



**MIDWEST
GENERATION EME, LLC**

an EDISON INTERNATIONAL COMPANY

Maria L. Race
Environmental Program Manager

July 22, 2008

Mr. Jaime Rabins
Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Springfield, Illinois 62794-9276

RE: Application for Permit or Construction Approval
Midwest Generation Will County South Ash Ponds 2 and 3
529 E Romeo Road, Romeoville, IL
NPDES Permit No. IL0002208

Dear Mr. Rabins:

Midwest Generation, LLC (MWG) is requesting a construction permit for liner replacement in South Ash Ponds 2 and 3 at the Will County Station. These activities are part of MWG's routine maintenance program for these facilities; no modifications will be made to the ponds' operation or treatment process. Please find enclosed a copy of the Application for Permit or Construction Approval WPC-PS-1 and supporting documents.

The following information is attached:

- A site location map is included in the "Figure" tab;
- A plan view of existing conditions, liner replacement plan, cross section and details drawings are included in the "Sheets" tab;
- Form WPC-PS-1 "Application for Permit or Construction Approval", and Schedules J "Industrial Treatment Works Construction or Pretreatment Works" and N "Waste Characteristics" are provided in Appendix A;
 - Schedule G is not included because the coal ash removed from the ponds is reused by a third-party manufacturer; and
 - The chemical constituent concentrations reported on Schedule N are from the ash pond effluent at MWG's Joliet 29 Station. The monitored outfall receives discharges from multiple sources, so is not representative of the effluent from the ash ponds. Since both stations share the same coal source and similar combustion process, MWG believes that effluent data from the ash ponds at the Joliet 29 Station is representative of the effluent from South Ash Ponds 2 and 3 at the Will County Station.
- Representative photographs of South Ash Ponds 2 and 3 are provided in Appendix B; and
- Specification Section 02600 for installation of high-density polyethylene (HDPE) geomembrane liner is provided in Appendix C.

Midwest Generation EME, LLC
One Financial Place
440 South LaSalle Street
Suite 3300
Chicago, IL 60605
Tel. 312 501 6000
Fax. 312 750 5526
Email marcel@mwg.com

MWG13-15_29023



FACILITY DESCRIPTION

South Ash Ponds 2 and 3 are settling ponds for bottom ash sluiced from coal combustion boilers associated with electrical power generation (Units 3 and 4). Only one pond is in service at any given time. The operating volume of South Ash Pond 2 is approximately 3.7 million gallons at 1.0 foot of freeboard. The operating volume of South Ash Pond 3 is approximately 4.0 million gallons at 1.0 foot of freeboard.

PROJECT DESCRIPTION

Liner replacement activities will include:

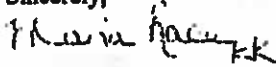
- Subgrade preparation for HDPE geomembrane liner, including removal of the remainder of the top layer of the existing Poz-o-Pac liner (12-inches thick) and 6-inches of the fill layer beneath the top layer of the existing Poz-o-Pac liner at the base of each ash pond to accommodate a warning layer above the replacement liner, as described below;
- Deployment and seaming of the HDPE geomembrane replacement liner; and
- Placement of cushion and warning layers over the replacement liner.

The warning layer will consist of dense-graded aggregate, limestone screenings, or other easily-identifiable material. Liner replacement activities for South Ash Pond 3 are anticipated to occur in Fall 2008 following scheduled dredging activities (dewatering followed by "dry" excavation). Liner replacement activities for South Ash Pond 2 are anticipated to occur in Spring/Summer 2009. This schedule may change based upon plant operation needs.

Sheet C010 shows the pond layout and utilities. Liner subgrade preparation instructions are shown on Sheet C020. The proposed HDPE geomembrane replacement liner, associated anchor trenches, and cushion and warning layers are shown on Sheet C030. Cross sections and details associated with the liner and cushion/warning layers are shown on Sheet C031.

If you have any questions or require additional information as you review this application, please call me at 312-583-6062.

Sincerely,



Maria Race
Senior Environmental Engineer

cc: Mr. Blake Connolly, MWG-Will County

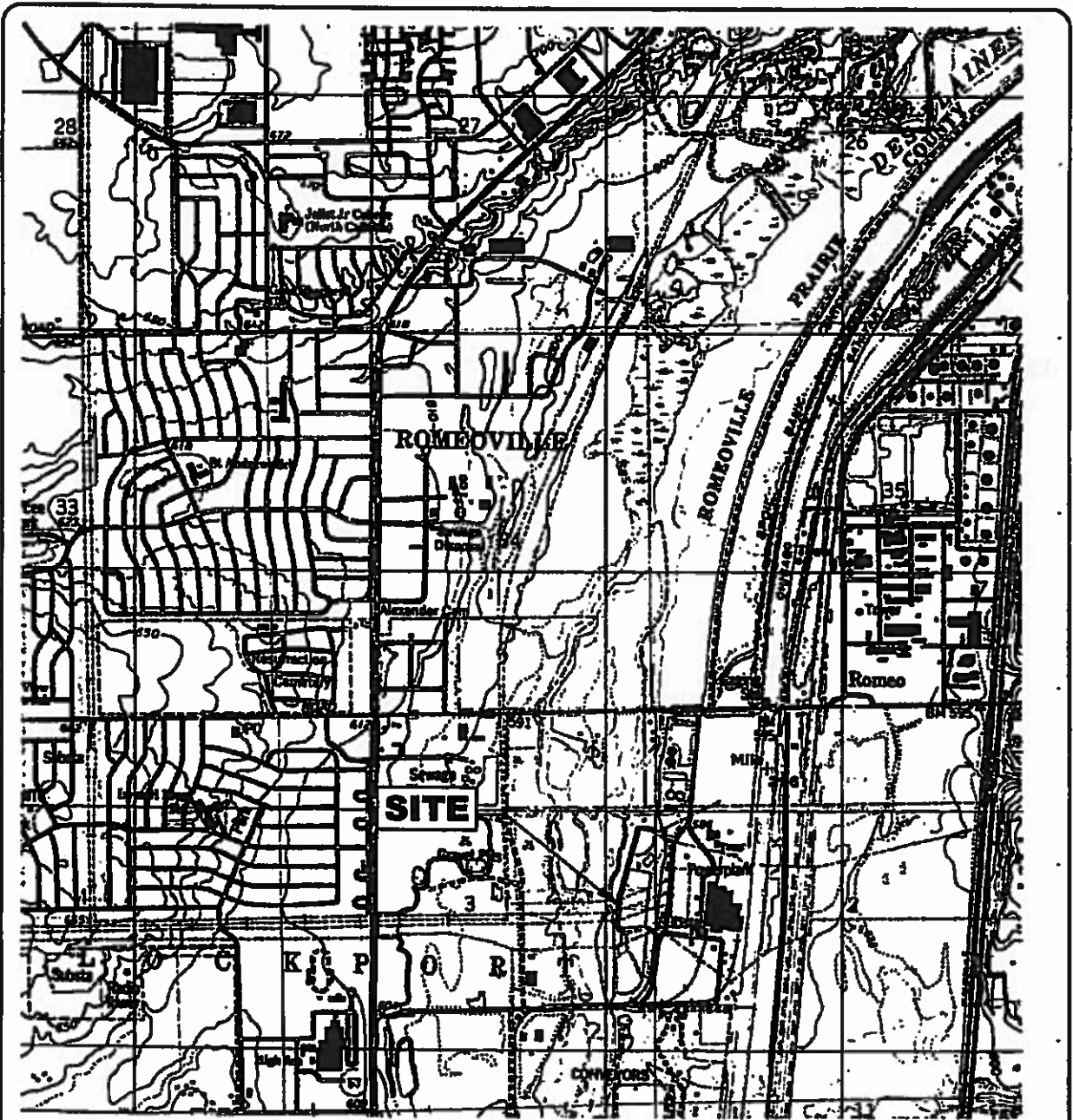
Attachments: Figure 1 – Site Location Map
Appendix A – WPC-PS-1 and Schedules J and N
Appendix B – Site Photographs
Appendix C – Specification Section 02600, HDPE Geomembrane
Sheet C010 – Existing Conditions
Sheet C020 – Liner Subgrade Preparation
Sheet C030 – Warning Layer Plan
Sheet C031 – Section and Details

FIGURE

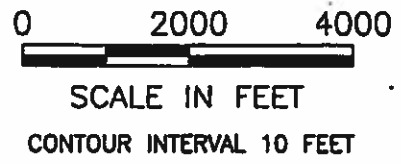
Table

MWG13-15_29025

FIGURE



SOURCE: DIGITAL DOWNLOAD FROM
<http://STORE.USGS.GOV>.
 USGS 7.5 MINUTE QUADRANGLE,
 ROMEOVILLE, ILL.
 DATED 1998.



SITE LOCATION MAP

MIDWEST GENERATION
 WILL COUNTY POWER PLANT
 ROMEOVILLE, ILLINOIS

PROJECT NO.
 1900

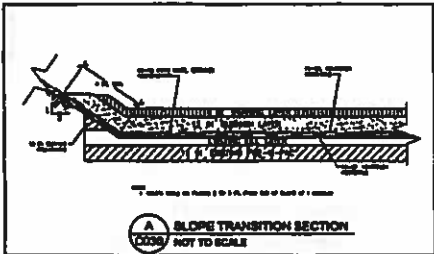
DRAWING NO.
 1900-A01

FIGURE NO.
 1

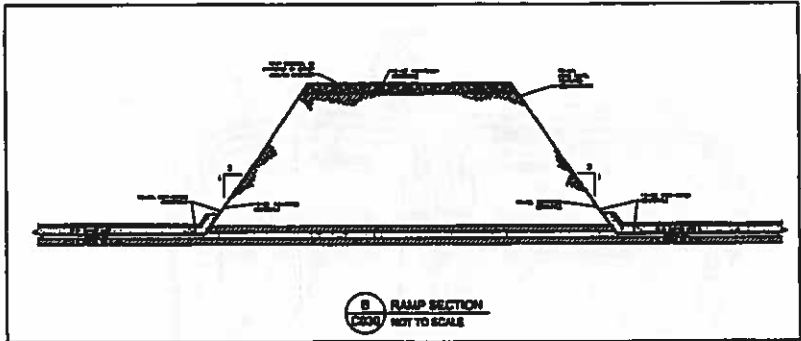
DRAWN BY: RLH 01/09/08 APP'D BY: HMS DATE: 01/25/08

