HISTORY OF CONSTRUCTION FOR EXISTING CCR SURFACE IMPOUNDMENT
PLANT DANIEL ASH POND B
40 CFR 257.73(c)(1)(i)-(xii)

(i) Site Name and Ownership Information:

Site Name:	Plant Victor Daniel
Site Location:	Moss Point, MS
Site Address:	13201 MS-63 Moss Point, MS 39562
Owner:	Mississippi Power Company
Owner Address:	2992 West Beach Boulevard Gulfport, MS 39502
CCR Impoundment Name:	Plant Daniel Ash Pond B
NID Identification Number:	N/A

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" Final Rule (40 C.F.R. Part 257 and Part 261), §257.73(c)(1), requires the owner or operator of an existing CCR surface impoundment to compile a history of construction. To the extent feasible, the following information is provided:

(ii) CCR Unit Location Map:

30°32'19"N, 88°33'26"W
See Location Map in the Appendix

(iii) Purpose of CCR Impoundment: Plant Daniel is an electric generating facility with two coal-fired units and two gas-fired combined cycle units. The Plant Daniel Ash Pond B is designed to receive and store coal combustion residuals produced during the coal-fired electric generating process at Plant Daniel. It also serves as a low-volume waste treatment pond for the plant.

(iv) Watershed Description: Plant Daniel is located within both the Upper West Pascagoula-Pascagoula Rivers HUC-12 watershed which has a total area of 39,036 acres and the Black Creek Cooling Pond-Black Creek HUC-12 watershed which has a total area of 31,098 acres. The Upper West Pascagoula-Pascagoula Rivers watershed is located within the Pascagoula HUC-8 watershed which has a drainage area of 390,563 acres. The Black Creek Cooling Pond-Black Creek watershed is located within the Escatawpa HUC-8 watershed which has a drainage area of 668,343 acres. The Plant Daniel Ash Pond B is located entirely within the Black Creek Cooling Pond-Black Creek watershed. However, there is no

uncontrolled run-on into the Ash Pond from the surrounding watershed. The only water that enters the pond is process water (ash sluice water and low-volume waste), stormwater from various sumps located within the generating plant and rainwater that falls directly into the pond.

(v) Description of physical and engineering properties of CCR impoundment foundation/abutments: Plant Daniel is located north of Moss Point, Mississippi, near the coast of the Gulf of Mexico. The geology of the area is mainly coastal deposits consisting of sands and clays.

The Ash Pond is constructed directly upon a unit of silty clay and clayey silt, with sandy soils beneath that serve as the shallow aquifer system. Generally, the plant site is underlain by weathered alluvium and terrace deposits of Recent and Pleistocene age. The unconsolidated material consists predominately of sand, sandy clay, and clayey silt with occasional organic material and peat. The material beneath the generating facility consists of a surficial deposit of approximately 20 feet of organic-rich silt and clay underlain by a fairly uniform sand which extends to a depth of about 100 feet. The static groundwater level at the facility is reported to be at an elevation of 7 feet NGVD.

(vi) Summary of Site Preparation and Construction Activities: Plant Daniel has been operating as a coal fire electric generating facility since 1978. Currently Ash Pond B is utilized to manage bottom ash. Ash Pond B is a 23 acre triangular shaped impoundment with earthen embankments. The embankments are at an elevation of 39 ft MSL. The bottom of the pond is at an elevation of approximately 3.5 ft MSL. The slopes of the Ash Pond dikes are constructed at a slope of 3H:1V. In 1993, a 60 mil High Density Polyethylene (HDPE) geomembrane liner was added to Ash Pond B to prevent interaction between the pond and the local aquifer. There was also a 2-ft clay layer constructed on the bottom of the pond prior to construction of the HDPE liner.

(vii) Engineering Diagram:

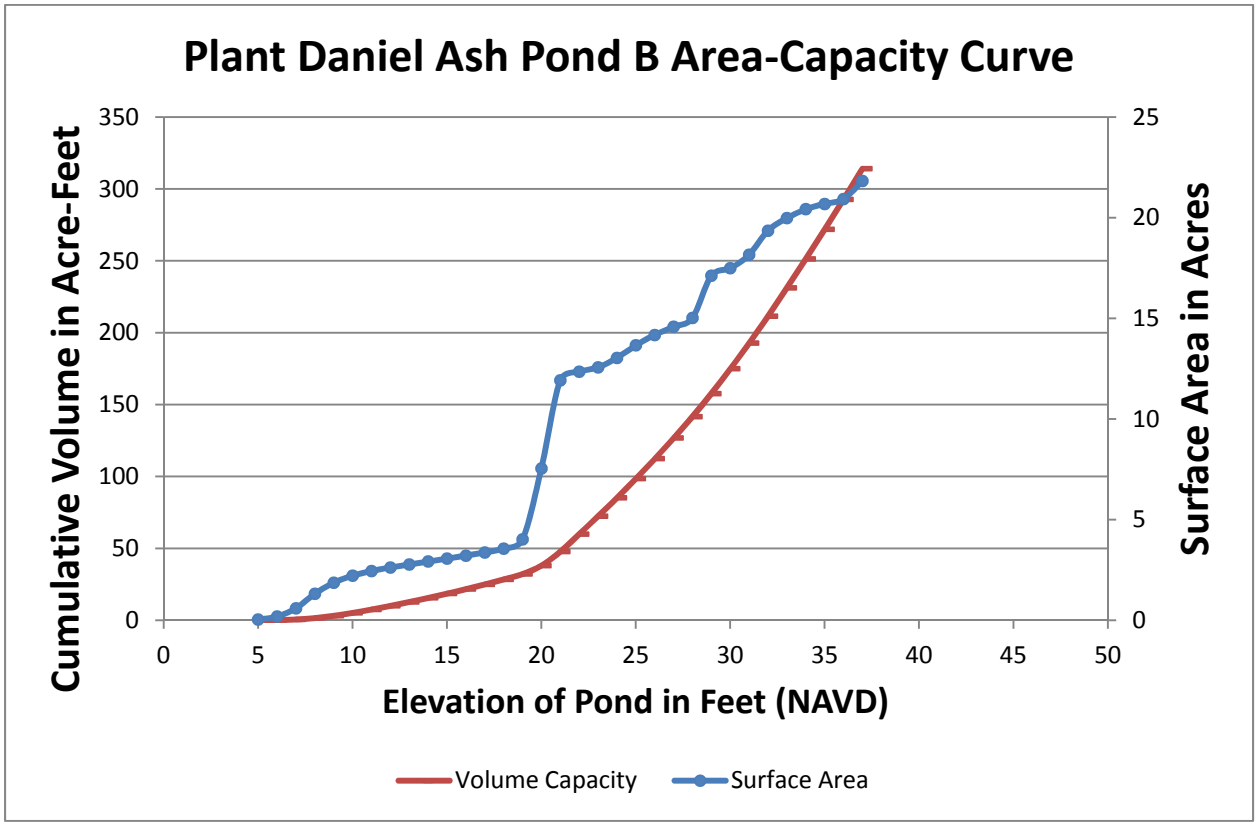
The following drawings reflecting the construction of the Plant Daniel Ash Pond can be found in the Appendix:

- Site Location map
- Southern Company Services Drawing D-189073 – Pond B – Installation of Clay Liner
- Southern Company Services Drawing D-189074 – Pond B – Foundation Backfill Grading Plan & Details
- Southern Company Services Drawing D-189075 – Pond B – Clay Liner Grading Plan & Details
- Southern Company Services Drawing D-189076 – Pond B Ash Sluice Pump Structure and Clay Placement Details
- Southern Company Services Drawing D-189077 – Pond B – Site Drawing Plan of 60 mil Geomembrane Liner
- Southern Company Services Drawing D-189078 – Pond B – Geomembrane Liner Details at Pump House Structure
- Southern Company Services Drawing D-189079 – Pond B – Geomembrane Liner Slope and Pipe Details
- Southern Company Services Drawing D-189080 – Pond B – Geomembrane Liner Splash Pad Details

- Southern Company Services Drawing ES2882 – Bottom Ash Pond Area Geologic Cross Section

(viii) Description of Instrumentation: There is currently no instrumentation associated with the CCR surface impoundment.

(ix) Area-capacity curves:



(x) Spillway/Diversion design features and capacity calculations:

Water entering the pond includes sluice water for bottom ash, additional plant process water streams and rainwater that falls directly into the pond. There is no passive (gravity) discharge from Pond B. Most water is pumped back to the plant for reuse or is pumped to the adjoining plant discharge canal at a permitted discharge point. There are three 5,000 gpm pumps in place at the impoundment, with two utilized on a regular basis, and one for backup/redundancy. Normal operating pool level is about EL 23 ft or lower. Assuming a "worst case" scenario of the 1,000-yr storm event with all process water inflow lines running at full capacity, the pond will maintain a freeboard of approximately 5 feet. The Inflow Design document for Daniel Ash Pond B can be referenced for additional details and the calculation summary.

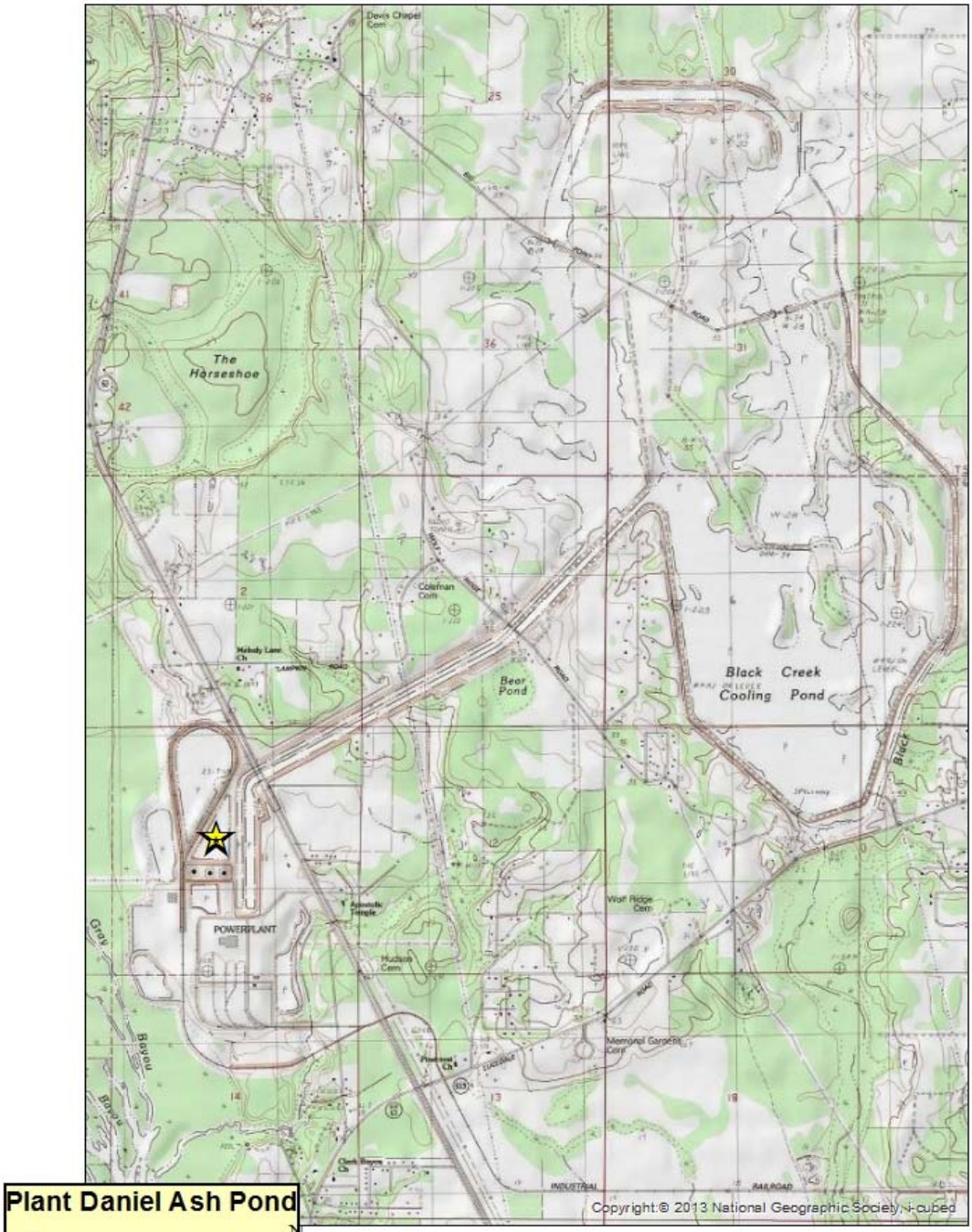
(xi) Provisions for surveillance, maintenance and repair: Inspections of dams and dikes are critical components and are conducted on a regular basis—at least annually by professional dam safety engineers and at least weekly by trained plant personnel. In addition, inspections are performed after

