Attachment III

SPECIFICATIONS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

Prepared By:

Ardaman & Associates, Inc.
8008 S. Orange Ave., Orlando, FL 32809
TEL 407/855-3860 FAX 407/859-8121 C.A.N. 5950

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Nadim F. Fuleihan, Sc.D., P.E.
Florida Registration No. 31953

SPECIFICATIONS

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LIST OF SPECIFICATION SECTIONS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

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SPECIFICATIONS

SECTION 2
INTENT

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

These Specifications cover all work related to constructing two lined ponds within an approximately 68-acre area atop the Old Gypsum Stack South (OGS-S) and North (OGS-N) compartments for Phase II closure of the Piney Point Phosphates Stack System in Manatee County, Florida.

The work covered by these specifications includes: (i) dewatering, excavating, moisture conditioning, hauling, placing and compacting on-site gypsum to alter the contours on the top of the OGS-S and OGS-N compartments to the bottom elevations of the lined ponds; (ii) excavating, moisture conditioning, hauling, placing and compacting on-site gypsum to construct approximately 6,750 lineal feet of perimeter dikes around the two ponds and approximately 1,700 lineal feet of partition dike between the ponds; (iii) installing 80-mil thick high density polyethylene (HDPE) liner over an approximately 2,591,000 square feet area with associated permanent wind ballast trenches and air vent system; and (iv) constructing two inlet structures.

Other work covered by the specifications includes: (i) surveying; (ii) earthwork with gypsum related to compaction, maintenance, regrading, restoration, slope dressing, and fine grading of surfaces to receive the HDPE liner; (iii) conveying runoff and water collected by dewatering operations to the seepage collection ditch, as directed by the Program Manager; (iv) abandoning two existing spillway structures; (v) earthwork related to construction of a grassed soil cover atop the lined partition dike; and (vi) site clean-up. The specifications also cover work related to installation of a relief drain in the OGS-N compartment that is included as a contingency item.

The work is divided in two phases. The first phase, designated Phase II-A, will involve all work related to closure construction within the OGS-S compartment. The Program Manager will continue to use the OGS-N compartment for process water storage, as needed, while earthwork and liner installation is undertaken in the OGS-S compartment. At least two weeks prior to releasing the OGS-N compartment for Phase II-B construction, the Program Manager will remove most of the surface water from the OGS-N compartment. In the event that facility surge storage requirements at that time dictate continued process water storage in the OGS-N compartment, Phase II-B construction will be suspended (possibly until November 2004) and the contingency relief drain will be required to enable completion of the Phase II-A work.

SPECIFICATIONS

SECTION 3
LIST OF DRAWINGS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

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The drawings listed below are for bidding purposes. Materials shall not be ordered or work started before receiving drawings marked "Issued for Construction". The drawings may be revised later to change the location or arrangement of the work, provide additional details, or include additional information or changes in some features of the work. Such revisions shall not be deemed cause for a price change unless it can be shown that the Contractor's work has changed materially.

Drawing No.	Revision	Title
G-1	0	Cover Sheet
G-2	0	Index of Drawings and Project Location Maps
G-3	0	General Notes, Abbreviations and Symbols
G-4	0	Aerial Photograph of Site
G-5	0	Topographic Map of Site
G-6	0	Topographic Map of Construction Area
G-7	0	Compartment Bottom Contours From 2001 Pond Soundings
C-1	0	South Compartment Dewatering Plan
C-2	0	South Compartment Grading Plan
C-3	0	South Compartment Cross Sections
C-4	0	Partition Dike Cross Sections
C-5	0	North Compartment Grading Plan
C-6	0	North Compartment Cross Sections
C-7	0	North Compartment Cross Sections
D-1	0	Outlet Profiles
D-2	0	Inlet Structure Details
D-3	0	Miscellaneous Details

Drawing No.	Revision	Title
L-1	0	South Compartment Liner Plan
L-2	0	North Compartment Liner Plan
L-3	0	Southeast Corner Liner Details
L-4	0	Northwest Corner Liner Details
L-5	0	Liner Details

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SECTION 4
CONTRACTOR'S UNDERSTANDING

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

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MANATEE COUNTY, FLORIDA

This Specification contains the following sections.

Section	Item	Page
4.1	Conditions and Nature of Work	1
4.2	Safety	1
4.3	Surveying and Layout of the Work	2
4.4	Site Access	2
4.5	Protection of Existing Facilities	2

4.1 Conditions and Nature of Work

It is understood and agreed that the Contractor has, by careful examination and inspection, fully satisfied himself as to the nature and location of the work, conformation and character of the Old Gypsum Stack South (OGS-S) and North (OGS-N) compartments, construction materials including phosphogypsum, site accessibility and site limitations, OGS-S and OGS-N surface and subsurface water conditions, character and quality of materials, kind of equipment, and facilities needed for the performance of this work, and general and local conditions which can affect the work covered hereunder. It is understood and agreed by the Contractor that all work performed in or on phosphogypsum will be in an acidic environment where the pore water within the phosphogypsum, the phosphogypsum itself and rainfall runoff from the stack surfaces will have a pH as low as 2 and elevated dissolved solids concentrations. Material Safety Data Sheets for phosphogypsum and the associated process water will be provided by the Program Manager.

4.2 Safety

The Contractor shall strictly comply with all applicable safety regulations and standards including all federal, state, and local laws, ordinances, rules and regulations, and site specific safety regulations of the Program Manager (Shaw Environmental, Inc.) as set forth in Attachment V. The Contractor shall also comply with all OSHA trench safety requirements and with the Trench Safety Act (Senate Bill 2626).

4.3 Surveying and Layout of the Work

The Receiver or Program Manager will establish reference points for horizontal and vertical control near and/or within the construction site at the beginning of construction. From these reference points, the Contractor shall provide all horizontal and vertical controls necessary to complete the work to the grades, slopes and dimensions shown on the Drawings. The Contractor's surveying shall be in compliance with the vertical and horizontal tolerances in the specifications, and shall be conducted under the direct supervision of a Florida Registered Land Surveyor. Markings and grade stakes shall be provided as needed by the Contractor to facilitate and expedite inspection of the finished grade for compliance with the dimensions on the Drawings and specified grade tolerances.

The lines, grades and dimensions shown on the Drawings have been selected to approximately balance cut and fill volumes based on certain simplifying assumptions, and as such are approximate. Final grades, elevations and dimensions are subject to adjustment during construction at the sole discretion of the Engineer, representing the Receiver, pending periodic re-evaluation of fill requirements based on actual shrinkage factors and actual settlement as determined by the Engineer during construction. Any such adjustment shall not constitute a changed condition and shall be undertaken at no additional cost.

It is the responsibility of the Contractor to verify all dimensions prior to fabrication, installation and/or construction of any item of work.

4.4 Site Access

The Contractor shall, by his own inspection and by careful examination, fully convince himself as to the accessibility of the site for performing the work. The Contractor shall be responsible for maintaining the gypsum stack access roads during the duration of construction. Any modifications to the gypsum stack outside the Phase II construction limits shall be submitted by the Contractor to the Program Manager and Engineer for approval at least one week prior to making any modifications.

All areas disturbed by the Contractor in constructing temporary access roads and ramps shall be regraded and restored to the pre-existing conditions, or as otherwise approved by the Engineer.

4.5 Protection of Existing Facilities

The Contractor shall be responsible, at no additional cost, for timely repair or replacement of structures, equipment, railroads, pipelines, power lines, piezometers, monitor wells, or any facilities and/or other on-going or completed construction item damaged by the Contractor's and/or his subcontractor's operations and/or personnel.

SPECIFICATIONS

SECTION 5
WORK BY CONTRACTOR

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

5.1 Contractor's Scope of Work

The work consists of furnishing all labor, materials, plant, equipment, tools, supervisory personnel, and Contractor's facilities to undertake construction of two lined ponds atop the Old Gypsum Stack compartments (i.e., the OGS-N and OGS-S compartments) to the lines, grades and dimensions shown on the Drawings and in accordance with these Specifications. The work includes all or parts of the following:

- General earthwork with phosphogypsum, including site preparation work, grading, dewatering, surface water control, excavation, moisture conditioning, hauling, placing and compacting gypsum materials, dike construction, base compaction, fine grading of surfaces to receive high density polyethylene liner, and maintenance of surfaces to receive liner until the surfaces are taken over by the Liner Contractor.

- High density polyethylene (HDPE) liner installation, including surface water control, maintaining surfaces to receive liner, associated permanent wind ballast and anchor trenches and air venting components.

- Inlet structure construction including reinforced concrete placement, and HDPE pipe and fitting installation and liner connections.

- Soil cover placement atop the HDPE liner on the partition dike, including grassing.

Other ancillary work covered by the Specifications includes: (i) surveying; (ii) backfilling dewatering ditches; (iii) abandoning two existing spillway structures; and (iv) site clean-up. In addition, the Receiver may direct the Contractor to install a relief drain in the OGS-N compartment, if needed.

The work shall be executed in conformity with the Drawings and these Specifications and the best acceptable standard practices. The Contractor shall use only competent, skilled workmen in all phases of construction.

SPECIFICATIONS

SECTION 6
GENERAL EARTHWORK USING PHOSPHOGYPSUM

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

6.1 **Description of Work**

This Specification covers general earthwork with phosphogypsum related to grading the top area of the Old Gypsum Stack South (OGS-S) and North (OGS-N) compartments, constructing elevated perimeter and partition dikes, and compacting and fine grading surfaces upon which the HDPE liner will be installed. General earthwork using phosphogypsum also includes excavating and backfilling liner anchor trenches and wind ballast trenches, backfilling dewatering ditches, and excavating and backfilling for installation of the inlet structures and discharge pipes.

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6.2 **Referenced Standards**

The following American Society for Testing and Materials (ASTM) standards are referenced in this Specification.

D 422: Standard Test Method for Particle-Size Analysis of Soils

D 698: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D 1140: Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve

D 1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D 2216: Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock

D 2487: Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D 2937: Standard Test Method for Density of Soil in Place by the Drive Cylinder Method

D 4944: Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method

6.3 **Source of Gypsum Fill**

The design grades of the OGS-S compartment (Phase II-A) and OGS-N compartment (Phase II-B) pond bottom areas, dike crests and side slopes were selected to preliminarily balance gypsum cut and fill volumes. Gypsum fill for base grading and dike construction within the OGS-S compartment shall be obtained from the interior pond bottom area of the OGS-S compartment and from the proposed excavation along the west slope of the OGS-S compartment. Gypsum fill for base grading and dike construction within the OGS-N compartment shall be obtained primarily from the interior pond bottom area of the OGS-N compartment.

The primary gypsum borrow areas for dike construction in both the OGS-S and OGS-N compartments are currently ponded for process water storage. The Program Manager will initiate removal of process water from each of the two construction areas, beginning with the OGS-S compartment, and will remove most ponded water at least two weeks prior to releasing the corresponding area to the Earthwork Contractor. The Contractor will need to implement substantial and aggressive dewatering efforts to facilitate gypsum borrow operations, which is likely to require an alternating sequence of dewatering and gradual excavation. Double- or multiple-handling of gypsum borrow materials should be anticipated to account for drainage and drying of freshly excavated materials.

6.4 **Material Requirements**

Phosphogypsum used for fill shall be non-cemented gypsum, free from trash, rocks, stones, debris, sharp objects, or other deleterious materials. Clean gypsum is typically light gray or light tan in color. Only clean gypsum shall be used as fill for pipe bedding and within the upper 12 inches of surfaces to receive liner.

Black stained or dark colored gypsum, and gypsum containing cemented, non-friable particles in excess of ¼-inch in size shall not be used as pipe bedding and within the upper 12 inches of surfaces to receive liner. These materials shall be used as random fill within the interior portions

of the dikes and more than 12 inches below the pond bottoms. Dark colored gypsum shall be mixed with clean gypsum as much as practical during construction to produce a uniform gypsum fill material. All gypsum fill material shall be approved by the Engineer.

Water used for wetting gypsum surfaces and moisture conditioning gypsum fill shall be process water (see Section 19.1.5). Process water has a pH on the order of 2 and is characterized by elevated dissolved solids concentrations. A chemical analysis is available from the Program Manager. The Contractor shall undertake all necessary safety precautions when handling process water. It shall be the responsibility of the Contractor to supply and maintain equipment and material that are compatible with the process water environment. Material Safety Data Sheets for phosphogypsum and associated process water will be provided by the Program Manager.

6.5 **Updating Cut and Fill Quantities**

The proposed OGS-S and OGS-N compartment pond bottom grades and perimeter dike grades shown on the Drawings have been selected to preliminarily balance gypsum cut with gypsum fill volumes within each compartment, based on a 2-foot contour interval topographic map of the site taken on November 14, 2003, pond bottom soundings undertaken in April 2003, and certain simplifying assumptions regarding settlement and shrinkage factors. Final pond bottom grades and dike elevations relative to the project datum are subject to adjustment prior to the start of construction and during construction at the discretion of the Engineer, pending evaluation of the planned pre-construction aerial topographic survey results and re-evaluation of fill requirements based on actual settlement and shrinkage factors. Any such adjustment shall not constitute a changed condition.

6.6 **Dewatering and Surface Water Control**

The Program Manager will initiate removal of process water from each construction area, starting with the OGS-S compartment, and will remove most ponded water at least two weeks prior to releasing the corresponding area to Earthwork Contractor. The Program Manager will remain responsible for water management outside the footprint of the project area. The Contractor shall coordinate all dewatering operations and runoff routing with the Program Manager.

The Contractor shall be responsible for establishing and maintaining a dewatering ditch network within each compartment in general accordance with the configurations shown on the Drawings, and excavating additional ditches, as needed to achieve and maintain adequate dewatering for gypsum borrow and site grading operations. The Contractor shall establish and maintain ditch grades to promote gravity drainage of seepage and rainfall runoff towards the proposed sump areas shown on the Drawings.

All grading, gypsum excavation and filling, and inlet structure installation work shall be performed in the dry. The Contractor shall be responsible for developing and maintaining temporary dewatering ditches as needed to maintain all work areas well drained and dry during construction. The method of dewatering will be the responsibility of the Contractor, subject to approval by the Engineer. The Contractor's proposed methods for dewatering and routing shall be submitted to the Engineer for approval prior to implementation.

All process water, extracted gypsum pore water, and rainwater runoff from the pond shall be conveyed by the Contractor to the seepage collection ditch in a manner and to a location approved

by the Program Manager and Engineer. The pore water within the gypsum stack system has a pH on the order of 2 and is characterized by elevated dissolved solids concentrations. A chemical analysis is available from the Program Manager. The Contractor shall undertake all necessary safety precautions when handling the extracted pore water. It shall be the responsibility of the Contractor to supply and maintain equipment and material that are compatible with the process water environment. Material Safety Data Sheets for phosphogypsum and associated process water will be provided by the Program Manager.

6.7 **Pond Bottoms**

The Contractor shall excavate, haul, place and compact gypsum, as needed, to alter the fundamental contours of the in-place gypsum to the pond bottom lines, grades and dimensions shown on the Drawings.

Gypsum fill on the pond bottoms shall be placed in lifts not exceeding 18 inches in loose thickness prior to compaction, and compacted as specified in Section 6.7.2. After a lift is placed and compacted in accordance with this Specification, its surface shall be scarified just before placement and compaction of the next lift to permit bonding between the two lifts. At no time shall a new lift of fill be placed over a non-scarified or dried surface. If a dried surface develops, it shall be re-wetted using process water, recompacted and scarified prior to placement and compaction of a new lift of fill. The filling and compacting operations shall continue in lifts, scarifying between layers, until the pond bottom is filled to the lines and grades shown on the Drawings, or as otherwise revised by the Engineer.

The upper 12 inches of in-place gypsum in excavated areas shall be compacted in accordance with Section 6.7.2. Any black or dark-colored gypsum exposed to the surface in cut areas shall be excavated and replaced with clean gypsum.

6.7.1 Dewatering Ditches

The side slopes of the existing dewatering ditches and any dewatering ditches excavated by the Contractor shall be cut-back to slopes no steeper than 2.0 Horizontal to 1.0 Vertical prior to backfilling with gypsum. Prior to placement of gypsum fill, the surface of the cut-back ditch side slopes shall be wetted or dried, as needed, recompacted and scarified to provide bonding with the gypsum backfill.