APPENDIX A

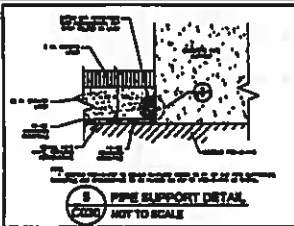
MWG13-15_29028



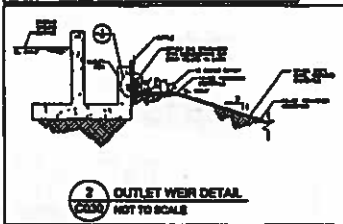
A SLOPE TRANSITION SECTION
NOT TO SCALE



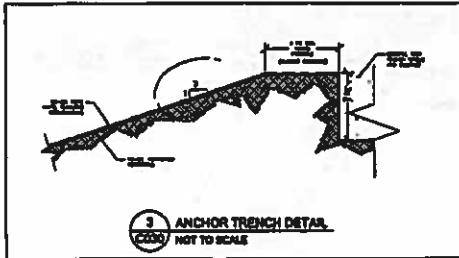
B RAMP SECTION
NOT TO SCALE



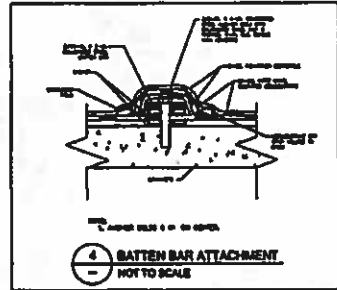
C PIPE SUPPORT DETAIL
NOT TO SCALE



D OUTLET WEIR DETAIL
NOT TO SCALE



E ANCHOR TRENCH DETAIL
NOT TO SCALE

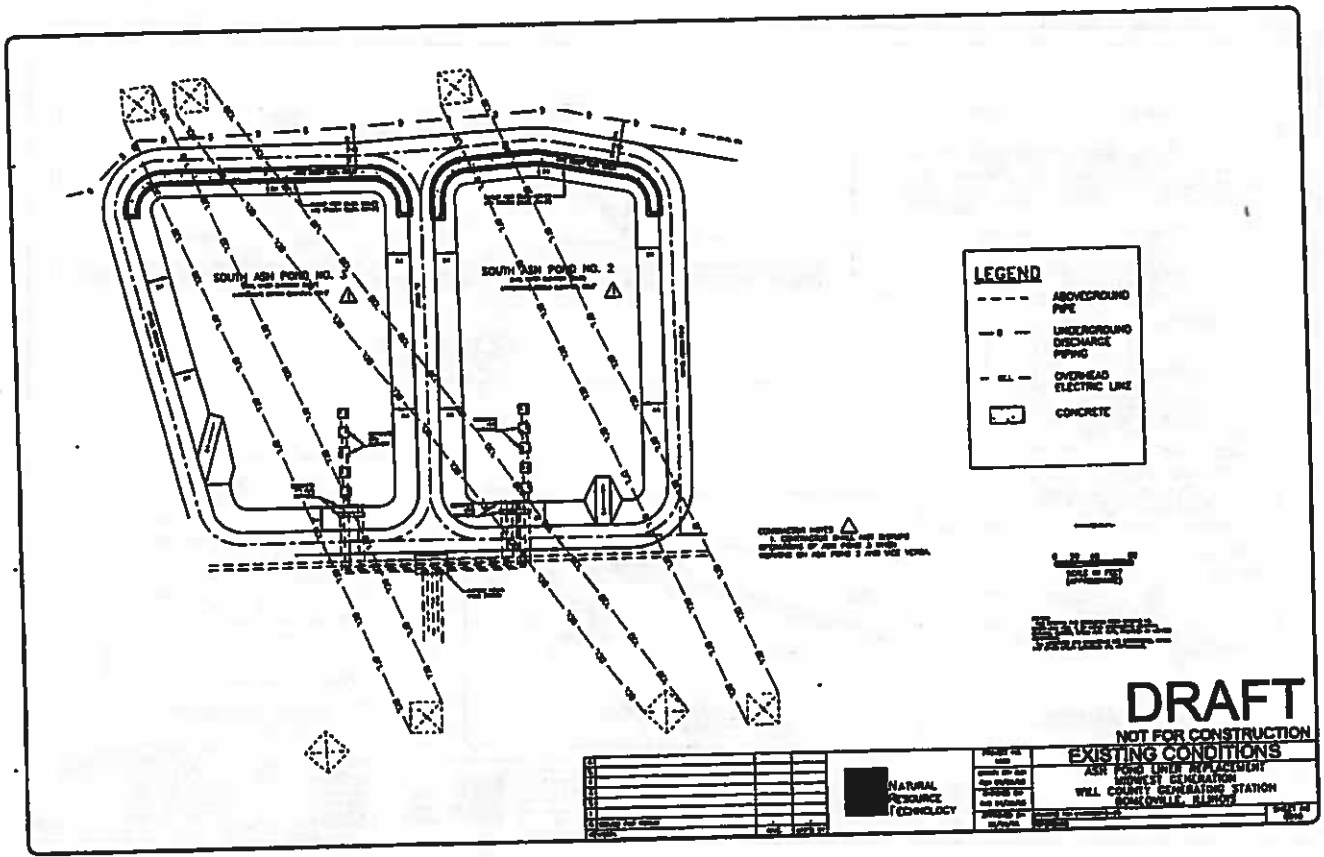


F BATTEN BAR ATTACHMENT
NOT TO SCALE

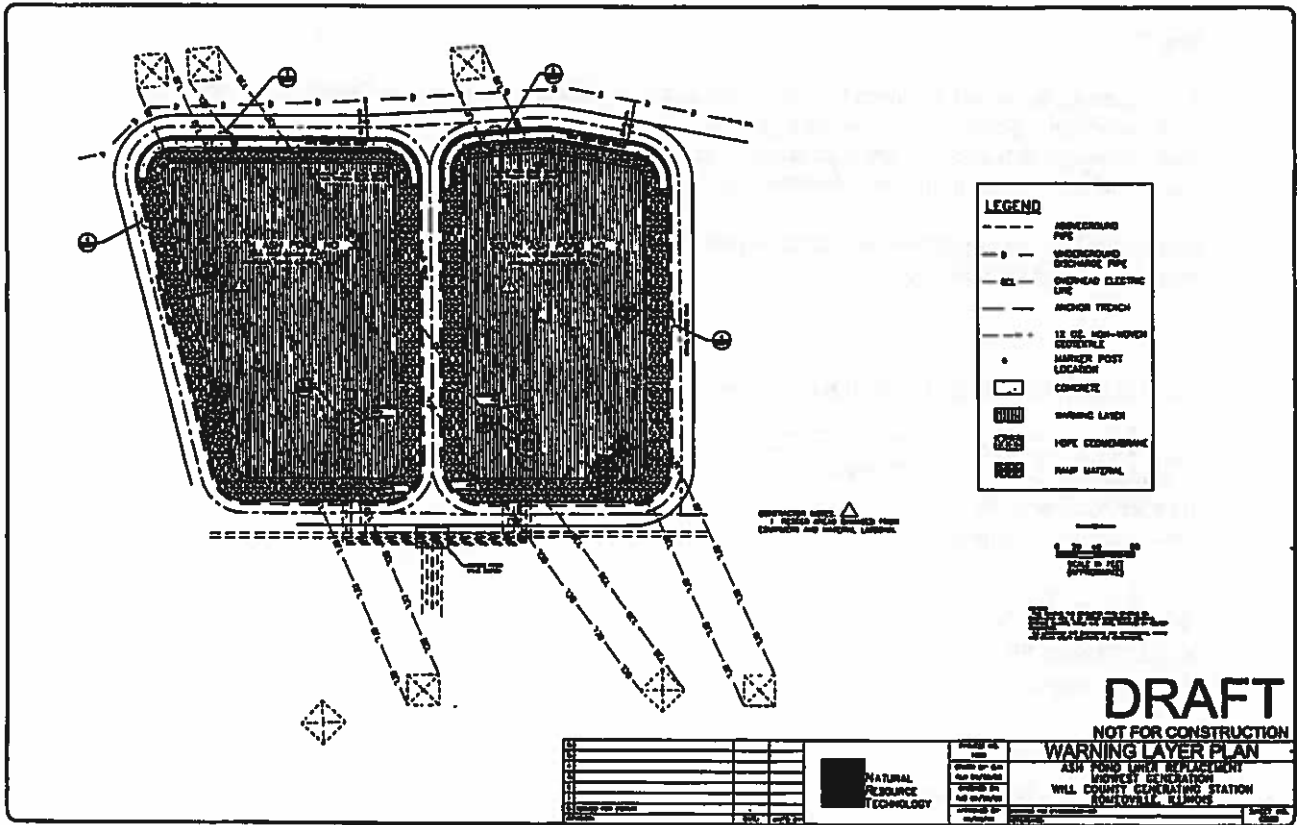
DRAFT



NOT FOR CONSTRUCTION
DETAILS AND SECTIONS
 ASH POND LIFT REPLACEMENT
 WILCOX COUNTY GENERATING STATION
 SOMEVILLE, GEORGIA



MWG13-15_29030





Mr. Blake Connolly
Midwest Generation, LLC
Will County Generating Station
529 E. 135th Street
Romeoville, Illinois 60446

July 23, 2008
(1900)

RE: Transmittal of the Application for Permit or Construction Approval Supporting Documents
Midwest Generation Will County Generating Station South Ash Ponds #2 and #3 Liner Replacement

Dear Blake:

As requested, please find enclosed five (5) copies of the Application for Permit or Construction Approval cover letter and supporting documentation for Will County south ash pond liner replacement. Please have Don Claybaugh sign and date the application. I have enclosed an addressed, stamped envelope for you to return 4 of the 5 copies to me for submittal to IEPA. Please keep the 5th signed copy for your records.

Should you have any questions or comments please contact us. We appreciate the continued opportunity to support Midwest Generation.

Sincerely,

NATURAL RESOURCE TECHNOLOGY, INC.

A handwritten signature in black ink, appearing to read "Heather M. Simon".

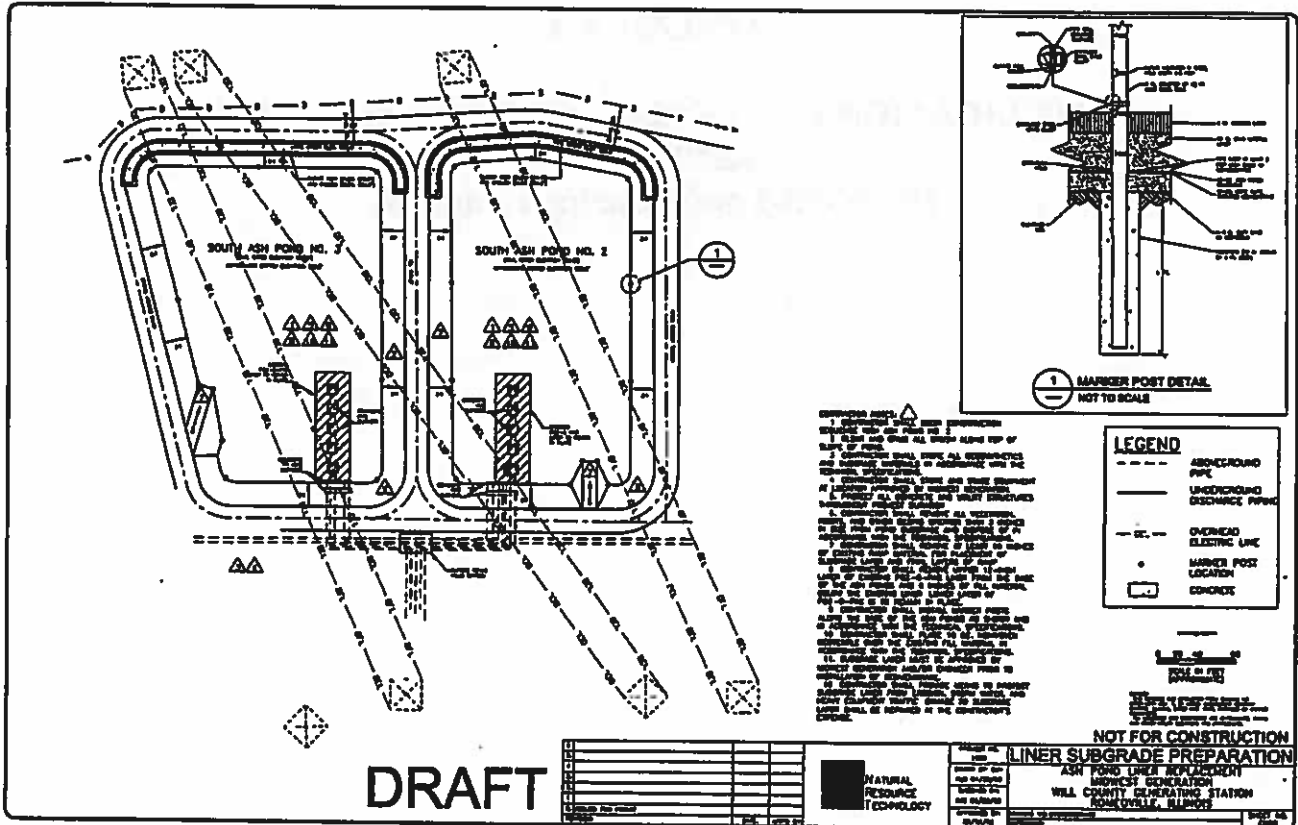
Heather M. Simon, PE
Environmental Engineer

A handwritten signature in black ink, appearing to read "Eric J. Tlachac".

Eric J. Tlachac, PE
Project Manager

Enclosures: As Stated

[1900 BConnolly Permit 080723trans.doc]



MWG13-15_29033

APPENDIX A

**APPLICATION FOR PERMIT OR CONSTRUCTION
APPROVAL
(WPC-PS-1 and Schedules J and N)**



Illinois Environmental Protection Agency
 Permit Section, Division of Water Pollution Control
 P.O. Box 19276
 Springfield, Illinois 62794-9276

For IEPA Use:

Application for Permit or Construction Approval
 WPC-PS-1

1. Owner Name: Midwest Generation, LLC
 Name of Project: Will County Ash Pond Liner Design
 Township: Romeoville County: Will

2. Brief Description of Project:
Maintenance on ash ponds #2 and #3 includes replacement of the pond liners. There will be no changes to current operation of the ponds.