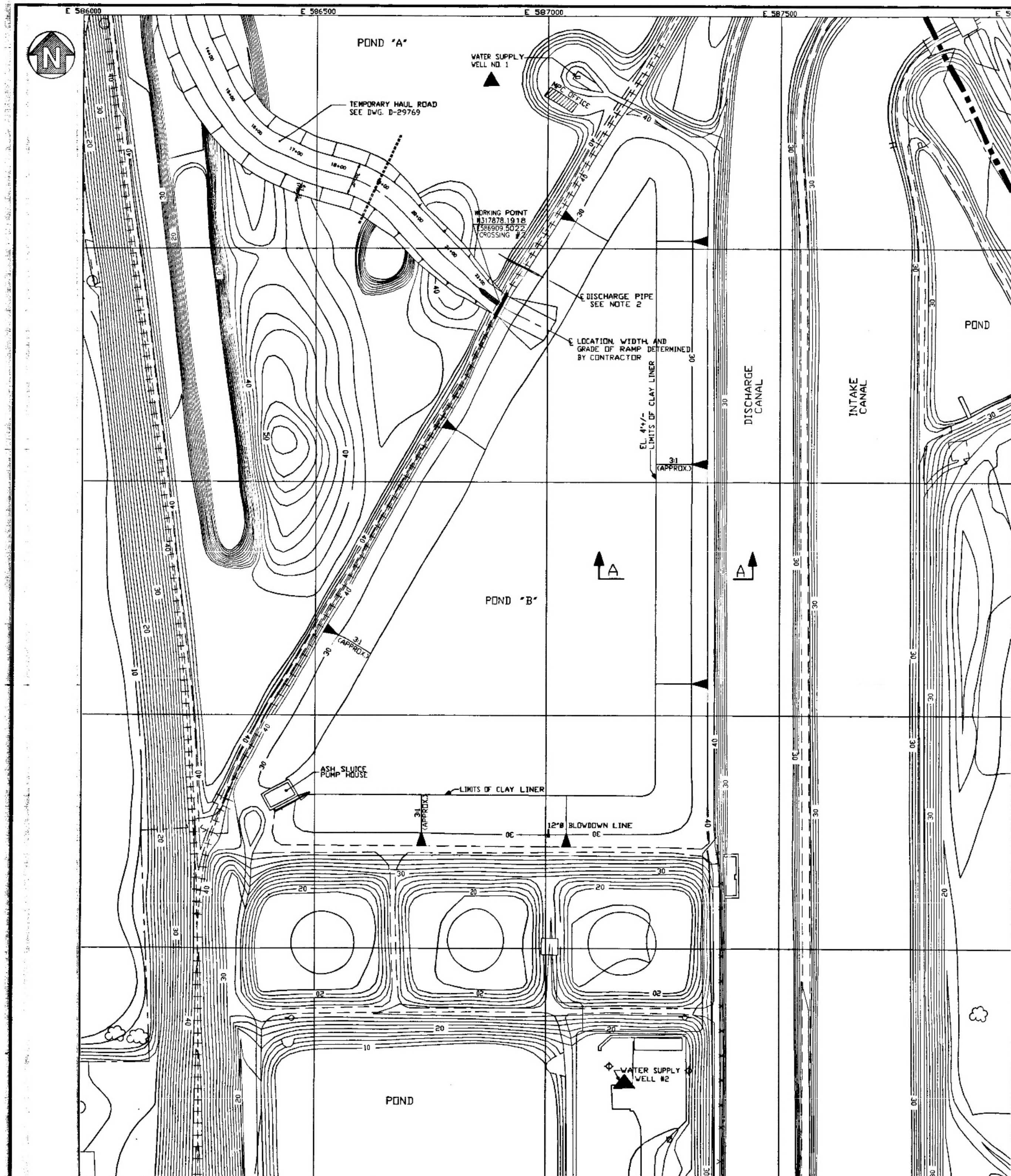
unusual events such as storms. The inspections provide assurance that structures are sound and that action is taken, as needed, based on the findings. Safety inspections include observations of such things as pond levels, weather conditions, rainfall since the prior inspection, conditions of slopes and drains, erosion, animal damage, ant hills, alignment of retaining structures and more. Dam safety engineers inspect any maintenance or remediation performed since the previous inspection, check the status of work recommended at prior inspections, ensure that the posting of emergency notification information is up-to-date and evaluate any items noted during plant personnel inspections.

Construction specifications: See the Appendix for construction specifications specific to the installation of the HDPE liner.

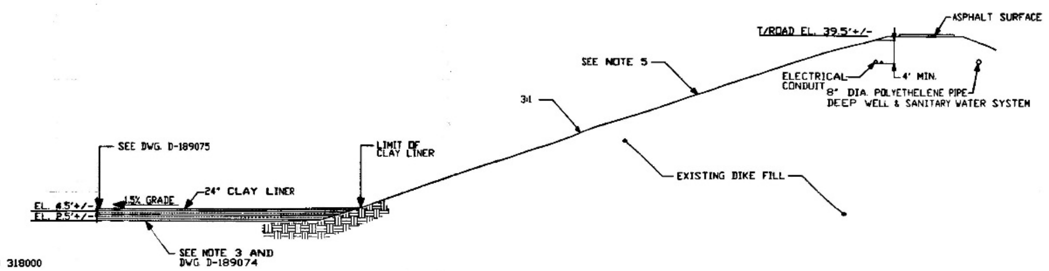
(xii) Known record of structural instability: There are no known instances of structural instability at the CCR unit.

Appendix


Davis Chapel Cem
The Horseshoe
Coleman Cem
Melody Lane Ch
Bear Pond
Black Creek Cooling Pond
POWERPLANT
Wolf Ridge Cem
Hudson Cem
Memorial Gardens Cem
Gray Bayou
Bayou
Copyright:© 2013 National Geographic Society, i-cubed
Plant Daniel Ash Pond
Ash Pond Location
USA Topo Maps
N
0 0.25 0.5 1 Miles



PLAN
SCALE 1"= 100'



SECTION A - A
SCALE 1" = 10'

NOTES:

1. ALL COORDINATES SHOWN ON THIS DRAWING ARE IN RELATIONSHIP TO REFERENCE MONUMENT TUNG-2 BASED UPON MISSISSIPPI STATE PLANE GRID.
2. PLUG 30" DIA. LOW LEVEL DISCHARGE PIPE LOCATED AT APPROXIMATELY EL. 6'.
3. PREPARE FOUNDATION PRIOR TO CLAY LINER PLACEMENT. SEE SPECIFICATIONS FOR DETAILS.
4. THE CONTRACTOR SHALL AVOID THE DEWATERING SYSTEM AND ASH SLUICE LINES DURING BACKFILL AND CLAY LINER PLACEMENT.
5. THE DIKE SLOPE SHALL BE FILLED AND GRADED WITH CLAYEY SOILS TO A 3.0 (HORZ.) TO 1.0 (VERT.) SLOPE PRIOR TO PLACEMENT OF THE BACKFILL AND CLAY LINER ON THE FOUNDATION.

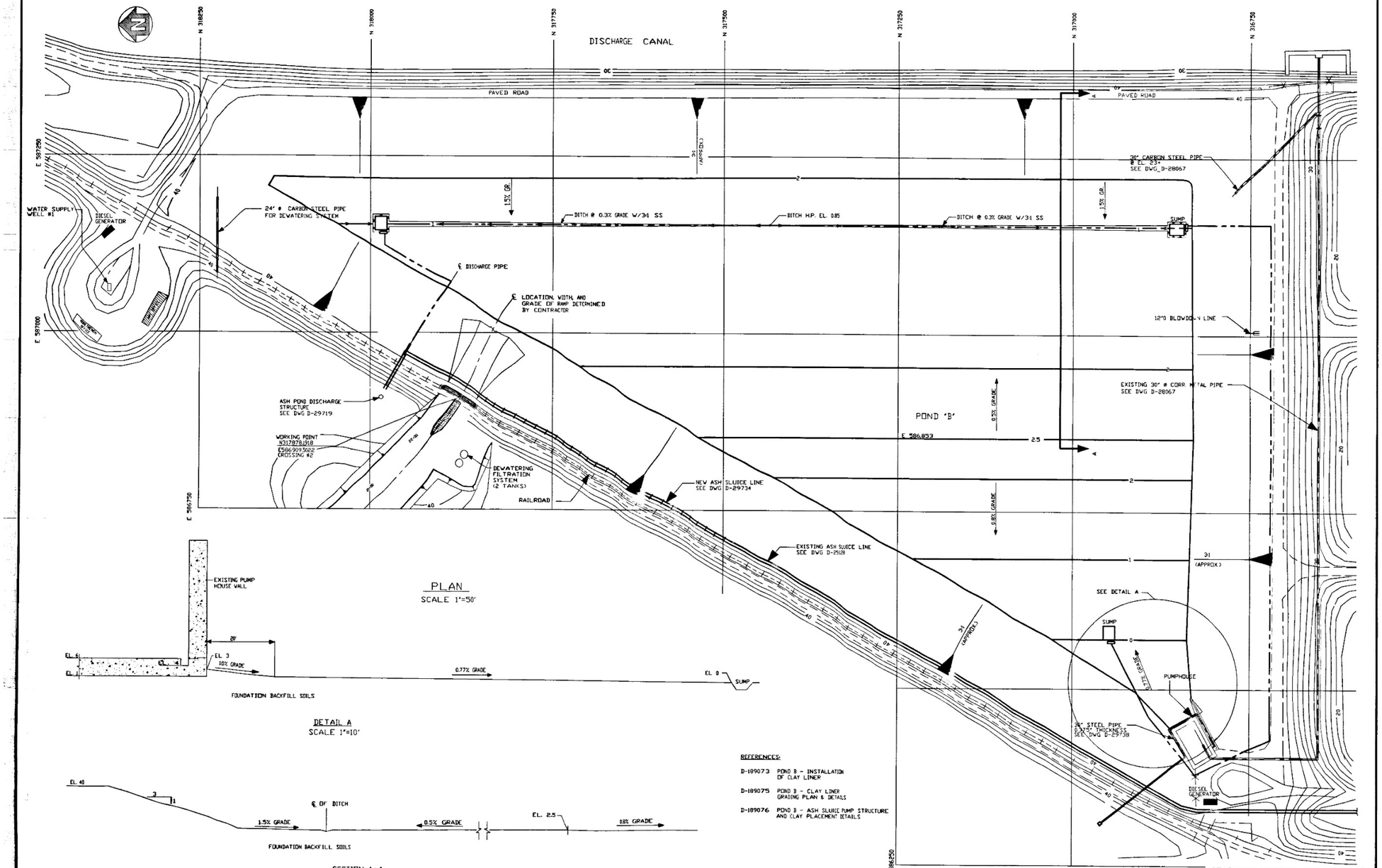
REFERENCES:

D-189071	CLAY BORROW AREA "C" - DESIGNATED USE OF MATERIAL
D-189074	POND B - FOUNDATION BACKFILL GRADING PLAN & DETAILS
D-189075	POND B - CLAY LINER GRADING PLAN & DETAILS
D-189076	POND B - ASH SLUICE PUMP STRUCTURE AND CLAY PLACEMENT DETAILS
D-29719	ASH POND DISCHARGE STRUCTURE
D-29769	ASH MANAGEMENT PROJECT - TEMPORARY HAUL ROAD
D-29787	POND B - EXCAVATION OF BOTTOM ASH
D-26793	OUTDOOR CONC ASH SLUICE PUMP HOUSE NEAT LINE SHT 1
D-26794	OUTDOOR CONC ASH SLUICE PUMP HOUSE NEAT LINE SHT 2

REV. 0 DATE 3-12-93
ISSUED FOR CONSTRUCTION
JOB NO. D092002

DRAWN M. WEEKS CHECKED J. MILLER DESIGNED D. BUTTS
APPROVED RMP DATE 3/10/93
APPROVED CLR DATE

SOUTHERN COMPANY SERVICES, INC. FOR
MISSISSIPPI POWER COMPANY
JOB PLANT DANIEL
DETAIL POND B - INSTALLATION OF CLAY LINER
SCALE AS SHOWN
SHEET 1 OF 1 SHEETS
SUPERSEDES
D- 189073



REFERENCES:

D-189073 POND B - INSTALLATION OF CLAY LINER

D-189075 POND B - CLAY LINER GRADING PLAN & DETAILS

D-189076 POND B - ASH SLUICE PUMP STRUCTURE AND CLAY PLACEMENT DETAILS

REV. 0	3-12-93	ISSUED FOR CONSTRUCTION
JOB NO.	D092002	

DRAWN D. CLICK CHECKED J. MILLER DESIGNED D. BUTTS

APPROVED [signature] DATE 4/6/93

APPROVED [signature] DATE

SOUTHERN COMPANY SERVICES FOR
MISSISSIPPI POWER COMPANY
JOB PLANT DANIEL
DETAIL POND B - FOUNDATION BACKFILL GRADING PLAN & DETAILS
SCALE AS SHOWN DWG
SHEET 1 OF 1 SHEETS
SUPERSEDES

D-189074

DISCHARGE CANAL

N 318250 | N 318000 | N 317750 | N 317500 | N 317250 | N 317000 | N 316750

E 587250 | E 587000 | E 586750 | E 586500 | E 586250

WATER SUPPLY WELL #1

DIESEL GENERATOR

ASH POND DISCHARGE STRUCTURE SEE DWG D-29719

WORKING POINT N3178781.918 E586969.5682 CROSSING #2

SEWATERING FILTRATION SYSTEM (2 TANKS)

RAILROAD

NEW ASH SLUICE LINE SEE DWG D-29734

EXISTING ASH SLUICE LINE SEE DWG D-25128

E LOCATION, WIDTH, AND GRADE OF RAMP DETERMINED BY CONTRACTOR

POND 'B'

E 586.853

0.5% GRADE

0.8% GRADE

1.5% GR.

