
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SEAL

REGISTERED PROFESSIONAL ENGINEER
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Date 2/11/2015
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UNDERWOOD, NORTH DAKOTA

PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
CROSS SECTIONS

PROJECT No. 1400644

Rev. B

6 of 10

SHEET 6

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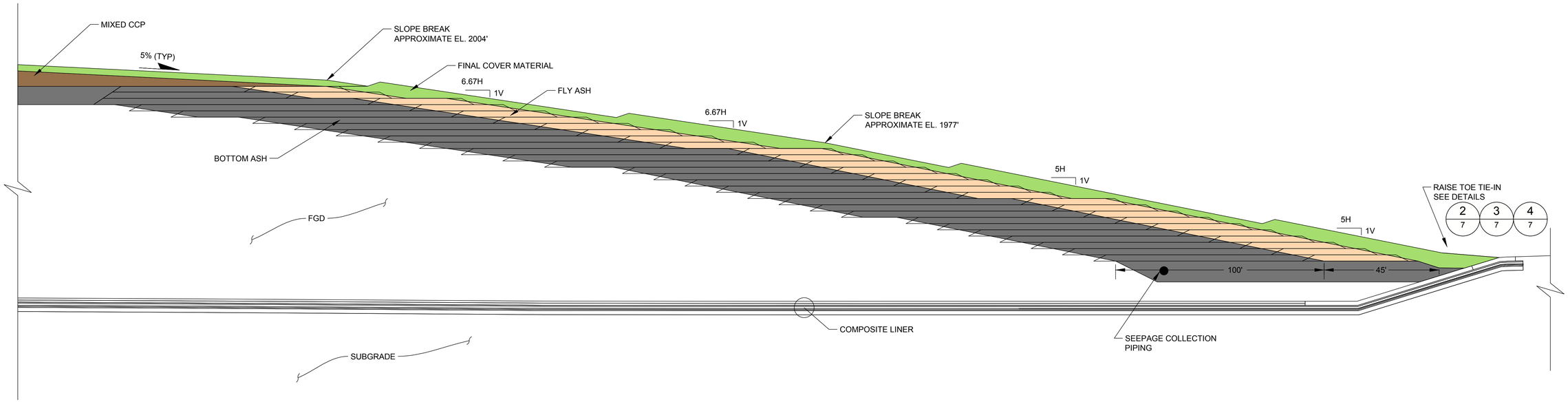
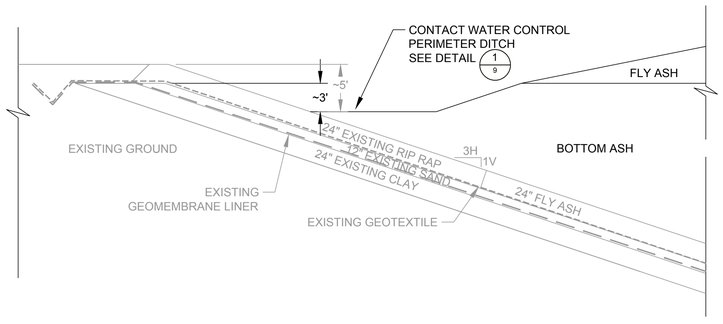
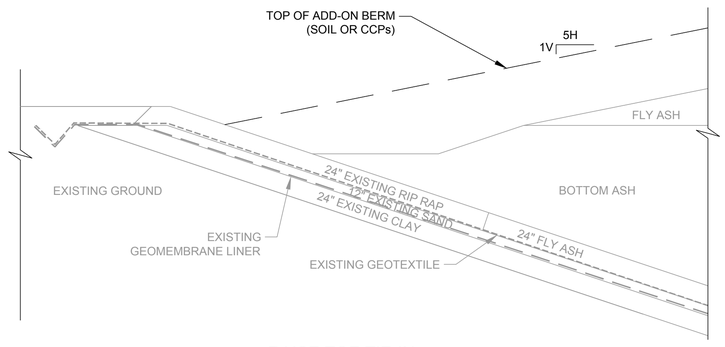