All dewatering ditches shall be backfilled by placement and compaction of gypsum fill in successive horizontal layers. The gypsum shall be placed in lifts not exceeding 18 inches in loose thickness prior to compaction, and compacted as specified in Section 6.7.2. Each loose lift shall be compacted prior to placement of the next lift.

After a lift is placed and compacted in accordance with this Specification, its surface shall be scarified just before placement and compaction of the next lift to permit proper bonding between the two lifts. At no time shall a new lift of fill be placed over a non-scarified or dried surface. If a dried surface develops, it shall be re-wetted using process water, recompacted and scarified prior to placement and compaction of a new lift of fill. The filling and compacting operations shall continue in lifts, scarifying between layers, until the ditches are backfilled to the pond bottom lines and grades shown on the Drawings.

Fill shall be hand-placed in areas inaccessible to heavy equipment. The hand-placed fill shall be placed in lifts not exceeding 6 inches in loose thickness prior to compaction. Compaction of hand-placed fill shall be by vibrating plate, mechanical tamper, or other equipment approved by the Engineer.

6.7.2 Compaction Criteria

Gypsum fill on the pond bottoms and used for backfilling dewatering ditches shall be placed and compacted at molding moisture contents not less than 3 percent dry of the Standard Proctor optimum moisture content (ASTM D 698, using a drying temperature of 40EC) to a dry density equal to or greater than 95 percent of the Standard Proctor maximum dry density (ASTM D 698, using a drying temperature of 40EC). Gypsum fill shall not be saturated, nor placed too wet, so as not to cause pumping during compaction.

6.8 **Dike Construction**

The existing gypsum dikes around the OGS-S and OGS-N compartments shall be modified and constructed to the lines, grades and dimensions shown on the Drawings.

6.8.1 Construction Procedures

Prior to placement of any fill for constructing the dikes, the existing surface shall be wetted or dried, as needed, recompacted and scarified to provide for proper bonding between the existing gypsum surface and new gypsum fill. The dikes shall be constructed by placement and compaction of gypsum fill in successive layers. The gypsum shall be compacted as specified in Section 6.8.2. Each loose lift shall be compacted prior to placement of the next lift. The fill shall be placed in lifts not exceeding 18 inches in loose thickness prior to compaction. The fill shall be wetted using process water or dried, and homogenized as needed prior to compaction to comply with the molding moisture content criteria in Section 6.8.2.

After a lift is placed and compacted in accordance with this Specification, its surface shall be scarified just before placement and compaction of the next lift to permit proper bonding between the two lifts. At no time shall a new lift of fill be placed over a non-scarified or dried surface. If a dried surface develops, it shall be re-wetted using process water, recompacted and scarified prior to placement and compaction of a new lift of fill. The filling and compacting operations shall continue in lifts, scarifying between layers, until the dikes are constructed to the lines, grades, and dimensions shown on the Drawings, or as otherwise revised by the Engineer.

The slopes of the dikes shall be overbuilt, as needed, prior to fine grading such that gypsum at the finished surface of the slope meets the compaction criteria in Section 6.8.2 of this Specification.

6.8.2 Compaction Criteria

Gypsum fill used for dike construction shall be placed and compacted at molding moisture contents not less than 3 percent dry of the Standard Proctor optimum moisture content (ASTM D 698, using a drying temperature of 40EC). Gypsum fill shall not be saturated, nor placed too wet, so as not to cause pumping during compaction. Gypsum fill shall be compacted to a dry density equal to or greater than 90 percent of the Standard Proctor maximum dry density within the interior portion of

the dikes and 95 percent of the Standard Proctor maximum dry density within the upper 2.0 feet of fill on all surfaces (ASTM D 698, using a drying temperature of 40EC).

6.9 **Liner Base Preparation**

6.9.1 Construction

All gypsum surfaces to receive the HDPE liner shall be free from trash, rocks, stones, debris, sharp objects, cemented gypsum or other soil particles larger than ¼-inch in size, and other deleterious materials. The upper 12 inches of the gypsum surface shall be compacted as specified in Section 6.7.2. The Engineer will inspect the surfaces to receive HDPE liner for compliance with the above material and compaction criteria. All surfaces to receive the HDPE liner shall be fine graded to within the grading tolerances specified in Section 6.10 of this Specification.

Prior to lining in any given area, the Liner Contractor shall inspect the condition of the surfaces to receive the liner for compliance with the above, and shall accept and approve, in writing, the condition of the surfaces on which the liner will be installed. The Liner Contractor shall maintain, regrade, and restore, as needed, the condition of the prepared base in any such area to within the grade tolerances and degree of compaction specified herein, and maintain the surface to be lined smooth and free from deleterious materials.

6.9.2 Maintenance

The Earthwork Contractor shall maintain the gypsum surfaces well drained, dewatered, sufficiently moist to prevent shrinkage cracking, compacted, smooth and generally free from roller marks, ruts, holes, depressions or protrusions until the surface is accepted by the Liner Contractor.

At the time the Liner Contractor accepts the fine graded liner base, the Liner Contractor shall maintain and restore, as needed, all surfaces to the lines, grades and dimensions shown on the Drawings or as otherwise directed by the Engineer throughout the duration of his work. The gypsum surfaces shall be maintained well-drained and dewatered. If needed, the prepared base shall be recompacted and fine graded prior to liner placement such that the surface to receive the HDPE liner is smooth, free from roller marks, ruts, holes, depressions or protrusions. The prepared liner base shall also be maintained sufficiently moist to prevent shrinkage cracking prior to placement of the HDPE liner. Any surface that develops shrinkage cracks shall be reworked and recompacted in accordance with this Specification. The Liner Contractor shall not deploy any HDPE liner over a surface that has not been approved by the Engineer.

6.10 **Grading Tolerances**

All work shall be performed to within a vertical tolerance of 0.2 feet from the grades and dimensions shown on the Drawings except that the vertical tolerance shall be reduced to 0.1 feet for the grades and dimensions of the dike crests. The directions of all sloping surfaces shall also be maintained in the directions shown on the Drawings. All construction shall be completed to within a horizontal tolerance of ±1 percent from the lines and dimensions shown on the Drawings, and within a maximum horizontal tolerance of ±0.3 feet.

Final pond bottom grades and dike elevations relative to the project datum are subject to adjustment prior to the start of construction and during construction at the discretion of the

Engineer, pending re-evaluation of fill requirements based on actual settlement and shrinkage factors. Any such adjustment shall not constitute a changed condition.

Notwithstanding the grading tolerances, all surfaces to receive liner shall be graded uniformly and smoothly to minimize puddling of water atop the liner and to prevent air entrapment below the liner.

6.11 **Pipe Bedding**

Select gypsum fill consisting of clean gypsum, as defined in Section 6.4 of this Specification, shall be placed and compacted to the lines and dimensions shown on the Drawings where specified as pipe bedding. Select gypsum fill shall consist of clean gypsum with a moisture content within the range specified below.

After installation of a pipe, gypsum bedding shall be worked under the haunch of the sides of the pipe to provide side support throughout. Placement of the gypsum shall be controlled such that the gypsum completely surrounds and is in full contact with the pipe surface to the lines and dimensions shown on the Drawings. The pipe bedding shall fill around and be in contact with the entire pipe circumference, with particular care taken to ensure that voids are not present around the lower one-third of the pipe circumference. Precautions shall be taken to prevent lateral or vertical movement of the pipe during filling and compaction, including the use of ground anchors if needed. Care shall be taken during placement and compaction of the gypsum bedding not to damage or displace the pipe.

Select gypsum fill pipe bedding shall be placed in level lifts not exceeding 9 inches in loose thickness, to at least the extent shown on the Drawings, and compacted at molding moisture contents in the range of 3 percent dry to 2 percent wet of the Standard Proctor optimum moisture content (ASTM D 698, using a drying temperature of 40EC) to a dry density equal to or greater than 95 percent of the Standard Proctor maximum dry density (ASTM D 698, using a drying temperature of 40EC).

Gypsum fill above the pipe bedding shall be placed in level lifts not exceeding 12 inches in loose thickness and compacted to a dry density equal to or greater than 95 percent of the Standard Proctor maximum dry density for a thickness of 3.0 feet as shown on the Drawings. The remaining trench shall be backfilled with gypsum fill placed in level lifts not exceeding 18 inches in loose thickness and compacted in accordance with the details shown on the Drawings and Section 6.8.2 of this Specification, with the added provision that a dry density equal to or greater than 95 percent of the Standard Proctor maximum dry density shall be achieved. The filling and compaction shall continue in lifts until the pipe trench is completely backfilled to the lines and grades shown on the Drawings.

6.12 **Dust Control**

The Contractor shall maintain the surfaces of gypsum in the work area, within the OGS-S west slope borrow area, and in the vicinity of liner installation sufficiently moist at all times to minimize the development of wind blown gypsum dust. The Earthwork Contractor shall coordinate the wetting of all gypsum surfaces until the responsibility of the surfaces are turned over to the Liner Contractor.

6.13 **Quality Control Inspection and Testing**

The Engineer will undertake observations and perform quality control tests to determine compliance of the materials and work with this Specification. Quality control by the Engineer will include monitoring: (i) the suitability and homogeneity of gypsum used in construction; (ii) placement, lift thickness, bonding between lifts, moisture conditioning, and compaction of gypsum fill; (iii) site dewatering and surface water control; and (iv) liner base maintenance activities.

The Engineer will perform moisture content determinations (ASTM D 2216, using a drying temperature of 40EC) and *in situ* density determinations by the drive cylinder method (ASTM D 2937) or sand cone method (ASTM D 1556) to determine compliance with this Specification. *In situ* density tests will be performed on average at the following rates or as otherwise directed by the Engineer:

- Once per 2,000 cubic yards of gypsum fill.
- Once per 2 acres of surfaces to receive HDPE liner.
- Once per 10 cubic yards of pipe bedding gypsum fill.

Moisture contents obtained using calcium carbide gas pressure meters (ASTM D 4944) calibrated for phosphogypsum may be used by the Engineer to provide guidance for construction control, but final acceptance will be based upon the ASTM Standard D 2216 test method (using a drying temperature of 40EC) unless approved otherwise by the Engineer. Penetration test probes will also be used as needed, at the Engineer's discretion, to verify the uniformity of compaction.

The Engineer will perform Standard Proctor compaction tests on gypsum fill (ASTM D 698, using a drying temperature of 40°C for gypsum) to determine compliance with compaction requirements.

Testing of the uppermost one foot of the surfaces to receive the HDPE liner will be made by the Engineer following final grading and compaction by the Earthwork Contractor before the surfaces are turned over to the Liner Contractor. Testing of the uppermost one foot of the surfaces to receive the liner will be repeated, as needed, immediately prior to liner placement. Final documentation and results from these tests, however, will not be available prior to liner deployment. Such testing shall not relieve the Liner Contractor from responsibility for restoration or repair of unsuitable areas following liner placement, in the event that such is deemed necessary by the Engineer.

6.14 **Submittals**

The Contractor shall submit his proposed methods for dewatering and routing water to the seepage collection ditch to the Program Manager and Engineer for approval at least two weeks prior to implementation.

SPECIFICATIONS

SECTION 7
SYNTHETIC LINER MATERIALS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

7.1 Description of Work

This Specification covers the material requirements for High Density Polyethylene (HDPE) geomembrane liner, factory inspection and testing requirements, and independent quality control testing. The Specification includes the following sections.

Section	Item	Page
7.2	Referenced Standards	1
7.3	Material Requirements	3
7.4	Manufacturing and Factory Inspection and Testing	6
7.5	Independent Quality Control Testing	9
7.6	Warranty	9
7.7	Submittals	10

7.2 Referenced Standards

The following American Society for Testing and Materials (ASTM) and Federal Test Method (FTM) standards are referenced in this Specification.

D 570: Standard Test Method for Water Absorption of Plastics

D 638: Standard Test Method for Tensile Properties of Plastics

D 746: Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

D 792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D 1004: Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting

D 1203: Standard Test Method for Volatile Loss from Plastics Using Activated Carbon Methods

D 1204: Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D 1238: Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

D 1248: Standard Specification for Polyethylene Plastics Molding and Extrusion Materials

D 1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique

D 1603: Standard Test Method for Carbon Black in Olefin Plastics

D 1693: Standard Test Method for Environmental Stress Cracking of Ethylene Plastics

D 1898: Standard Recommended Practice for Sampling of Plastics

D 2663: Standard Test Methods for Carbon Black Dispersion in Rubber

D 3015: Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds

D 3895: Standard Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis

D 4833: Standard Test Method for Index Puncture Resistance of Geotextiles and Geomembranes

D 5199: Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

D 5321: Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

D 5397: Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Load Test; Appendix - Procedure to Perform a Single Point Notched Constant Load (Appendix (SP-NCTL) Test

D 5596: Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics

D 5994: Standard Test Method for Measuring Core Thickness of Textured Geomembranes

E 96: Standard Test Methods for Water Vapor Transmission of Materials

FTM 101: Puncture Resistance and Elongation Test (1/8 inch Radius Probe Method), Federal Test Method 2065

7.3 **Material Requirements**

Smooth, two-sided textured, and one-sided textured geomembrane liner shall consist of unreinforced high density polyethylene (HDPE), designed and manufactured specifically for the purpose of liquid containment.

Product data sheets listing the minimum and nominal liner physical properties shall be provided for each type liner prior to shipment. Product data sheets for the HDPE resin, listing density, melt index, low temperature brittleness and environmental stress crack resistance, shall be provided for each type resin prior to shipment.

7.3.1 Base Resin

The uncolored base resin used to manufacture the liner shall be polyethylene having a minimum density of 0.932 g/cm^3. The formulated colored resin shall classify as a Type III, Category 4 or 5, Grade P34, Class C High Density Polyethylene in accordance with ASTM Standard D 1248. The resin shall contain not less than 97 percent of the base polymer, and not less than 2.0 percent carbon black. Carbon black dispersion in the liner shall be rated as: (i) $9 of 10 views as Category 1 or 2, and # 1 of 10 views as Category 3 classified using ASTM Standard D 5596; or (ii) A1, A2 or B1 classified using the ASTM Standard D 2663 dispersion classification chart on specimens prepared in accordance with ASTM Standard D 3015. The variation in carbon black content within each resin batch shall be no greater than ±5 percent from the average carbon black content. The liner material shall contain no more than 3 percent carbon black, anti-oxidants and heat stabilizers combined, and no other additives, fillers or extenders. The liner shall be manufactured from virgin resin, with no more than 3 percent regrind material. Regrind material, if used, must be of the same formulation as the virgin resin. No post consumer resin of any type may be used.

Liner sheets shall be manufactured using one of the following base resins unless otherwise approved by the Engineer:

- Mobil HDA 601
- Chevron Phillips 66 HHM TR-400, or K306
- BP Solvay G36-24x1767

Use of any of the approved base resins shall not relieve the Liner Manufacturer from complying with all other Specification criteria.

HDPE welding rods shall be manufactured from the same resin used to manufacture the liner.

7.3.2 Physical Appearance of Liner Sheets

All liner sheets shall have good appearance qualities. The surface of smooth liner shall be smooth with no visible defects. Texturing on the surface of textured sheets shall be uniform and homogeneously distributed.

All liner sheets shall be free of pinholes, holes, blisters, gels, undispersed ingredients, any signs of contamination by foreign matter, or any defect that may affect serviceability. The edges of the sheets shall be straight and free from nicks and cuts.

7.3.3 Smooth Liner Physical Properties

Smooth liner shall meet the following criteria.