3. Documents Being Submitted: If the Project involves any of the items listed below, submit the corresponding schedule, and check the appropriate boxes.

	Schedule		Schedule
Private Sewer Connection/Extension	A/B <input type="checkbox"/>	Spray Irrigation	H <input type="checkbox"/>
Sewer Extension Construct Only	C <input type="checkbox"/>	Septic Tanks	I <input type="checkbox"/>
Sewage Treatment Works	D <input type="checkbox"/>	Industrial Treatment/Pretreatment	J <input checked="" type="checkbox"/>
Excess Flow Treatment	E <input type="checkbox"/>	Waste Characteristics	N <input checked="" type="checkbox"/>
Lift Station/Force Main	F <input type="checkbox"/>	Erosion Control	P <input type="checkbox"/>
Fast Track Service Connection	FTP <input type="checkbox"/>	Trust Disclosure	T <input type="checkbox"/>
Sludge Disposal	G <input type="checkbox"/>		

Plans: Title Ash Pond Liner Design, Midwest Generation, Will County Power Plant,
Romeoville, IL No. of Pages: 4

Specifications: Title Section 02600, High Density Polyethylene (HDPE) Geomembrane
 No. of Books/Pages: 20

Other Documents: Facility photos (see attached)
 (Please Specify)

- 3.1 Illinois Historic Preservation Agency approval letter: Yes No
4. Land Trust: Is the project identified in item number 1 herein, for which a permit is requested, to be constructed on land which is the subject of a trust? Yes No
- If yes, Schedule T (Trust Disclosure) must be completed and item number 7.1.1 must be signed by a beneficiary, trustee or trust officer.
5. This is an Application for (Check Appropriate Line):
- A. Joint Construction and Operating Permit
 - B. Authorization to Construct (See Instructions) NPDES Permit No. IL00 02208
 - C. Construct Only Permit (Does Not Include Operations)
 - D. Operate Only Permit (Does Not Include Construction)

6. Certifications and Approval:

6.1 Certificate by Design Engineer (When required: refer to instructions)

I hereby certify that I am familiar with the information contained in this application, including the attached schedules indicated above, and that to the best of my knowledge and belief such information is true, complete and accurate. The plans and specifications (specifications other than Standard Specifications or local specifications on file with this Agency) as described above were prepared by me or under my direction.

Engineer Name: Heather M. Simon

Registration Number: 062 - 060491
(3 digits) (6 digits)

Firm: Natural Resource Technology, Inc.

Address: 23713 W. Paul Rd, Suite D



City: Pewaukee State: WI Zip: 53072 Phone No: _____

Signature X *Heather M. Simon* Date: 7/22/08

7. Certifications and Approvals for Permits:

7.1 Certificate by Applicant(s)

I/We hereby certify that I/we have read and thoroughly understand the conditions and requirements of this Application, and am/are authorized to sign this application in accordance with the Rules and Regulations of the Illinois Pollution Control Board. I/We hereby agree to conform with the Standard Conditions and with any other Special Conditions made part of this Permit.

7.1.1 Name of Applicant for Permit to Construct: Midwest Generation, LLC

Address: 1 Financial Place, 440 S. La Salle St, Suite 3500

City: Chicago State: IL Zip Code: 60605

Signature X *Dori Claybaugh* Date: 7/25/08

Printed Name: Dori Claybaugh Phone No: 815-372-4512

Title: Station Director

Organization: Midwest Generation, Will County Station

7.1.2 Name of Applicant for Permit to Own and Operate: Same as above

Address: _____

City: _____ State: _____ Zip Code: _____

Signature X _____ Date: _____

Printed Name: _____ Phone No: _____

Title: _____

7.2 Attested (Required When Applicant Is a Unit of Government) N/A

Signature X _____ Date: _____

Title: _____
(City Clerk, Village Clerk, Sanitary District Clerk, Etc.)

7.3 Applications from non-governmental applicants which are not signed by the owner, must be signed by a principal executive officer of at least the level of vice president, or a duly authorized representative.

7.4 Certificate By Intermediate Sewer Owner N/A

I hereby certify that (Please check one):

- 1. The sewers to which this project will be tributary have adequate reserve capacity to transport the wastewater that will be added by this project without causing a violation of the environmental Protection Act or Subtitle C, Chapter I, or
- 2. The Illinois Pollution Control Board, in PCB _____ dated _____ granted a variance from Subtitle C, Chapter I to allow construction of facilities that are the subject of this application.

Name and location of sewer system to which this project will be tributary:

Sewer System Owner: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Signature X _____ Date: _____

Printed Name: _____ Phone No: _____

Title: _____

7.4.1 Additional Certificate By Intermediate Sewer Owner N/A

I hereby certify that (Please check one):

- 1. The sewers to which this project will be tributary have adequate reserve capacity to transport the wastewater that will be added by this project without causing a violation of the environmental Protection Act or Subtitle C, Chapter I, or
- 2. The Illinois Pollution Control Board, in PCB _____ dated _____ granted a variance from Subtitle C, Chapter I to allow construction facilities that are the subject of this application.
- 3. Not applicable

Name and location of sewer system to which this project will be tributary:

Sewer System Owner: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Signature X _____ Date: _____

Printed Name: _____ Phone No: _____

Title: _____

7.5 Certificate By Waste Treatment Works Owner N/A

I hereby certify that (Please check one):

- 1. The waste treatment plant to which this project will be tributary has adequate reserve capacity to treat the wastewater that will be added by this project without causing a violation of the Environmental Protection Act or Subtitle C, Chapter I, or
- 2. The Illinois Pollution Control Board, in PCB _____ dated _____ granted a variance from Subtitle C, Chapter I to allow construction and operation of the facilities that are the subject of this application.
- 3. Not applicable

I also certify that, if applicable, the industrial waste discharges described in the application are capable of being treated by the treatment works.

Name of Waste Treatment Works: _____

Waste Treatment Works Owner: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Signature X _____ Date: _____

Printed Name: _____ Phone No: _____

Title: _____

Please return completed form to the following address:

Illinois Environmental Protection Agency
Permit Section, Division of Water Pollution Control
P.O. Box 19276
Springfield, Illinois 62794-9276

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 ½, Section 1038. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

IL 532-0010
WPC 150

MWG13-15_29038

FOR IEPA USE:
LOG #
DATE RECEIVED:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF WATER POLLUTION CONTROL
PERMIT SECTION

Springfield, Illinois 62708

SCHEDULE J INDUSTRIAL TREATMENT WORKS CONSTRUCTION OR PRETREATMENT WORKS

1. NAME AND LOCATION:

1.1 Name of project Will County Ash Pond Liner Design

1.2 Plant Location

1.2.1 NE 2 T36N R10E
Quarter Section Section Township Range P.M.
1.2.2 Latitude 41 deg. 38 min. 26 sec. "NORTH"
1.2.3 Longitude 88 deg. 3 min. 46 sec. "WEST"
1.2.3 Name of USGS Quadrangle Map (7.5 or 15 minute) Romeoville

2. NARRATIVE DESCRIPTION AND SCHEMATIC WASTE FLOW DIAGRAM: (see instructions)

Ash sluice, gas-side & water side metal cleaning waste, slag tank overflow sumps, south area runoff basin, and WWTP sludge recycle flow to one of the ash ponds (#2 and #3), as shown on attached waste flow diagram.

2.1 PRINCIPAL PRODUCTS:

electrical power; coal ash a by-product of electrical generation

2.2 PRINCIPAL RAW MATERIALS:

coal

3. DESCRIPTION OF TREATMENT FACILITIES:

- 3.1 Submit a flow diagram through all treatment units showing size, volumes, detention times, organic loadings, surface settling rate, weir overflow rate, and other pertinent design data. Include hydraulic profiles and description of monitoring systems.
- 3.2 Waste Treatment Works is: Batch , Continuous , No. of Batches/day _____ , No. of Shifts/day _____
- 3.3 Submit plans and specifications for proposed construction.
- 3.4 Discharge is: Existing ; Will begin on _____

4. DIRECT DISCHARGE IS TO: Receiving Stream Municipal Sanitary Sewer Municipal storm or municipal combined sewer

If receiving stream or storm sewer are indicated complete the following:

Name of receiving stream Chicago Sanitary and Ship Canal ; tributary to Des Plaines River ; tributary to _____ ; tributary to _____

5. Is the treatment works subject to flooding? Yes No If so, what is the maximum flood elevation of record (in reference to the treatment works datum) and what provisions have been made to eliminate the flooding hazard?

6. APPROXIMATE TIME SCHEDULE: Estimated construction schedule:

Start of Construction Fall 2008 ; Date of Completion Summer 2009

Operation Schedule #2 operating concurrently ; Date Operation Begins #3 now; #2 Spring 2009

100% design load to be reached by year _____

7. DESIGN LOADINGS

7.1 Design population equivalent (one population equivalent is 100 gallons of wastewater per day, containing 0.17 pounds of BOD₅ and 0.20 pounds of suspended solids;

BOD NA ; Suspended Solids NA ; Flow NA

7.2 Design Average Flow Rate NA MGD.

MWG13-15_29039

- 7.3 Design Maximum Flow Rate NA MGD.
- 7.4 Design Minimum Flow Rate NA MGD.
- 7.5 Minimum 7-day, 10-year low flow NA cfs NA MGD.
Minimum 7-day, 10-year flow obtained from NA
- 7.6 Dilution Ratio NA ; _____.

8. **FLOW TO TREATMENT WORKS (if existing):**

- 8.1 Flow (last 12 months)
 - 8.1.1 Minimum Flow 4.9 MGD Intermittent
 - 8.1.2 Maximum Flow 8.7 MGD
- 8.2 Equipment used in determining above flows

9. Has a preliminary engineering report for this project been submitted to this Agency for Approval?

Yes No . If so, when was it submitted and approved. Date Submitted _____
 Certification # _____
 Dated _____

10. List Permits previously issued for the facility:

NPDES Permit No. IL 0002208

11. Describe provisions for operation during contingencies such as power failures, flooding, peak loads, equipment failure, maintenance shut downs and other emergencies.

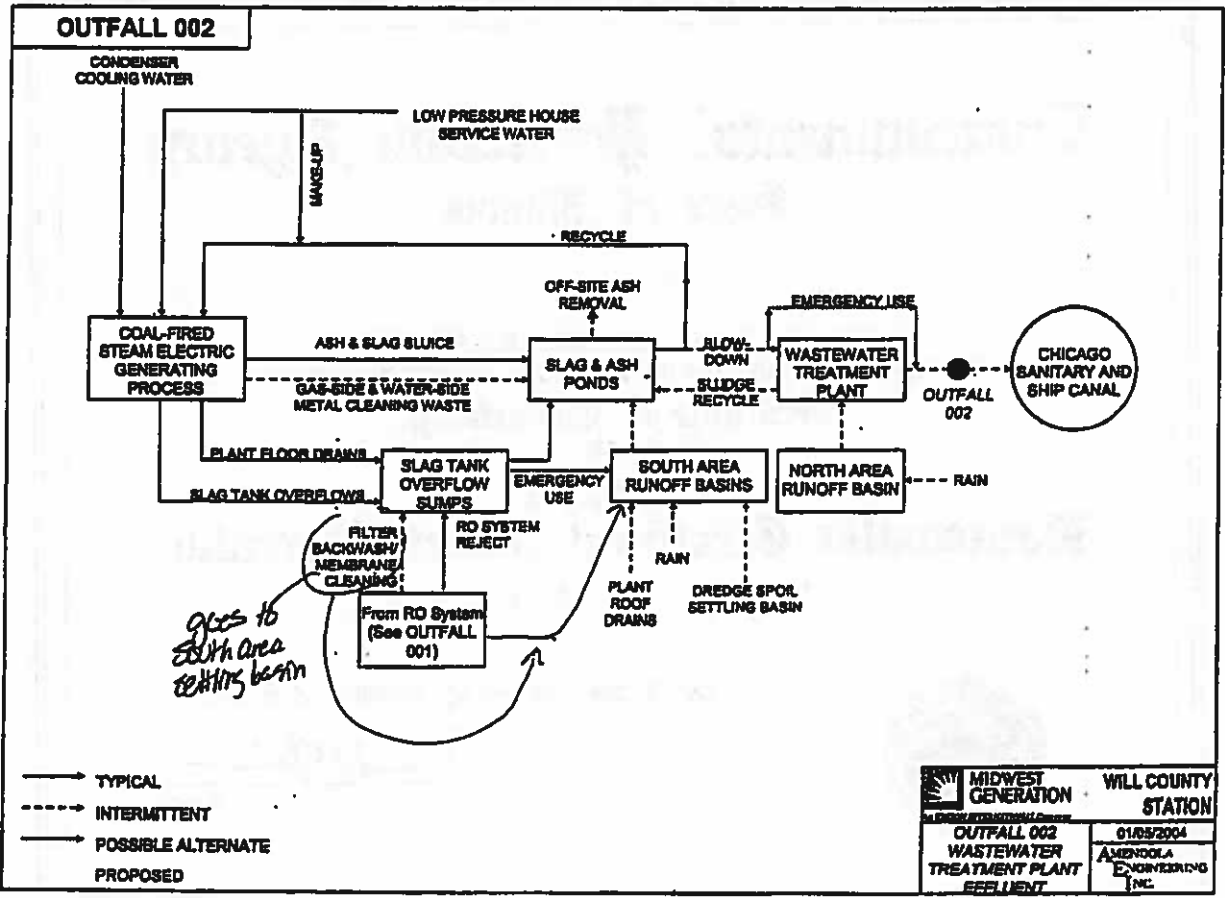
There is no equipment in the impoundments. In the event of power failure or equipment malfunction, the flow of influent to the impoundments stops.