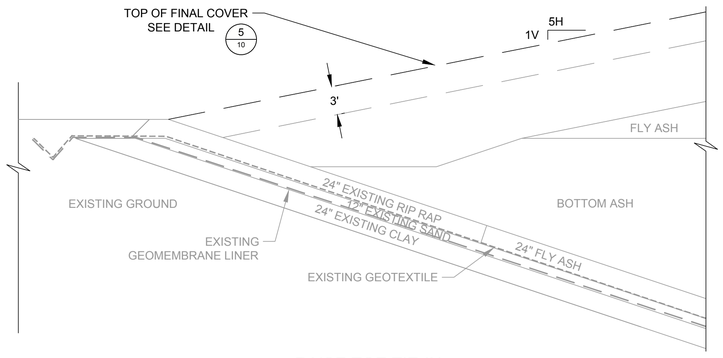
N.T.S. 1/7 ASH POND 91 PROFILE



N.T.S. 2/7 RAISE TOE TIE-IN
OPERATION AND CONSTRUCTION DETAIL



N.T.S 3/7 RAISE TOE TIE-IN
ADD-ON BERM CONSTRUCTION DETAIL



N.T.S. 4/7 RAISE TOE TIE-IN
FINAL COVER CONSTRUCTION

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

SEAL

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

CLIENT
GREAT RIVER ENERGY

CONSULTANT
Golder Associates

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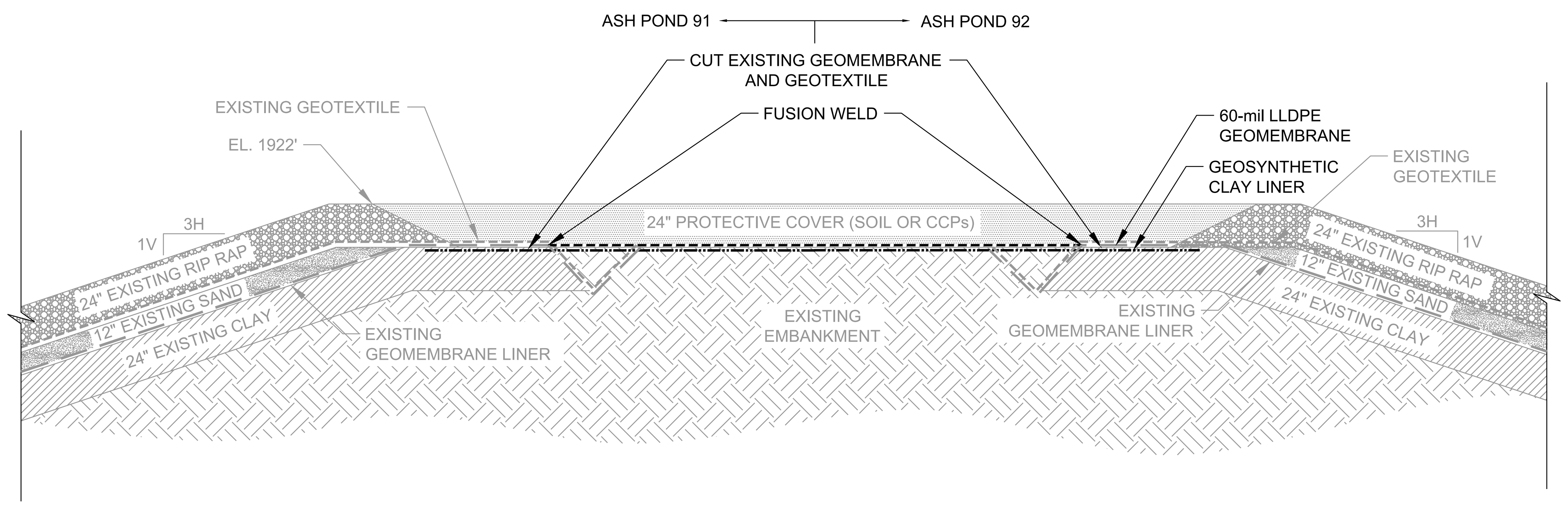
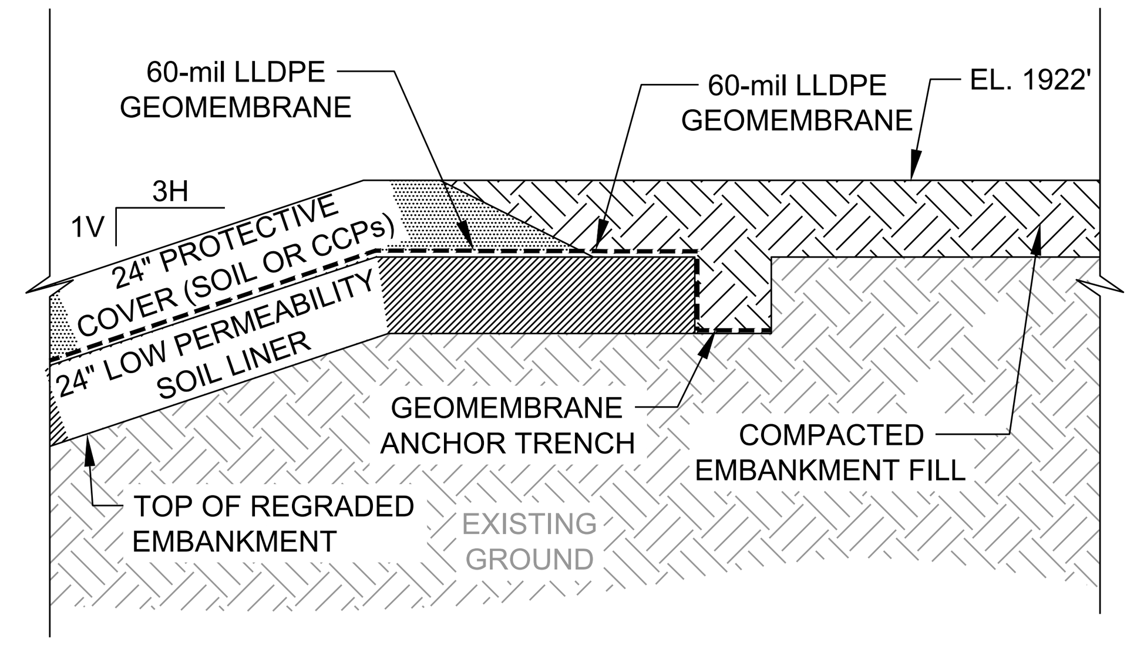
PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
RAISE DETAILS