Property	Test Method	Criterion
Minimum Thickness	ASTM D 5199	$72 mil
Average Thickness	ASTM D 5199	$80 mil
Density	ASTM D 792 or D 1505	> 0.940 g/cm^3†
Melt Index	ASTM D 1238, Condition E	<1.0 g/10 min
Carbon Black Content	ASTM D 1603	$2.0% & <3.0%
Carbon Black Dispersion	ASTM D 3015; or ASTM D 5596 (10 views)	A1, A2 or B1 Cat. 1 or 2 ($9 views) and Cat. 3 (# 1 view)
Tensile Strength at Yield	ASTM D 638, Type IV*	>168 lb/in
Tensile Strength at Break	ASTM D 638, Type IV*	>280 lb/in
Elongation at Yield	ASTM D 638, Type IV*	>12%
Elongation at Break	ASTM D 638, Type IV*	>650%
Modulus of Elasticity	ASTM D 638, Type IV*	>80,000 lb/in^2
Tear Resistance	ASTM D 1004	>56 lb
Puncture Resistance	FTMS 101 (Method 2065); or ASTM D 4833	>100 lb > 158 lb
Water Vapor Transmission	ASTM E 96, Procedure BW	<0.03 g/m^2/24 hrs
Dimensional Stability	ASTM D 1204, 100EC / 1 hr	±2% (max)
Low Temperature Brittleness	ASTM D 746, Procedure B	<-94EF (<-70EC)
Volatile Loss	ASTM D 1203, Method A	<0.1%
Water Absorption	ASTM D 570	<0.1%
Environmental Stress Crack Resistance	ASTM D 1693, Condition B	>1,500 hrs
Constant Tensile Load Stress Crack Resistance (Single Point at 30% of yield stress)	ASTM D 5397 (SP-NCTL)	> 200 hrs
Oxidative Induction Time	ASTM D 3895 200EC & 14.7 lb/in^2 O_2	>140 min

† The density of the uncolored base resin shall be greater than 0.932 g/cm^3.
* Tested at a rate of displacement of 2 inches/minute in both machine and transverse directions. Strain at yield shall be calculated using a 1.3" gauge length and strain at break shall be calculated using a 2.0" gauge length.

All individual test specimens shall meet the minimum or maximum criterion tabulated above, with the following exceptions:

- The average elongation at break and modulus of elasticity in both the machine and transverse directions, determined as the average of five test specimens in each direction, shall meet the specified values. All individual test specimen results shall display an elongation at break equaling or exceeding 520 percent, and a modulus of elasticity equaling or exceeding 64,000 lb/in^2.

- The average water vapor transmission shall meet the specified value, and all individual test specimen results shall be equal to or less than 0.05 g/m^2/24 hours.

Routine testing for modulus of elasticity, dimensional stability, low temperature brittleness, environmental stress crack resistance, volatile loss, water absorption and water vapor transmission will not be required from the Liner Manufacturer. Certification in writing shall be provided by the Liner Manufacturer that the liner meets the Specification requirements. In support of the certification, the Liner Manufacturer shall submit at least one test result for each property performed within one year prior to the date of the certification on liner manufactured with each type resin supplied to the project.

7.3.4 Textured Liner Physical Properties

Two-sided and one-sided textured liner shall meet the following criteria.

Property	Test Method	Criterion
Minimum Thickness	ASTM D 5994	$ 72 mil
Average Thickness	ASTM D 5994	$80 mil
Density	ASTM D 792 or D 1505	> 0.94 g/cm^3†
Melt Index	ASTM D 1238, Condition E	<1.0 g/10 min
Carbon Black Content	ASTM D 1603	$2.0% & <3.0%
Carbon Black Dispersion	ASTM D 3015; or ASTM D 5596 (10 views)	A1, A2 or B1; or Cat. 1 or 2 ($9 views) and Cat. 3 (# 1 view)
Tensile Strength at Yield	ASTM D 638, Type IV*	>168 lb/in
Tensile Strength at Break	ASTM D 638, Type IV*	>160 lb/in
Elongation at Yield	ASTM D 638, Type IV*	>12%
Elongation at Break	ASTM D 638, Type IV*	>200%
Tear Resistance	ASTM D 1004	>56 lb
Puncture Resistance	FTMS 101 (Method 2065); or ASTM D 4833	>100 lb; or >158 lb

† The density of the uncolored base resin shall be greater than 0.932 g/cm^3.
* Tested at a rate of displacement of 2 inches/minute in both machine and transverse directions. Strain at yield shall be calculated using a 1.3" gauge length and strain at break shall be calculated using a 2.0" gauge length.

All individual test specimens shall meet the minimum or maximum criterion tabulated above, with the following exceptions:

- The average tensile strength and elongation at break in both the machine and transverse directions, determined as the average of five test specimens in each direction, shall meet the criteria tabulated above. All individual test specimen results shall display tensile strengths at break equaling or exceeding 48 lb/in, and elongations at break equaling or exceeding 60 percent.

Textured liner shall also meet the criteria specified in Section 7.3.3 for water vapor transmission, dimensional stability; low temperature brittleness; volatile loss; water absorption; environmental stress crack resistance; constant tensile load stress crack resistance; and oxidative induction time.

7.3.5 Frictional Characteristics

The surface roughness of textured liner shall be such that the peak interface friction angle is equal to or greater than 33° between the liner and phosphogypsum and equal to or greater than 28° between the liner and soil.

For determining compliance with the specified interface friction angle, the compliance tests will be performed by the Engineer using silty fine sand and phosphogypsum from the site meeting the following gradations in accordance with Standard ASTM D 422.

Soil Type	Silty Fine Sand	Gypsum
Soil Classification (ASTM D 2487)	SM	ML
U.S. Standard Sieve Size	Percent Passing (Dry Weight Basis)	
No. 4	100	100
No. 10	97-100	100
No. 20	95-100	100
No. 40	90-100	100
No. 60	60-95	95-100
No. 100	20-80	85-100
No. 140	15-40	80-95
No. 200	12-20	75-90
No. 270	-	60-85
No. 400	-	40-75

The interface frictional resistance shall be determined by direct shear tests in general accordance with ASTM Standard D 5321 at normal stresses ranging from 0 to 3 lb/in^2. The silty fine sand shall be compacted to a dry density equal to 95 percent of the Standard Proctor maximum dry density (ASTM D 698). The gypsum shall be compacted at a molding moisture content ranging from 2 percent dry to 3 percent wet of the Standard Proctor optimum moisture content to a dry density equal to 95 percent of the Standard Proctor maximum dry density (ASTM D 698 with a drying temperature of 40EC). The interface and soil or gypsum shall be tested saturated with water. The tests shall be performed using a horizontal displacement rate of 0.3 inches per hour.

7.4 **Manufacturing and Factory Inspection and Testing**

The Liner Manufacturer shall submit product data sheets and test data for each liner type to the Engineer presenting the liner minimum physical properties for each property listed in Section 7.3.3 and 7.3.4, the resin types and properties. Written certification shall be provided by the Liner Manufacturer confirming compliance of the resin and liner sheets with this Specification.

7.4.1 Minimum Sheet Dimensions

The HDPE liner shall be supplied in rolled sheets having a minimum width of 22 feet and minimum length of 400 feet. Variances for shorter roll lengths may be allowed at the discretion of the Engineer.

7.4.2 Marking and Packaging

The Liner Manufacturer shall label each roll with the roll number, thickness, length, width and date manufactured.

Each roll shall be individually packaged at the factory and protected to prevent damage during shipment. If the liner is not packaged and a roll is damaged during shipment, it shall be rejected. If only the outermost surface of the roll is affected, it shall be peeled back, cut, and wasted (i.e., it shall be treated as if it were the protective packaging for the remainder of the roll). Rolled out liner stock that requires more than one repair patch per 5,000 square feet prior to installation shall be considered faulty, and shall be rejected and replaced.

7.4.3 Factory Inspection and Spark Testing

The Liner manufacturer shall inspect all liner sheets at the factory for compliance with the physical appearance requirements listed in Section 7.3.2. The Liner Manufacturer shall continuously spark test all liner sheets during manufacturing. The spark tester shall be capable of detecting defects or pinholes equal to or less than 10 mils (0.25 mm) in diameter. The Liner Manufacturer shall submit a complete description of the spark tester, operating protocols, factory QA/QC plan for operating the system and identifying defective liner, and methods for removing or patching liner with pinholes to the Engineer prior to shipping liner to the project. All necessary repairs to the liner shall be made by the Liner Manufacturer at the factory before shipment.

The Liner Manufacturer shall provide written certification that all liner rolls delivered to the project were continuously spark tested and do not contain pinhole defects.

7.4.4 Factory Testing

The Liner Manufacturer shall submit the factory testing QA/QC plan, and factory laboratory quality manual for all liner and resin tests required in this Specification to the Engineer prior to shipping liner to the project.

7.4.4.1 HDPE Resin

Factory sampling and testing of raw materials shall be in conformance with ASTM Standard D 1898. Factory test reports for the HDPE resin shall include the proportions of HDPE resin, carbon black and other additives, and test results for melt index, specific gravity, environmental stress crack resistance, low temperature brittleness and oxidative induction time. These reports shall be submitted for approval by the Engineer before installation of any liner material. The following tests and minimum frequency of testing shall be undertaken by the Liner Manufacturer.

Resin Property	Method	Minimum Frequency
Density	ASTM D 792	Once per Batch of Resin
Melt Index	ASTM D 1238, Condition E	Once per Batch of Resin
Oxidative Induction Time	ASTM D 3895	Once per Batch of Resin

The resin density and melt index shall be reported for both the unblended resin and the blended resin after adding carbon black and antioxidants. The oxidative induction time shall be reported for

the blended resin. Routine testing for low temperature brittleness and environmental stress crack resistance is not required. Certification of these properties, in accordance with the requirements in Section 7.3.3, will be accepted.

7.4.4.2 Liner Rolls

Factory test reports for each roll of liner shall include test results for the following properties: tensile strength and elongation at yield and at break; tear resistance; puncture resistance; minimum and average thickness; density; carbon black content; and carbon black dispersion. These reports shall be submitted for approval by the Engineer before installation of the liner. Failure of any of the tests shall result in rejection of the corresponding liner rolls.

At the request of the Receiver, but not more than once per day during each production run, the Liner Manufacturer shall furnish production line samples to the Receiver who reserves the right to have these samples tested by the Engineer to evaluate compliance with this Specification. Failure of any of the tests shall result in rejection of the corresponding batch or production run of liner material.

The following tests and minimum frequencies of testing shall be undertaken by the Liner Manufacturer on the liner rolls.

Liner Property	Test Method	Minimum Frequency
Thickness (Smooth Liner)	ASTM D 5199	Every Roll
Core Thickness (Textured Liner)	ASTM D 5994	Every Roll
Tensile Strength at Yield	ASTM D 638	Every Roll
Tensile Strength at Break	ASTM D 638	Every Roll
Elongation at Yield	ASTM D 638	Every Roll
Elongation at Break	ASTM D 638	Every Roll
Tear Resistance	ASTM D 1004	Every Roll
Puncture Resistance	FTMS 101 (Method 2065); or ASTM D 4833	Every Roll
Density	ASTM D 792 or D 1505	Every 5 Rolls
Carbon Black Content	ASTM D 1603	Every 5 Rolls
Carbon Black Dispersion	ASTM D 3015; or ASTM D 5596	Every 5 Rolls
Notched Constant Load ESCR (Single Point at 30% of Yield Stress)	ASTM D 5397 (SP-NCTL)	Every 20 Rolls

Tensile tests (ASTM D 638) and tear resistance tests (ASTM D 1004) shall be performed in both the machine and transverse directions. Tensile properties (ASTM D 638), tear resistance (ASTM D 1004) and puncture resistance (FTMS 101 or ASTM D 4833) tests may be performed on only one test specimen from each roll of smooth liner (in each direction, where applicable) and the moving average as well as the minimum value from each five consecutive rolls reported to the Engineer. Five test specimens shall be tested in each direction for tensile properties (ASTM D 638) from each of the first 20 rolls of textured liner manufactured for delivery to this project. Provided all test results are in compliance with Specifications, the number of test specimens may then be reduced as allowed above for smooth liner if approved by the Engineer. All factory testing shall be at the Liner Contractor's or Liner Manufacturer's expense.

Certification of the liner modulus of elasticity, dimensional stability, environmental stress crack resistance (ASTM D 1693, Condition B), volatile loss, water absorption and water vapor transmission shall be provided in accordance with Section 7.3.3 of this Specification.

7.5 **Independent Quality Control Testing**

The Liner Contractor shall obtain and secure samples (coupons) of the liner for destructive testing by the Engineer from locations designated by the Engineer, and shall properly mark all test specimens as needed to identify the liner roll or panel from which the specimen was obtained. Testing by the Engineer will be made for the following liner properties at the following sampling frequencies unless revised otherwise by the Engineer during construction.

Property	Test Method	Sampling Frequency
Thickness	ASTM D 5199 (Smooth Liner)	2 per acre
Thickness	ASTM D 5994 (Textured Liner)	2 per acre
Density	ASTM D 792 or D 1505	1 per acre*
Carbon Black Content	ASTM D 1603	1 per acre*
Tear Resistance	ASTM D 1004	2 per acre**
Tensile Strength at Yield	ASTM D 638, Type IV, 2 ipm	2 per acre**
Tensile Strength at Break	ASTM D 638, Type IV, 2 ipm	2 per acre**
Elongation at Yield	ASTM D 638, Type IV, 2 ipm	2 per acre**
Elongation at Break	ASTM D 638, Type IV, 2 ipm	2 per acre**
Frictional Characteristics	ASTM D 5321	1 per 10 acres
Other Properties	As requested by the Engineer	Up to 2 samples per acre

* The sampling frequency may be reduced, at the sole discretion of the Engineer, to 1 per 10 acres once sufficient data is available to demonstrate consistent compliance with this Specification.

** Tested in machine and transverse directions. The sampling frequency may be reduced, at the sole discretion of the Engineer, to 1 per 3 acres once sufficient data is available to demonstrate consistent compliance with this Specification.

Failure of any sample to meet or exceed the requirements specified herein shall be considered cause for rejection of the material or installed liner section from which the sample was collected to the extent designated by the Engineer. If the Liner Contractor or Liner Manufacturer can establish to the Engineer, via additional test results, that the failed sample is representative of a smaller section of the liner, then only that portion will be rejected, provided that such additional tests are performed, at the Liner Contractor's or Liner Manufacturer's expense, by the Engineer representing the Receiver.

7.6 **Warranty**

A written warranty shall be provided to the Owner from the Manufacturer. This document shall warrant the quality of the liner material for a period of not less than 20 years.

7.7 **Submittals**

The following submittals are required as part of the requirements of this Specification.

- Product data sheets and test data for each liner type listing the minimum liner physical properties, and the product data sheets for each type resin listing the resin properties (Sections 7.3 and 7.4).

- A written certification from the Liner Manufacturer that the resin and liner materials are in compliance with this Specification (Section 7.4).

- Written certification from the Liner Manufacturer that the liner modulus of elasticity, dimensional stability, low temperature brittleness, environmental stress crack resistance, volatile loss, water absorption and water vapor transmission meet the requirements of this Specification. In support of the certification, the Liner Manufacturer shall submit the result of at least one test for each certified property performed within one year prior to the date of the certification for each type liner manufactured with the same type resin supplied to the project (Section 7.3.3).

- Written certification from the Liner Manufacturer that the HDPE resin low temperature brittleness and environmental stress crack resistance meet the requirements of this Specification. In support of the certification, the Liner Manufacturer shall submit the result of at least one test for each certified property performed within one year prior to the date of the certification for each type resin used to manufacture the liner supplied to the project (Section 7.4.4.1).

- Description of the spark testing device, the factory QA/QC plan for operating the system, and written certification that all liner rolls have been factory spark tested and do not contain pinhole defects (Section 7.4.3).

- Factory testing QA/QC plan and factory laboratory quality control manual for all liner and resin tests required in this Specification (Section 7.4.4)

- Factory test reports for each batch of HDPE resin used in the liner sheets including proportions of base polymer and additives, oxidative induction time, melt index and density. The resin manufacturer's certificate of analysis for each batch of resin shall also be provided (Section 7.4.4.1).

- Factory quality control certificates for each liner roll including minimum and average thickness, tensile properties, tear resistance, puncture resistance, density, carbon black content and carbon black dispersion (Section 7.4.4.2).

SPECIFICATIONS

SECTION 8
SYNTHETIC LINER INSTALLATION

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

8.1 **Description of Work**

This Specification covers the installation of High Density Polyethylene (HDPE) geomembrane liner and associated ancillary work. The HDPE liner shall be installed in accordance with this Specification and as shown on the Drawings. Liner installation includes: (i) surface water control during liner installation; (ii) maintenance of the prepared gypsum base for the liner; (iii) placement and seaming of smooth and textured liners; (iv) excavation and backfilling liner anchor trenches and permanent wind ballast trenches; (v) placement of temporary ballast loading; (vi) installation of flap vents; (vii) liner connections to the inlet structures; and (viii) installation of permanent concrete bag wind ballast atop the liner. The Specification includes the following sections.