30" CARBON STEEL PIPE @ EL 23' SEE DWG D-28867

12"Ø BLOWDOWN LINE

3H (APPROX.)

SEE DETAIL A

0.77% GRADE

PUMPHOUSE

36" STEEL PIPE 0.375" THICKNESS SEE DWG D-29738

DIESEL GENERATOR

PLAN
SCALE 1"=50'

EXISTING PUMP HOUSE WALL

EL. 5 | EL. 6 | EL. 4 | EL. 1 | EL. 3 | EL. 2

10:1

CLAY LINER

0.77% GRADE

24" CLAY LINER

FOUNDATION BACKFILL SOILS

DETAIL A
SCALE 1"=10'

EL 39.5

EXISTING DIKE FILL

3:1

EL. 4 | 1.5% GRADE | EL. 3 | 24" CLAY LINER | 0.5% GRADE | EL. 4.5 | 0.8% GRADE

FOUNDATION BACKFILL SOILS

SECTION A-A
SCALE: 1"=30'

REFERENCES:

D-189073 POND B - INSTALLATION OF CLAY LINER

D-189074 POND B - FOUNDATION BACKFILL GRADING PLAN & DETAILS

D-189076 POND B - ASH SLUICE PUMP STRUCTURE AND CLAY PLACEMENT DETAILS

REV.	DATE	DESCRIPTION
0	3-12-93	ISSUED FOR CONSTRUCTION JOB NO. 0092002

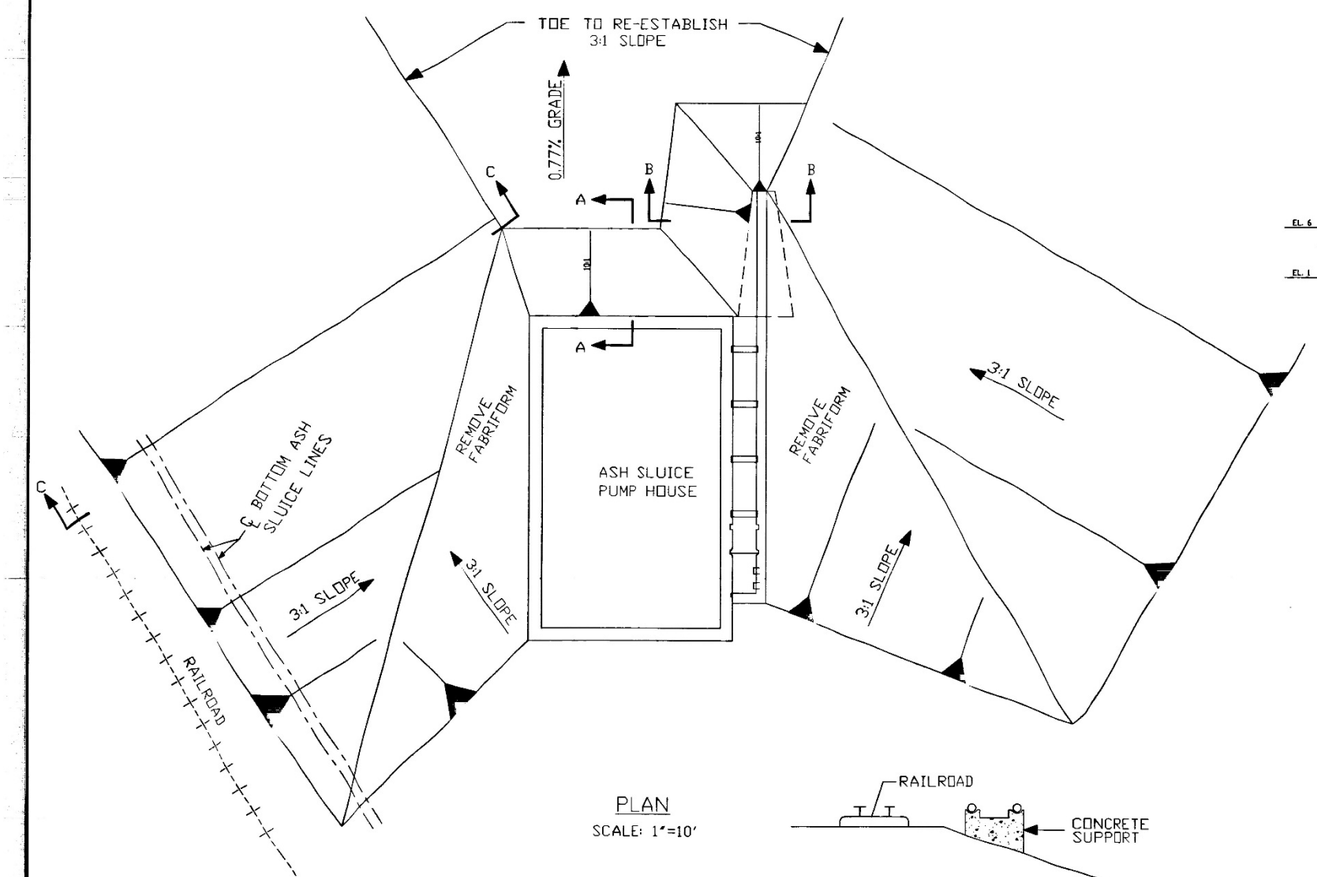
DRAWN B. CLICK | CHECKED J. MILLER | DESIGNED D. BUTTS

APPROVED | DATE

APPROVED | DATE

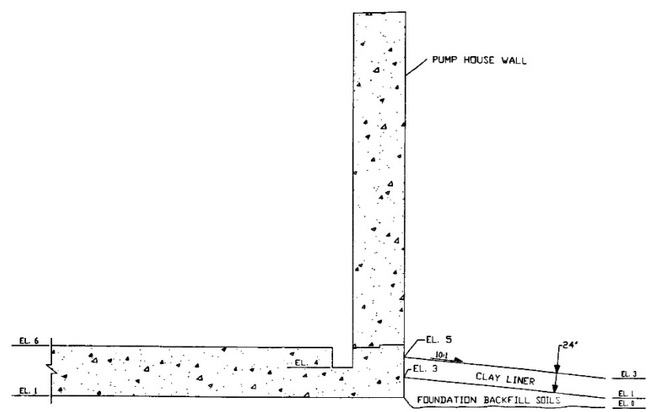
SOUTHERN COMPANY SERVICES FOR
MISSISSIPPI POWER COMPANY
JOB PLANT DANIEL
DETAIL POND B - CLAY LINER GRADING PLAN & DETAILS
SCALE AS SHOWN DWN
SHEET 1 OF 1 SHEETS
SUPERSEDES

D-189075



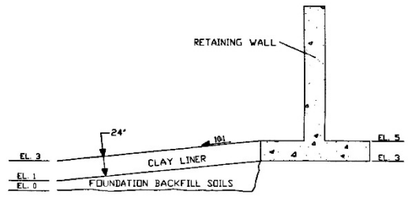
PLAN

SCALE: 1"=10'



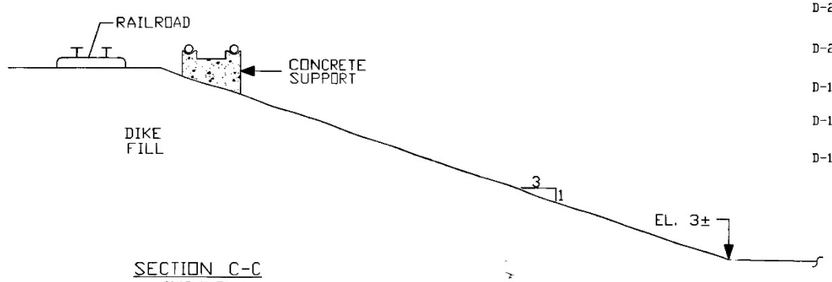
SECTION A-A

SCALE: 1"=5'



SECTION B-B

SCALE: 1"=5'



SECTION C-C

SCALE: 1"=5'

REFERENCES:

D-26793	OUTDOOR CONCRETE ASH SLUICE PUMP HOUSE NEAT LINE SHT 1
D-26794	OUTDOOR CONCRETE ASH SLUICE PUMP HOUSE NEAT LINE SHT 2
D-189073	POND B - INSTALLATION OF CLAY LINER
D-189074	POND B - FOUNDATION BACKFILL GRADING PLAN AND DETAILS
D-189075	POND B - CLAY LINER GRADING PLAN AND DETAILS

REV. 0 3-12-93
ISSUED FOR CONSTRUCTION
JOB NO. 10592002

DRAWN D. CLICK CHECKED J. MILLER DESIGNED D. BUTTS
APPROVED DATE
APPROVED DATE

SOUTHERN COMPANY SERVICES, INC. FOR
MISSISSIPPI POWER COMPANY
JOB PLANT DANIEL
DETAIL POND 'B' ASH SLUICE PUMP STRUCTURE AND CLAY PLACEMENT DETAILS
SCALE AS SHOWN
SHEET OF SHEETS
SUPERSEDES
D-189076

DISCHARGE CANAL

PAVED ROAD

PAVED ROAD

W-1 W-2 W-3 W-4 W-5 W-6 W-7 W-8 W-9 W-10 W-11 W-12 W-13 W-14 W-15

N 318250 N 318000 N 317750 N 317500 N 317250 N 317000 N 316750

E 397250 E 397000 E 396750 E 396500 E 396250

CAPPED

24"ø CARBON STEEL PIPE FOR DEWATERING SYSTEM

30" CARBON STEEL PIPE ø EL. 23±
SEE DWG D-28005

12"ø BLOWDOWN LINE
(D-28103)

WATER SUPPLY WELL #1

DIESEL GENERATOR

DETENTION POND LINES SPLASH PAD

BOTTOM ASH LINES SPLASH PAD

POND 'B'

NEW ASH SLUICE LINE
SEE DWG D-29734

EXISTING ASH SLUICE LINE
SEE DWG D-28120

WASTE LINE SPLASH PAD

WORKING POINT
N317878.918
E396929.5022
CROSSING #2

DEWATERING FILTRATION SYSTEM (2 TANKS)

RAILROAD

TEMPORARY HAUL ROAD
SEE DWG D-29769

PUMPHOUSE

30" STEEL PIPE
.375" THICKNESS
SEE DWG D-29736

DIESEL GENERATOR

LEGEND

DEWATERING WELL

NOTES:
1. LINER ANCHORS TO SLOPE AT EL. 92.
2. CONTRACTOR SHALL NOT DAMAGE DEWATERING SYSTEM, ASH SLUICE LINES, AND PIPELINES DURING DEPLOYMENT OF LINER.