PROJECT No. 1400644
Rev. B
SHEET 7 of 10



N.T.S. 1/8 ASH POND 91 TO ASH POND 92 BERM CONNECTION DETAIL



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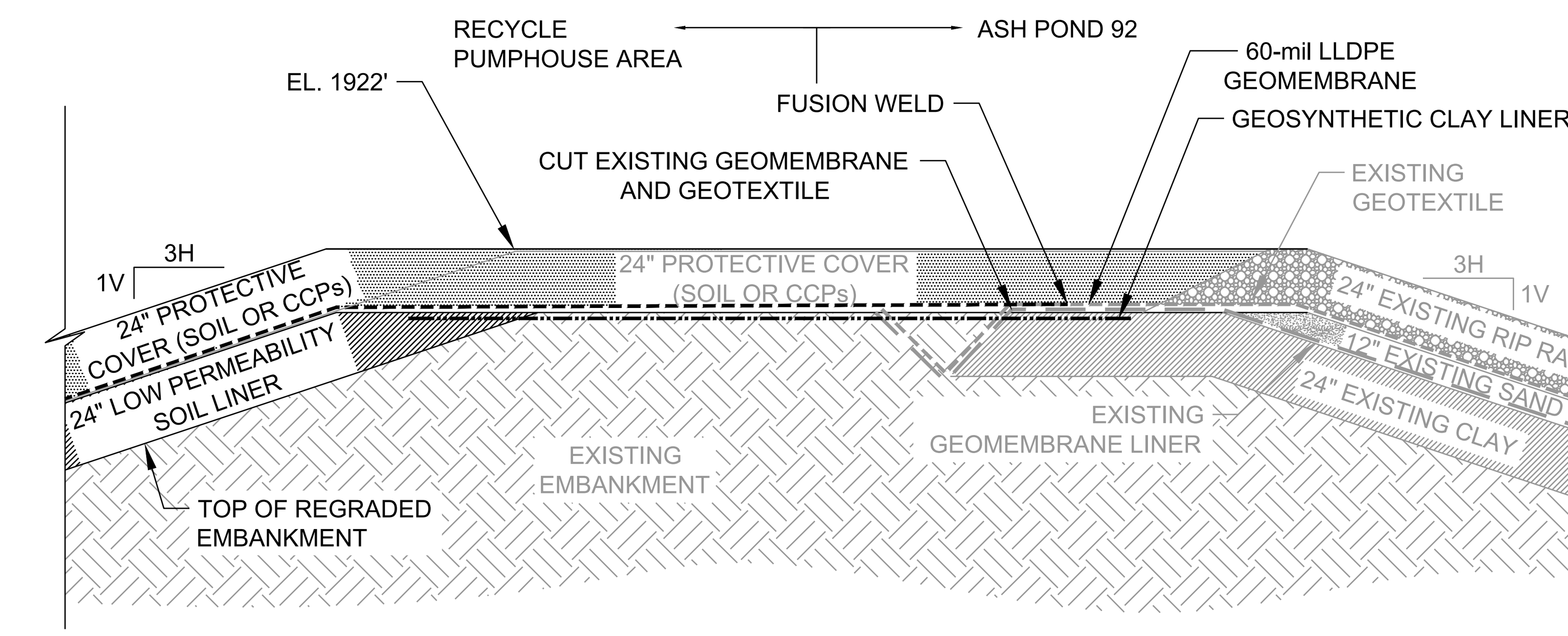
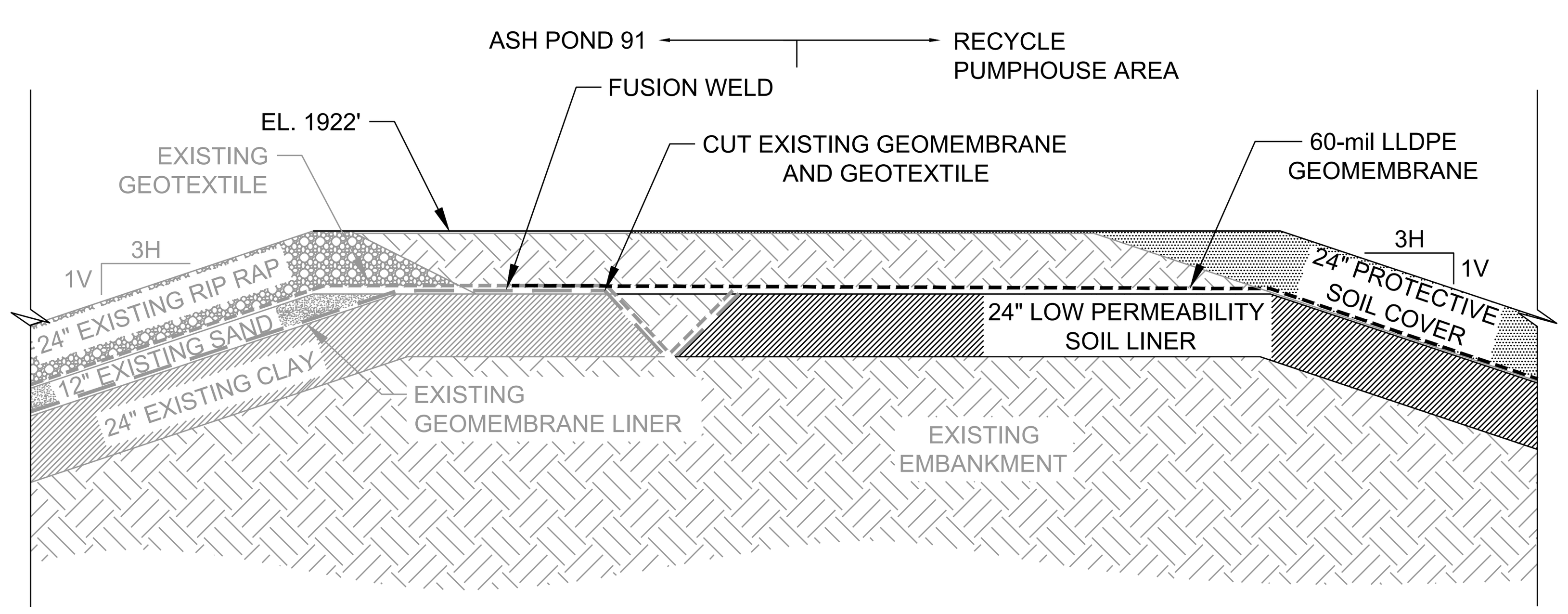