Section	Item	Page
8.2	Referenced Standards	1
8.3	Surface Water Control and Base Maintenance	2
8.4	Liner Handling and Installation	2
8.5	Inspection and Field Testing by Contractor	7
8.6	Quality Control Inspection and Testing	9
8.7	Insurance	11
8.8	Warranty	11
8.9	As-Built Drawings	11
8.10	Submittals	11

8.2 **Referenced Standards**

The following American Society for Testing and Materials (ASTM) standards are referenced in this Specification.

D 698: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D 1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D 2216: Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock

D 2937: Standard Test Method for Density of Soil in Place by the Drive Cylinder Method

D 4253: Standard Test Methods for Maximum Index Density and Unit Weight of Soils

D 4254: Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

D 4437: Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes

D 4944: Standard Test Method for Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method

D 6392: Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

8.3 **Surface Water Control and Base Maintenance**

The base of the construction area shall be maintained well-drained prior to and during liner installation. Liner work areas shall be maintained well-drained and dry to prevent uplift of the liner after installation. The Contractor's proposed methods for dewatering, surface water control and routing water to the seepage collection ditch shall be submitted to the Program Manager and Engineer for approval at least two weeks prior to implementation.

The Liner Contractor shall maintain and restore, as needed, the condition of the prepared base prior to and during liner deployment and installation such that the prepared base is maintained in accordance with the Specifications in Section 6.9 at the time of liner deployment.

8.4 **Liner Handling and Installation**

Installation of the liner shall be in compliance with this Specification and with the Manufacturer's standard guidelines and specifications for liner installation, subject to approval by the Engineer, including, but not limited to: handling and site storage requirements; unrolling and laying of liner sheets; field welding techniques; anchor trench and temporary ballast details; vent details; and connections to the inlet structures.

8.4.1 On-Site Storage

On-site storage shall be as needed to protect the liner rolls from excessive accumulations of phosphogypsum and soil on the liner surfaces, water, heat, mechanical abrasion, puncture and

vehicular traffic. Liner rolls shall be stored on a firm, dry, elevated surface in a protected storage area approved by the Engineer or Receiver. The liner rolls shall not be stacked more than three rolls high, or as otherwise recommended by the Manufacturer.

8.4.2 Handling and Panel Placement

Appropriate handling equipment shall be used when loading or moving rolled liner sheets from one place to another. Appropriate equipment includes spreader and roll bars for deployment, and cloth chokers with a spreader bar for off-loading.

The liner shall be installed at the locations and to the lines, grades and dimensions shown on the Drawings, or as otherwise directed by the Engineer. A detailed layout plan and shop drawings shall be prepared and submitted for approval by the Engineer at least two weeks prior to liner installation.

Liner deployment shall not be performed when precipitation is occurring, when excessive moisture or wet conditions exist, or when high winds or other adverse climatologic conditions exist. The liner sheets shall be unrolled and deployed in a manner which minimizes wrinkles and prevents the occurrence of folds and creases.

Panel layout and deployment shall be such that the seams run down the slope of the dikes and are oriented perpendicular to the top of slope of the dikes. This seam orientation shall be maintained for a distance of at least 10 feet from the inside toe of the dikes or as otherwise shown on the Drawings or approved by the Engineer. The Liner Contractor shall submit a panel layout plan indicating the proposed liner panel configuration, and identifying field seams, anchor trenches, permanent wind ballast trenches, permanent bag wind ballast atop the liner, vents, inlet structure connections, and other details needed to complete the work, for approval by the Engineer, at least two weeks prior to liner installation.

8.4.3 Field Seams

All liner shall be seamed the same day that the liner is deployed. All liner shall be ballasted immediately after deployment to prevent uplift by winds. Welding of field seams shall not take place except during suitable ambient weather conditions, as confirmed by field trial test welds.

All liner sheets must be continuously and tightly bonded using continuous extrusion fillet welds or double wedge fusion welds and automated welding equipment approved by the Engineer. Field seaming shall be conducted in the dry, on a compacted smooth surface, and in such a manner to prevent phosphogypsum, dust, dirt, or other foreign material from being included in the seam.

Adjoining liner sheets shall be overlapped a minimum of 4 inches, and in no case less than 3 inches at any location, by adequately lapping the edges of the sheets. The overlap shall not exceed 6 inches for double-wedge fusion welds. Seam overlaps on the bottom area of the pond shall be made such that the direction of flow over the lined surface is from the top sheet toward the bottom sheet to form a shingle effect.

The edges to be welded shall be wiped and cleaned thoroughly to remove any phosphogypsum, dirt, dust, moisture or other foreign materials. All field seams must be uniform in appearance, width and properties, and shall not exhibit warping due to overheating from welding. The peel and shear

strengths of the welded seams must comply with the strength criteria in Section 8.4.3.1 of this Specification.

8.4.3.1 Field Seam Strength

All welded field seams shall meet the following criteria:

(i) When the weld is tested in shear in accordance with ASTM Standard D 6392, the specimen shall exhibit a film tear bond failure (FTB), and the strength shall be equal to or greater than 160 ppi. The tests shall be performed at a rate of displacement of 2 ipm until the maximum load is achieved, and the test then continued at a rate of displacement of 20 ipm until rupture.

(ii) When the weld is tested in peel in accordance with ASTM Standard D 6392, the specimen shall exhibit a film tear bond failure (FTB) and/or the liner must fail before the weld, and the strength shall be equal to or greater than 109 ppi. The peel strength criteria shall apply to both the top and bottom welds of double wedge fusion welds.

8.4.3.2 Pass/Fail Criteria

The following pass/fail criteria shall be used to determine compliance of field seams with the above strength criteria:

(i) All five seam specimens from a given sample or coupon tested in peel (both top and bottom for double wedge fusion welds) and all five specimens tested in shear shall exhibit the required strengths, and display film-tear bond (FTB) failures (i.e., 0 percent strength failures and 0 percent non-FTB failures); or

(ii) All five seam specimens from a given sample or coupon tested in peel and all five specimens tested in shear shall exhibit the required strengths and at least four out of five test specimens, for each type of test, shall exhibit a film tear bond (FTB) failure (i.e., 0 percent strength failures and up to 20 percent non-FTB failures); or

(iii) One seam specimen from a given sample or coupon tested in peel or shear may exhibit a non-FTB failure and a strength no less than 50 percent of the specified strength provided that all five field seam specimens tested from the duplicate (or archive) sample coupon exhibit the required strength and no more than one test specimen out of the five additional specimens exhibits a non-FTB failure (i.e., 10 percent (1 out of 10) strength failures and up to 20 percent (2 out of 10) non-FTB failures).

If a field seam fails the criteria specified herein, and the Liner Contractor wishes to establish to the Engineer that the failed sample represents a smaller section of the field seam than designated by the Engineer, additional coupons may be obtained at progressively increasing distances from both sides of the failed sample, at locations approved by the Engineer, until two consecutive samples on each side of the original sample pass the field seam criteria. At that point, the extent of the original defect in both directions along the field seam will be considered isolated and the Liner Contractor may then: (i) either cap, re-weld and re-test the seam up to and including the closest of the two passing samples, and patch and weld the hole of the furthest passing sample; or (ii) cap, re-weld and re-test the entire length of sampling.

If approved by the Engineer, double-wedge fusion welds may be repaired by extrusion welding the flap of the top sheet to the bottom sheet if the seam non-compliance is due only to a non-FTB failure of the destructive test sample.

Duplicate coupons of additional samples requested by the Liner Contractor for identifying the extent of a defective seam will not be tested, i.e., the seam shall meet either pass/fail criteria (i) or (ii). The Liner Contractor shall reimburse the Receiver for the cost of any such additional tests that he requests and which fail to meet the requirements of this Specification.

8.4.4 Anchor Trenches

The liner shall be anchored in anchor trenches in the crest of the dikes at the locations shown on the Drawings. Field Seams shall be welded continuously through the anchor trench.

Liner anchor trenches shall be no less than 18 inches in width and 24 inches in depth, and the corners of the trenches shall be slightly rounded to minimize sharp bends in the liner. After placement of the liner along one side and across the bottom of the trench, the trench shall be backfilled with gypsum fill meeting the materials requirements specified in Section 6.4. Anchor trench backfill shall be compacted to a dry density not less than 95 percent of the Standard Proctor maximum dry density (ASTM D 698 using drying temperature of 40EC). Care shall be taken not to damage the liner during placement and compaction of the gypsum.

8.4.5 Temporary Ballast Loading

Adequate loading that will not damage the liner shall be placed by the Liner Contractor over the liner during installation as needed to prevent uplift by wind and by rapid changes in barometric pressure. This temporary ballast loading shall be in addition to the anchor trenches and permanent wind ballast trenches. Sufficient temporary ballast loading shall be placed along panel edges, in particular, as needed to minimize the risk of wind flow under the panels. Continuous loading shall be provided at all panel edges during days off, at night, and whenever inclement or stormy weather is anticipated.

Temporary ballast loading may consist of gypsum filled or sand filled bags. Bags used for containing gypsum or sand shall be resistant to degradation by ultraviolet rays, shall contain the selected material without leakage, and shall be approved by the Engineer. No gypsum or soil fill shall be placed atop the liner, as ballast loading, without it being adequately and completely contained.

Temporary ballast loading shall be maintained as necessary or as otherwise directed by the Engineer. All temporary ballast loading shall be removed by the Liner Contractor prior to demobilizing from the site unless otherwise approved by the or Engineer.

The Liner Contractor shall submit a complete description and details of the proposed temporary wind ballast at least two weeks prior to liner installation. Approval by the Engineer shall not relieve the Liner Contractor from responsibility to provide all temporary wind ballast loading as needed to prevent uplift during construction.

8.4.6 Wind Ballast Trenches

The liner on the pond bottom area and dike slopes shall be anchored using permanent wind ballast trenches at the locations and to the lines and dimensions shown on the Drawings. Design orientations of the wind ballast trenches on the pond bottom area are generally perpendicular to the pond bottom contours. One-sided textured liner shall be used in the wind ballast trenches with the textured side in contact with the prepared gypsum base and smooth side facing up as shown on the details in the Drawings.

The permanent wind ballast trenches shall be excavated to the dimensions shown on the Drawings, and backfilled with gypsum meeting the material requirements specified in Section 6.4 of the Specifications. The backfill shall be compacted to a dry density equal to or greater than 95 percent of the Standard Proctor maximum dry density determined in accordance with ASTM D 698 (using a drying temperature of 40EC).

8.4.7 Other Ballast Loading

Permanent ballast loading consisting of 80-lb premix concrete bags placed long-side to long-side along the dike slope shall be installed at the locations shown on the Drawings. The concrete bags shall meet the requirements of Section 16.2 of the Specifications.

8.4.8 Liner Penetration at Inlet Structure

Penetrations through the HDPE liner at the inlet structures shall be made by welding the HDPE liner to the HDPE plate within the top of the structure as shown on the Drawings. The HDPE liner shall overlap the HDPE plate by 9 to 12 inches and shall be continuously extrusion welded all around the plate. An 80-mil thick HDPE cap strip continuously extrusion welded to the plate and liner shall be installed as shown on the Drawings. The extrusion welds shall comply with the requirements of Section 8.4.3. The Liner Contractor shall use caution when working near or around the pipe penetration connection to prevent damage to the HDPE pipe, HDPE plate or connection of the plate to the pipe.

8.4.9 Flap Vents

Flap vents shall be installed in the liner at the locations and to the lines and dimensions shown on the Drawings. The flap vents shall consist of a 6-inch diameter hole cut in the liner and covered by a 12-inch square flap of liner material welded across the top and sides using an extrusion weld.

8.4.10 Repairs

All liner defects (scratches, blisters, rips, punctures, tears, holes, pinholes, creases, folds, etc.) and holes created by removal of samples or coupons for destructive testing shall be marked and repaired by completely covering the defect or hole with an oval-shaped piece of the corresponding HDPE geomembrane material, and continuously welding the patch to the liner sheet using an extrusion weld. Holes created by removal of samples or coupons for destructive testing shall be marked, patched and repaired as specified above for liner defects. Liner repairs shall be documented including date, liner panel number, repair location, type of defect, and description of repairs made.

8.4.11 Liner Protection

No equipment, tools or personnel that can readily cause damage to the HDPE liner shall be allowed on the liner during and after installation. Personnel working on the HDPE liner shall not smoke, wear potentially damaging shoes, dispose of trash or other debris, or engage in any activity that could damage the liner.

The passage of construction equipment, other than light rubber-tired equipment approved by the Engineer, over any exposed HDPE liner surface is strictly prohibited. Light rubber-tired equipment exerting a contact stress less than 6 lb/in^2 will be allowed provided proper care is taken when operating the vehicle to avoid pulling, displacing or damaging the liner.

Any damage to the liner shall be immediately reported to the Engineer, and repaired by the Liner Contractor at his expense.

8.4.12 Fuel and Oil Spill Clean-Up

All spills or leaks of fuels or oils from equipment and vehicles on the surface of the liner shall be thoroughly cleaned with soap and water or, at the discretion of the Engineer, the affected liner shall be cut, removed and replaced with new liner material.

8.5 Inspection and Field Testing by Contractor

8.5.1 Initial Qualifying Welds

All master seamers/welders and seamers/welders shall demonstrate their ability to consistently make successful seams prior to installation of the liner. Each seamer or welder shall prepare test strips for each type of seam between different liner types and for both extrusion or double-wedge fusion welds. Each test strip shall have a minimum length of 20 feet. The welds shall be inspected for compliance with the requirements in Section 8.4.3. Six samples from each test strip shall be cut at locations selected by the Engineer and tested by the Liner Contractor in both shear and peel for compliance with the Specification requirements in Section 8.4.3. No seamer/welder shall be allowed to perform any production welds in the liner without first successfully passing these initial field tests.

8.5.2 Daily Qualifying Welds

At the beginning of each working day, after any interruption in power, after any prolonged idle period during the day, and at the request of the Engineer at any other time during the day, each seamer/welder shall prepare a 3-foot (for extrusion welds) to 10-foot (for double-wedge fusion welds) long test strip using the welding apparatus assigned to him. Five samples from the test strip shall be cut at locations selected by the Engineer and tested by the Liner Contractor in both shear and peel for compliance with the specification requirements in Section 8.4.3. The sample weld shall successfully pass the test requirements before either the welder or welding apparatus are allowed to operate on production welds.

8.5.3 Non-Destructive Testing of Welds

The Liner Contractor shall continuously test every field weld (i.e., 100 percent of the length of all field seams), including field welds around patches, using non-destructive testing techniques. These tests shall be performed in the presence of the Engineer. Extrusion welds shall be tested using a vacuum box and test procedures specified in ASTM Standard D 4437. Once the soap solution is uniformly placed over the weld and suction applied to the seam, any bubble formation must be noted and the corresponding defective area identified, marked, and subsequently repaired.

Double-wedge fusion welds with a continuous air gap between the two welds, shall be non-destructively tested by pressurizing the gap between the two welds to a pressure between 25 and 30 lb/in^2 and monitoring the pressure for any decline with time. After allowing 2 minutes for relaxation, the pressure shall be monitored over a test period of not less than 5 minutes. A weld will be considered satisfactory if either of the following criteria are satisfied:

(i) the loss in pressure is equal to or less than 2 lb/in^2 and the pressure stabilizes within the 5-minute test period; or

(ii) if criteria (i) is not satisfied, the additional pressure drop is equal to or less than 1 lb/in^2 during an additional test period of 5 minutes (i.e., the total pressure drop is less than or equal to 3 lb/in^2 over a 10-minute test period), and the pressure stabilizes during the second test period.

The length of welded section tested by air pressure shall not exceed 450 feet, without prior approval by the Engineer. If a non-compliant pressure drop is noted, pressure testing may be repeated in a step fashion each time halving the length of weld being tested until the extent of the defective weld is determined. Vacuum box testing (ASTM D 4437) may also be used to locate a defect in the top weld or in the top of the air channel.