12. Complete and submit Schedule G if sludge disposal will be required by this facility.

13. **WASTE CHARACTERISTICS:** Schedule N must be submitted.

14. **TREATMENT WORKS OPERATOR CERTIFICATION:** List names and certification numbers of certified operators:

Fredrick D. Veenbaas (see attached certificate)



 MIDWEST GENERATION	WILL COUNTY STATION
OUTFALL 002 WASTEWATER TREATMENT PLANT EFFLUENT	01/05/2004 AMENDOLA ENGINEERING INC.

P.002
0402/002

1815886296

Ex Date/Time JAN-28-2000(1000) 16:31
01/28/2000 MON 16:35 FAX 1815886296

Environmental Protection Agency
State of Illinois

FREDRICK D. VEFNRAAS

having fulfilled the requirements therefore, is hereby awarded this

Certificate of Competency

as an

Industrial
Wastewater Treatment Works Operator

MIDWEST GENERATION
WILL COUNTY



Issued this 3RD day of OCTOBER A.D. 2000

Thomas V. Gier

Director

MWG13-15_29042

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 1/2, Section 1039. Disclosure of this information is required under that section. Failure to do so may prevent this form from being processed and could result in your application being denied.

For IEPA Use:
LOG #
DATE RECEIVED:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF WATER POLLUTION CONTROL
PERMIT SECTION
Springfield, Illinois 62784-8276

SCHEDULE N WASTE CHARACTERISTICS

1. Name of Project Will County Ash Pond Liner Design

2. FLOW DATA	EXISTING	PROPOSED DESIGN
2.1 Minimum Daily Flow (gpd)	<u>4,925,000 (Intermittent)</u>	<u>Same</u>
2.2 Maximum Daily Flow (gpd)	<u>8,898,000</u>	<u>Same</u>

2.3 TEMPERATURE

Time of Year	Avg. Intake Temp. F	Avg. Effluent Temp. F	Max. Intake Temp. F	Max. Effluent Temp. F	Max. Temp. Outside Mixing Zone F
SUMMER	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
WINTER	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>

2.4 Minimum 7-day, 10-year flow: NA cfs NA MGD.

2.5 Dilution Ratio: NA

2.6 Stream flow rate at time of sampling NA cfs NA MGD.

3. CHEMICAL CONSTITUENT Existing Permitted Conditions ; Existing conditions ; Proposed Permitted Conditions

Type of sample: grab (time of collection _____); composite (Number of samples per day NA)

(see instructions for analyses required)

CONSTITUENT	RAW WASTE (mg/l)	TREATED EFFLUENT Avg. (mg/l) Max.	UPSTREAM (mg/l)	DOWNSTREAM SAMPLES (mg/l)
Ammonia Nitrogen (as N)	0.36	NA	NTF	NTF
Arsenic (total)	0.004	<0.005	NTF	NTF
Barium	0.4	0.123	NTF	NTF
Boron	0.81	0.351	NTF	NTF
BOD ₅	NA	NA	NTF	NTF
Cadmium	<0.0002	<0.01	NTF	NTF
Carbon Chloroform Extract	NA	NA	NTF	NTF
Chloride	65	NA	NTF	NTF
Chromium (total hexavalent)	<0.1	<0.04	NTF	NTF
Chromium (total trivalent)	<0.1	<0.04	NTF	NTF

CONSTITUENT	RAW WASTE (mg/l)	TREATED EFFLUENT Avg. (mg/l) Max.	UPSTREAM (mg/l)	DOWNSTREAM SAMPLES (mg/l)
Copper	<0.01	<0.02	NTF	NTF
Cyanide (total)	0.013	<0.005	NTF	NTF
Cyanide (readily released @ 150° F & pH 4.5)	NA	NA	NTF	NTF
Dissolved Oxygen	NA	NA	NTF	NTF
Fecal Coliform	NA	NA	NTF	NTF
Fluoride	0.47	0.61	NTF	NTF
Hardness (as Ca CO ₃)	NA	NA	NTF	NTF
Iron (total)	<0.04	0.311; 0.786	NTF	NTF
Lead	<0.005	<0.2	NTF	NTF
Manganese	0.03	<0.01	NTF	NTF
MBAS	NA	NA	NTF	NTF
Mercury	<0.0002	<0.0002	NTF	NTF
Nickel	<0.07	<0.05	NTF	NTF
Nitrates (as N)	3.39	4.0	NTF	NTF
Oil & Grease (hexane solubles or equivalent)	NA	<5.2; 7.0	NTF	NTF
Organic Nitrogen (as N)	1.1	1.05	NTF	NTF
pH	11.44	8.6	NTF	NTF
Phenols	<0.005	<0.02	NTF	NTF
Phosphorous (as P)	NA	0.67	NTF	NTF
Radioactivity	NA	NA	NTF	NTF
Selenium	<0.002	<0.005	NTF	NTF
Silver	<0.02	<0.04	NTF	NTF
Sulfate	89	101	NTF	NTF
Suspended Solids	NA	9.3; 24.4	NTF	NTF
Total Dissolved Solids	402	NA	NTF	NTF
Zinc	0.04	<0.02	NTF	NTF
Others				

APPENDIX B

MWG13-15_29045

APPENDIX C

MWG13-15_29046

APPENDIX B
PHOTOGRAPHS

PHOTOGRAPH LOG

**Will County Ash Impoundments
Midwest Generation, LLC
Romeoville, Illinois**

Photograph Number	Photograph Description
1.	Southwest corner of ash pond #2 looking northeast on December 17, 2007 when pond is operating.
2.	Northwest corner of ash pond #2 looking southeast on December 17, 2007.
3.	Southwest corner of ash pond #2 looking north on December 17, 2007 at the outlet weir.
4.	Southside of ash pond #2 looking northeast at inlet pipes on December 17, 2007.
5.	Northeast corner between ponds #2 and #3 looking west on October 4, 2007 when pond #3 is operating and pond #2 is down for ash removal.
6.	Southwest corner of ash pond #3 looking northeast on December 17, 2007
7.	Inlet pipes on ash pond #3 on December 17, 2007.