N.T.S. 3/8 RECYCLE PUMPHOUSE AREA TO ASH POND 92 LINER CONNECTION DETAIL



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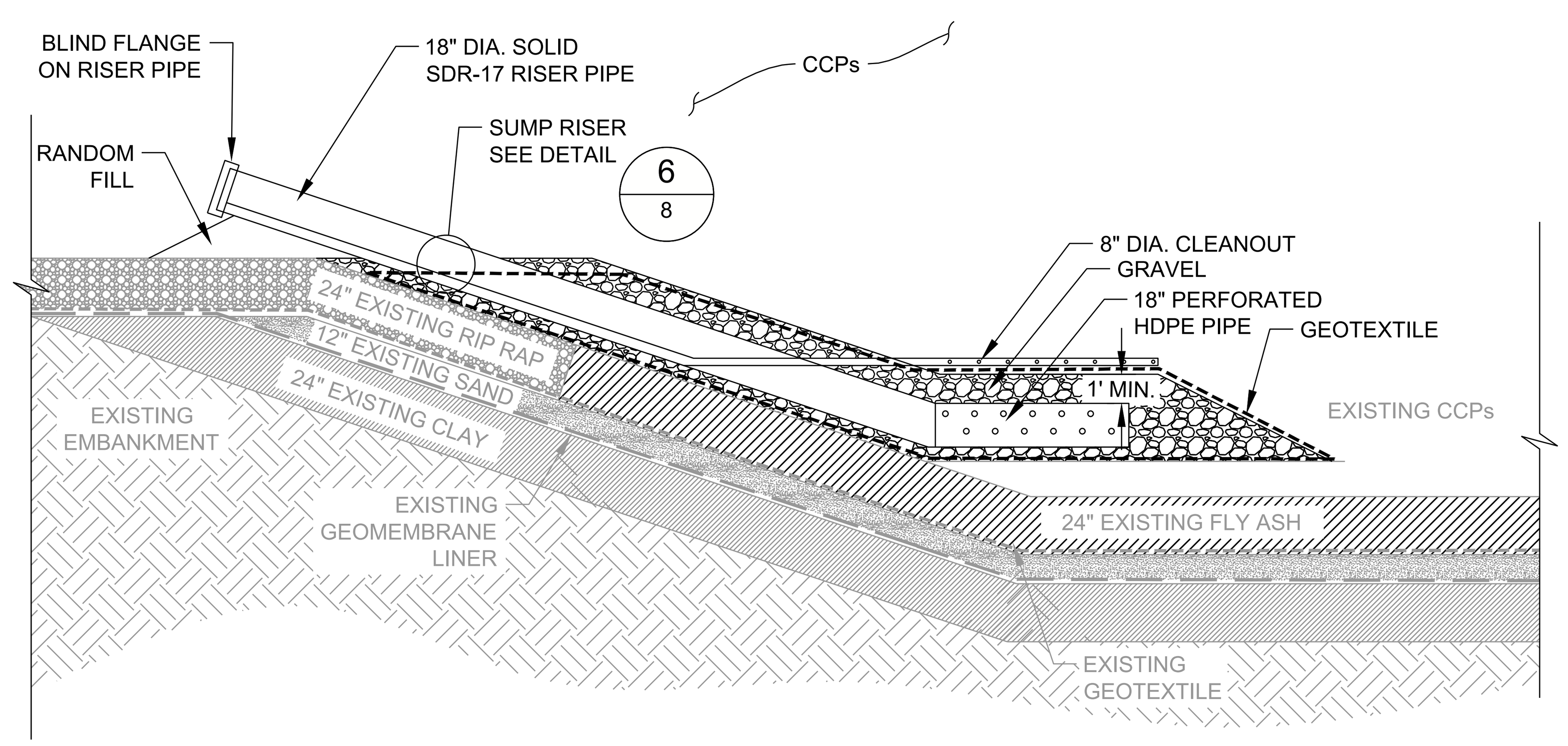
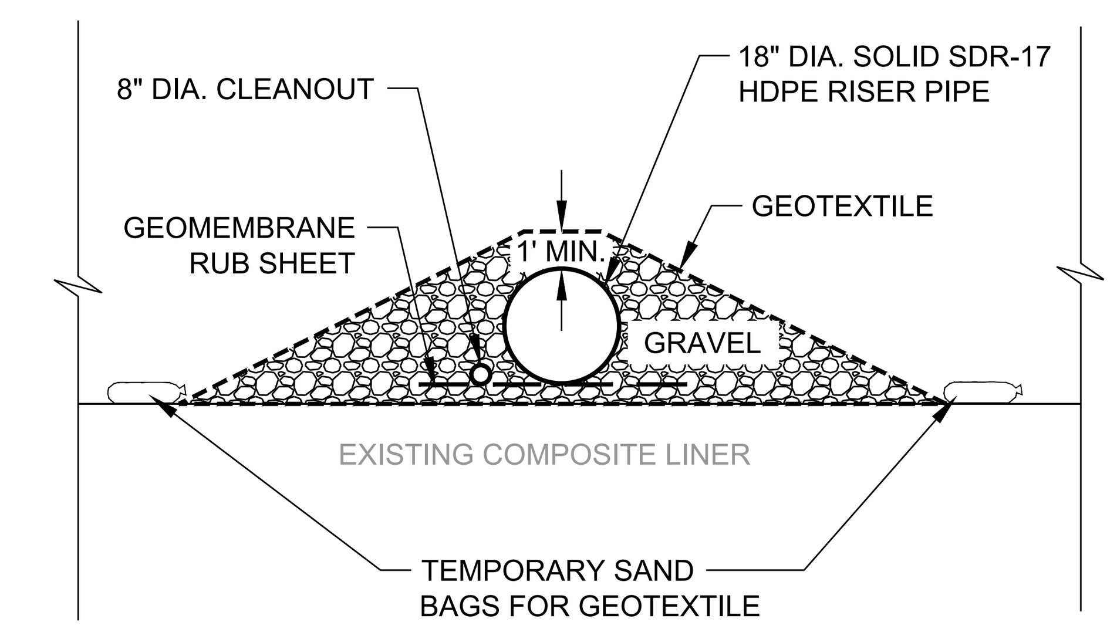