Once the defect is found, it shall be clearly identified, marked and repaired. Any defective seam shall be repaired so that it meets or exceeds the minimum requirements specified herein.

8.5.4 Sampling and Destructive Testing

The Liner Contractor shall obtain and secure samples of the liner and field seams for destructive testing by the Engineer at locations designated by the Engineer. Samples shall be obtained at the frequency specified in Section 8.6.3. The Liner Contractor shall obtain seam samples, in triplicate, from the designated location for laboratory testing. One portion of the sample shall be retained by the Liner Contractor for testing. If the results of field tests performed by the Liner Contractor, in the presence of the Engineer, indicate compliance with the criteria in Section 8.4.3, then the Liner Contractor shall provide the second portion of the sample to the Engineer for independent testing, and the third portion will be retained by the Receiver's designated representative for archive storage. If the results of peel and shear tests performed by the Liner Contractor in the field do not meet or exceed the requirements specified herein, then the provisions of Section 8.4.3 shall apply for temporarily determining the extent of repairs pending performance of independent quality control tests by the Engineer.

The portions of seam samples provided to the Engineer for laboratory destructive testing, and provided to the Receiver's designated representative for archive storage, shall each be not less

than 12 inches wide by 18 inches long in the direction of the seam. The seam shall be centered along the sample length. Each of the triplicate sample portions shall be properly marked and identified by the Liner Contractor. All samples shall be properly marked and identified by the Liner Contractor. The Liner Contractor shall repair all holes created by sampling in accordance with Section 8.4.10.

8.5.5 Visual Inspection

The Liner Contractor shall visually inspect the entire liner surface for any defects including, but not limited to, seam imperfections, badly scuffed areas, scratches, blisters, tears, rips, holes, pinholes, and punctures. He shall identify, mark, and repair all noted defects, as well as defects designated by the Engineer. Repairs shall be made in accordance with Section 8.4.10.

8.5.6 Quality Assurance Forms

The Liner Contractor shall adopt and use the quality assurance forms prepared by the Engineer, or other forms approved by the Engineer, during all applicable phases of liner installation, inspection and testing. The Liner Contractor can request to use his forms. The forms must be submitted to the Engineer at least two weeks prior to liner installation for review and approval.

8.5.7 Certification

The Liner Contractor's installation supervisor shall observe and check all phases of the liner installation. When the liner is finally accepted, the Liner Contractor shall submit written certification that the installation conforms to the requirements of the Liner Manufacturer.

8.6 **Quality Control Inspection and Testing by Engineer**

8.6.1 Base Maintenance and Repair During Liner Installation

The Engineer will undertake observations and perform quality control tests to determine compliance with these Specifications. Quality control by the Engineer will include monitoring gypsum fill placement to determine the suitability of subgrade materials and adequacy of compaction. The Engineer will perform *in situ* density tests: (i) after compaction of fill as needed to fine grade, maintain and restore the condition of the prepared base; (ii) after dressing the slopes of dikes; (iii) after compaction of fill in excavations as needed to restore the grade; and (iv) after compaction of backfill in anchor and wind ballast trenches. *In situ* density tests will be performed by the drive cylinder method (ASTM D 2937), sand cone method (ASTM D 1556) or other methods approved by the Engineer. Moisture content tests made in the field using a calcium carbide gas pressure moisture tester (ASTM D 4944) may be used to provide moisture content information for construction control, but final acceptance of all liner subgrade material will be based upon the ASTM Standard D 2216 test method (using a drying temperature of 40EC) unless approved otherwise by the Engineer. Penetration test probes may also be performed as needed to verify the uniformity of compaction. The Engineer will perform Standard Proctor compaction tests on gypsum fill (ASTM D 698, using a drying temperature of 40°C for gypsum) to determine compliance with compaction requirements.

Testing of the uppermost one foot of gypsum base will be made by the Engineer following final grading and compaction by the Earthwork Contractor before the surfaces are turned over to the

Liner Contractor. Testing of the uppermost one foot of the surfaces to receive the liner will be repeated, as needed, immediately prior to liner placement. Final documentation and results from these tests, however, will not be available prior to liner deployment. Such testing shall not relieve the Liner Contractor from his responsibility for restoration or repair of unsuitable areas following liner placement, in the event that such is deemed necessary by the Engineer.

8.6.2 Liner Installation

All aspects of the liner installation will be inspected on a full-time basis by the Engineer. The Engineer will conduct his own inspections and tests in addition to those performed by the Liner Contractor. The Engineer will undertake observations and perform quality control tests to determine compliance of the liner installation with these Specifications. Quality control by the Engineer will include monitoring: (i) liner handling and panel deployment; (ii) field welding of liner sheets and non-destructive testing of field welds; (iii) installation of anchor and wind ballast trenches; (iv) placement and maintenance of temporary ballast loading; (v) attachment of the liner to the inlet structures; (vi) construction of flap vents; and (vii) placement of permanent concrete bag wind ballast atop the liner. The Engineer will also monitor liner repair work, and evaluate the adequacy and acceptability of all repair work.

8.6.3 Destructive Testing

The Liner Contractor shall obtain and secure samples (coupons) of the liner and field seams for destructive testing by the Engineer from locations designated by the Engineer, and shall properly mark all test specimens as needed to identify the particular seam or liner panel from which the specimen was obtained. Testing of the liner materials will be conducted by the Engineer as specified in Section 7.5. Seam samples will be taken for destructive peel and shear strength testing by the Engineer at a minimum frequency of 1 sample per 500 feet of field seam.

Duplicate samples of all HDPE liner material and all field seams tested destructively by the Liner Contractor shall also be secured by the Liner Contractor and submitted to the Engineer for independent testing. All samples shall be properly marked and identified.

Failure of any sample to meet or exceed the requirements specified herein shall be considered cause for rejection of the material, installed liner section, or field seam from which the sample was collected to the extent designated by the Engineer. If the Liner Contractor can establish to the Engineer, via submittal of additional test results, that the failed sample is representative of a smaller section of the liner or field seam, then only that portion will be rejected, provided, however, that the additional tests are performed by the Engineer. The Liner Contractor shall reimburse the Receiver for the cost of any such additional tests that he requests and which fail to meet the requirements of the Specifications.

8.7 **Insurance**

The Liner Contractor shall provide the Receiver insurance coverage against blowout or uplift of the liner during installation. The insurance coverage shall remain in effect until the Receiver issues a Letter of Acceptance to the Liner Contractor.

The Liner Contractor shall agree to provide the Receiver with a commitment to re-install or replace any liner that may blowout during the time when the insurance coverage is in effect, at the same

rate as required during initial installation, without adversely affecting the rate of progress of work yet to be performed. Additional material, manpower and equipment shall be mobilized to the site within two weeks of a blowout occurrence as needed to comply with this commitment.

8.8 **Warranty**

A written warranty shall be provided to the Receiver by the Liner Contractor. This document shall warrant the quality of the workmanship for a period of not less than 2 years beginning on the date of the Letter of Acceptance from the Receiver.

8.9 **As-Built Drawings**

The Liner Contractor shall submit to the Engineer, within 30 days of completion of installation of the liner, an as-built plan in AutoCAD format showing the location and identification of all installed liner panels, anchor trenches, repairs and destructive test samples.

8.10 **Submittals**

The following submittals are required from the Liner Contractor as part of the requirements of the Specifications.

- The proposed methods for dewatering, surface water control and routing water to the seepage collection ditch shall be submitted at least two weeks prior to implementation (Section 8.3).

- Shop drawings showing the proposed liner panel layout and details of the liner installation, including wind ballast trenches, anchor trenches, vents, permanent concrete bag wind ballast atop the liner, and connection to the inlet structures shall be submitted at least two weeks prior to liner installation (Section 8.4.2).

- A complete description and details of the proposed temporary wind ballast loading shall be submitted at least two weeks prior to liner installation (Section 8.4.5).

- Quality assurance forms proposed for use by the Contractor for all phases of liner installation, inspection and testing shall be submitted at least two weeks prior to liner installation (Section 8.5.6).

- Certification by the Liner Contractor, when the liner is accepted by the Receiver, that the liner installation is in compliance with the requirements of the Liner Manufacturer (Section 8.5.7).

- Workmanship warranty for a period of at least two years beginning on the date of the Letter of Acceptance from the Receiver (Section 8.8).

- As-built plan of the installed HDPE liner within 30 days of completion of liner installation (Section 8.9).

SPECIFICATIONS

SECTION 9
PRESSURE-RATED HDPE PIPES AND FITTINGS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

9.1 **Description of Work**

This Specification covers the material requirements and installation of pressure-rated HDPE pipe and fittings shown on the Drawings. This Specification contains the following sections.

Section	Item	Page
9.2	Referenced Standards	1
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9.2 **Referenced Standards**

The following American Society for Testing and Materials (ASTM) standards are referenced in this Specification.

D 638: Standard Test Method for Tensile Properties of Plastics

D 695: Standard Test Method for Compressive Properties of Rigid Plastics

D 696: Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics

D 790: Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D 792: Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D 1238: Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

D 1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique

D 1603: Standard Test Method for Carbon Black in Olefin Plastics

D 1693: Standard Test Method for Environmental Stress Cracking of Ethylene Plastics

D 2240: Standard Test Method for Rubber Property - Durometer Hardness

D 2412: Standard Test Method for External Loading Properties of Plastic Pipe by Parallel-Plate Loading

D 2513: Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings

D 2837: Standard Specification for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

D 3261: Standard Specification for Butt Heat Fusion Polyethylene Plastic Pipe and Tubing

D 3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

F 714: Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter

9.3 **Material Requirements**

9.3.1 Base Resin

The base resin shall be high density, high molecular weight polyethylene (HDPE) with properties equivalent to ASTM D 3350 cell classification PE345444C or PE345464C. The pipe and fittings shall be manufactured from virgin resin with no regrind material. The resin shall contain not less than 97 percent of the base resin, and not less than 2.0 percent carbon black. The pipe material shall contain no more than 3 percent carbon black, anti-oxidants and heat stabilizers combined, and no other additives, fillers or extenders.

9.3.2 Physical Appearance

All pipes and fittings shall have good appearance qualities. The pipe and fittings shall be homogeneous throughout, and the surfaces shall be smooth and uniform with no visible defects. The pipes shall be free of holes, cracks, nicks, cuts, gouges, scratches, blisters, gels, undispersed ingredients, any signs of contamination by foreign inclusions, or any defect that may affect serviceability.

9.3.3 Physical Properties

Pipe and fitting dimensions, workmanship, standard dimension ratio (SDR) and corresponding pressure rating shall be in accordance with the requirements of ASTM F 714. Pipes shall be furnished in Standard 40-foot lengths. The pipe material shall meet the following criteria:

Property	Test Method	Criterion
Density	ASTM D 1505	>0.945 g/cc
Melt Index	ASTM D 1238	<0.15 g/10 minutes
Carbon Black Content	ASTM D 1603	$2.0% & <3.0%
Flexural Modulus	ASTM D 790	>125,000 psi
Tensile Strength at Yield	ASTM D 638, Type IV*	>3,000 psi
Elongation at Yield	ASTM D 638, Type IV*	>8%
Modulus of Elasticity	ASTM D 638, Type IV*	>100,000 psi
Environmental Stress Crack Resistance	ASTM D 1693, Condition C	>5,000 hrs
Hardness	ASTM D 2240	>60 Shore "D"
Compressive Strength at Yield	ASTM D 695	>1,600 psi
Hydrostatic Design Basis	ASTM D 2837	>1,600 psi
Low Temperature Brittleness	ASTM D 746	<-118EC
Thermal Expansion Coefficient	ASTM D 696	<0.022%/EC
*Type IV Specimen tested at a rate of strain of 2 inches/minute		

The Contractor or Supplier shall submit a complete description of the HDPE pipe and fittings proposed for use to the Engineer for approval at least two weeks prior to pipe installation. The Manufacturer's product data sheets and certification from the Manufacturer that the pipe and fittings are in compliance with this Specification shall also be supplied to the Engineer at least two weeks prior to installation.

9.3.4 Fabricated Fittings

Fabricated fittings made by butt fusing cut segments of pipe shall be used where shown on the Drawings. Fabricated fittings shall be made using pipe segments meeting the base resin, physical appearance and physical property requirements specified in Sections 9.3.1, 9.3.2 and 9.3.3 of this Specification. Shop drawings for fabricated fittings shall be submitted to the Engineer for approval at least two weeks prior to fabrication.

9.2.5 Approved Manufacturers

The following manufacturers and corresponding pipe series designations are approved for use:

- Chevron Phillips DriscoPlex PE 3408 Pipe Series
- Poly Pipe PE 3408 Pipe Series

Other manufacturers producing equivalent pipes may be approved provided product data sheets and resin certificates are submitted to the Engineer to confirm compliance with this Specification.

The Manufacturer’s product data sheets, resin certificates, and certification from the Manufacturer that the pipe and fittings are in compliance with the Specifications shall be submitted to the Engineer for approval at least two weeks prior to installation.

9.3.6 Marking and Packaging

The pipe Manufacturer shall mark each pipe length and each fitting with the Manufacturer's name or trademark, pipe series designation, size and SDR.

Packaging, handling and shipment shall be in accordance with the pipe Manufacturer's standards, instructions and recommendations.

9.3.7 Plate

HDPE plate on the inlet structures shall have the thicknesses and dimensions shown on the Drawings. The HDPE plate shall meet the material property requirements in Sections 9.3.1, 9.3.2 and 9.3.3 of this Specification.

9.4 Joint Requirements and Pressure Testing

The HDPE pipe, and the pipe and fittings, shall be joined using butt, heat fusion wells. All joints shall be made in compliance with the Manufacturer's recommended practice for heater surface temperature, heating time, applied pressure and cooling time, subject to the Engineer's approval. All joints shall be made by trained technicians qualified by the Manufacturer and using equipment and controlled procedures approved by the Manufacturer.

All pipe joints shall be stronger than the pipe itself under both tension and hydrostatic loading conditions. The joints shall be leak-tight, homogeneous and uniform throughout. The Contractor shall submit written documentation certifying compliance with the Manufacturer's standard specifications and Quality Assurance/Quality Control plan for the butt, heat fusion technique. Bend back tests shall be performed at least once per day for each pipe diameter and SDR to demonstrate the integrity of the fusion welds.

The joined outlet pipe for the inlet structure shall be hydrostatically pressure tested prior to burial in accordance with the Manufacturer's recommendations. At a minimum, the pipes shall be filled with water, trapped air bled from the pipe, and the pipe then pressurized to 90 psi. The initial pressure shall be applied and allowed to stand for 3 hours. During this time water should be added at hourly increments to maintain the pressure. After the initial testing period, the pipe shall be filled with water, the pressure returned to 90 psi, and the pressure held for at least 2 hours. The pipeline and joints will be considered to have passed the pressure test if there are no visual leaks, and less than 4.3 gallons of water per 100 feet of 18-inch diameter pipe is added at the end of the 2-hour test period (or 6.5 gallons of water per 100 feet of 18-inch pipe after 3 hours) to restore the pressure to 90 psi to compensate for expansion of the pipe under the final test pressure.

Bolted flange connections, where specified on the Drawings, shall be made in accordance with the Manufacturer's recommendations and the details shown on the Drawings. The flange outside diameter and drilling configuration shall conform to ANSI standards. The bolts, nuts and washers shall be AISI type 316 stainless steel. The HDPE flanges shall have AISI type 316 stainless steel back-up rings. Bolts shall be torqued in accordance with the Manufacturer's recommendations, and as approved by the Engineer. The torque of each bolt shall be checked when the bolts are cool. Flanged connections will not be allowed to be buried unless the bolts are cool and the torque of each bolt checked just prior to burial.

9.5 Storage and Handling

The Contractor shall comply with the pipe Manufacturer's recommendations for handling and storing pipe and fittings. The pipe shall be stored on clean, level ground to prevent undue scratching or gouging and as needed to protect the pipe from being covered with excessive dirt and/or phosphogypsum, from water and moisture, and from mechanical abrasion. Care shall be taken to minimize the amount of soil or phosphogypsum collected inside the pipe while handling and installing. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp objects, and care shall be exercised during installation not to damage the pipes and fittings.