Photo 1

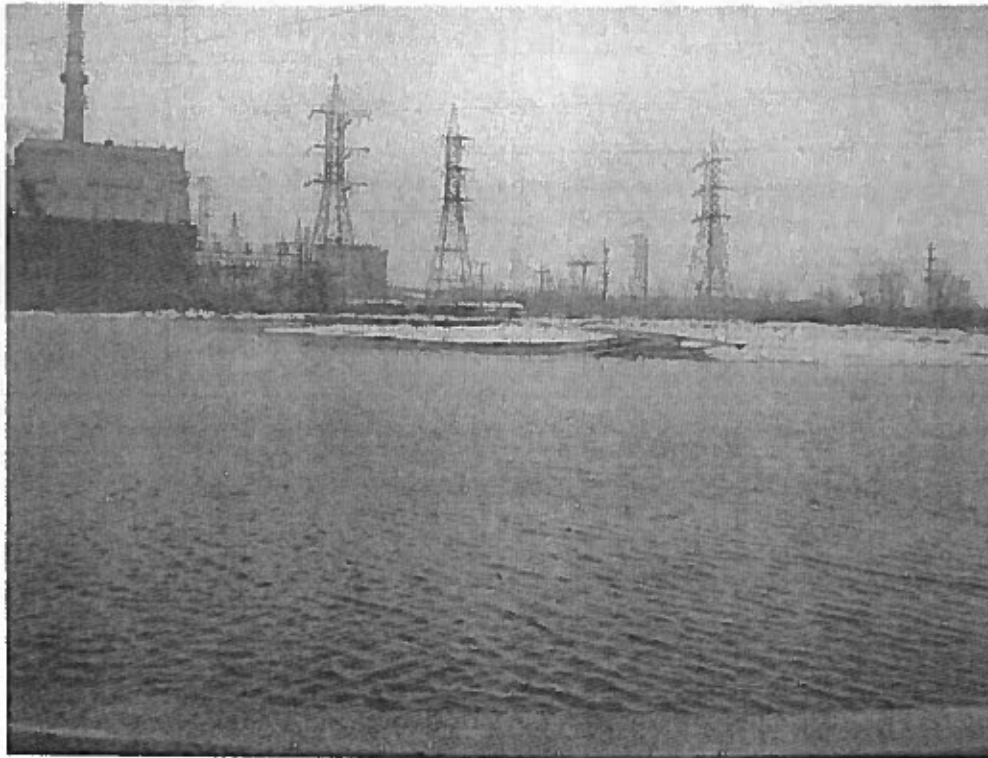


Photo 2

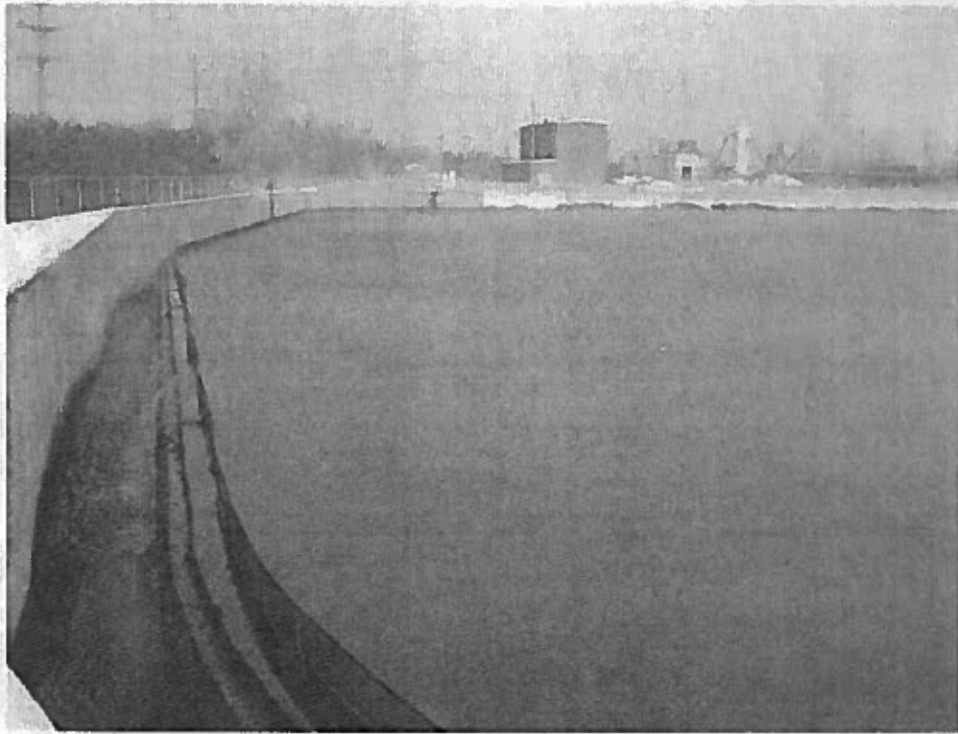


Photo 3

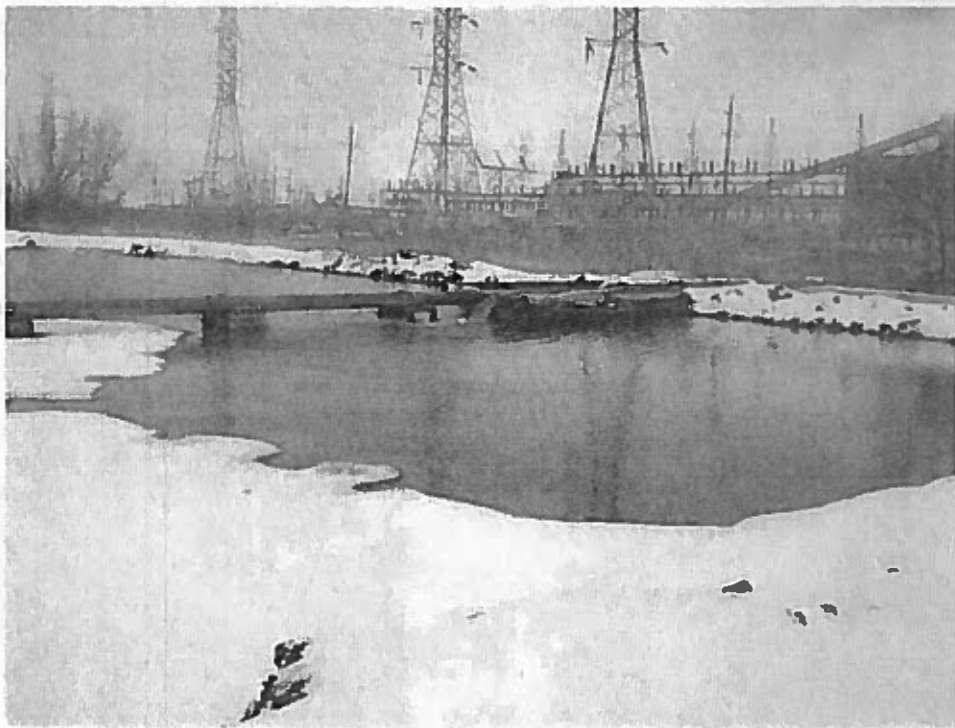


Photo 4



Photo 5



Photo 6



Photo 7

APPENDIX C

MWG13-15_29053

APPENDIX C

SPECIFICATION SECTION 02600

SECTION 02600
HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for installation of 60-mil High Density Polyethylene (HDPE) geomembrane, as specified herein, and as shown on Contract Drawings.

1.02 REFERENCE STANDARDS

- A. ASTM D1004 – Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
- B. ASTM D1238 – Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
- C. ASTM D1505 – Test Method for Density of Plastics by the Density-Gradient Technique.
- D. ASTM D1603 – Test Method for Carbon Black in Olefin Plastics.
- E. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
- F. ASTM D5199 – Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
- G. ASTM D5397 – Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
- H. ASTM D5596 – Test Method for Microscopic Evaluation of Dispersion of Carbon Black in Polyolefin Geosynthetics.
- I. ASTM D5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes.
- J. ASTM D6392 – Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
- K. ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
- L. GRI Test Method, GM 13 - Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- M. GRI Test Method, GM 14 – Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes.

- N. **GRI Test Method, GM 19 – Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.**

1.03 DEFINITIONS

- A. **Geomembrane Installer:** hired by Contractor or Owner responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.
- B. **Geomembrane Manufacturer:** hired by Geomembrane Installer to provide HDPE geomembrane.
- C. **Geosynthetic Quality Assurance Consultant:** Consultant, independent from the Owner, Manufacturer, and Installer, responsible for field oversight of geosynthetics installation, and related testing, usually under the direction of the Owner.
- D. **Geosynthetic Quality Assurance Laboratory (Testing Laboratory):** Party, independent from the Owner, Manufacturer and Installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the Owner.
- D. **Lot:** A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- E. **Resin Supplier:** selected by Geomembrane Manufacturer to provide resin used in manufacturing geomembrane.
- F. **Panel:** Unit area of a geomembrane that will be seamed in the field that is larger than 100ft².
- G. **Patch:** Unit area of a geomembrane that will be seamed in the field that is less than 100ft².
- H. **Subgrade Surface (Bedding Layer):** Soil Layer surface which immediately underlies the geosynthetic material(s).

1.04 QUALITY ASSURANCE

- A. **Qualifications:**
1. **Geomembrane Installer:**
 - a. 5 years of continuous experience in installation of HDPE geomembrane.
 - b. Experience totaling a minimum of 5,000,000 square feet of installed HDPE geomembrane on some combination of at least 10 completed facilities.
 - c. Personnel performing seaming operations qualified by experience or by successfully passing seaming tests. Master seamer shall have experience

seaming a minimum of 3,000,000 square feet of geomembrane using same type of seaming apparatus to be used on this project.

B. Quality Assurance Program:

1. Geomembrane Manufacturer/Installer shall conform with requirements of these Technical Specifications.
2. The Engineer will document geomembrane installation including panel placement, seaming, pre-qualification seam testing, non-destructive seam and repair testing, repair size and locations, weather conditions.
3. The Owner will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.05 SUBMITTALS

A. Prior to project start, submit the following to Geosynthetic Quality Assurance Consultant in accordance with Section 01300, Submittals:

1. Raw Materials:

- a. Name of Resin Supplier, location of supplier's production plant(s), resin brand name and product number.
- b. Source and nature of plasticizers, fillers, carbon black and any other additives along with their percent addition to geomembrane material.
- c. Test results documenting conformance with the "index properties" of GRI Test Method, GM 13.

2. Geomembrane Manufacturer's Certification:

- a. Written certification that Geomembrane Manufacturer's Quality Control Plan was fully implemented during production of geomembrane material supplied for this project. (Submittal shall be made within 5 working days of delivery to site).

3. Geomembrane Installer's Seaming Personnel

- a. Corporate background information indicating compliance with qualification requirements.
- b. Training completed by personnel.
- c. Seaming experience for each personnel.

4. Geomembrane Manufacturer Production Information:

- a. Corporate background information indicating compliance with qualification requirements.

- b. Quality control plan for manufacturing.
 - c. Copy of quality control certificates demonstrating compliance with the quality control plan for manufacturing and the test property requirements of GRI Test method, GM 13 (i.e. mill certificates).
5. Geomembrane Installer's Information:
- a. Corporate background information indicating compliance with qualification requirements.
 - b. List of completed facilities, totaling 5,000,000 square feet minimum for which Geomembrane Installer has completed installation of a HDPE geomembrane. Include name and purpose of facility, location, date of installation, and quantity installed.
 - c. Resumes of personnel performing field seaming operation, along with pertinent experience information. Include documentation regarding which seamers are qualified to use thermal fusion welding apparatus.
 - d. Installation quality control plan.
6. Installation panel layout diagram identifying placement of geomembrane panels, seams, and any variance or additional details which deviate from Contract Drawings or Technical Specifications. Layout shall be drawn to scale and shall be adequate for use as a construction plan. Layout shall include dimensions and pertinent seam and anchorage details.
7. Installation Sequence and Schedule shall be included as part of Construction Progress Schedule.
8. Description of seaming apparatus to be used indicating compliance with specified requirements.
- B. During installation, submit the following to the Geosynthetic Quality Assurance Consultant:
1. Daily records/logs prepared by Geomembrane Installer documenting work performed, personnel involved, general working conditions, and any problems encountered or anticipated on project. Submit on a weekly basis.
 2. Copy of subgrade acceptance signed by Geomembrane Installer for areas to be covered with geomembrane each day.
- C. Within 10 days of geomembrane installation completion, submit the following to Geosynthetic Quality Assurance Consultant:
1. Geomembrane installation certification that Work was performed under Geomembrane Installer's approved quality control plan and in substantial compliance with Technical Specifications and Contract Drawings.

2. As-built panel diagram identifying placement of geomembrane panels, seams, repairs, and destructive seam sample locations.
 3. Copy of warranty for material (including factory seams) and installation covering both for a period of 2 years from the date of substantial completion.
- D. The Geosynthetic Quality Assurance Consultant will review and inspect HDPE geomembrane installation upon completion of all Work specified in this Section. Deficiencies noted shall be corrected at no additional cost to the Owner.
- E. The Geosynthetic Quality Assurance Consultant will provide written final acceptance of the geomembrane installation after completion of material placement above geomembrane. Written conditional geomembrane installation acceptance can be provided to the Contractor prior to completion of material placement above geomembrane when the following conditions are satisfied, if necessary, and requested by the Contractor:
1. The entire geomembrane installation is completed or any pre-determined subsection if the project is phased.
 2. All installation quality assurance/control documentation has been completed and submitted to the Geosynthetic Quality Assurance Consultant or Owner.
 3. Verification of the adequacy of all field seams, repairs and associated testing is complete.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transportation:
1. Geomembrane rolls shall be transported, unloaded and handled at the job site in accordance with manufacturer recommendations. Damaged material may be rejected by the Geosynthetic Quality Assurance Consultant. Manufacturer packaging shall be labeled in accordance with Section 02700, 2.02G.
- B. On-site Storage:
1. Geomembrane rolls which have been delivered to job site shall be unloaded and stored in original, unopened packaging in a secure location, determined by Owner and/or Geosynthetic Quality Assurance Consultant.
 2. Store geomembrane rolls to ensure adequate protection against exposure to the following:
 - a. Equipment;
 - b. Strong oxidizing chemicals, acids, or bases;
 - c. Flames, including welding sparks;

HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE

- d. Temperatures in excess of 160 deg. F;
 - e. Dust;
 - f. Ultraviolet radiation (i.e. sunlight); and
 - g. Inclement weather.
3. Whenever possible, provide a 6-inch minimum air space between rolls.
 4. Containers/rolls shall not be stacked.
- C. On-Site Handling:
1. Handle rolls per Geomembrane Manufacturer's recommendations and as necessary to prevent damage.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. High Density Polyethylene (HDPE) White Textured Geomembrane.
1. HDPE geomembrane shall be white, textured, 60-mil product approved by the Engineer and/or Geosynthetic Quality Assurance Consultant.
 2. The Contractor shall submit, with the bid, written certification from the proposed Geomembrane Manufacturer that geomembrane products proposed in the bid satisfy the following requirements:
 - a. The proposed Geomembrane Manufacturer shall have a minimum of 5 years of continuous experience manufacturing HDPE geomembrane totaling 1,000,000 square feet.
 - b. The proposed HDPE compound shall be comprised entirely of virgin materials. Compliance with this specification shall be documented in accordance with Geomembrane Manufacturer's quality control program and submitted to the Geosynthetic Quality Assurance Consultant with the written conformance certification.
 - c. The proposed Geomembrane Manufacturer shall certify that any plasticizers, fillers and additives incorporated into the manufacturing process for the proposed HDPE geomembrane have demonstrated acceptable performance on past projects.
 - d. The proposed geomembrane shall meet the requirements of Geosynthetic Research Institute's test method GM 13.
 - e. The nominal thickness of proposed geomembrane shall be 60 mil., or as approved by the Engineer and/or Geosynthetic Quality Assurance Consultant.

3. Geomembrane sheets shall be visually consistent in appearance and shall contain no holes, blisters, undisbursed raw materials or other signs of contamination by foreign material. Geomembrane must have no striations, roughness or bubbles on the surface.

B. Seaming Apparatus

1. Thermal fusion welding machines used for joining geomembrane surfaces may be either extrusion or hot wedge. These machines shall include sufficient temperature and rate-of-travel monitoring devices to allow continuous monitoring of operating conditions.
2. One spare, operable thermal fusion seaming device shall be maintained on site at all times.

C. Field Test Equipment

1. Field Tensiometer: the field tensiometer shall be calibrated within three months prior to project start date over the range of field test values.
2. Air Channel Test Equipment: air channel test equipment shall consist of hoses, fittings, valves and pressure gauge(s) needed to deliver and monitor the pressure of compressed air through an approved pressure feed device.
3. Air Compressor: the air compressor utilized for field testing shall be capable of producing and maintaining an operating pressure of at least 50 psi.
4. Vacuum Box: the vacuum box shall consist of a vacuum gage, valve, and a gasket around the edge of the open bottom needed to apply vacuum to a surface.