N.T.S. 5/8 SUMP DETAIL



N.T.S. 6/8 TYPICAL SUMP RISER DETAIL

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

SEAL

REGISTERED PROFESSIONAL ENGINEER
TODD J. STONG
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PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
LINER DETAILS

PROJECT No. 1400644 | Rev. B | 8 of 10 | SHEET 8

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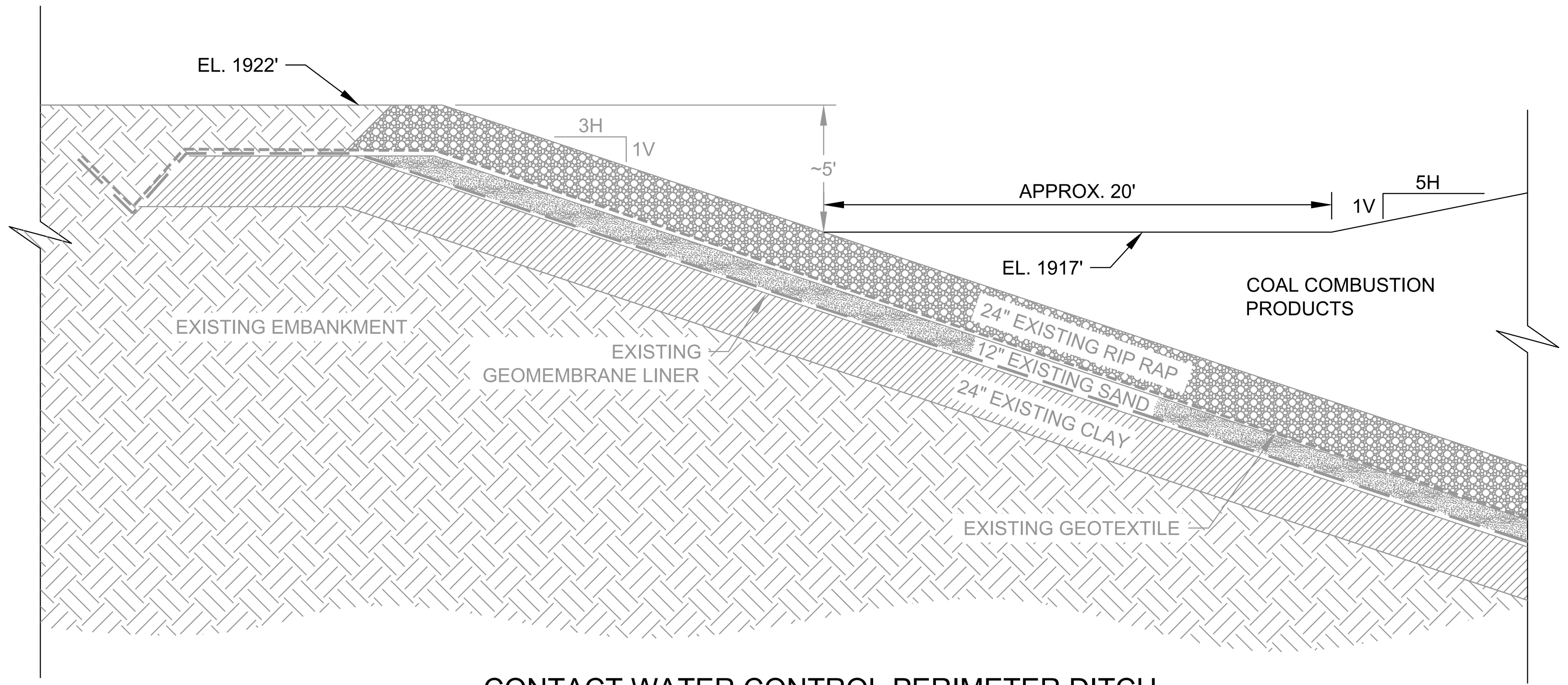