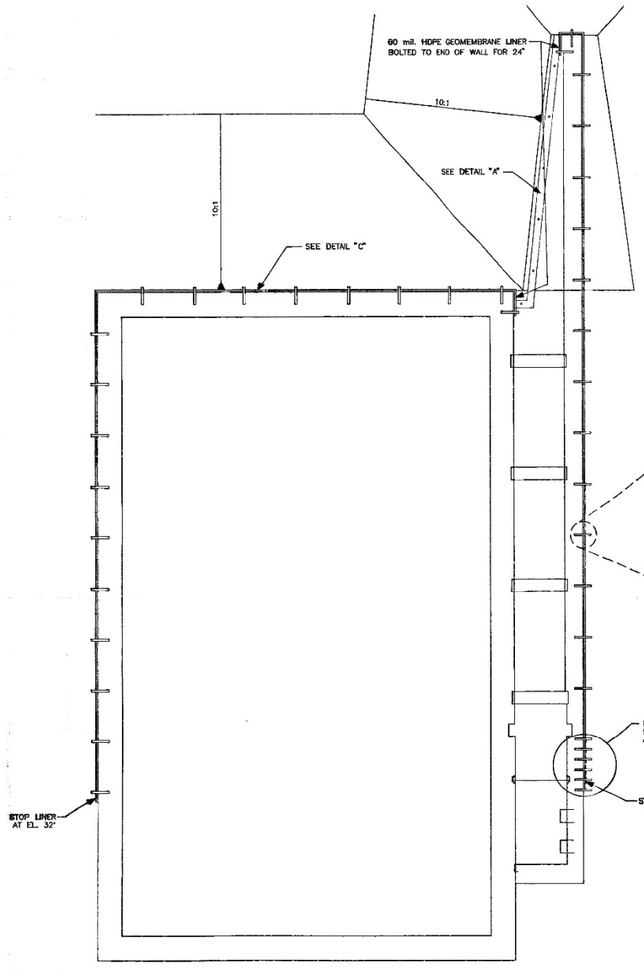
REFERENCES:
D-189078 DETAILS AT PUMP HOUSE STRUCTURE
D-189079 SLOPE AND PIPE DETAILS
D-189075 POND-B CLAY LINER GRADING PLAN AND DETAILS
D-189080 SPLASH PADS DETAILS

REV.	DATE	DESCRIPTION
0	04-22-93	ISSUED FOR CONSTRUCTION

DRAWN D. CLICK CHECKED JPW DESIGNED JPW
APPROVED [illegible] DATE
APPROVED [illegible] DATE 4/22/93

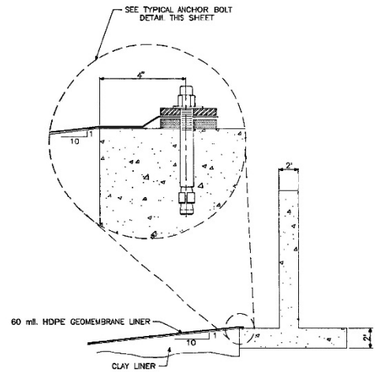
SOUTHERN COMPANY SERVICES FOR
MISSISSIPPI POWER COMPANY
JOB PLANT DANIEL
DETAIL POND B - SITE DRAWING
PLAN OF 60 MIL GEOMEMBRANE LINER
SCALE 1" = 50' B/M
SHEET OF SHEETS
SUPERSEDES

D-189077



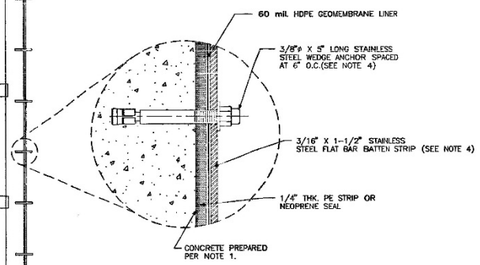
ASH SLUICE PUMP HOUSE

NOT TO SCALE



DETAIL "A" - ATTACHMENT TO HORIZONTAL CONCRETE SURFACE

SCALE IN FEET
0 5 10



DETAIL "B"

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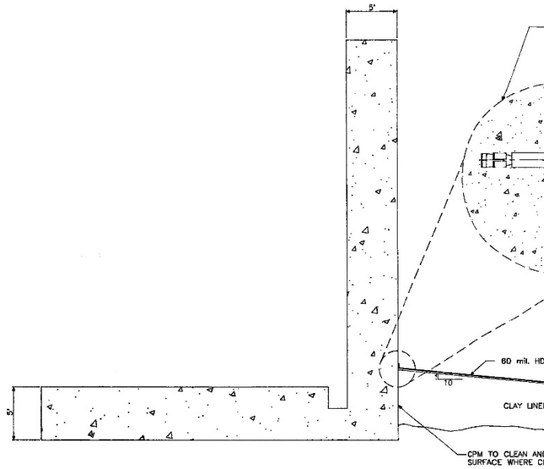
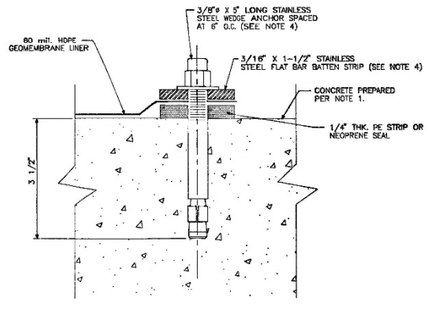


DETAIL "C" ATTACHMENT TO VERTICAL CONCRETE SURFACE

SCALE IN FEET
0 5 10



TYPICAL ANCHOR BOLT DETAIL

SCALE IN INCH
0 1 2

REFERENCES:

D-189077	POND B – PLAN OF 60 mil. GEOMEMBRANE LINER
D-189079	POND B – GEOMEMBRANE LINER – SLOPE AND PIPE DETAILS
D-189080	POND B – GEOMEMBRANE LINER – SPLASH PAD DETAILS
D-26793	OUTDOOR CONCRETE – ASH SLUICE PUMP HOUSE NEAT LINE SHT 1
D-26794	OUTDOOR CONCRETE – ASH SLUICE PUMP HOUSE NEAT LINE SHT 2
D-189076	ASH SLUICE PUMP STRUCTURE AND CLAY PLACEMENT DETAILS

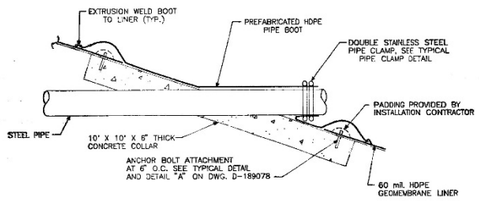
NOTES:

1. ALL PUMP HOUSE CONCRETE SURFACES UNDER THE POINT AT LINER ATTACHMENT SHALL BE THOROUGHLY CLEANED OF ANY FOREIGN SUBSTANCE OR DEBRIS. ALL CAVITIES SHALL BE GROUTED FLUSH USING A HIGH STRENGTH NON-SHRINK GROUT. ALL PROTRUSIONS SHALL BE REMOVED AND MADE FLUSH AND SMOOTH TO PROVIDE A LEVEL SURFACE FOR ATTATCHMENT.
2. ALL ANCHORS INSTALLED BY THE CONTRACTOR SHALL BE HILTI-QUIK BOLTS AS SPECIFIED ON THIS DRAWING AND INSTALLED BY THE MANUFACTURER'S SPECIFICATIONS.
3. ALL HOLES IN LINER, BATTEN STRIP AND NEOPRENE SEAL SHALL BE DRILLED TO 3/8 INCH DIAMETER.
4. BOLTS AND NUTS SHALL BE ASTM A-193 GRADE 316 OR 317 STAINLESS STEEL. FLAT BAR BATTEN STRIP SHALL BE A-276 GRADE 316 OR 317 STAINLESS STEEL. ALL BOLTS, NUTS AND STRIPS SHALL HAVE MATCHING GRADES.

REV.0 4-22-93
ISSUED FOR CONSTRUCTION

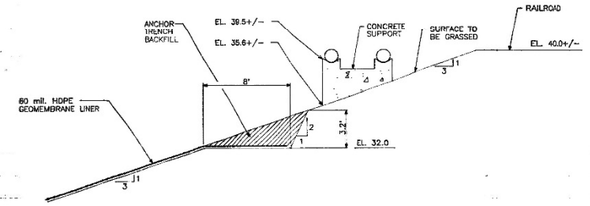
DRAWN D.M.C. CHECKED J.P.M. BLUELINED J.P.M.
APPROVED PMP DATE 4/22/93
APPROVED DATE
SUPERSEDES

SOUTHERN COMPANY SERVICES, INC. FOR
MISSISSIPPI POWER COMPANY
JOB PLANT DANIEL
DETAIL POND B – GEOMEMBRANE LINER
DETAILS AT PUMP HOUSE STRUCTURE
SCALE AS SHOWN DWG
SHEET OF SHEETS
D- 189078



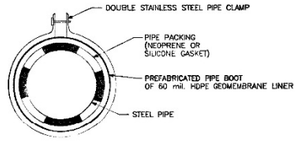
TYPICAL PIPE PENETRATION DETAIL

NOT TO SCALE



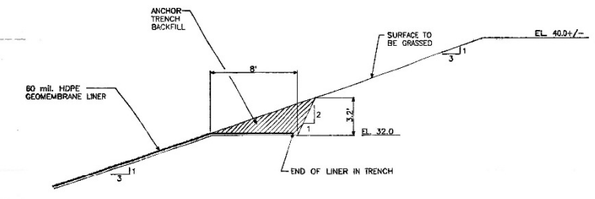
ANCHOR TRENCH DETAIL AT PIPE SUPPORT LOCATION

SCALE IN FEET
0 5 10



TYPICAL PIPE CLAMP DETAIL

NOT TO SCALE



TYPICAL ANCHOR TRENCH DETAIL

SCALE IN FEET
0 5 10

REFERENCES:

D-189077	POND B – PLAN OF 60 mil. GEOMEMBRANE LINER
D-189078	POND B – GEOMEMBRANE LINER – DETAILS AT PUMP HOUSE STRUCTURE
D-189080	POND B – GEOMEMBRANE LINER – SPLASH PAD DETAILS
D-189073	POND B – INSTALLATION OF CLAY LINER
D-28067	PIPING – ASH PUMP SLUICE SUCTION
D-29738	PIPING – TEMPORARY ASH SLUICE PUMP SUCTION

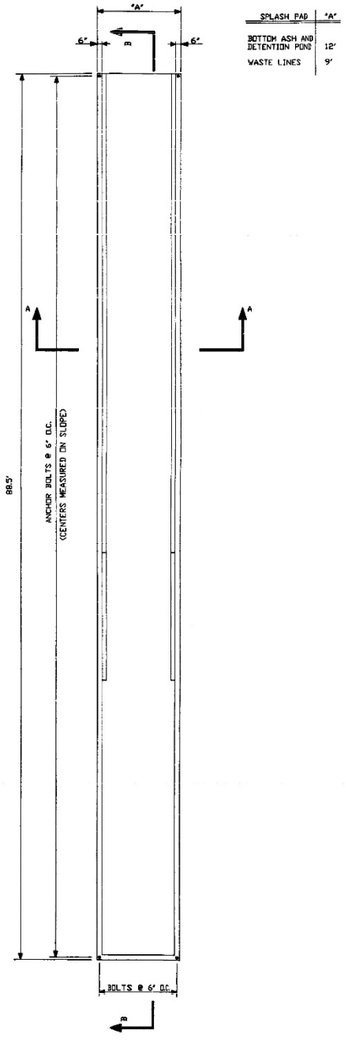
NOTES:

1. GRASSING PROVIDED BY SEPARATE CONTRACT.
2. ANCHOR TRENCH BACKFILL TO BE DONE IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION.
3. INSTALLATION CONTRACTOR TO PLAN, PROCURE, AND INSTALL THE PRE-FABRICATED PIPE BOOT.