2.02. CONFORMANCE TESTING REQUIREMENTS

- A. Geomembrane shipped to site shall undergo conformance testing. Manufacturer's roll certificates may be used for conformance evaluation at the option of the Geosynthetic Assurance Consultant. Nonconforming material shall either be retested at the direction of the Geosynthetic Quality Assurance Consultant or removed from site and replaced at Contractor's expense.**

B. Conformance Test Methods

1. Samples will be located and collected by the Geosynthetic Quality Assurance Consultant at a rate of one sample per 100,000 square feet of geomembrane delivered to site.
2. One sample will be obtained from each geomembrane production batch delivered to the site.

3. Samples shall be cut by Geomembrane Installer and be at least 45 square feet in size.
4. Samples shall be tested in accordance with Table 1 (Smooth) or Table 2 (Textured) specified in GRI Test Method GM13.
5. Geomembrane thickness shall be measured a minimum of three times per panel during deployment to verify conformance with GRI Test Method GM13.

C. Role of Testing Laboratories

1. The Geosynthetic Quality Assurance Consultant will be responsible for acquiring samples of the geomembrane for conformance testing. The Owner or Geosynthetic Quality Assurance Consultant will retain an independent, third party laboratory to perform conformance testing on samples of geomembrane.
2. Retesting of geomembrane panels by the Geomembrane Installer because of failure to meet any of the conformance specifications can only be authorized by the Geosynthetic Quality Assurance Consultant. Non-conforming panels may be retested in accordance with Subsection 2.03(B) and 2.03(D) under authorization of the Geosynthetic Quality Assurance Consultant only.
3. The Geomembrane Manufacturer and/or Geomembrane Installer may perform independent tests in accordance with methods and procedures specified in Subsection 2.03(B). Results shall not be substituted for quality assurance testing described herein.

D. Procedures for Determining Conformance Test Failures

1. If conformance test results fail to meet specifications, the roll and/or batch may be retested using specimens from either the original roll sample or from another sample collected by the Geosynthetic Quality Assurance Consultant. Two additional tests (retests) shall be performed for each failed test procedure. Each retest shall consist of multiple specimen tests if multiple specimens are specified in the test procedure. If the results of both retests meet specifications, the roll and batch will be considered to have passed conformance testing.
2. Failure of any retest shall be cause for rejection of the entire roll or batch depending on the type of failing test. The Geosynthetic Quality Assurance Consultant reserves the right to collect samples from other roll of a particular batch for further conformance testing. The Geosynthetic Quality Assurance Consultant may choose to accept only a portion of the batch on the basis of the results of conformance testing of samples collected from other rolls.
3. If retesting does not result in conformance with the specifications as defined in preceding paragraph, or if there are any other nonconformities with the material

specifications, the Contractor shall remove the rolls from use in project. The Contractor shall also be responsible for removal of rejected geomembrane from the site and replacement with acceptable geomembrane at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION MEETING

- A. A Pre-Construction Meeting shall be held at the site in accordance with Section 01040, Project Administration, to discuss and plan the details of geomembrane installation. This meeting shall be attended by the Geomembrane Installer, Owner, Geosynthetic Quality Assurance Consultant and the General Contractor.
- B. The following topics relating to geomembrane installation shall be addressed:
 - 1. Responsibilities of each party.
 - 2. Lines of authority and communication.
 - 3. Methods for documenting, reporting and distributing documents and reports.
 - 4. Procedures for packaging and storing archive samples.
 - 5. Review of the schedule for all installation and quality assurance testing, including third-party testing turnaround times.
 - 6. Review of panel layout, access and numbering systems for panels and seams including details for marking on the HDPE geomembrane.
 - 7. Procedures and responsibilities for preparation and submittal of as-built drawings.
 - 8. Temperature and weather limitations, installation procedures for adverse weather conditions and defining acceptable subgrade or ambient moisture and temperature conditions for working during liner installation.
 - 9. Subgrade conditions, dewatering responsibilities and subgrade maintenance plan.
 - 10. Deployment techniques including allowable subgrade for geomembrane.
 - 11. Procedures for covering of the geomembrane to prevent damage.
 - 12. Plan for minimizing wrinkles in the geomembrane.
 - 13. Measurement and payment schedules.
 - 14. Site health and safety procedures/protocols.

3.02 SUBGRADE PREPARATION

- A. Contractor shall prepare a subgrade surface in accordance with Section 02243, Subgrade Layer Preparation, and excavate and backfill in accordance with Section 02222, Anchor Trenching, Backfilling and Compaction.
- B. The Contractor shall not excavate more than the amount of anchor trench required for one day of geosynthetics deployment, unless otherwise specified by the Geosynthetic Quality Assurance Consultant. Rounded corners shall be provided in the trenches where the geosynthetics enter the trench to allow them to be uniformly supported by the subgrade and to avoid sharp bends. The geosynthetics shall not be supported by loose soils in anchor trenches.
- C. The Geomembrane Installer shall visually inspect the subgrade immediately prior to geomembrane deployment. Inspection shall verify that there are no potentially harmful foreign objects present, such as sharp rocks and other deleterious debris. Any foreign objects encountered shall be removed by Geomembrane Installer or Contractor. All subgrade damaged by construction equipment and deemed unsuitable for geomembrane deployment shall be repaired prior to geomembrane deployment. All repairs shall be approved by the Geosynthetic Quality Assurance Consultant and Geomembrane Installer. The responsibility for preparation, repairs, and maintenance of the subgrade shall be defined in the preconstruction meeting. The Geomembrane Installer shall provide the Geosynthetic Quality Assurance Consultant with written acceptance of subgrade surface over which geomembrane is deployed (Part 1 .05B) for each day of deployment.

3.03 GEOMEMBRANE DEPLOYMENT

- A. Geomembrane shall not be deployed until all applicable certifications/quality control certificates listed in subsection 1.05 of this section and conformance testing listed in subsection 2.03 of this section are submitted and approved by the Geosynthetic Quality Assurance Consultant. Any geomembrane deployed prior to approval by the Geosynthetic Quality Assurance Consultant shall be at the sole risk of the Geomembrane Installer and/or Contractor. If material installed prior to approval by the Geosynthetic Quality Assurance Consultant does not meet the requirements of this specification, it shall be removed from the site at no additional cost to the Owner.
- B. Geomembrane will be deployed according to submitted panel layout drawing as approved by the Geosynthetic Quality Assurance Consultant. The Geosynthetic Quality Assurance Consultant is to be notified of and approve any revisions or modifications to the approved panel layout drawing prior to deploying geomembrane in the area of review.
- C. Adequate temporary anchoring (sand bags, tires, etc.) that will not damage the geomembrane shall be placed on a deployed panel to prevent uplift by wind.
- D. Geomembrane shall not be deployed if:
 - 1. Ambient temperatures are below 41 degrees F (5 degrees C) or above 104 degrees F (40 degrees C) measured six inches above geomembrane surface unless approved by the Geosynthetic Quality Assurance Consultant.
 - 2. Precipitation is expected or in the presence of excessive moisture or ponded water on the subgrade surface.

3. Winds are excessive as determined by Geomembrane Installer in agreement with the Geosynthetic Quality Assurance Consultant.
4. The Geosynthetic Quality Assurance Consultant will have the authority to suspend work during such conditions.

E. The Geomembrane Installer shall be responsible for conformance with the following requirements:

1. Equipment utilized for installation/quality assurance testing does not damage geomembrane. Such equipment shall have rubber tires and a ground pressure not exceeding 5 psi or total weight exceeding 750 lbs. Only equipment necessary for installation and quality assurance testing is allowed on the deployed geomembrane.
2. Personnel working on geomembrane do not damage geomembrane (activities such as smoking or wearing damaging clothing shall not be allowed).
3. Method of deployment does not damage geomembrane.
4. Method of deployment minimizes wrinkles.
5. Temporary loading or anchoring does not damage geomembrane.
6. Direct contact with geomembrane is minimized.

F. No vehicles shall be allowed on deployed geomembrane under any circumstances.

3.04 FIELD SEAMS

A. Seam Layout

1. In general, seams shall be oriented parallel to the line of the maximum slope. In corners and at other odd-shaped geometric intersections, number of seams should be minimized. If at all possible, seams shall not be located at low points in the subgrade unless geometry requires seaming to be done at these locations.
2. A seam numbering system compatible with the panel numbering system shall be agreed upon at the Pre-Construction Meeting.

B. Seaming Processes/Equipment

1. Approved processes for field seaming (panel to panel) are extrusion or hot wedge fusion-type seam methods. No other processes can be used without prior written authorization from the Geosynthetic Quality Assurance Consultant. Only equipment which has been specifically approved by make and model shall be used, if applicable.
2. The Geomembrane Installer will meet following requirements regarding use, availability, and cleaning of welding equipment at job site:

- a. Intersecting hot wedge seams shall be patched using extrusion welding process.
 - b. Electric generator for equipment shall be placed on a smooth base such that no damage occurs to geomembrane. A smooth insulating plate or fabric shall be placed beneath hot equipment after usage.
3. The Geomembrane Installer shall keep records for performance and testing of all seams.

C. Seaming Requirements/Procedures

1. Weather Conditions - Range of weather conditions under which geomembrane seaming can be performed are as follows:
 - a. Unless otherwise authorized in writing by Geosynthetic Quality Assurance Consultant, no seaming shall be attempted or performed at an ambient temperature below 41 degrees F (5 degrees C) or above 104 degrees F (40 degrees C).
 - b. Between ambient temperatures of 32 degrees F (0 degrees C) and 41 degrees F (5 degrees C), seaming shall be performed only if geomembrane is preheated by either sun or a hot air device, provided there is no excessive ambient cooling resulting from high winds. Pre-qualification seams shall be produced under identical conditions.
 - c. Above 41 degrees F (5 degrees C), no preheating of geomembrane will be required.
 - d. Geomembrane shall be dry and protected from wind.
 - e. Seaming shall not be performed during any precipitation event.
 - f. Seaming shall not be performed in areas where ponded water has collected below surface of geomembrane.
2. If the Geomembrane Installer chooses to use methods which may allow seaming at ambient temperatures below 41 degrees F or above 104 degrees F, the Geomembrane Installer shall demonstrate and submit certification to Geosynthetic Quality Assurance Consultant that methods and techniques used to perform seaming produce seams that are equivalent to seams produced at temperatures above 41 degrees F and below 104 degrees F. The Geosynthetic Quality Assurance Consultant may deny approval for use of the proposed technique regardless of demonstration results.
3. Overlapping - Geomembrane panels shall have finished overlap as follows:
 - a. Minimum of 6 inches for thermal fusion welding.
 - b. Insufficient overlap will be considered a failed seam.

4. Pre-qualification tests for geomembrane fusion welding shall be conducted by a minimum of 2 pre-qualification seams conducted per day per welding machine by each seaming technician performing welding with that machine. At least one test shall be performed at the start of each work day, with tests at intervals of no greater than 5 hours and additional pre-qualification tests following work interruptions, weather changes, changes to machine settings, or as directed by the Geosynthetic Quality Assurance Consultant. Pre-qualification seams shall be made under the same conditions as the actual seams.
 - a. Pre-qualification seam samples shall be 5 feet long by 1-foot wide (minimum) after seaming, with seam centered along its length. Each pre-qualification seam shall be labeled with the date, geomembrane temperature, seaming unit identifier, seam number or test location, technician performing the test seam and description of testing results.
 - b. Seam overlap shall be in accordance with subsection 3.04(C)(3).
 - c. Pre-qualification seams shall be inspected for proper squeeze-out, footprint pressure, and general appearance.
 - d. Four specimens, each 1-inch in length, shall be cut from opposite ends of the pre-qualification seam sample by the Geomembrane Installer. The remainder of pre-qualification seam shall be retained by the Geosynthetic Quality Assurance Consultant and may be submitted for laboratory testing.
 - e. The Geomembrane Installer shall complete two shear tests and two peel tests.
 - f. Pre-qualification seams failed by inspection or testing may be retested at request of the Geomembrane Installer. If the second pre-qualification seam fails, then the seaming apparatus or seaming technique shall be disqualified from use until two consecutive, satisfactory pre-qualification seams are obtained.
5. **Seam Preparation**
 - a. Prior to seaming, seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.
 - b. Seams shall be aligned so as to minimize number of wrinkles and fishmouths.
6. **General Seaming Procedures**
 - a. Fishmouths or wrinkles at seam overlaps shall be cut along ridge of the wrinkle to achieve a flat overlap. Cut fishmouths or wrinkles shall be repaired, and/or patched in accordance with Part 3.07.
 - b. Seaming shall extend to the outside edge of geomembrane panels including material placed in anchor trenches.