9.6 Installation

The inlet structure 90° ell, pipe, tee, plate and gusset plates shall be fabricated to the dimensions shown on the Drawings. Installation methods and handling shall be in accordance with the Manufacturer's recommendations as approved by the Engineer. Concrete, reinforcing steel and closed cell polyethylene shall be installed to the lines, dimensions, and details shown on the Drawings, and in accordance with the requirements of Sections 14 and 16 of the Specifications. The Contractor shall survey the elevation of the installed 90° ells prior to completion of placement of reinforcing steel and prior to placement of concrete to verify installation to within ±0.05 feet of the required vertical location.

Outlet pipe laying, handling and installation shall be in accordance with the Manufacturer's recommendations, this Specification, and the details shown on the Drawings. Pipe sections shall be joined adjacent to the trench, prior to placing the pipe on the pipe bedding. Care shall be taken not to drop the pipe while moving it, and to avoid excess stress or strain during installation. When pulling the pipe, either a pulling head or a suitable wraparound sleeve with rubber protective cover shall be used to prevent the pulling cables from damaging the pipe. The maximum pulling length shall be limited to 500 feet.

Pipe installation and placement of backfill around pipelines shall be performed when the pipe is in a contracted state, i.e., during the cool of the morning, at night, or during periods of over-cast skies.

Immediately after placement, the pipe shall be thoroughly and completely embedded, supported, and covered, and the backfill compacted, in accordance with Section 6.11 and Section 12.4.2 of the Specifications, and the details shown on the Drawings.

9.7 Protection and Repairs

Care shall be exercised during construction not to damage the pipelines and fittings. Construction equipment shall not be allowed to pass over any pipeline until a minimum of 3 feet of compacted cover is placed above the crown of the pipe.

Any pipe section, fitting or joint which becomes broken, cracked, crushed, cut, scratched, gouged or otherwise rendered unsuitable, as determined by the Engineer, shall be removed and replaced by the Contractor. Scratches greater than 6 inches in length and gouges exhibiting a depth in excess of 8 percent of the wall thickness of the pipe or fitting shall be cause for rejection of a pipe section or fitting to the extent designated by the Engineer.

9.8 **Quality Control Inspection and Testing**

The Engineer will undertake observations and inspections to determine compliance of the materials and work with this Specification. Quality control by the Engineer will include monitoring and/or inspecting: (i) the HDPE pipe and fittings for correct size, SDR rating workmanship, and fabrication; (ii) damage during installation; (iii) the installation, alignment and welding of all pipe and fittings; (iv) backfilling around and cover placement over the pipe; and (v) liner connections and construction of the inlet structures.

9.9 **Submittals**

The following submittals are required from the Contractor as part of the requirements of Section 9 of the Specifications.

- A complete description of the HDPE pipe and fittings with the Manufacturer's product data sheets, description of the HDPE resin, Manufacturer's certificate of analysis for the HDPE resin, and Manufacturer's certification that the pipe and fittings satisfy the requirements of this Specification.

- Shop drawings for the inlet structure HDPE pipe fittings.

SPECIFICATIONS

SECTION 10
CORRUGATED HDPE PIPE AND FITTINGS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

10.1 **Description of Work**

This Specification covers the material requirements and installation of corrugated HDPE pipe and fittings shown on the Drawings. This Specification contains the following sections.

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10.2 **Referenced Standards**

The following American Society for Testing and Materials (ASTM) and American Association of State Highway and Transportation Officials (AASHTO) standards are referenced in this Specification.

ASTM D 1248: Standard Specification for Polyethylene Plastics Molding and Extrusion Materials

AASHTO M 252: Corrugated Polyethylene Drainage Tubing

10.3 **Material Requirements**

The relief drain collection pipe (if required) shall consist of a 6-inch diameter slotted corrugated HDPE pipe. The pipe and fittings shall be in compliance with AASHTO specification M 252 "Corrugated Polyethylene Drainage Tubing". The HDPE pipe and fittings shall satisfy the following criteria:

10.3.1 Base Resin

High-density polyethylene resin with properties equivalent to ASTM D 1248 Type III, Class C, Category 4 or 5, Grade P33 or P34, and ASTM D 3350 classification PE335434C shall be used in the manufacture of the HDPE pipe and fittings. The resin must contain at least 2 percent carbon black as defined in ASTM D 1248 for Class C pipe. The pipe and fittings material shall contain no more than 3 percent carbon black, anti-oxidants and heat stabilizers combined, and no other additives, fillers or extenders. The pipe and fittings shall be manufactured from virgin resin with less than 3 percent regrind material.

10.3.2 Physical Appearance

All pipes and fittings shall have good appearance qualities. The pipe and fittings shall be homogeneous throughout, and the surfaces shall be smooth and uniform with no visible defects. The pipes shall be free of holes, cracks, nicks, cuts, gouges, scratches, blisters, gels, undispersed ingredients, any signs of contamination by foreign inclusions, or any defect that may affect serviceability.

10.3.3 Perforations

Perforations in the corrugated HDPE pipe shall consist of slots cleanly cut and evenly spaced along 4 lines around the pipe circumference and centered within the corrugation valleys along the length of the pipe. Perforations located in immediately adjacent corrugation valleys shall be offset by 45 degrees. Perforations shall satisfy the following criteria:

- Slot Width (inches) < 0.125
- Slot Length (inches) < 1.0
- Perforated Area (in^2/foot) > 4.0

A complete description of the proposed HDPE base resin, pipe perforations and fittings that meet the requirements of the Specifications, in addition to a 2-foot long sample of the perforated pipe, shall be submitted to the Engineer for approval at least two weeks prior to installation.

10.4 **Storage and Handling**

The Contractor shall comply with the pipe Manufacturer's recommendations for handling and storing pipe and fittings. The pipe shall be stored on clean, level ground to prevent undue scratching or gouging and as needed to protect the pipe from being covered with excessive dirt and/or phosphogypsum, from water and moisture, and from mechanical abrasion. Care shall be taken to minimize the amount of soil or phosphogypsum collected inside the pipe while handling and installing. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp objects, and care shall be exercised during installation not to damage the pipes and fittings.

Any pipe section, fitting or joint which becomes broken, cracked, crushed, cut, scratched, gouged or otherwise rendered unsuitable, as determined by the Engineer, shall be removed and replaced by the Contractor. Scratches greater than 6 inches in length and gouges exhibiting a depth in excess of 8 percent of the wall thickness of the pipe shall be cause for rejection of pipe or fittings to the extent designated by the Engineer.

10.5 **Pipe Fitting and Joint Requirements**

Joints between corrugated pipe sections and fittings shall be the split coupling type. All joints shall be made by: (i) butting the two adjacent pipe sections end-to-end; (ii) centering the coupling at the joint and wrapping it tightly around the pipe sections; (iii) tightly wrapping the coupling to the adjacent pipe sections with PVC pipe tape around the pipe and coupling circumference a minimum of 3 times for at least a length of 2 inches at each end of the coupling; and (iv) placing one weather resistant polypropylene lashing or stainless steel tie wire tightly around each end of the coupling. The joint shall prevent structural separation of adjacent pipe sections and provide a tightly fitting joint such that gaps do not exist which could allow the migration of the surrounding filter gravel into the pipe. Tape used for the joints shall be PVC-type, black color, 2 inch wide, 10 mil thick pipe wrapping tape approved by the Engineer. A minimum of 2 polypropylene lashing ties or 2 stainless steel wire ties shall be used to secure each coupling. Polypropylene lashing ties shall be weather-resistant polypropylene non-releaseable ties with minimum loop tensile strength of 90 lb. Stainless steel tie wire shall be AISI Type 316 stainless steel. Joints between fittings and pipe sections shall be made in a similar manner.

10.6 **Laying and Installation**

Laying, handling and installation of the pipe shall be in accordance with the Manufacturer's recommendations, this Specification, and the details shown on the Drawings. Pipe sections shall be joined adjacent to the trench, prior to placing the pipe on the pipe bedding. Care shall be taken not to drop the pipe while moving it, and to avoid excess stress or strain during installation. When pulling the pipe, either a pulling head or a suitable wraparound sleeve with rubber protective cover shall be used to prevent the pulling cables from damaging the pipe.

Pipeline installation and placement of backfill around pipelines shall be performed when the pipe is in a contracted state, i.e., during the cool of the morning, at night, or during periods of over-cast skies.

Immediately after placement, the pipe shall be thoroughly and completely embedded, supported, and covered, and the backfill compacted, in accordance with the Specifications and the details shown on the Drawings.

10.7 **Protection and Repairs**

Care shall be exercised during construction not to damage the pipe or fittings. Construction equipment shall not be allowed to pass over any pipe until a minimum of 3 feet of compacted cover is placed above the crown of the pipe.

Any pipe section, fitting or joint which becomes broken, cracked, crushed, cut, scratched, gouged or otherwise rendered unsuitable, as determined by the Engineer, shall be removed and replaced by the Contractor. Scratches greater than 6 inches in length and gouges exhibiting a depth in

excess of 8 percent of the wall thickness of the pipe or fitting shall be cause for rejection of a pipe section or fitting to the extent designated by the Engineer.

10.8 **Quality Control Inspection and Testing**

The Engineer will undertake observations and inspections to determine compliance of the materials and work with this Specification. Quality control by the Engineer will include monitoring and/or inspecting: (i) the HDPE pipe and fittings; (ii) damage during installation; and (iii) the installation, alignment and joining of all pipe, and fittings.

10.9 **Submittals**

The following submittals are required from the Contractor as part of the requirements of this Specification.

- A complete description of the HDPE pipe and fittings with the Manufacturer's product data sheets, description of the HDPE resin, Manufacturer's certificate of analysis for the HDPE resin, and Manufacturer's certification that the pipe and fittings satisfy the requirements of this Specification.

- A 2-foot long sample of the perforated HDPE pipe.

SPECIFICATIONS

SECTION 11
GEOTEXTILES AND HDPE GEONET

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

11.1 **Description of Work**

This Specification covers the material requirements and installation of geotextiles and HDPE geonet/geotextile composites shown on the Drawings. The Specification contains the following sections.

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11.2 **Referenced Standards**

The following American Society for Testing and Materials (ASTM) standards are referenced in the Specification.

D 413: Standard Test Methods for Rubber Property-Adhesion to Flexible Substrate.

D 1238: Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

D 1248: Standard Specification for Polyethylene Plastics Molding and Extrusion Materials

D 1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique

D 1603: Standard Test Method for Carbon Black in Olefin Plastics

D 1683: Standard Test Method for Failure of Sewn Seams in Woven Fabrics

D 3776: Standard Test Methods for Weight (Mass) per Unit Area of Woven Fabrics

D 3786: Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics-Diaphragm Bursting Strength Tester Method

D 4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity

D 4533: Standard Test Method for Trapezoid Tearing Strength of Geotextiles

D 4632: Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

D 4716: Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products

D 4751: Standard Test Method for Determining Apparent Opening Size of a Geotextile

D 4833: Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

D 5035: Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)

D 5199: Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

11.3 **Material Requirements**

The geonet/geotextile composite shall consist of a HDPE geonet with non-woven geotextiles heat bonded to both sides of the geonet. The geonet shall be manufactured from unreinforced HDPE designed and manufactured for use in drainage geonets. All geotextiles shown on the Drawings shall be non-woven geotextiles.

11.3.1 Geonet

11.3.1.1 HDPE Resin

The uncolored base resin shall have a density of at least 0.932 gms/cm^3. The formulated colored resin shall have properties equivalent to ASTM D 1248, Type III, Category 4 or 5, and Grade P34. The resin shall contain not less than 97 percent of the base polymer, and not less than 2.0 percent carbon black as defined in ASTM D 1248 for Class C high density polyethylene. The geonet shall contain no more than 3 percent carbon black, anti-oxidants and heat stabilizers combined, and no other additives, fillers or extenders. The geonet shall be manufactured from virgin resin, with no more than 3 percent regrind material. No post-consumer resin of any type shall be used.

11.3.1.2 Physical Appearance

The geonet shall be uniform in appearance and composition and shall be free of tears, cuts, gels, undispersed ingredients, any signs of contamination by foreign matter, or any defect that may affect serviceability.

11.3.1.3 Physical Properties

The HDPE geonet shall meet the following criteria:

Property	Test Method	Criterion
Melt Index	ASTM D 1238, Condition E	#1.0 gm/10 minutes
Carbon Black Content	ASTM D 1603	$2.0% & <3.0%
Density	ASTM D 1505	$0.94 g/cm^3
Thickness	ASTM D 5199	$0.20 inches
Mass Per Unit Area	ASTM D 3776	$23 oz/yd^2
Transmissivity	ASTM D 4716	$1.0x10^{-3} m^2/sec*
Tensile Strength	ASTM D 5035	$45 lb/in **

* Machine direction under a compressive load of 10 lb/in^2 and at a gradient of 1.0.
**Machine direction.

A complete description of the geonet proposed for use and the Manufacturer's product data sheets shall be submitted to the Engineer for approval at least two weeks prior to installation. Certification from the Manufacturer that the geonet is in compliance with this Specification shall also be supplied to the Engineer two weeks prior to installation.

11.3.2 Geotextiles

Geotextiles for the geonet/geotextile composite and where shown on the Drawings shall be a non-woven, needle-punched fabric manufactured from 100 percent polyester or 100 percent polypropylene. The geotextiles shall be uniform and homogeneous in appearance and composition, and free from tears, cuts, thin spots, or any defects that may affect serviceability. The geotextiles shall meet the following criteria.

Property	Units	Test Method	Criteria	
			Composite Geotextiles	12 oz/yd^2 Geotextile
Mass per Unit Area	oz/yd^2	ASTM D 3776	$8	$12
Thickness	mils	ASTM D 5199	$90	$130
Apparent Opening Size	USSS†	ASTM D 4751	$100	$100
Grab Tensile Strength*	lbs	ASTM D 4632	$120	$275
Grab Elongation*	%	ASTM D 4632	$50	$50
Trapezoidal Tear Strength*	lbs	ASTM D 4533	$50	$110
Puncture Resistance	lbs	ASTM D 4833	$80	$150
Mullen Burst Strength	psi	ASTM D 3786	$360	$480
Permeability to Water	cm/sec	ASTM D 4491	$0.2	$0.2

* Machine and transverse directions.
† United States Standard Sieve Size

The following manufacturers and 12 oz/yd^2 geotextile types are approved for use, provided the above criteria are satisfied:

- Polyfelt TS-800 non-woven polypropylene geotextile.
- Amoco 4512 non-woven polypropylene geotextile.

A complete description of the geotextiles proposed for use and the Manufacturer's product data sheets shall be submitted to the Engineer for approval at least two weeks prior to installation. Certification from the Manufacturers that the geotextiles are in compliance with this Specification shall also be supplied to the Engineer two weeks prior to installation.

11.3.3 Geonet/Geotextile Composite

The geonet and geotextiles in the composite shall meet the requirements of Sections 11.3.1 and 11.3.2. The geonet/geotextile composite shall also: (i) display a transmissivity (ASTM D 4716 using a compressive load of 10 lb/in^2 and a gradient of 1.0) equal to or greater than 2.0×10^{-4} m^2/sec in the machine direction and 1.0×10^{-4} m^2/sec in the transverse direction; and (ii) the bond between the geotextiles and the geonet shall exhibit an average ply adhesion of equal to or greater than 4.0 lb/in and a minimum peel strength on any specimen of 2.0 lb/in determined in accordance with ASTM D 413.

A complete description of the geonet/geotextile composite proposed for use with a minimum 1 square yard sample and the Manufacturer's product data sheets shall be submitted to the Engineer for approval at least two weeks prior to installation. Certification from the Manufacturer that the geonet/geotextile composite is in compliance with this Specification shall also be supplied to the Engineer at least two weeks prior to installation.

11.4 **Factory Testing and Inspection**

11.4.1 Factory Testing

Standard factory testing reports for raw materials including melt index and specific gravity or density for each batch of resin used to manufacture the geonet shall be submitted to the Engineer for approval at least two weeks prior to installation. The resin Manufacturer's certificate of analysis for each batch of resin shall also be provided to the Engineer at least two weeks prior to installation.