REV.0	4-22-93	ISSUED FOR CONSTRUCTION

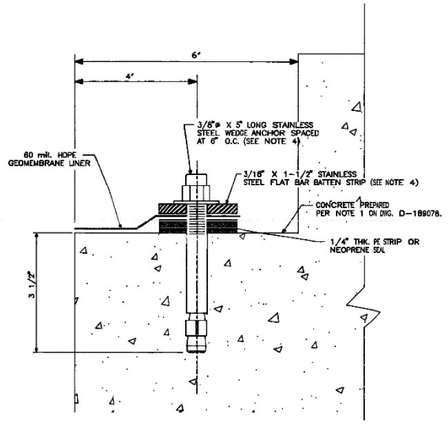
DRAWN D.M.C. CHECKED J.P.M. DESIGNED
APPROVED DMP 12-22-92 DATE
APPROVED DATE
4/22/93

SOUTHERN COMPANY SERVICES, INC. FOR
MISSISSIPPI POWER COMPANY
JOB PLANT DANIEL
DETAIL POND B – GEOMEMBRANE LINER SLOPE AND PIPE DETAILS
SCALE AS SHOWN W/P
SHEET OF SHEETS
SUPERSEDES
D-189079

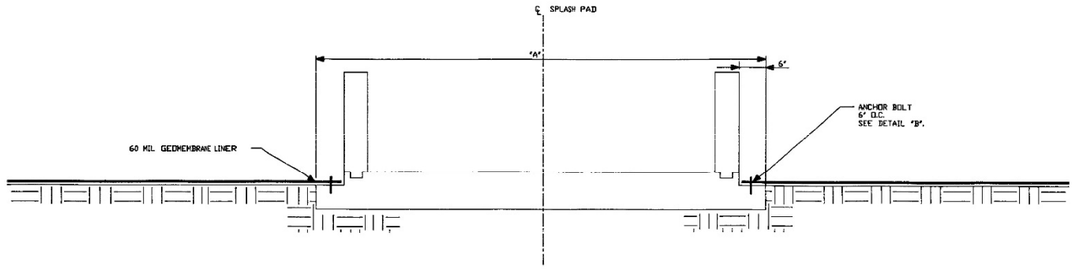


SPLASH PAD	"A"
BOTTOM ASH AND DETENTION PONDS	12'
WASTE LINES	9'

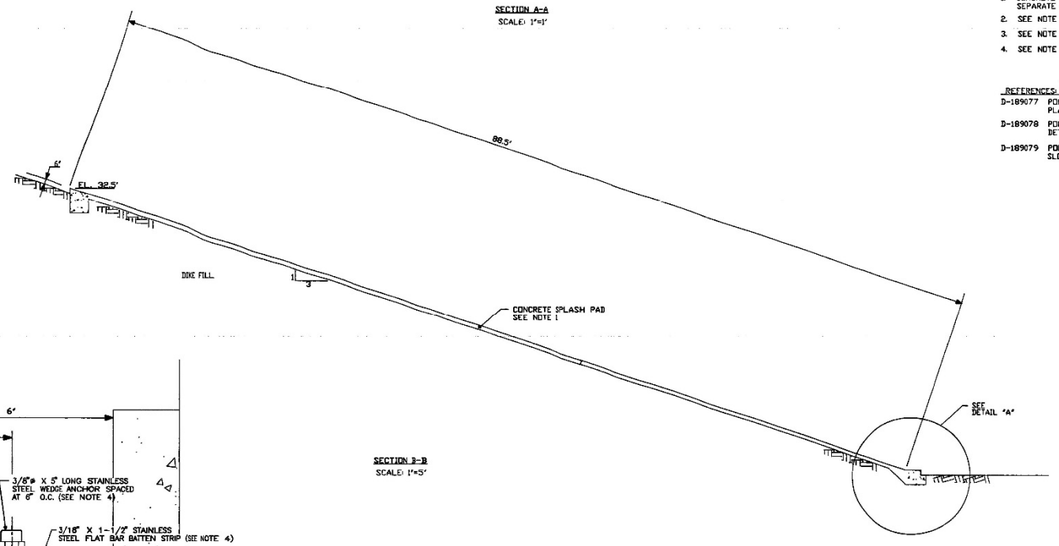
PLAN
SCALE: 1"=5'



DETAIL "B" - TYPICAL ANCHOR BOLT DETAIL
NTS



SECTION A-A
SCALE: 1"=1'



SECTION B-B
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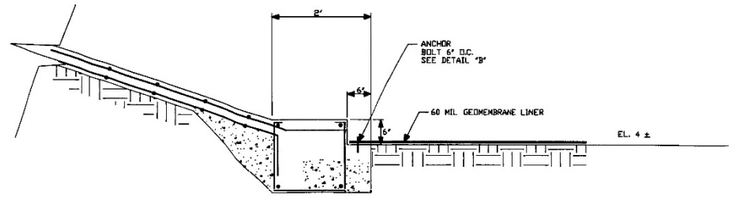


DETAIL "A"
SCALE: 1"=1'

NOTES:
1. CONCRETE SPLASH PADS INSTALLED BY SEPARATE CONTRACT.
2. SEE NOTE 2 ON DWG. D-189078.
3. SEE NOTE 3 ON DWG. D-189078.
4. SEE NOTE 4 ON DWG. D-189078.

REFERENCES:

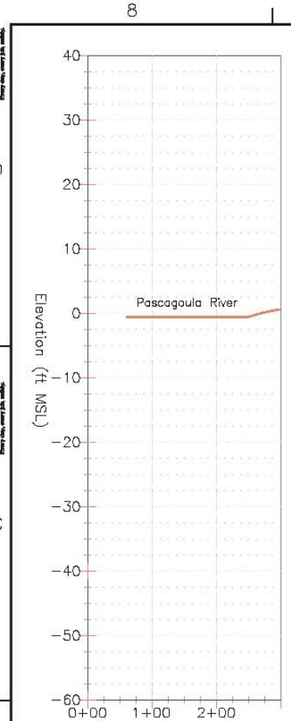
D-189077	POND B - SITE DRAWING PLAN OF 60 MIL GEOMEMBRANE LINER
D-189078	POND B - GEOMEMBRANE LINER DETAILS AT PUMP HOUSE STRUCTURE
D-189079	POND B - GEOMEMBRANE LINER SLOPE AND PIPE DETAILS

REV.	DESCRIPTION	DATE
1	CHANGED CAST IN PLACE BOLTS TO TYP ANCHOR BOLTS	08/06/93
0	ISSUED FOR CONSTRUCTION	4-22-93

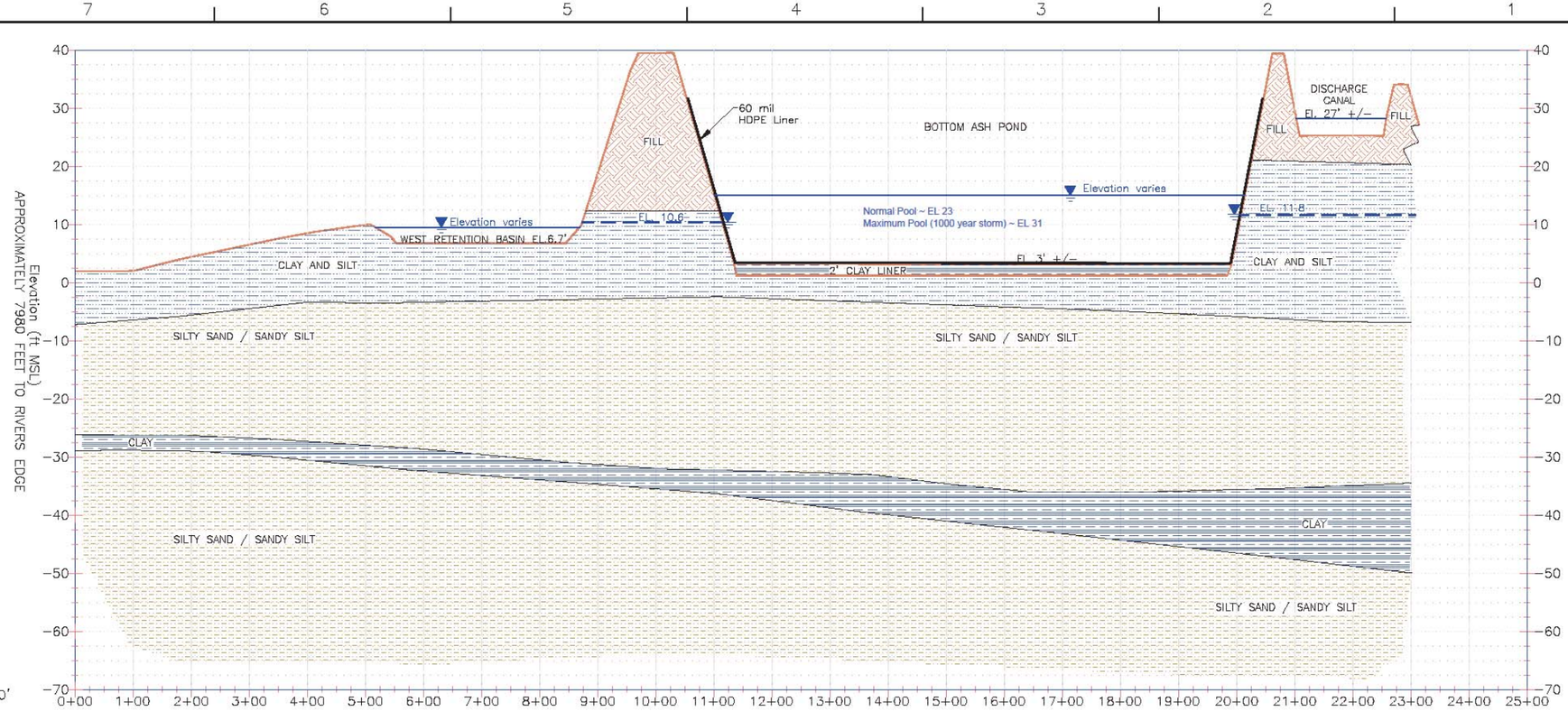
JDB

DRAWN DMC | CHECKED JPM | DESIGNED JPM
APPROVED RPM | CLR JCM DATE
APPROVED REP JRK | RMF DATE 4/22/93

SOUTHERN COMPANY SERVICES, INC. FOR
MISSISSIPPI POWER COMPANY
FOR PLANT DANIEL
DETAIL POND B - GEOMEMBRANE LINER
SPLASH PAD DETAILS
SCALE AS SHOWN
SHEET OF SHEETS
SUPERSEDES
D-189080



SECTION SCALE
HORZ: 1" = 100' VERT: 1"= 10'



REVISION	DATE

REVISION	0	DATE	04/29/2016
ISSUED FOR REVIEW			

BY	CHK'D	CIVIL APPR	ELECT APPR	I/C APPR	MECH APPR	DISC MGR

BY	CHK'D	CIVIL APPR	ELECT APPR	I/C APPR	MECH APPR	DISC MGR
ASF	JAL					

Southern Company Generation
Engineering and Construction Services
FOR
Mississippi Power Company

PLANT DANIEL
BOTTOM ASH POND AREA
GEOLOGIC CROSS SECTION

SCALE	DRAWING NUMBER	SHEET	CONT'D	REV
NONE	**ES2882**	1	FINAL	0

ANSI D 34X22 Civil 2013

INQUIRY NO. SS-373-DAN

SOUTHERN COMPANY SERVICES, INC.

BIRMINGHAM, ALABAMA

FOR

INSTALLATION OF GEOMEMBRANE LINER

AT POND B

FOR

PLANT DANIEL

OF

MISSISSIPPI POWER COMPANY

PREPARED BY: _____ DATE: April 22, 1993

REVIEWED BY: _____ DATE: April 22, 1993

APPROVALS:

	INITIAL	DATE
Project Engr. Manager		4-22-93
Project Civil Engr.	RMF	4-22-93

REVISIONS:

NO.	DESCRIPTION	BY	REVIEWED	DATE
0	Issue for Construction		RMF	4/22/93

Revision 0
April 23, 1993

MISSISSIPPI POWER COMPANY

PLANT DANIEL

POND B

TECHNICAL SPECIFICATION

INSTALLATION OF GEOMEMBRANE LINER

INQUIRY NO. SS-373-DAN

1.0 SCOPE

1.1 OBJECTIVE

A 60 mil High Density Polyethylene (HPDE) geomembrane liner system shall be installed on a properly prepared clay liner foundation in the Bottom Ash Pond B. The geomembrane liner shall be installed to the guidelines and requirements stated in this specification.

1.2 WORK ACTIVITIES

1) Submittal of installation drawings showing the plan of the panel arrangement and details for the seaming of sheets along the dike slope and foundation surface.

2) Mobilization of equipment, materials and labor to site to provide the installation service. (See Paragraph 3.1 for conditions and limitations).

3) Procure the 60 mil geomembrane liner, along with plans to transport the liner to the site, inspect the material after arrival, and plans for unloading and storage at the site.

4) Installation of the geomembrane liner in accordance with approved design drawings on the clay liner foundation.

5) Quality Control testing of the liner and locating the defects, if any, after the installation work and repairing these defects.

1.3 WORK BY OTHER CONTRACTORS

Concurrent with work under this contract, other work will be in progress. The Installation Contractor shall cooperate with all other work forces.

Work which will be performed concurrent with work under this contract.

1) Modifications to the bottom ash pipelines and supports.

2) Operations and maintenance of the dewatering system.

3) Final clay liner earthwork operations to support the geomembrane liner installation.

4) Final grading and preparation of the dike slopes (3.0 Hor. to 1.0 Vert.) to support the geomembrane liner installation.

5) Construction of splash pads along dike slope.

6) Construction of the anchor trench and the backfill work.

7) Periodic use of railroad by the Mississippi Export Railroad Company which supplies coal to the power plant.

8) Periodic inspections by Mississippi Power Company for the plant service well, railroad, and the fly ash Pond A.

1.4 DEFINITION OF TERMS

The terms used in these Specifications shall be interpreted and understood as stated:

1) Owner - denotes Mississippi Power Company.

2) Construction Project Manager (CPM) - denotes the on-site manager of the project representing Mississippi Power Company.

3) Engineer - denotes Southern Company Services representative for design of the work.

4) Manufacturer - the entity that manufactures the HDPE geomembrane that will be used in the project.