- c. For cross seams, the intersecting thermal fusion seams shall be patched using the extrusion welding process.

3.05 NON-DESTRUCTIVE TESTING

- A. Each field seam shall be non-destructively tested over its entire length by the Installer. Testing shall be conducted as field seaming progresses, not at completion of all seams, unless specifically agreed to by the Geosynthetic Quality Assurance Consultant in writing.
- B. Vacuum Testing – shall be performed in accordance with ASTM D5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
- C. Air Pressure Testing – shall be performed in accordance with ASTM D5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes, and GRI GM 6, Pressurized Air Channel Test for Dual Seamed Geomembranes.
- D. Each seam tested non-destructively shall be marked with the date of the test, name of the testing technician, length of the seam, test method and results. The same shall also be recorded by the Geosynthetic Quality Assurance Consultant on the appropriate CQA documentation.
- E. Non-Destructive Seam Test Failures
 - 1. Seams failing non-destructive testing shall be repaired by the Geomembrane Installer according to Part 3.07. Seams shall be non-destructively retested. If the seam defect cannot be located, the entire section of seams affected shall be repaired and retested.

3.06 DESTRUCTIVE TESTING

- A. The Owner shall have the option to conduct destructive testing of geomembrane panel seams completed in the field. Destructive seam sampling and testing shall be performed by the Geomembrane Installer under the observation of the Geosynthetic Quality Assurance Consultant.
- B. Sampling Procedure
 - 1. For each sample location, the Geosynthetic Quality Assurance Consultant will:
 - a. Assign a sample number and mark the sample accordingly.
 - b. Record the sample location on the as-built layout drawing.
 - c. By sample number, record reason for collecting sample (e.g., as part of statistical testing program, suspicious seam, retest, etc.).

- d. Record pertinent information, including date, time, seam number, number of seaming unit, and name of seamer, on both the seam sample and CQA documentation.
2. Each destructive sample shall be at least 12 inches wide (at least 6 inches on each side of seam) by 54 inches long. Samples will be cut by the Geomembrane Installer into three parts and distributed as follows:
 - a. A 12-inch by 12-inch portion shall be cut and tested in accordance with subsection 3.06(C) by the Geomembrane Installer.
 - b. A 12-inch by 12-inch portion shall be cut and retained by the Geomembrane Installer. The Geomembrane Installer may elect to omit this requirement.
 - c. A 12-inch by 12-inch portion shall be cut and retained by the Geosynthetic Quality Assurance Consultant as an archive sample.
 - d. A 12-inch by 18-inch portion shall be submitted by the Geosynthetic Quality Assurance Consultant for laboratory testing as described in Part 3.06(D).
 3. Ten specimens, each 1 inch wide by 12 inches long with seam centered perpendicular to width, shall be collected and field tested by the Geomembrane Installer prior to shipping the sample to the laboratory. If all samples pass field tensiometer test described in Part 3.06(C), then the laboratory sample shall be collected according to procedure described in Part 3.06(B)(2)(d).
 4. Holes cut into geomembrane resulting from destructive seam sampling shall be immediately repaired by Geomembrane Installer in accordance with repair procedures described in Part 3.07.

C. Field Test Methods

1. Ten 1-inch-wide samples described above under Part 3.06(B)(3) shall be field tested for peel (5 samples) and shear (5 samples).
2. One end of seam sample shall be field tested for peel and shear at end of each continuous field seam 100 feet long or greater.
3. Testing shall be performed in accordance to with ASTM D6392 using a field tensiometer or equivalent device to qualitatively and quantitatively determine mode of failure.
4. Seam shall be considered passing if failure in both peel and shear meet criteria listed in GRI GM 19, Table 2.

5. The procedures specified in Subsection 3.06(D) shall be implemented when sample passes field tensiometer test.

D. Laboratory Test Methods

1. Laboratory testing of seam samples shall be conducted by the Geosynthetic Quality Assurance Laboratory under contract with the Geosynthetic Quality Assurance Consultant or Owner. Five specimens shall be tested in shear and five in peel.
2. Laboratory testing shall be conducted in accordance with ASTM D6392.
3. For both seam shear and peel tension tests, an indication will be given for each specimen tested which defines locus of failure.
4. For shear tests, the following values, along with the mean and standard deviation where appropriate, will be reported for each specimen tested:
 - a. Maximum tension in pounds per square inch.
 - b. Elongation at break (up to a tested maximum of 100 percent).
 - c. Locus of failure using ASTM designations.
5. For peel tests, the following values, along with the mean and standard deviation where appropriate, will be reported for each specimen tested:
 - a. Maximum tension in pounds per square inch.
 - b. Seam separation (expressed as percent of original seam area).
 - c. Locus of failure.
4. Retesting of seams due to nonconformance with specifications may be performed at the discretion of the Geosynthetic Quality Assurance Consultant.

E. Destructive Seam Test Failure

1. Shear and peel test results derived from testing described in Parts 3.06(C) and 3.06(D) shall comply with GRI GM 19, Table 2 for seam to be considered acceptable.
2. The Geomembrane Installer has two options in determining the repair boundary whenever a seam has failed destructive testing:

- a. The seam can be reconstructed between the two previously tested and passed destructive sample locations; or,
 - b. The Geomembrane Installer can trace the welding path to an intermediate location at least ten feet from point of failed test in each direction and obtain destructive test samples collected from these locations. If destructive tests on these samples are acceptable, then the seam shall be reconstructed between the intermediate locations. If either sample fails, the process may be repeated until an acceptable seam test has been performed on both sides of the original failed sample. If a passing sample is not realized on one (or both) side of the original failed sample, then seam repair must extend to the end(s) of the seam. Retesting of seams according to this procedure shall utilize the sampling methodology described in Part 3.06(B). The Owner reserves the right to terminate this process, at the discretion of the Geosynthetic Quality Assurance Consultant, after the second retesting. An additional sample taken from the reconstructed zone must pass destructive seam testing, if destructive sample failure(s) causes reconstruction.
3. The Geosynthetic Quality Assurance Consultant shall be responsible for documenting all actions taken in repairing seams. The Geomembrane Installer will be responsible for keeping the Geosynthetic Quality Assurance Consultant informed of seaming progress.
 3. Additional fees for destructive seam test failures shall be assessed to the Contractor and deducted from payment. This fee shall be assessed only if the failing sample is a laboratory sample.

3.07 DEFECTS AND REPAIRS

- A. The geomembrane shall be examined by the Geomembrane Installer and the Engineer for defects, holes, blisters, undispersed raw materials, and any signs of contamination by foreign matter. The geomembrane surface shall be swept and/or washed by the Geomembrane Installer if the amount of dust or mud inhibits examination. The Contractor shall provide a water truck, an operator, clean water and hoses as reasonably necessary to assist the Geomembrane Installer in this activity.
- B. Portions of geomembrane exhibiting flaws, or failing a non-destructive or destructive (if conducted) test, shall be repaired or replaced by the Geomembrane Installer. Repair procedures available include:
 1. Patching - used to repair large holes, tears, undispersed raw materials, contamination by foreign matter, holes resulting from destructive sampling (if conducted), and locations where seam overlap is insufficient;
 2. Capping - used to repair large lengths of failed seams; and

3. Additional Procedures - used upon recommendation of the Geomembrane Installer if agreed to by the Engineer.
- C. Patches or caps.
1. Extend patch or cap 6 inches (minimum) beyond the edge of the defect.
 2. Round corners of patch and/or cap (suggest 3-inch radius).
 3. Repair procedures, equipment, materials, and techniques will be approved by the Geosynthetic Quality Assurance Consultant prior to repair.
 4. Geomembrane below large caps shall be appropriately cut to avoid water or gas collection between two sheets.
- D. The Geomembrane Installer shall mark on the geomembrane (using a non-puncturing writing utensil), repair date, time, and personnel involved.
- E. Each repair shall be non-destructively tested in accordance with Part 3.05. Large caps may require destructive test sampling at the discretion of the Geosynthetic Quality Assurance Consultant (in accordance with Part 3.06).
- F. Repairs which fail testing shall be redone and retested until a passing result is obtained. The Geomembrane Installer will perform non-destructive testing or repairs and will document retesting of repairs.
- G. The Geosynthetic Quality Assurance Consultant will document repairs, repair testing, and retesting results.
- H. The Geomembrane Installer shall cut and seam wrinkles which may adversely affect long-term integrity of the geomembrane, hinder subsequent construction of overlying layers, or impede drainage off of the geomembrane after it is covered by soil. Seaming shall be done in accordance with procedures described in Parts 3.04(B) and 3.04(C), and it shall be subject to test provisions of Parts 3.05 (non-destructive testing) and 3.06 (destructive testing - if conducted).
- 3.08 PROTRUSIONS AND CONNECTIONS TO GEOMEMBRANE

- A. If required, the Geomembrane Installer shall install geomembrane around utility poles, guy wires, and other structures according to the Contract Drawings and the following requirements:
1. Use minimum 1-ft long membrane pipe boots and steel straps to seal the geomembrane around pole or structure.
 2. Use standard welding procedures to seam the membrane boot to the geomembrane.
 3. Seaming performed on and around penetrations, and other appurtenances shall be non-destructively tested using the vacuum testing method.

3.09 SURVEY DOCUMENTATION

- A. The Geomembrane Installer shall survey the completed geomembrane prior to covering and provide the Geosynthetic Quality Assurance Consultant with 24-hour notification of survey. The Contractor shall document the location of all seams (panel corners acceptable), destructive test samples (if conducted) and repairs. The Contractor shall provide survey data to the Geosynthetic Quality Assurance Consultant within one working day of survey completion and in accordance with Section 01050.

3.10 DAILY FIELD INSTALLATION REPORTS

- A. At the beginning of each day, the Geomembrane Installer shall provide the Geosynthetic Quality Assurance Consultant with a report for all work completed the previous day.
- B. The Daily Field Installation Report shall include the following:
1. The total amount and location of geomembrane placed.
 2. The total length and location of seams completed, technician name and welding unit numbers.
 3. A drawing or sketch depicting the geomembrane installed the previous day including the panel number, seam number and locations of non-destructive and destructive testing (if conducted).
 4. Results of pre-qualification test seams, if available.
 5. Results of non-destructive testing.
- C. Destructive test results (if conducted) shall be reported within 48 hours or prior to covering the geomembrane, whichever is practical.

3.10 MATERIAL ABOVE GEOMEMBRANE

- A. The Geosynthetic Quality Assurance Consultant and Geomembrane Installer shall verify the area of geomembrane completion prior to placement of material over the geomembrane.
- B. Soils - Requirements for placement of general fill are described in Sections 02221 and 02222. Apply following general criteria for covering of the geomembrane:
1. Do not place soils on the geomembrane at an ambient temperature below 32 degrees F, (0 degrees C) nor above 104 degrees F (40 degrees C), unless otherwise specified.
 2. Do not drive equipment used for placing soil directly on the geomembrane.
 3. A minimum thickness of 1 foot of soil is specified between a low ground pressure dozer (maximum contact pressure of 5 lb/sq. inch) and the geomembrane.

HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE

4. A minimum thickness of 2 feet of soil is required between rubber-tired vehicles and the geomembrane.
5. Do not compact soils placed directly on geomembrane.
6. Damage to the geomembrane resulting from placement of cover soils shall be repaired in accordance with Part 3.07 by the Geomembrane Installer at the Contractor's expense.
7. Do not push soil downslope. Soil shall be placed over the geomembrane starting from base of the slope, up to top of the slope.