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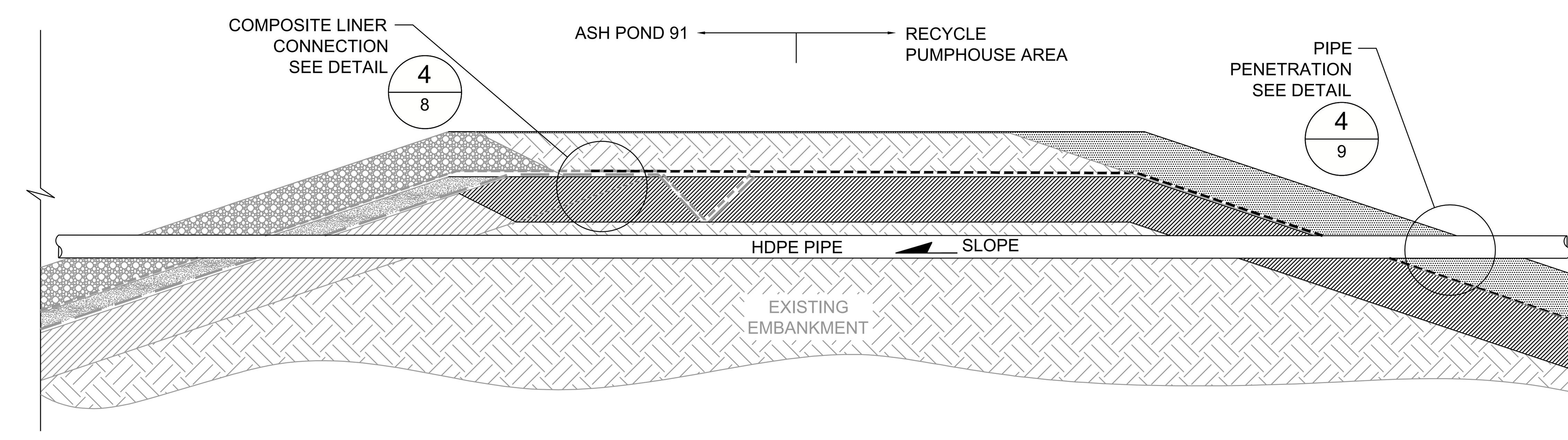