5) Installation Contractor - is defined as an approved contractor trained and licensed to install the geomembrane by the manufacturer.

6) Installation Supervisor - is defined as an individual employed by the Installation Contractor qualified to supervise the installation and having the experience with the geomembrane installation as stated in Section 3.2.2.

7) Inspector - an individual employed by the Owner, serving as a third party contractor on behalf of the Owner, who is knowledgeable with the installation of HDPE liners. This individual shall be responsible for inspecting the installation of the geomembrane liner to fully insure the proper and complete work under this contract and herein described in these specifications.

8) Earthwork Contractor - is defined as the entity that is awarded a contract for the Ash Management Project to support earthwork operations in and around the Pond B area.

1.5 LIST OF DRAWINGS

The following drawings shall be used by the Installation Contractor for planning and installing the geomembrane liner.

Drawing No.	Title
D-189077	Pond B - Site Drawing Plan of 60 mil Geomembrane Liner
D-189078	Pond B - Geomembrane Liner Details at Pump House Structure
D-189079	Pond B - Geomembrane Liner Slope and Pipe Details
D-189080	Pond B - Geomembrane Liner Splash Pad Details

1.6 SITE CONDITIONS

The Contractor shall be responsible for familiarizing himself with the existing site conditions prior to mobilization and execution of this Contract.

The Contractor shall not damage, in any way, the dewatering system installed along the inside crest of the dike at Pond B. Damages to a well, collector pipe, electrical system (480 voltage), or any related parts to the system and the resulting repair shall be completely paid for by the Installation Contractor to the Dewatering Contractor. Damage to the dewatering system during the deployment work and installation activities for the geomembrane liner could result in serious problems for the

safety and integrity of the dike slope, foundation bottom, and the clay liner system. It shall be the responsibility of the Installation Contractor to fully pay to the Owner the costs for repairs to the dike, foundation, and clay liner that results from damage to the dewatering system and is due to the Installation Contractor's operations and work activities.

Likewise, the Installation Contractor shall be responsible for the costs to repair any damages to the ash sluice lines and supports, pipelines, and concrete structures that result from the Contractor's operations and work activities. All costs shall be paid to the Owner.

1.7 PREVIOUS FIELD INVESTIGATIONS AND REPORTS

Several field investigations have been performed around the plant site area during the past twenty years. Test boring and test pit investigations have been performed. A drawing showing the test boring and test pit locations is available for inspection at the plant site. The associated soil logs and investigation reports are also available for review and inspection. The Owner assumes no responsibility for the accuracy of the explorations, the resulting data, or the interpretation thereof; nor does he guarantee that the materials will not vary from those indicated by the explorations. In addition the Owner will not be responsible for any deduction, interpretation, or conclusion drawn therefrom by the Installation Contractor.

2.0 CODES AND STANDARDS

The codes and standards referred to in these Specifications shall govern in the applicable cases. In the case of a conflict between codes and standards with the Specifications and/or accompanying drawings, then the Specifications and drawings shall govern to the extent of such differences. It is the Contractor's responsibility to inform the Owner of any code or standard revision affecting the requirements of the Specifications.

The codes and standards of the following agencies are to be considered a part of these Specifications:

1) American Society for Testing and Materials, Section 4, Volume 04.08, 1990 Edition.

2) Environmental Protection Agency

3) Occupational Safety and Health Administration

4) National Sanitation Foundation

5) Federal Test Method Standards

3.0 DESIGN REQUIREMENTS

3.1 GENERAL

These specifications describe parameters for the manufacture, supply, and installation of a 60 mil thick High Density Polyethylene (HDPE) geomembrane liner system. These specifications require the Installation Contractor to supply all labor, geomembrane liner materials, transportation, handling, storage, supervision, tools, and other equipment that may be necessary to install and test the liner installation as described herein, in the associated plans, and in the engineering drawings. All operations by the Installation Contractor shall be in strict accordance with these specifications, plans, and drawings.

The proposed liner system is designed for an approximate 22 acre bottom ash storage pond. The geomembrane liner shall be installed on top of a 24 inch thick clay liner and along the dike slopes from approximately El. 3.5 to El. 32.

3.2 QUALIFICATIONS OF CONTRACTOR WORK ACTIVITIES

3.2.1 Manufacturing

The Manufacturer shall be listed by the National Sanitation Foundation as having met Standard 54 for Flexible Membrane Liners, and shall have at least five (5) years continuous experience in the manufacture of HDPE geomembrane rolls and\or experience totaling 10,000,000 square feet of manufactured HDPE geomembrane. The Manufacturer shall permit the Owner or his authorized representatives to visit the manufacturing plant.

3.2.2 Installation

The Installation Contractor shall be an approved contractor trained and licensed to install the manufacturer's geomembrane.

Installation shall be performed under the constant direction of a Field Installation Supervisor who shall remain on site and be responsible, throughout the liner installation, for liner layout, seaming, patching, testing, repairs, and all other activities by the Installation Contractor. This Installation Supervisor shall have installed or supervised the installation and seaming of a minimum of 3,000,000 square feet of HDPE geomembrane. Actual seaming shall be performed under the

direction of a Master Seamer (who may also be the Installation Supervisor) who has seamed a minimum of 2,000,000 square feet of HDPE geomembrane, using the same type of seaming apparatus specified in the current project. This Installation Supervisor and/or Master Seamer shall be present whenever seaming is performed.

3.3 SUBMITTALS

3.3.1 Manufacturer

The Installation Contractor shall obtain the following information from the Manufacturer:

1. Submittals with Bid Documents

   A. Information on factory size, equipment, personnel, number of shifts per day, and capacity per shift.

   B. Quality control program and manual, or descriptive documentation.

   C. List of material properties and samples of the 60 mil HDPE liner.

   D. A list documenting no less than 10 completed facilities totaling a minimum of 3,000,000 square feet. Each entry in this list should specify the name and purpose of the facility, its location and date of installation, the name of the owner, the project manager, designer, fabricator (if any), and the installer, as well as the name and telephone number of the contact at the facility who can discuss the project. In addition, the geomembrane thickness and total square footage of the installation surface should be included.

2. Submittals After Contract Award, Prior to Liner Installation

   A. Raw Materials:

   - Certification that all resin used in the manufacture of geomembrane for this job meets the specifications.

   - Copy of quality control certificates issued by the HDPE resin supplier.

   - Production date(s) of the HDPE resin.

- Reports on the tests conducted to verify the quality of the HDPE resin used to manufacture the geomembrane rolls and extrudate assigned to the considered facility.

- Statement that no reclaimed polymer is added to the resin during the manufacture of the actual geomembrane to be used in this project, (however, the use of polymer recycled during the manufacturing process may be permitted if done with appropriate cleanliness and if recycled polymer does not exceed two (2) percent by weight).

B. Geomembrane Roll Production:

Copy of quality control certificates in conformance with Sections 4.2 and 4.5.

The quality control certificate shall include:

- roll numbers and identification;

- a properties sheet including, at a minimum, all specified properties measured using test methods indicated in the specifications, or equivalent;

- a list of quantities and descriptions of materials other than the base polymer which comprise the geomembrane;

- the sampling procedure and results of testing;

- certification that property values given in the properties sheet are guaranteed by the manufacturer;

- the signature of a responsible party employed by the manufacturer, such as a Production Manager; and

- certification that the geomembrane and extrudate produced for this project have the same properties.

3.3.2 Installation Contractor

The Installation Contractor shall provide the following written information:

1. Submittals With Bid Documents

   Certification that both the Installation Supervisor for the Installation Contractor and the Master Seamer have reviewed the Quality Assurance Plan, the design drawings and these specifications which should include the following:

   A. Brief historical background of company

   B. Insurance coverage

   C. Installation capabilities

   D. Information on equipment and personnel.

   E. The Contractor shall also provide a list of seam properties and test methods employed.

2. Qualification Proof (Submitted with Bid Documents)

   A list of at least 10 completed facilities, totaling a minimum of 3,000,000 square feet for which the Installation Contractor has installed an HDPE geomembrane. For each installation, the following information shall be provided:

   A. Name and purpose of facility, its location, and date of installation.

   B. Name of Owner, Design Engineer, Manufacturer, Fabricator, if applicable, and name and telephone number of contact at the facility who can discuss the project.

   C. Thickness of geomembrane and surface area of the installed geomembrane.

   D. Type of seaming, patching, and tacking equipment.

   E. A copy of the Manufacturer's and/or Fabricator's approval letter(s) and/or license(s), if applicable.

   F. Resume of the qualifications of the Installation Supervisor and Master Seamer to be assigned to this project.

3. Submittals by Installation Contractor prior to Commencement of Installation

A. Proposed installation panel layout identifying seams and concurrence with the details around obstructions provided with the bid package.

B. Any proposed variance or deviation from the design documents shall be submitted in writing by the Contractor to the CPM a minimum of seven (7) working days prior to the scheduled start of geomembrane installation and will be accepted/rejected by the CPM prior to start of installation activities.

3.4 MEETING

A daily meeting shall be held at the CPM field office just prior to commencement of the work day. At minimum, the meeting will be attended by the Installation Contractor and the Inspector. The purpose of the meeting is to:

1. Review the work activity and location for the day.

2. Discuss the Contractor's personnel assignment for the day.

3. Review the previous day's activity.

4. Review the work schedule.

5. Discuss possible problem areas and situations.

3.5 WARRANTY

A written Warranty shall be submitted to the Owner from the Manufacturer (for material) and the Installation Contractor (for workmanship). These documents shall warrant both the quality of the material and workmanship for a specified duration of time.

4.0 MATERIAL SPECIFICATIONS

4.1 MATERIALS

1. The geomembrane shall be a 60 mil thick High-Density Polyethylene.

2. Gasket material shall be neoprene, closed cell medium, 1/4 inch thick, 50 foot lengths with adhesive on one side.

3. Metal battens or straps and hardware shall be ASTM A-276 Grade 316 or 317 stainless steel.

4. Water cut-off mastic shall be a Neoprene Flashing Cement.

5. Sealant shall be General Electric Silicone, RTV 103 or approved equal.

6. 3/8 inch diameter x 3 1/2 inch long ASTM A-193 Grade 316 or 317 stainless steel wedge anchor and nuts (Hilti Bolts per Manufacturer's specifications).

4.2 GEOMEMBRANE RAW MATERIALS

The geomembrane shall be manufactured of new, first-quality resin containing no more than two(2) percent clean recycled Polymer by weight and produced in the United States. The geomembrane shall be compounded and manufactured specifically for the intended purpose. The resin manufacturer shall certify each batch for the following properties.

The High Density Polyethylene (Compounded) resin shall meet the following specifications:

Property	Test Method	Requirements
Specific Gravity	(ASTM* D 729 or ASTM D 1505	>0.940
Melt Index	(ASTM D 1238 Condition E	<0.4 g/10 min.
Carbon Black Content	(ASTM D 1603)	2 - 3%

4.3 ROLLS

The geomembrane shall be a minimum 22.5 ft. seamless width High Density Polyethylene, as manufactured by the Gundle, SLT, National Seal, or Poly-America Companies, or an approved equal. Carbon black shall be added to the resin if the resin is not compounded for ultra-violet resistance. The geomembrane rolls shall meet the following specifications:

1. The surface of the geomembrane shall not have striations, roughness, pinholes, or bubbles and shall be free of holes, blisters, undispersed raw materials, or any contamination by foreign matter; except that if in the opinion of the Inspector the blemish will not adversely affect properties and use of the geomembrane, the Inspector may accept the geomembrane after sufficient laboratory test data are provided to support such acceptance, and further provided all such testing is done at the sole expense of the Contractor.

2. The geomembrane shall be supplied in rolls. Labels on each roll shall identify the thickness of the material, the length and width of the roll, batch and roll numbers, and name of manufacturer.

3. The geomembrane rolls shall meet the following properties:

TYPICAL PROPERTIES: 60 mil liner

Property	Test Method	Test Results*
Thickness, mils, minimum	ASTM D 1593	54
Density (g/cc), minimum	ASTM D 1505	0.94
Melt Index (g/10 min., max.)	ASTM D 1238	0.4
Carbon Black content (%)	ASTM D 1603	2-3
Carbon Black Dispersion	ASTM D 3015	A-2
Tensile Properties	ASTM D 638	
1. Tensile Strength at Yield (pounds/inch width)	Type IV specimen at 2 inches/minute	150
2. Tensile Strength at Break (pounds/inch width)		250
3. Elongation at Yield (%)		13
4. Elongation at Break (%)		750
5. Modulus of Elasticity (1% secant; pounds/square inch)		90,000
Tear Strength (lbs.)	ASTM D 1004 Die C	47
Puncture Resistance(lbs.)	**FTMS 2031,(2065)	260,(90)
Hydrostatic Resistance	ASTM D 751	495
Low Temp. Brittleness	ASTM D 746	<-94°F
Dimensional Stability (% change max.)	ASTM D 1204 212°F, 15 min.	±1
Volatile Loss (%)	ASTM D 1203	0.4
Resistance to Soil Burial (% change max. in orig. val.)	ASTM D 3083 type IV specimen	

A. Tensile Strength at Yield & Break	at 2 inches/minute	10
B. Elongation at Yield & Break		10
Ozone Resistance	ASTM D 1149 7 days, 1000 pphm 104°F, bent loop	no cracks
Environmental Stress Crack (hours)	ASTM D 1693 Condition C (modified NSF 54)	>2000
Water Absorption (% change max in original weight)	ASTM D 570	0.1
Coefficient of Linear Thermal Expansion (cm/cm °c)x10 -4	ASTM D 696	1.2
Moisture Vapor Transmission Rate (g/100 in^2 day)	ASTM E 96 100° F,100% relative humidity	0.020

*All values except when specified as minimum or maximum, represent average lot property values.