Factory quality control certificates for the geonet component of the geonet/geotextile shall be provided to the Engineer by the Manufacturer at least two weeks prior to installation. As a minimum, the quality control certificates shall contain the geonet roll identification number, date manufactured, roll width and length, and resin batch number. The following factory quality control tests shall be provided at the indicated frequencies:

Property	Test Method	Frequency
Mass per Unit Area	ASTM D 3776	Every 10 Rolls
Thickness	ASTM D 5199	Every 10 Rolls
Tensile Strength*	ASTM D 5035	Every 10 Rolls
Transmissivity**	ASTM D 4716	Every 20 Rolls
Melt Index	ASTM D 1238	Once per Batch of Resin or Every 10 Rolls
Carbon Black Content	ASTM D 1603	Once per Batch of Resin or Every 10 Rolls
Density	ASTM D 1505	Once per Batch of Resin or Every 10 Rolls
* Machine and transverse direction. ** Machine direction.		

Failure of any of the tests shall result in rejection of the corresponding lot of geonet.

Factory quality control certificates for the geotextile component of the geonet/geotextile composite shall be provided to the Engineer by the Manufacturer at least two weeks prior to installation. The quality control certificates shall contain the geotextile roll number, date manufactured, roll length and width. The Manufacturer shall provide test results to the Engineer for every 5,000 yd^2 of geotextile or at least one sample per lot of geotextile for mass per unit area, thickness, apparent opening size, permeability to water, and grab tensile strength and elongation in accordance with the test procedures in Section 11.3.2. Failure of any of the tests shall result in rejection of the corresponding lot of geotextile.

11.4.2 Factory Inspection

The geotextiles and geonet/geotextile composite shall be visually inspected at the factory prior to shipment for compliance with the physical appearance requirements in Sections 11.3.1.2 and 11.3.2. All necessary repairs shall be made by the Manufacturer at the factory prior to shipment.

11.4.3 Marking and Packaging

Each geotextile and geonet/geotextile composite roll shall be individually packaged at the factory to prevent damage during shipping and handling, and shall be completely wrapped by a protective ultraviolet resistant thin plastic film having a minimum thickness of 2 mils. The Manufacturer shall provide each roll with a label indicating the roll number, product name, length, width and date manufactured.

11.5 **Handling and Installation**

11.5.1 Storage and Handling

The Contractor shall be responsible for unloading and storing the geotextile and geonet/geotextile composite rolls. The geotextiles and geonet/geotextile composite shall remain wrapped in the protective cover and shall be stored, as recommended by the Manufacturer and approved by the Engineer, in an area of the site that protects the geotextiles from moisture, water, phosphogypsum, dirt, ultraviolet light and mechanical damage until the time of installation. The rolls shall not be unwrapped more than one hour before use. Handling of the rolls shall be in accordance with the Manufacturer's recommendations, and shall be as needed to protect the geotextiles from damage.

11.5.2 Laying and Installation

The geonet/geotextile composite and geotextiles shall be installed at the locations and to the lines and dimensions shown on the Drawings.

The geonet/geotextile composite shall be cut to the widths shown on the Drawings and deployed, where practical, with the roll length parallel to the edge of the crest of the dike to minimize joints. The geonet/geotextile composite and geotextiles shall be installed in a smooth and unwrinkled condition in uniform contact with the underlying materials, and held in place as needed and approved by the Engineer until covered.

The ends of the geonet at a joint shall be overlapped 4 inches, and tied together with polyethylene or polypropylene ties recommended by the Manufacturer and approved by the Engineer. Metallic ties shall not be used. A minimum of three ties shall be used at each joint, and the ties shall be of a color to allow easy inspection (e.g., white or yellow) against the black geonet. The upper and lower geotextiles of the composite at the joint shall be overlapped a minimum of 4 inches, and the top geotextile overlap shall be sewn in accordance with Section 11.5.3.

After installation, the geonet/geotextile composite shall not be left exposed for more than 48 hours prior to covering.

The exposed edge of the geonet on all cut sides and ends of the geonet/geotextile composite shall be covered with a piece of the same geotextile as on the composite overlapped 12 inches minimum on the bottom and top of the composite. The edge of the top lap shall be held in-place until covered using spot thermal bonding or black PVC pipe wrapping tape as approved by the Engineer and, if needed, temporary sand bags. The upper and lower geotextiles along the uncut edge of the geonet/geotextile composite shall be sewn in accordance with Section 11.5.3.

Geotextiles shall be installed where shown on the Drawings in a manner that minimizes seams. The geotextiles shall be cut to the dimensions shown on the Drawings, overlapped if needed, and installed in a smooth unwrinkled condition in contact with the underlying materials. The geotextiles shall be held in place as needed until covered, and shall always be covered within 48 hours of installation.

11.5.3 Geotextile Field Seams

Field seams in geotextiles shall be made using a minimum overlap of 4 inches. The geotextile panels shall be sewn together with a sewing machine using a flat sewn seam with one row of stitches with a minimum of 4 stitches per inch, or a seam and stitching pattern recommended by the Manufacturer and approved by the Engineer. The thread used to sew the seams shall be 2000 denier minimum, or as recommended by the Manufacturer and approved by the Engineer, and shall have the same composition as the geotextile. The strength of field seams shall not be less than 50 percent of that of the unaged geotextile in any principal direction when tested in accordance with ASTM D 1683 at a strain rate of 12 inches/minute. The Contractor shall submit details of the proposed sewing method (type of stitch, number of stitches per inch, number of stitching rows, distance from the edge of the geotextile to the stitches, weight and type of thread, etc.) and a minimum 3 feet long sample of the sewn seam for approval by the Engineer at least one week prior to installation.

11.5.4 Geotextile Repairs

All tears, punctures, thinly stretched sections, or any other defect that may, as determined by the Engineer, render the geotextile unsuitable, shall be repaired by the Contractor. Repairs shall be made by overlaying a patch of geotextile over the damaged area with a 12 inch minimum lap all around. The patch shall be sewn to the geotextile, as specified in Section 11.5.3, all around the patch perimeter. Patches on geotextiles on the geonet/geotextile composite shall be held in place by thermal bonding or 2-inch wide black PVC pipe wrapping tape, and sewn in accordance with Section 11.5.3 of this Specification where directed by the Engineer.

Geotextile and geonet/geotextile composite that require more than one repair to the geotextile per roll shall be rejected and replaced.

11.6 **Sampling and Inspection by Contractor**

11.6.1 Sampling

The Contractor shall obtain and secure samples of the non-woven geotextiles, and geonet/geotextile composite for destructive testing by the Engineer when the rolls are delivered to the site or subsequently during installation as requested by the Engineer. The samples shall be obtained from locations designated by the Engineer. All samples shall be properly marked and identified by the Contractor. The Contractor shall repair all openings created by sampling in accordance with Section 11.5.4 or completely remove the full width of the roll at the sampling location.

11.6.2 Visual Inspection

The Contractor shall visually inspect the surfaces of the installed non-woven geotextiles, and geonet/geotextile composite for any defects including, but not limited to, rips, tears, punctures and defective seams. The Contractor shall identify, mark, and repair all noted defects, as well as defects designated by the Engineer. Repairs to geotextiles shall be made in accordance with Section 11.5.4. Geonet/geotextile composite with damage to both geotextile surfaces at any location shall be removed and replaced.

The Contractor shall visually inspect the surfaces for soil, phosphogypsum, dust or debris that could result in clogging of the geonet or geotextiles. If soil, phosphogypsum, dust or debris is entrapped in the geonet, it shall be removed and replaced or the surfaces cleaned as approved by the Engineer.

11.7 **Quality Control Inspection and Testing**

The Engineer will undertake observations and perform quality control tests to determine compliance of the materials and work with this Specification. Quality control by the Engineer will include monitoring and/or inspecting: (i) geotextile handling, installation, overlapping and field seaming; (ii) geonet/geotextile composite handling, installation, overlapping and field joining; (iii) the geotextile and geonet for damage; and (iv) the geotextile and geonet for excessive entrapped soil, phosphogypsum, dust or debris that could reduce the transmissivity of the composite.

Laboratory quality control tests will be performed by the Engineer on the geonet/geotextiles composite materials at the following minimum indicated frequencies.

Material	Property	Test Method	Minimum Testing Frequency
Geonet Component	Thickness Mass Per Unit Area Density Carbon Black Content Tensile Strength	ASTM D 5199 ASTM D 3776 ASTM D 1505 ASTM D 1603 ASTM D 5035	Once per 10 rolls
	Transmissivity	ASTM D 4716	Once per 20 rolls
Geotextile Component	Thickness Mass Per Unit Area Grab Strength & Elongation	ASTM D 5199 ASTM D 3776 ASTM D 4632	Once per 10 rolls
	Apparent Opening Size Permeability	ASTM D 4751 ASTM D 4491	Once per 20 rolls
	Field Seam Strength	ASTM D 1683	Once per 200 feet of field seam
Geonet/Geotextile Composite	Transmissivity Ply Adhesion	ASTM D 4716 ASTM D 413	Once per 20 rolls Once per 10 rolls

Failure of any sample to meet or exceed the requirements specified herein shall be considered cause for rejection of the material or installed section from which the sample was collected to the extent designated by the Engineer. If the Contractor can establish to the Engineer, via additional tests performed by the Engineer at Contractor's expense, that the failed sample is representative of a smaller section of the installed material than the entire lot represented by the original test sample, then only that portion will be rejected, provided, however, that the additional tests are performed by the Engineer representing the Receiver.

11.8 **Submittals**

The following submittals are required from the Contractor as part of the requirements of this Specification.

- A complete description of each non-woven geotextile, the Manufacturer's product data sheets for each, and the Manufacturer's certification that the geotextiles meet the requirements of this Specification.
- Factory quality control certificates for each roll of non-woven geotextile HDPE geonet, and geonet/geotextile composite.
- Proposed sewing method for field seaming the non-woven geotextiles and a minimum 3 feet long sample of sewn seam.

- A complete description of the HDPE geonet/geotextile composite, a minimum 1 square yard sample of the composite and 1 square yard sample of the non-woven geotextile used on the composite, the Manufacturer's product data sheets, and the Manufacturer's certification that the geonet/geotextile composite meets the requirements of this Specification.

SPECIFICATIONS

SECTION 12
SOILS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

12.1 Description of Work

This Specification covers material requirements, placement and compaction of soil beneath the concrete apron at the inlet structures, soil for pipe bedding, soil cover atop the HDPE liner on the partition dike, and soil used to backfill the vertical risers of the existing spillway structures where shown on the Drawings. The Specification includes the following sections.

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12.2 Referenced Standards

The following American Society for Testing and Materials (ASTM) standards are referenced in this Specification.

D 422: Standard Test Method for Particle-Size Analysis of Soils

D 698: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D 1140: Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve

D 1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D 2216: Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock

D 2487: Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D 2937: Standard Test Method for Density of Soil in Place by the Drive Cylinder Method

D 2974: Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D 4253: Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

D 4254: Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

D 4944: Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method

12.3 **Material Requirements**

12.3.1 Pipe Bedding, Soil Below Concrete Aprons and Spillway Riser Backfill

Soil materials used for pipe bedding, soil below the concrete apron at the inlet structures and soil used to backfill the vertical risers of the existing spillway structures shall be non-cemented and free from rocks, stones, gravel and other deleterious materials (organic material, wood, trash, debris, sharp objects, particles greater than 1/4-inch in size, etc.), and shall consist of clean sand classifying as SP type soil in accordance with ASTM D 2487 (e.g., fine sand meeting the gradation criteria of Section 902-2.1 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction; Latest Version). The organic content shall be equal to or less than 1 percent determined in accordance with ASTM D 2974.

12.3.2 Soil Cover on Lined Partition Dike

Soil materials used for cover on the lined partition dike shall be non-cemented and free from rocks, stones, gravel and other deleterious materials (organic material, wood, trash, debris, sharp objects, particles greater than 1/4-inch in size, etc.), and shall consist of slightly silty sand, silty sand, and/or slightly clayey sand classifying as SP-SM, SM and/or SP-SC type soils in accordance with ASTM D 2487. Slightly clayey SP-SC type soils shall have a fines content of less than 10 percent as determined in accordance with ASTM D 1140. The organic content of all soils used for cover shall be equal to or less than 1 percent as determined in accordance with ASTM D 2974.

2.4 **Placement and Compaction**

12.4.1 Pipe Bedding

Pipe bedding shall be placed and compacted to the lines and dimensions shown on the Drawings.

After installation of the pipeline, the soil bedding shall be worked under the haunch of the sides of the pipe to provide side support throughout. Placement of the soil shall be controlled such that the soil completely surrounds and is in full contact with the pipe surface to the lines and dimensions shown on the Drawings. The pipe bedding shall fill around and be in contact with the entire pipe circumference, with particular care taken to ensure that voids are not present around the lower one-third of the pipe circumference. Precautions shall be taken to prevent lateral or vertical movement of the pipe during filling and compaction, including the use of ground anchors if needed. Care shall be taken during placement and compaction of the soil bedding not to damage the pipe.

Soil used for pipe bedding shall be placed in uniform horizontal layers and compacted to a dry density equal to or greater than 70 percent of the relative density determined in accordance with ASTM D 4253 and ASTM D 4254. The soil shall be moisture conditioned as needed to achieve the required in-place dry density.

12.4.2 Soil Below Concrete Aprons

The soil base for the concrete aprons at the inlet structures shall be hand-placed in a single lift and compacted with a vibrating plate compactor, mechanical tamper, or other equipment approved by the Engineer. The soil shall be compacted to an in-place dry density equal to or greater than 70 percent of the relative density determined in accordance with ASTM Standards D 4253 and D 4254.

12.4.3 Spillway Riser Backfill

After the common lateral outlet pipe of the two existing spillway structures is backfilled in accordance with Section 16.5, the vertical riser of each structure shall be backfilled with soil fill. The soil fill shall be placed by sluicing in a controlled manner into the open top of the structure. During backfill soil placement, the water level in the risers shall be maintained (by pumping to the Phase II-B dewatering ditch network) at least 5 feet below the lowest level of the riser section to prevent discharge of displaced process water onto the Phase II-A liner.

12.4.4 Soil Cover on Lined Partition Dike

The soil cover atop the HDPE liner on the partition dike crest road shall be constructed to the lines, grades and dimensions shown on the Drawings.

Placement of the cover shall be undertaken by light track-mounted or rubber-tired equipment exerting a relatively low contact stress (e.g., low ground pressure D-4 or D-5 dozer exerting less than 4.5 lb/in^2 of contact stress) and traveling on a minimum of 18 inches of soil end dumped ahead of the equipment with front-end loaders. Care should be exercised during placement to not damage the HDPE liner and pipe vents, or damage or displace the geonet/geotextile drainage layer and plywood protection sheets above the HDPE liner with the blade, bucket, tracks or tires of the equipment. Any damage to the liner or geonet/geotextile composite shall be immediately reported to the Engineer and repaired at Contractor's expense.

The soil cover shall be placed in two lifts. The first lift above the HDPE liner shall be 18 inches in loose thickness. The surface of the first lift shall be carefully scarified prior to placement of the second lift. Each lift shall be compacted to an in-place dry density equal to or greater than 95 percent of the Standard Proctor maximum dry density (ASTM D 698).

12.5 **Quality Control Inspection and Testing**

The Engineer will undertake observations and perform quality control tests to determine compliance of soil materials with this Specification. Quality control by the Engineer will include monitoring: (i) the suitability of the borrow soils used in construction; (ii) placement and compaction; (iii) any repair work necessitated by damage caused by the Contractor's operations; and (iv) thickness measurements to verify compliance with the geometric requirements of the Drawings and this Specification.

The Engineer will perform moisture content determinations (ASTM D 2216) and *in-situ* density tests on the compacted soils. Density tests will be performed using the drive cylinder method (ASTM D 2937) or sand cone method (ASTM D 1556). Moisture content tests made in the field using calcium carbide gas pressure moisture meters (ASTM D 4944) may be used to provide moisture content information for construction control. The Engineer will perform Standard Proctor compaction tests (ASTM D 698) and minimum and maximum density tests (ASTM D 4253 and ASTM D 4254) on representative samples of borrow materials as needed for compaction control.

The Engineer will perform the following quality control tests on soil materials at the indicated minimum testing frequencies.