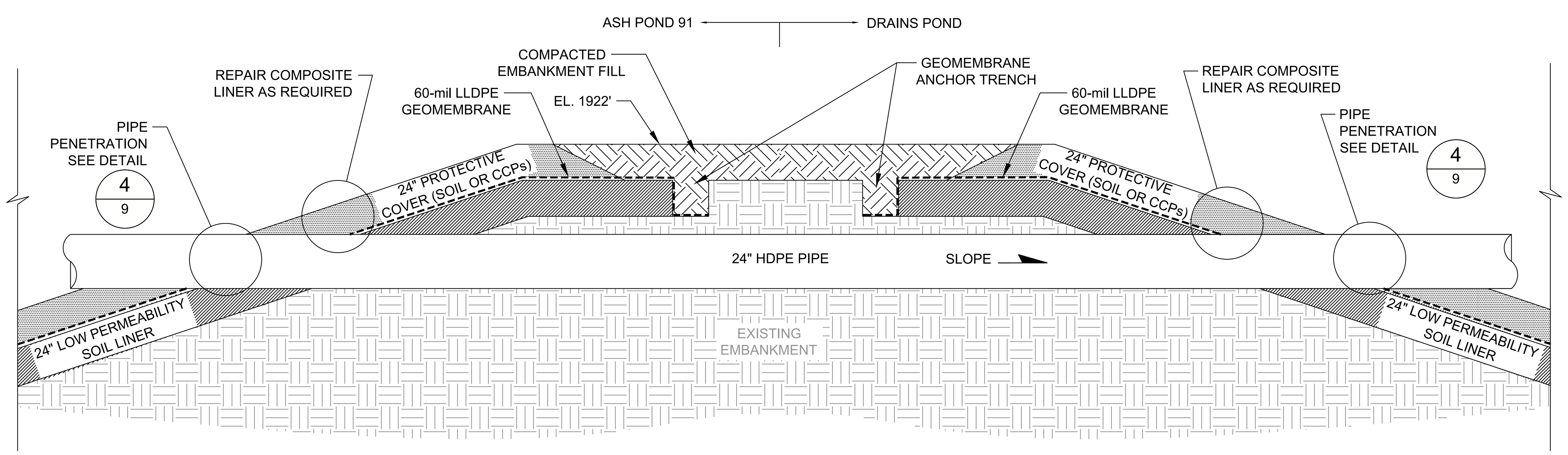
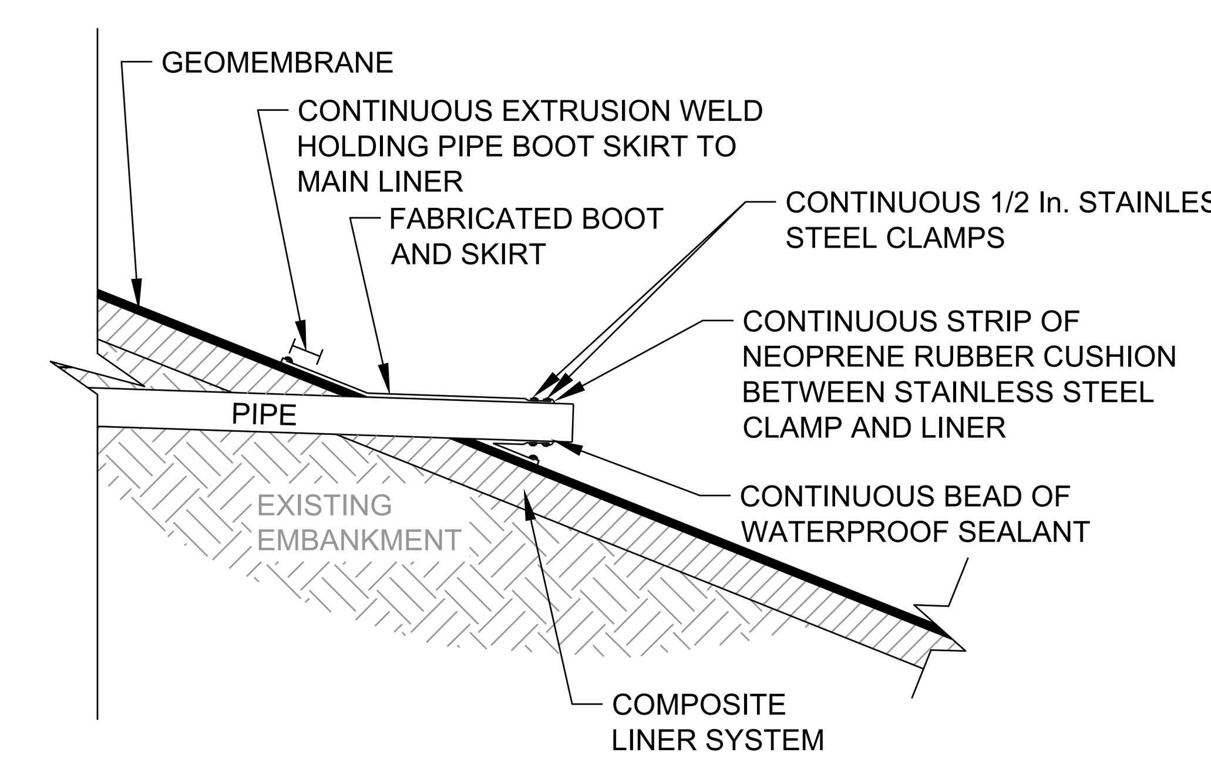