**Federal Test Method Standards

4.4 FIELD SEAMS

4.4.1 The field seams shall meet the following specifications:

Seam Property	Test Method	Requirements
Shear Strength	ASTM D 3083 (as modified in App. A of NSF 54*)	>95% of liner minimum yield strength, Film Tear Bond**
Peel Strength	ASTM D 413 (as modified in App. A of NSF 54*)	>70% of liner min. Yield

*National Sanitation Foundation, Standard 54; "Flexible Membrane Liners."

**Film Tear Bond (FTB) is defined as failure of one of the sheets by tearing, instead of separating from the other sheet at the weld interface area (sheet fails before weld).

4.4.2 Seam Details and Field Seam Testing by Contractor:

1. Shear seam specimens are 1 inch wide, with a grip separation of 4 inches plus the width of the seam. The seam is to be centered between the clamps. The grip separation rate is 2 ipm.

2. Both shear seam strength and peel tests shall be run on five replicate specimens. A break through the weld or at the weld-sheet interface shall be considered a Non-FTB (failure) in both seam strength (shear) and peel strength tests.

3. Approved field seaming process are hot shoe fusion welding and extrusion welding.

4. Welding rods or beads used for extrusion welding shall be HDPE and the physical properties shall be the same as those of the resin used in the manufacture of the HDPE geomembrane.

4.5 QUALITY CONTROL SPECIFICATIONS FOR THE MANUFACTURER

4.5.1 Raw Materials

The following subparagraphs give the specifications for the individual components for the manufacture of the HDPE liner.

4.5.1.1 Resin

All resins for use in the geomembrane liner must pass a candidate pre-approval process before being eligible for use. The following testing shall be performed and compared to the manufacturer's specifications:

1. Density: ASTM D 1505.

2. Melt Index: ASTM D 1238.

4.5.1.2 Additives

All additives and concentrates must pass a candidate pre-approval process. All incoming materials are to be statistically sampled with the following testing performed and compared to the manufacturer's specifications:

1. Density: ASTM D 1505.

2. Melt Index: ASTM D 1238.

3. Carbon Black Content: ASTM D 1603.

4.5.2 Finished Product: On-Line During Production

4.5.2.1 Coverage

A minimum of one person from the Quality Control Department, independent of the Production Department, shall be present for on-line inspection of every roll for 100% of every run.

4.5.2.2 Inspection

Performed on each roll.

1. Thickness

   A full width sample shall be cut from the end of each roll, and thickness shall be checked across the entire sample.

2. Appearance

   Constant monitoring of:

   a. Sheet surface appearance.

   b. Knife-cut edge.

   c. Folds, holes, creases, abrasions, or other damage.

4.5.2.3 Roll Identification

The Quality Control Inspector controls all paperwork, including roll tags. Four tags per roll shall be used.

1. On the roll sleeve.

2. Inside the core.

3. On the production roll sample.

4. On the roll surface.

4.5.2.4 Out-of-Specification Material

Any roll not meeting the specification for any of the above inspections shall be placed on hold.

4.5.3. Finished Product: Laboratory Testing During Production

4.5.3.1 Sampling

The lab shall take samples at approximately every 50,000 square feet of produced material, as well as any other samples needed.

4.5.3.2 Testing

On each sample:

1. Thickness: ASTM D 374 or ASTM D 1593
2. Tensile Properties: ASTM D 638
    a. Tensile Strength at Yield
    b. Tensile Strength at Break
    c. Elongation at Yield
    d. Elongation at Break
3. Tear Resistance: ASTM D 1004, Die C
4. Puncture Resistance: FTMS 101C 2031/FTMS 101C 2065
5. Carbon Black Content: ASTM D 1603

    On daily basis:

    1. Density: ASTM D 1505, twice per day
    2. Melt Index: ASTM D 1238, twice per day
    3. Carbon Black Dispersion: ASTM D 3015, twice per day
    4. Dimensional Stability: ASTM D 1204, twice per day
    5. Modulus of Elasticity (Secant Modulus), once per day

4.5.3.3 Reporting

All results shall be logged into the batch file. Any testing that yields out-of-specification results shall be brought to the immediate attention of the Quality Control Manager. All material produced after the last sample meeting and all specifications shall be retrieved and placed on hold.

4.5.4 Finished Product: Laboratory Testing Post-Production

4.5.4.1 Sampling

Samples shall be taken at random from each batch.

4.5.4.2 Testing

1. Soil Burial: ASTM D 3083

2. ESCR: ASTM D 1693

3. Low temperature: ASTM D 746

4.5.4.3 Reporting

All results shall be logged into the batch file. These results shall be the official properties for that batch. Any batch that fails any specification shall be placed on hold for further evaluation.

5.0 GEOMEMBRANE INSTALLATION

5.1 MATERIALS

5.1.1 Transportation

The geomembrane rolls or panels shall be packaged and shipped by appropriate means so that no damage is caused. Transportation shall be the responsibility of the Installation Contractor.

5.1.2 Delivery

Off-loading and storage of the geomembrane is the responsibility of the Installation Contractor. The Installation Contractor shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner. No off-loading shall be done unless the Inspector is present. Damage during off-loading shall be documented by the Inspector and Installation Contractor. All damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the CPM. The CPM will be the final authority on determination of damage.

5.1.3 On-Site Storage

The geomembrane shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage.

The rolls shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than two rolls high.

5.2 EARTHWORK PREPARATION BY THE CPM

5.2.1 General

The Owner's Earthwork Contractor has constructed the clay liner over which the geomembrane is planned to be installed. The CPM and his designated subcontractor shall be required to prepare the final dike slope and the clay liner surface immediately preceding the geomembrane liner installation. The clay material shall be sealed on the top surface by the use of a smooth drum roller or other suitable equipment. Weak or compressible areas which cannot be satisfactorily compacted should be removed and replaced by the CPM's designated subcontractor with properly compacted clay fill and in accordance with the clay liner specification. A survey of the final clay surface will be obtained prior to any deployment of the HDPE liner. All surfaces to be lined with the geomembrane shall be smooth, free of all foreign and organic material, sharp objects, stones greater than 1/2 inch in diameter, or debris of any kind. These surfaces shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed. All dike earthwork and clay liner surface preparation shall be performed under the direction of the CPM. These activities described above shall be coordinated with the Installation Contractor to insure a proper surface to place and install the geomembrane liner.

The CPM and Inspector, on a daily basis, shall certify that the surface on which the geomembrane will be installed is acceptable and plans for clay and dike slope surface preparation should be discussed at the Daily Meetings (Para. 3.4). After the surface has been accepted, it shall be the Installation Contractor's responsibility to indicate to the CPM or Inspector any change to its condition due to natural causes or occurrences that may require repair work. All work for final surface preparation shall require the approval of the CPM, prior to placing panel(s) of the geomembrane liner by the Installation Contractor.

5.2.2 Anchor Trench Construction by the CPM

The anchor trench shall be excavated to the lines, grades, and width shown on the construction drawings, prior to liner system placement. The Inspector shall verify that the anchor trench has been constructed according to construction drawings.

If the anchor trench is located in a clay susceptible to desiccation, no more than the amount of trench required for the base geomembrane to be anchored in one day shall

be excavated to minimize desiccation of the anchor trench soils.

Rounded corners shall be provided in the trench where the geomembrane adjoins the trench so as to avoid sharp bends in the geomembrane. See trench details on Drawing No. D-189079. All work shall be performed to the satisfaction and approval of the CPM and the Inspector.

The anchor trench shall be backfilled and compacted under the direction of CPM and the Inspector. Trench backfill material shall be placed in 8 inch thick loose lifts and compacted by a roller with light, rubber-tired or other light compaction equipment; or placed in 4 inch thick loose lifts and compacted by an approved hand tamper or vibratory power tamper. The backfill material shall be placed to a minimum of 92% of the maximum dry density per the Standard Proctor Density test (ASTM D-698). In-place field density tests shall be performed at 300 foot intervals along the anchor trench. These tests shall be performed in accordance with the clay liner specifications.

Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. At no time shall construction equipment come into direct contact with the geomembrane. If damage occurs to the geomembrane, it shall be repaired by the Contractor prior to the completion of backfilling.

5.2.3 Vegetation Control By the Installation Contractor

The Installation Contractor, if necessary, shall sterilize the liner installation area using an effective soil sterilant specifically formulated for vegetation present in the area. The sterilant shall meet all applicable environmental regulations for the site, shall not be harmful to the liner and shall be applied according to the recommendations of its manufacturer.

5.3 METHOD OF PLACEMENT OF THE GEOMEMBRANE

The Installation Contractor shall be responsible for the following:

1. No equipment or tools shall damage the geomembrane by handling, trafficking, or other means.

2. No personnel working on the geomembrane shall smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane.

3. The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil.

4. The method used to place the panels shall minimize wrinkles (especially differential wrinkles between adjacent panels). Wrinkles shall be identified on the Final as-built drawing. Both the location and means of repair will be documented by the Installation Contractor and Inspector.

5. Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

6. Direct contact with the geomembrane shall be minimized, i.e., the geomembrane in traffic areas is protected by geotextiles, extra geomembrane, or other suitable materials.

7. The Installation Contractor shall ensure that each field panel is given an "identification code" (number or letter) consistent with the layout plan. The panels will also be identified in the field by the Inspector.

8. The panels shall be deployed parallel to the line of maximum slope and will be oriented such that the seams will be shingled toward the sump to facilitate drainage.

9. The prepared surface underlying the geomembrane has not deteriorated since previous acceptance, and is still acceptable immediately prior to geomembrane deployment.

The Inspector shall be responsible for verifying that the deployed panels meet the project thickness specifications, by using a micrometer to obtain thickness measurements. The number and location of these thickness measurements shall be agreed upon between the CPM and Inspector at the preconstruction meeting.

5.3.1 Weather Conditions

Geomembrane deployment shall proceed between ambient temperatures of 40°F to 105°F. Placement can proceed below 40° only after it has been verified by the Inspector that the material can be seamed according to the specification and is approved by the CPM. Geomembrane placement shall not be done during any precipitation, in

the presence of excessive moisture (e.g., fog, rain, dew) or in the presence of excessive winds, as determined by the Installation Supervisor or the CPM.

5.3.2 Factory Seam Quality Verifications

The Inspector will require the Installation Contractor to test up to as much as 20% of factory fusion welds (non-destructive air pressure test and/or vacuum test) in the field to verify factory test results. Additional testing at the Installation Contractor's expense will be required if failed tests are obtained in the field.

5.4 FIELD SEAMING

Seams shall be oriented parallel to the line of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized.

No base T-seam shall be closer than 5 feet from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles. If a wrinkle is found, it shall be relieved and cap-stripped.

Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

As deemed necessary by the Installation Contractor or Inspector, a movable protective layer shall be used below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets.

For seams which are to be extrusion welded, and as necessary for fusion welds, the seam overlap shall be ground in accordance with the Manufacturer's instructions, within one hour of the seaming operation and in a way that does not damage the geomembrane.

For cross seams, the edge of the cross seam shall be ground to a smooth incline (top and bottom) prior to welding.

For extrusion welded seams, the extrusion weld device shall be purged prior to beginning a seam and until all heat-degraded extrudate has been removed from the barrel.

In locations where a firm substrate does not exist, a flat board, a conveyor belt, or a similar hard surface shall be provided directly under the seam overlap to achieve proper support.

Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

5.4.1 Seam Overlap

Panels of geomembrane must have a finished overlap of a minimum of 4 inches for hot shoe fusion welding and 3 inches for extrusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam.

No solvent or adhesive may be used for seaming.

The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus shall be controlled such that the geomembrane is not damaged.

5.4.2 Seaming Equipment and Accessories

Approved equipment for field seaming are hot shoe fusion welders and extrusion welders listed below, or equal.