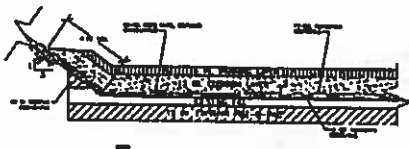
END OF SECTION

SHEETS

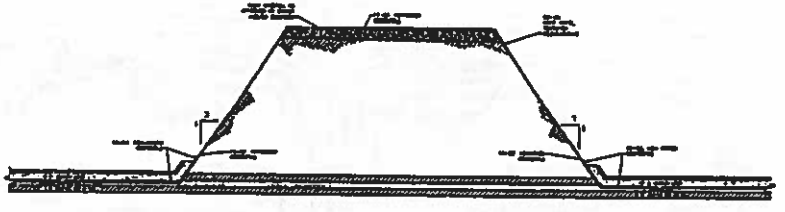
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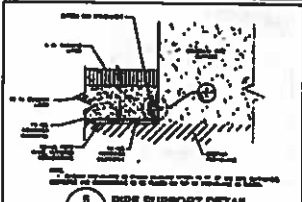
SHEETS



A SLOPE TRANSITION SECTION
NOT TO SCALE



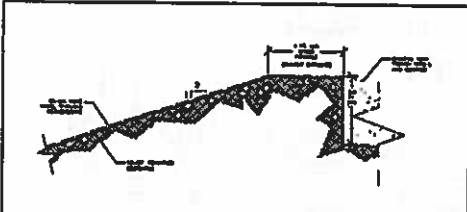
B RAMP SECTION
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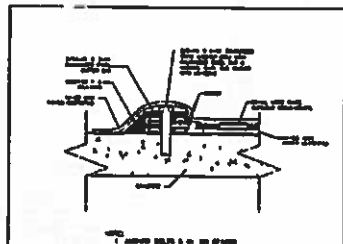
C PIPE SUPPORT DETAIL
NOT TO SCALE



2 OUTLET WEIR DETAIL
NOT TO SCALE



3 ANCHOR TRENCH DETAIL
NOT TO SCALE

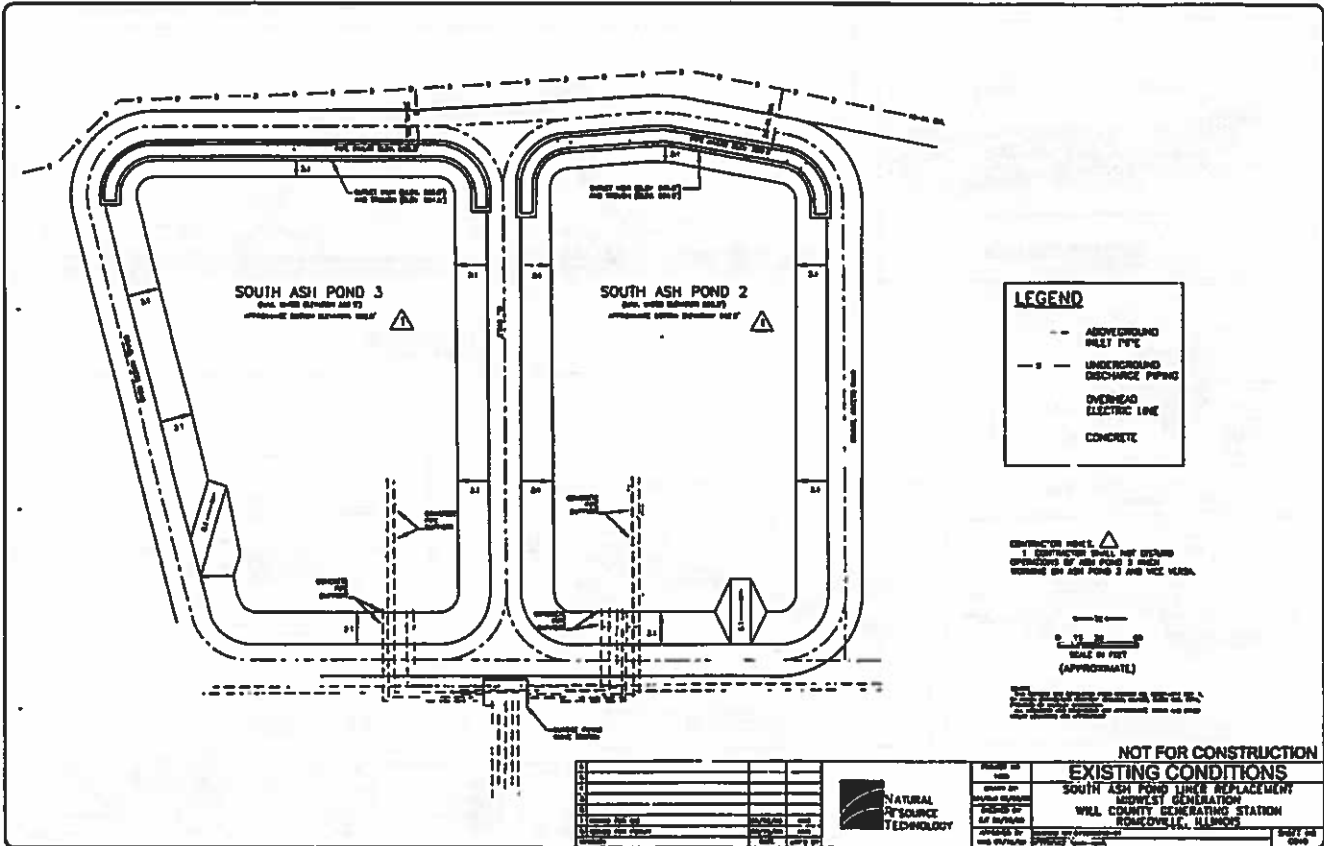


4 BATTEN BAR ATTACHMENT
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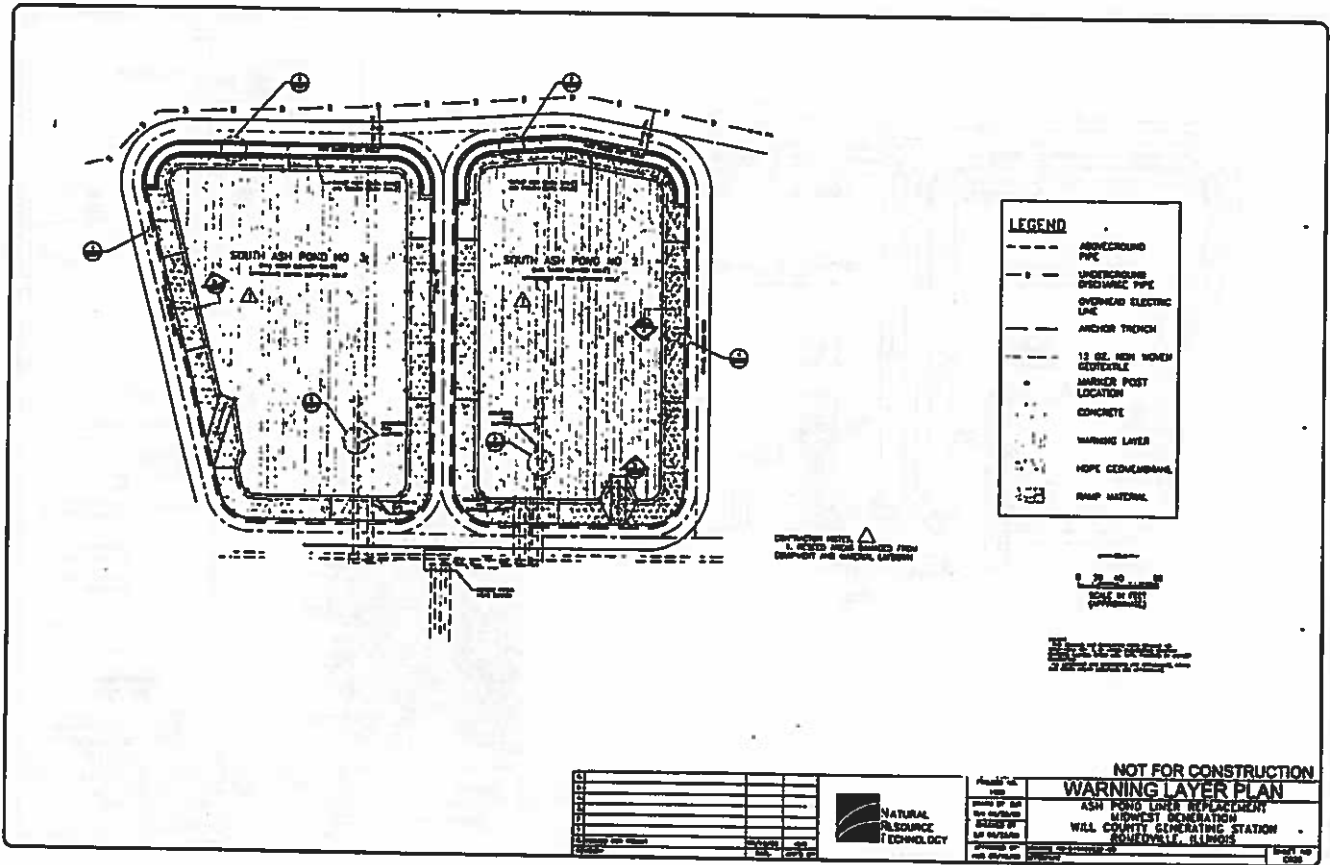
NO.	DESCRIPTION	DATE	BY	CHECKED



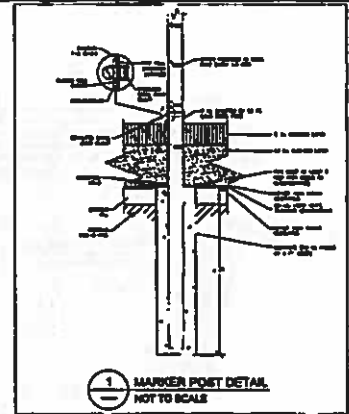
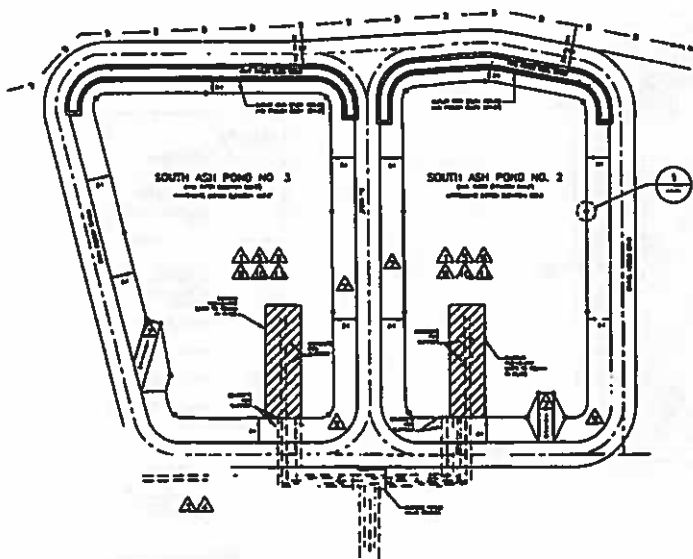
NOT FOR CONSTRUCTION
DETAILS AND SECTIONS
 ASH POND LINER REPLACEMENT
 HUNTERS GENERATION
 WILL COUNTY GENERATING STATION
 HUNTSVILLE, ALABAMA



MWG13-15_29078



MWG13-15_29079



CONTRACTOR SHALL

1. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS AND CONDITIONS OF CONTRACT NO. 1.
2. CLEAR AND MARK ALL WORK ALONG TOP OF BANK OF POND.
3. CONTRACTOR SHALL MAINTAIN ALL OPERATIONS AND EXISTING UTILITIES TO REMAIN AND THE ORIGINAL SPECIFICATIONS.
4. CONTRACTOR SHALL STAKE AND MARK EXISTING AND PROPOSED ALL CONCRETE AND METAL STRUCTURES IN ACCORDANCE WITH THE ORIGINAL SPECIFICATIONS.
5. CONTRACTOR SHALL PROVIDE ALL VERTICAL ALIGNMENT AND FINISH GRADES TO BE SHOWN IN THE ORIGINAL SPECIFICATIONS FOR ALL STRUCTURES TO BE CONSTRUCTED.
6. CONTRACTOR SHALL PROVIDE ALL VERTICAL ALIGNMENT AND FINISH GRADES TO BE SHOWN IN THE ORIGINAL SPECIFICATIONS FOR ALL STRUCTURES TO BE CONSTRUCTED.
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13. CONTRACTOR SHALL PROVIDE ALL VERTICAL ALIGNMENT AND FINISH GRADES TO BE SHOWN IN THE ORIGINAL SPECIFICATIONS FOR ALL STRUCTURES TO BE CONSTRUCTED.

LEGEND	
---	ADJACENT POND
---	UNDERGROUND DISCHARGE PIPING
---	OVERHEAD ELECTRIC LINE
●	MARKER POST LOCATION
■	CONCRETE

SCALE IN FEET (APPROXIMATE)

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR PERMIT	10/15/15	...
2
3
4
5
6
7
8
9
10



LINER SUBGRADE PREPARATION
 ASH POND LINER REPLACEMENT
 HUNTERS GENERATING STATION
 WILL COUNTY GENERATING STATION
 BOWLING GREEN, MISSISSIPPI



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