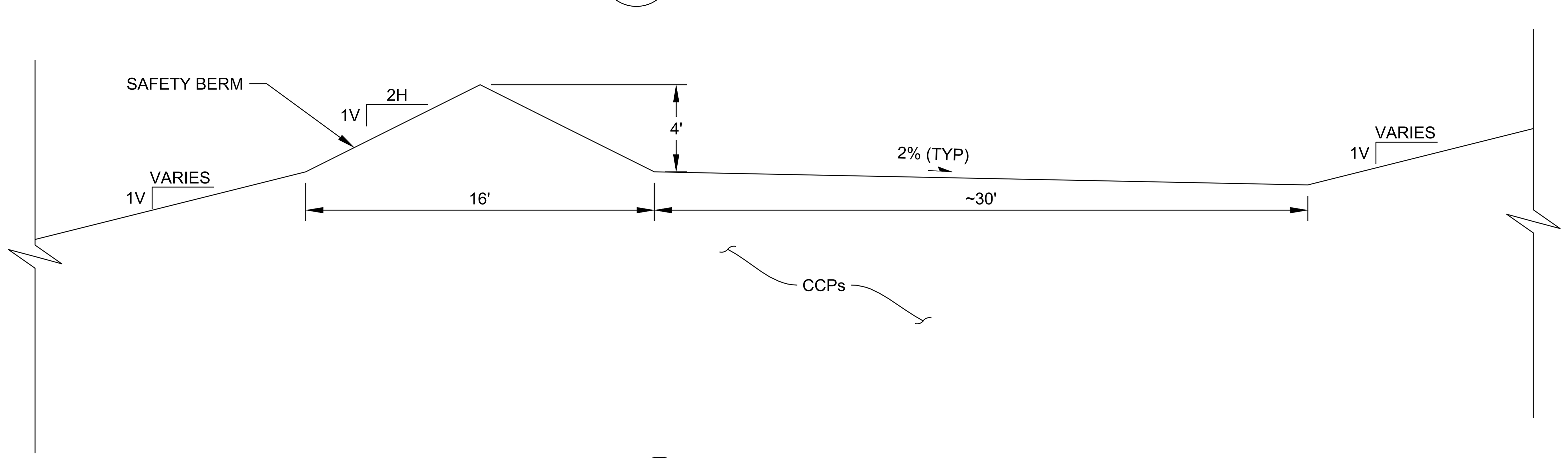
N.T.S. 2/9 ASH POND 91 TO RECYCLE PUMPHOUSE HYDRAULIC CONNECTION DETAIL



N.T.S. 3/9 ASH POND 91 TO DRAINS POND HYDRAULIC CONNECTION DETAIL



N.T.S. 4/9 PIPE PENETRATION DETAIL



N.T.S. 5/9 ACCESS HAUL ROAD DETAIL

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

SEAL

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

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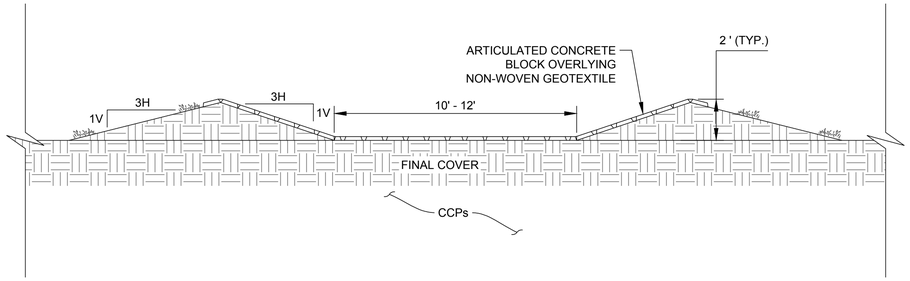
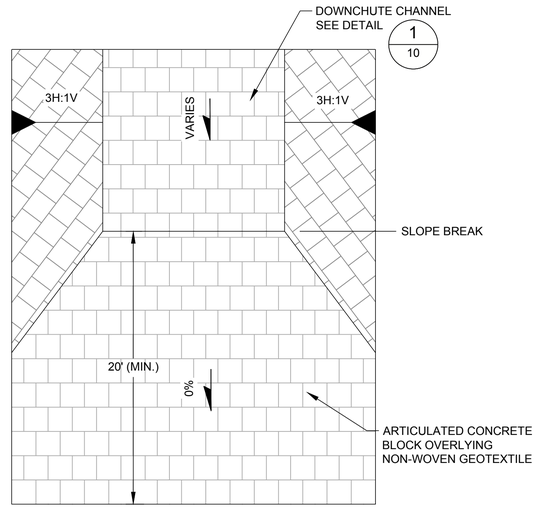
PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
HYDRAULIC DETAILS

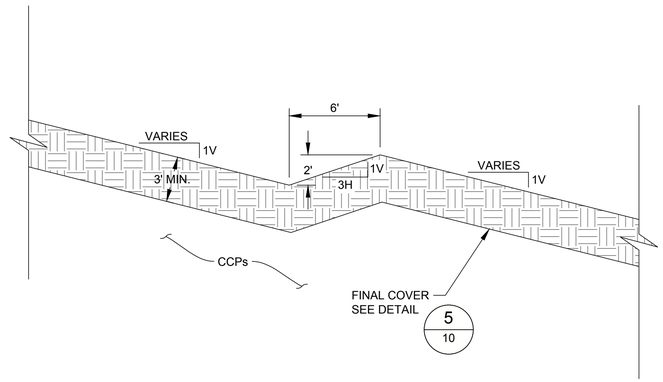
PROJECT No. 1400644
Rev. B
9 of 10
SHEET 9



N.T.S. 1/10 DOWNCHUTE DETAIL



N.T.S. 2/10 HYDRAULIC JUMP BASIN DETAIL



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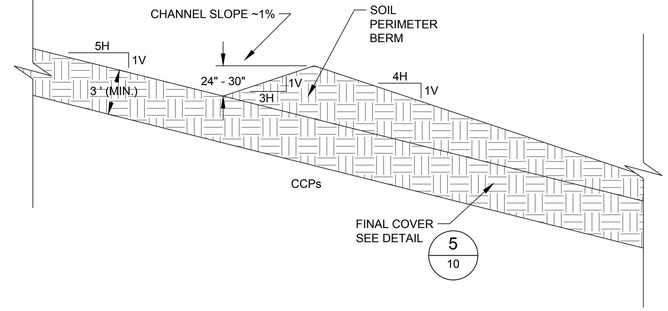
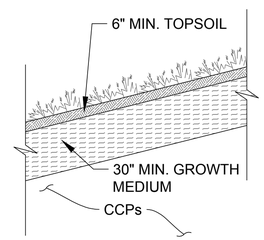


N.T.S. 4/10 PERIMETER CHANNEL DETAIL



N.T.S. 5/10 FINAL COVER DETAIL

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
C	2015-03-20	REVISED ISSUED FOR PERMIT MODIFICATION	RFS	RFS	TJS	RRJ
B	2015-02-11	ISSUED FOR PERMIT MODIFICATION	RFS	RFS	TJS	RRJ
A	2014-11-10	ISSUED FOR CLIENT REVIEW	RFS	RFS	TJS	RRJ

SEAL

REGISTERED PROFESSIONAL ENGINEER
TODD J. STONG
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DATE 3/20/2015
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PROJECT
ASH POND 91
PERMIT NO. 0033 MODIFICATION

TITLE
COVER DETAILS

PROJECT No. 1400644
Rev. C
10 of 10
SHEET 10

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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Australasia	+ 61 3 8862 3500
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