1. Hot Shoe Welder, 110 Volt, 10 Amps.

2. Extrusion Welder, 220 Volt, 19 Amps.

3. High-speed, 10,000 rpm, 4 1/2 inch side grinder with 89-grit discs.

4. 7.5 KW Generator, single-phase with 110/220 Volt Outputs.

5. Power Cord, minimum S. O. type, 10 O.S.H.A. approved electrical cord with O.S.H.A. approved twist-type plugs and connections.

6. Seam Vacuum Tester for non-destructive seam and patch testing.

7. Field Tensiometer, capable of performing seam and peel adhesion tests for quantitative testing on-site.

5.4.3 Test Seams

Field test seams shall be conducted on the geomembrane liner to verify that seaming conditions are satisfactory. Test seams shall be conducted at the beginning of each seaming period, at the Inspector's discretion, and at least once each 4 hours, for each seaming apparatus used that day.

All test seams shall be made at a location selected by the Inspector. The test seam samples shall be 10 feet long for hot shoe welding and 3 feet long for extrusion welding with the seam centered lengthwise. Two (2) specimens each 1 inch wide shall be cut from each opposite end of the test seam by the Installation Contractor. The Installation Contractor shall use a tensiometer to test these specimens for shear and peel. If a test seam fails to meet field seam specifications, the seaming apparatus and/or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full test seams are achieved.

The remainder of the successful test seam sample itself shall be cut into three (3) pieces, one to be retained in the Owner's archives, one to be given to the Installation Contractor, and one to be tested by the Geosynthetics QA Laboratory (if necessary).

At the discretion of the Inspector, the remaining portion of the test seam sample may be subjected to destructive testing. If a test seam sample fails a test conducted by the Geosynthetics QA Laboratory, then a destructive test seam sample shall be taken from each of the seams completed by the seamer during the shift related to the considered test seams. These samples shall be forwarded to the Geosynthetics QA Laboratory and, if they fail the tests, the procedure indicated in Section 5.4.5.5 shall apply. The conditions of this paragraph shall be considered as met for a given seam if a destructive seam test sample has already been taken.

5.4.4 Testing

5.4.4.1 Conformance Testing of Geomembrane

Upon, or prior to, delivery of the rolls of geomembrane, the Inspector shall verify that samples are removed and forwarded to the Geosynthetics Laboratory for testing to verify conformance with the test methods and values presented in the Technical Specifications.

5.4.4.1.1 Sample Collection

Using the packing list provided by the Manufacturer or a sequential inventory list made by the Inspector, rolls shall be selected for sampling at a minimum frequency of one sample per 100,000 square feet of material. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is made at that each different lot or manufacturing run is represented by at least one sample.

Samples will be taken across the entire width of the roll and will not include the 3 lineal feet at the end of the roll. Unless otherwise specified, samples will be 3 feet long by the roll width. The Inspector will mark the machine direction on the samples with an arrow.

5.4.4.1.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

- If the average test values for the sample meet both the requirements presented in the Technical Specifications and the Manufacturer's guaranteed minimum values, the sample passes.

- If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the Resident QA Manager. Additional tests required for further evaluation shall be at no expense to the Owner.

  - For the failing parameter(s), perform two additional tests on the sample. These tests may be performed by another Geosynthetics Laboratory at the discretion of the QA Engineer and the Construction Project Manager.

  - If the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.

  - If one or more of the average test values do not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll and test for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the QA Engineer and Construction Project Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

5.4.4.2 Non-Destructive Seam Testing

The Installation Contractor shall perform non-destructive tests on all field seams over their full length. All test equipment, including but not limited to the following shall be furnished by the Installation Contractor:

5.4.4.2.1 Vacuum Box Testing

Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:

1. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.

2. A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections.

3. A rubber pressure/vacuum hose with fittings and connections.

4. A plastic bucket and wide paint brush or mop.

5. A soapy solution.

The following procedures shall be followed by the installer:

1. Excess sheet overlap shall be trimmed away.

2. Clean the window, gasket surfaces and check for leaks.

3. Energize the vacuum pump and reduce the tank pressure to approximately 3-5 psi.

4. Wet a strip of geomembrane approximately 12 inches by 48 inches (length of box) with the soapy solution.

5. Place the box over the wetted area and compress.

6. Close the bleed valve and open the vacuum valve.

7. Ensure that a leak tight seal is created.

8. For a period of approximately 15 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

9. If no bubbles appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches overlap and repeat the process.

10. All areas where soap bubbles appear shall be marked and repaired in accordance with Section 5.4.6 and then retested.

The following procedures shall apply to locations where seams cannot be non-destructively tested, as determined by the inspector:

1. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.

2. If the seam cannot be tested prior to final installation, the seaming operations shall be capped-stripped with the same geomembrane material by the Installation Contractor and monitored by the Inspector for uniformity and completeness.

5.4.4.2.2 Air Pressure Testing (For Double Fusion Seam Only)

The following procedures are applicable to those processes which produce a double seam with an enclosed space.

Equipment for testing double fusion seams shall be comprised of the following:

1. An air pump equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi and mounted on a cushion to protect the geomembrane.

2. A manometer equipped with a sharp hollow needle, or other approved pressure feed device.

The following procedure shall be followed by the installer:

1. Seal one end of the seam to be tested.

2. Insert needle or other approved pressure feed device through the sealed end of the channel created by the double wedge fusion weld.

3. Energize the air pump to verify the unobstructed passage of air through the channel.

4. Seal the other end of the channel.

5. Energize the air pump to a pressure between 25 and 30 psi, close valve, and sustain pressure for approximately 5 minutes.

6. If loss of pressure exceeds 4 psi, or pressure does not stabilize, locate faulty area, repair in accordance with Section 5.4.6, and retest.

7. Remove needle or other approved pressure feed device and seal.

5.4.5 Destructive Seam Testing

The Installation Contractor shall provide the Inspector with a minimum of one destructive test sample per 500 feet of seam length from a location specified by the Inspector. The Installation Contractor shall not be informed in advance of the sample location.

5.4.5.1 Sampling Procedure

In order to obtain test results prior to completion of liner installation, samples shall be cut by the Installation Contractor as the seaming progresses. Sampling times and locations shall be determined by the Inspector. The Inspector must witness the obtainment of all field test samples and the Installation Contractor shall mark all samples with their location roll and seam number. The Installation Contractor shall also record in written form the date, time, location, roll seam number, ambient temperatures, and pass or fail description. A copy of the information must be attached to each sample portion. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately repaired. All patches shall be vacuum tested.

5.4.5.2 Size and Disposition of Samples

The samples shall be 12 inches wide by 24 inches long with the seam centered lengthwise. The sample shall be cut into two equal length pieces, half to be given to the Inspector and the other half to be given to the CPM. If the Installation Contractor desires a sample the size should be increased to 12 inches wide by 40 inches long.

5.4.5.3 Field Laboratory Testing

The Inspector shall cut ten 1 inch wide replicate specimens from his sample and these shall be tested by the Inspector. The Inspector shall test five specimens for seam strength and five for peel strength. To be acceptable, four out of the five replicate test specimens must pass. Any specimen that fails through the weld or by adhesion at the weldsheet interface is a Non-FTB break (see Paragraph 4.4) and shall be considered a failure.

5.4.5.4 Independent Laboratory Testing

The Inspector will package and ship at least two seam samples received from the Installation Contractor to a Laboratory for the determination of shear and peel strengths. The test method and procedures to be used by the Independent Laboratory shall be the same used in field testing, where seam samples are 1 inch wide, and the grip separation rate is 2 inches per minute. Four of five

specimens per sample shall pass. It should also be noted that all destructive seam testing may be performed at a certified laboratory at the request of the CPM.

5.4.5.5 Procedures for Destructive Test Failure

The following procedures shall apply whenever a sample fails the field destructive test:

1. The Installation Contractor shall cap strip the seam between the failed location and any two (2) passing test locations.

2. The Installation Contractor can retrace the welding path to an intermediate location (at a minimum of 10 feet from the location of the failed test in both directions), at the Inspector's discretion, and take a small sample for additional field tests. If both of these tests pass, then the seam shall be cap stripped between the two (2) passing locations. If either test fails, the process is repeated until two (2) passing destructive test samples are obtained, one on each side of the original failed destructive test sample.

3. Over the length of seam failure, the Installation Contractor shall either cut out the old seam, reposition the panel and reseam, or add a cap strip, as required by the Inspector.

4. After reseaming or placement of the cap strip, additional destructive field test(s) shall be taken within the reseamed area. The reseamed area sample shall be found acceptable if test results are approved by the Inspector. If test results are not acceptable, this process shall be repeated until the reseamed length is judged satisfactory by the Inspector.

   In the event that a sample fails a laboratory destructive test, then the above procedures shall be followed.

   The Inspector will document all actions taken in conjunction with destructive test failures.

5.4.6 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be inspected by the Inspector for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be brushed, blown, or washed by the Installation Contractor if the amount of dust or mud

inhibits inspection. The Inspector shall decide if cleaning of the geomembrane is needed to facilitate inspection.

5.4.6.1 Evaluation

Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate in the presence of the Inspector. Each location that fails the non-destructive testing shall be marked by the Inspector, and repaired accordingly.

5.4.6.2 Repair Procedures

1. Defective seams shall be restarted/reseamed as described in these specifications.

2. Small holes shall be repaired by extrusion cap welding. If the hole is larger than 1/4 inch, it shall be patched.

3. Tears shall be repaired by patching. Where the tear is on a slope or an area of stress and has a sharp end it must be rounded prior to patching.

4. Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.

5. Surfaces of HDPE which are to be patched shall be abraded and cleaned no more than 15 minutes prior to the repair. No more than 10% of the thickness shall be removed.

   Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. All patches shall be of the same compound and thickness as the geomembrane specified. All patches shall have their top edge beveled with an angle grinder prior to placement on the geomembrane. Patches shall be applied using approved methods only.

5.4.6.3 Restart/Reseaming Procedures

The welding process shall restart by grinding the existing seam and rewelding a new seam. Welding shall commence where the grinding started and must overlap the previous seam by at least 2 inches. Reseaming over an existing seam without regrinding shall not be permitted.

5.4.6.4 Verification of Repairs

Each repair shall be non-destructively tested, except when the Inspector requires a destructive seam sample obtained from a repaired seam. Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.

5.4.6.5 Recording of Results

Daily documentation of all non-destructive and destructive testing shall be provided to the Inspector by the Installation Contractor. This documentation shall identify all seams that initially failed the test and include evidence that these seams were repaired and successfully retested.

5.5 INSTALLATION AT CONCRETE AND PIPE STRUCTURES

The Installation Contractor shall be responsible for installing the geomembrane liner to the concrete pump house and retaining wall structures, splash pads, and the pipe obstructions entering the pond at or below El. 32.0. The Installation Contractor shall provide all material and labor for this work and procure all clamps, pre-fabricated boot sections, anchor bolts, neoprene seal, batten strip, padding, etc., as shown on drawings D-189078, D-189079, and D-189080.

The CPM shall prepare the concrete and pipe surfaces for the Installation Contractor. The Inspector and Installation Contractor shall approve the surface just prior to the start of the installation work at these structures. For all surfaces where the liner is clamped or bolted onto, the surface shall be free of all dirt, oil/grease, ash residue, dust, moisture, irregular edges, offsets, and protrusions that would inhibit a complete and fully acceptable bond of the seal and liner to the surface.

At the completion of this work to concrete and pipe structures, the Inspector shall carefully inspect the bonded areas and perform necessary field testing to fully insure that seals are in-place, bolts are properly installed, clamps are tightly fitted around the pipe and boot, no stress cracks or tears have occurred to the liner in the bonded area, and no damage has occurred to the liner prior to final acceptance by the Owner.

5.6 GEOMEMBRANE ACCEPTANCE

The Installation Contractor shall retain all ownership and responsibility for the geomembrane until acceptance by the Owner.

The geomembrane liner shall be accepted by the Owner when all of the following conditions are met:

1. Installation is finished.

2. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.

3. Certification, including "as built" drawing(s), is provided by the Installation Contractor to the CPM.

4. The Inspector has given a written approval to the Owner for fully completing the installation work by the Installation Contractor, assures the Owner of a quality product, and the work has been satisfactorily field and laboratory tested to meet the requirements of the drawings, design documents, and these specifications.

5.7 SCHEDULE

The Installation Contractor shall submit with the bid a schedule showing the major installation activities. The Installation Contractor shall plan to start the liner installation work on August 2, 1993 and shall complete all installation work by October 15, 1993. A bar graph schedule shall show the mobilization, liner deployment and seaming, pre-fabricated boot installation, construction to concrete structures, demobilization, and the period for procuring, manufacturing, transporting the materials to the site.