Material	Property	Test Method	Minimum Testing Frequency
Soil on Partition Dike Crest Road	Thickness	Survey or Measurement	1/300' of dike
	In-Place Density	ASTM D 2937 ASTM D 1556	1/200' of dike
	Fines Content	ASTM D 1140	1/200 yd^3
	Organic Content	ASTM D 2974	1/400 yd^3
Pipe Bedding	In-Place Density	ASTM D 2937 ASTM D 1556	1/50 yd^3
	Fines Content	ASTM D 1140	1/100 yd^3
	Organic Content	ASTM D 2974	1/200 yd^3
Spillway Riser Backfill	Fines Content	ASTM D 1140	1/Structure
Soil Below Concrete Aprons	In-Place Density	ASTM D 2937 ASTM D 1556	1/10 yd^3
	Fines Content	ASTM D 1140	1/20 yd^3
	Organic Content	ASTM D 2974	1/40 yd^3

12.6 **Submittals**

The Contractor shall submit minimum 10-pound samples of the soils proposed for use along with his proposed methods and equipment for borrowing and hauling soil to the top of the Old Gypsum Stack, and for placing and compacting soil above the HDPE liner, for approval by the Engineer at least two weeks prior to undertaking placement of any soil.

SPECIFICATIONS

SECTION 13
AGGREGATES

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

13.1 **Description of Work**

This Specification section covers the material requirements and installation of aggregates for construction of a relief drain in the base of the OGS-S compartment, if required. The Specification contains the following sections:

Section	Item	Page
13.2	Referenced Standards	1
13.3	Silica Gravel	2
13.4	Coarse Sand	2
13.5	Fine Sand	3
13.6	Placement	3
13.7	Quality Control Inspection and Testing	4
13.8	Submittals	4

13.2 **Referenced Standards**

The following American Society for Testing and Materials (ASTM) and Florida Department of Transportation (FDOT) standards are referenced in this Specification.

ASTM D 422: Standard Test Method for Particle-Size Analysis of Soils

ASTM D 2488: Practice for Description and Identification of Soils (Visual-Manual Procedure)

ASTM D 4373: Standard Test Method for Calcium Carbonate Content of Soils

FDOT Standard Specifications for Road and Bridge Construction

13.3 **Silica Gravel**

The silica gravel shall consist of rounded, sub-rounded to sub-angular processed clean silica gravel, and shall classify as a GP-type poorly graded fine gravel, or fine gravel with coarse sand in accordance with ASTM Standard D 2487. The silica gravel shall contain at least 98 percent silica (of which at least 50 percent is in the form of primary silica), less than 1 percent carbonate minerals (ASTM Standard D 4373), and less than 0.1 percent organic material (ASTM Standard D 2974 - Method C). The silica gravel shall exhibit the following gradation requirements as determined using ASTM Standards D 421 and D 422 unless approved otherwise by the Engineer.

U.S. Standard Sieve Size	Percent Passing (Dry Weight Basis)
3/4-inch	100
3/8-inch	65-100
No. 4	6-50
No. 8	0-8
No. 40	0-1
No. 200	0-0.3

A complete description of the proposed silica gravel, mineralogic composition, gradation test results, a 25 pound sample of aggregate, and the Supplier's certification confirming compliance with this Specification shall be submitted to the Engineer for approval at least two weeks prior to construction.

13.4 **Coarse Sand**

The coarse sand shall consist of clean coarse silica sand containing at least 35 percent rounded, sub-rounded to sub-angular particles, and no more than 65 percent angular particles. The coarse sand shall contain at least 98 percent silica, no more than 1 percent carbonate minerals (ASTM Standard D 4373), and shall classify as an SP-type poorly graded coarse sand with fine gravel to SP-type poorly graded medium to coarse sand in accordance with ASTM Standard D 2487. The coarse sand shall exhibit the following gradation requirements as determined using ASTM Standards D 421 and D 422 unless approved otherwise by the Engineer.

U.S. Standard Sieve Size	Percent Passing (Dry Weight Basis)
3/8-inch	100
No. 4	62-100
No. 6	35-87
No. 8	15-64
No. 10	12-50
No. 20	0-20
No. 40	0-10
No. 200	0-0.5

A complete description of the proposed coarse sand, mineralogic composition, gradation test results, a 25 pound sample of aggregate, and the Supplier's certification confirming compliance with this Specification shall be submitted to the Engineer for approval at least two weeks prior to construction.

13.5 **Fine Sand**

The fine sand shall consist of clean fine silica sand. The fine sand shall contain at least 98 percent silica, no more than 1 percent carbonate minerals (ASTM Standard D 4373) and shall classify as an SP-type poorly graded medium to fine sand in accordance with ASTM Standard D 2487. The fine sand shall exhibit the following gradation requirements as determined using ASTM Standards D 421 and D 422 unless approved otherwise by the Engineer.

U.S. Standard Sieve Size	Percent Passing (Dry Weight Basis)
No. 10	100
No. 20	60-100
No. 40	25-72
No. 60	10-41
No. 100	0-20
No. 140	0-11
No. 200	0-4
No. 270	0-1

A complete description of the proposed fine sand, mineralogic composition, gradation test results, a 25 pound sample of aggregate, and the Supplier's certification confirming compliance with this Specification shall be submitted to the Engineer for approval at least two weeks prior to construction.

13.6 **Placement**

Placement of the aggregate in the relief drain shall be in accordance with the locations, lines, grades, dimensions and details shown or identified on the Drawings, and in compliance with this section.

A 6-inch thick layer of silica gravel shall be placed over the non-woven geotextile fabric across the entire width of the gravel drain. The gravel bedding (on which the slotted corrugated HDPE pipe invert will rest) shall be carefully shaped to grade along the pipe length to be installed. Care shall be exercised during placement so as not to damage the geotextile fabric and to avoid pulling the fabric. Any damage to the fabric shall be repaired by the Contractor at his expense.

Following installation of the HDPE pipe, silica gravel shall then be placed on both sides of the pipe and above the pipe to the minimum thickness and dimensions shown on the Drawings. Placement of the silica gravel shall be controlled such that the gravel completely surrounds the pipe. Sufficient silica gravel material shall be worked under the haunch of the pipe up to the springline to provide side support throughout, and precautions shall be taken to prevent lateral or vertical movement of the pipe during filling. The pipe shall be weighted down as needed. The silica gravel shall completely fill around and be in contact with the entire pipe circumference, with particular care taken to ensure that voids are not present around the lower one-third of the pipe circumference. Care shall be exercised so as not to damage the pipes and filter fabric. Any damage to the pipes and filter fabric shall be repaired by the responsible party at their expense.

Sand filter sections shall be placed at each end of the silica gravel, as shown on the Drawings, and in accordance with the installation procedures described above for the gravel. Care shall be taken to prevent the silica gravel and sand materials from becoming contaminated with gypsum or dust, prior to and during placement.

13.7 **Quality Control Inspection and Testing**

The Engineer will undertake observations and perform quality control tests to determine compliance of the materials and work with this Specification. The Engineer will obtain samples of aggregates and perform quality control tests, including particle shape (ASTM D 2488), gradation (ASTM D 422), and total carbonates (ASTM D 4373), as needed, and will monitor the placement of aggregates.

13.8 **Submittals**

The following submittals are required from the Contractor as part of the requirements of this Specification.

- A complete description of the Contractor's proposed silica gravel, mineralogic composition and gradation test results, a 25 pound sample or each aggregate, and the Supplier's certification confirming compliance with the Specification requirements.

- A complete description of the Contractor's proposed coarse sand, mineralogic composition and gradation test results, a 25 pound sample or each aggregate, and the Supplier's certification confirming compliance with the Specification requirements.

- A complete description of the Contractor's proposed fine sand, mineralogic composition and gradation test results, a 25 pound sample or each aggregate, and the Supplier's certification confirming compliance with the Specification requirements.

SPECIFICATIONS

SECTION 14
CONCRETE AND REINFORCING STEEL

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

14.1 **Description of Work**

This Specification covers the requirements for reinforced cast-in place concrete at the inlet structures. The Specification includes the following sections.

Section	Item	Page
14.2	Referenced Standards	1
14.3	General Requirements	2
14.4	Reinforcing Steel	4
14.5	Cast-in-Place Concrete	5
14.6	Quality Control Inspection and Testing	8
14.7	Submittals	8

14.2 **Referenced Standards**

The following American Society for Testing and Materials (ASTM) and American Concrete Institute (ACI) standards are referenced in the Specification.

ACI 301: Specifications for Structural Concrete

ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

ACI 305: Recommended Practice for Hot Weather Concreting

ACI 306: Recommended Practice for Cold Weather Concreting

ACI 347: Recommended Practice for Concrete Formwork

ACI SP-66: Recommended Practice for Placing Reinforcing Bars

ASTM A 82: Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement

ASTM A 185: Specifications for Welded Steel Wire Fabric for Concrete Reinforcement

ASTM A 615: Specifications for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement

ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C 33: Standard Specification for Concrete Aggregates

ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C 94: Standard Specification for Ready-Mixed Concrete

ASTM C 143: Standard Test Method for Slump of Hydraulic Cement Concrete

ASTM C 150: Standard Specification for Portland Cement

ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete

ASTM C 192: Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

ASTM C 309: Standard Specification for Liquid Membrane - Forming Compounds for Curing Concrete

ASTM C 618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

14.3 **General Requirements**

14.3.1 Product Handling

The Contractor shall use all means necessary to protect materials before, during and after installation and to protect any other completed work. In the event of damage, the Contractor shall immediately make all repairs and replacements specified by the Engineer at no additional cost.

Concrete reinforcement shall be stored in a manner to prevent excessive rusting and fouling with dirt, grease and other bond-breaking coatings. Precautions shall be taken to maintain reinforcing steel identification after the bundles are broken.

14.3.2 Formwork

Formwork, where required, shall comply with all pertinent codes and regulations, and all pertinent recommendations contained in ACI 347. Where provisions of pertinent codes and standards conflict with the requirements of this section of this Specification, the more stringent provisions shall govern.

All form lumber in contact with exposed concrete shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic, or other acceptable material capable of producing the desired finish. No selected form facing materials shall

be specified for rough form finish surfaces. Form sealers shall be first quality of their respective kinds and subject to approval by the Engineer.

Form ties shall be a type which do not leave an open hole through the concrete and which permit neat and solid patching at every hole. Wire ties and wood spreaders shall not be used. When forms are removed, all metal shall be not less than 2 inches from the surface. Alternate forming systems may be used subject to approval by the Engineer.

All other materials, not specifically described but required for proper completion of concrete formwork, shall be as selected by the Contractor subject to approval by the Engineer.

14.3.3 Design and Construction of Forms

Design and construction of all forms, where required, shall be sufficiently tight to prevent leakage of mortar, and able to prevent excessive deflection when filled with wet concrete. Design loads and pressures shall conform to those stipulated in ACI 347.

All required cast-in-place concrete shall be formed, where needed, to the shapes, sizes, lines, and dimensions indicated on the Drawings. The Contractor shall exercise care in the layout of forms to avoid the necessity for cutting of concrete after it is in place. Proper provisions shall be made for all openings, offsets, recesses, anchorage, blocking, and other features of the work as shown on the Drawings or as required. Reinforcement and other such items required to be anchored in the concrete shall be set before the concrete is placed. Reinforcement shall not be used to support forms or keyways.

The forms shall be braced and tied together to maintain position and shape and to ensure safety to personnel. Bracing and supporting members of ample size and strength shall be constructed to safely carry, without excessive deflection, all dead and live loads to which they may be subjected. The Contractor shall provide metal spreader ties that give positive tieing and accurate spreading. Forms shall be constructed straight, true, plumb, and square within a tolerance horizontally of 1 in 400 and a tolerance vertically of 1 in 500. Forms shall be sufficiently wetted to prevent joints from opening up before concrete is placed.

14.3.4 Removal of Forms

Side forms of footings and foundations may be removed, with Engineer's approval, 24-hours after placement of concrete, but the time may be extended if deemed necessary. The Contractor shall use all means necessary to protect workmen, the installed work and materials, and ensure the complete safety of the work. Nails and tie wires or form ties shall be cut off flush, and all surfaces left smooth and clean. Metal spreader ties on exposed concrete shall be removed by snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas. Holes resulting from the use of the spreader rods and sleeve nuts shall be flushed using water and then solidly packed throughout the wall thickness with cement grout applied under pressure by means of a grouting gun. Grout shall be one (1) part Portland cement to two and one-half (2-1/2) parts sand. Grout shall be applied immediately after removing forms.

14.4 **Reinforcing Steel**

The Contractor shall comply with all pertinent codes and regulations, the pertinent recommendations contained in ACI SP-66 and "Recommended Practice for Placing Reinforcing

Bars" of the Concrete Reinforcing Steel Institute. When provisions of pertinent codes and standards conflict with the requirements of this section of the Specification the more stringent provisions shall govern.

The Contractor shall submit shop drawings he has reviewed and approved for each cast-in-place concrete structure to the Engineer for approval. Submittals shall include bending diagrams, assembly diagrams, splicing and laps of rebar, and shapes, dimensions and details of bar reinforcing and accessories.

All concrete reinforcement materials shall be new, free from rust, and comply with the following standards:

- Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (ASTM A 615, Grade 60).
- Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement (ASTM A 82).
- Specifications for Welded Steel Wire Fabric for Concrete Reinforcement (ASTM A 185).

All materials shall be stored in a manner to prevent excessive rusting and fouling within dirt, phosphogypsum, grease, and other bond-weakening coatings. All other materials, not specifically described but required for a complete and proper installation of concrete reinforcement, shall be as selected by the Contractor subject to approval by the Engineer.

Reinforcement shall be fabricated in strict accordance with the approved shop drawings. The Contractor shall not use bars with kinks or bends not shown on the Drawings or on the accepted shop drawings. Bending or straightening steel which has been partially embedded in hardened concrete or in any other manner that will injure the material will not be permitted. Any bending shall be done cold. Bends for stirrups and ties shall be made around a pin having a diameter not less than four times the minimum thickness of the bar. Bends for other bars, including hooks, shall be made around a pin having a diameter not less than six times the minimum thickness of the bar for bars up to 1 inch in diameter and eight times the minimum thickness of the bar for bars over 1 inch in diameter.

All concrete reinforcement shall be accurately placed, secured and supported with metal chairs, spacers or hangers before the start of concrete placement. The clear space between bars shall not be less than the nominal diameter of round bars. In no case shall the clear distance be less than 1 inch nor less than one and one-third times the maximum size of aggregate. The Contractor shall provide the following minimum concrete covering of reinforcement:

- Concrete placed against soil or phosphogypsum: 3 inches.
- Concrete cover over all reinforcing steel: 3 inches

14.5 **Cast-in-Place Concrete**

14.5.1 General

The Contractor shall comply with all pertinent codes and regulations, and all pertinent recommendations of ACI 301 and ACI 304. Where provisions of pertinent codes and standards conflict with this Specification, the more stringent provisions shall govern.

14.5.2 Documentation

Before any concrete is delivered, the Contractor shall furnish to the Engineer for approval, a concrete mix design for each class of concrete to be used. The design mixes shall be proven by compression test cylinders, tested by a recognized testing laboratory or by certification and test results of a standard mix of the transit-mix concrete supplier in accordance with ACI 301. All material used in the design mixes shall be that proposed for this project. Tests shall be in accordance with ASTM C 39. The slump of the concrete used in these test cylinders shall not be less than the maximum slump specified.

The Contractor shall keep a record at the job-site showing time and location of each placement of concrete, together with transit-mix delivery slips certifying contents of the pour per ASTM C 94. The record shall be made available to the Engineer for his use upon request. Upon completion of this portion of the work, the Contractor shall deliver the record and the delivery slips to the Engineer.

14.5.3 Concrete

All concrete, unless otherwise specifically permitted by the Engineer, shall be transit-mixed in accordance with ASTM C 94. The control of concrete production and all tests of cement, aggregates, and water shall be by a recognized testing laboratory, approved by the Engineer.

Concrete shall be air entrained and shall conform to the following requirements:

Minimum Compressive Strength at 28 days (psi):	3000
Minimum Cement Content (sacks per cyd):	5 ½
Maximum Water to Cement Ratio:	0.45
Percent Air by Volume:	4 to 6
Slump (inches):	4 to 5

Cement shall be Portland cement conforming to ASTM C 150, modified Type II, Low C_3A (5 percent max.), or equivalent approved by the Engineer.

Aggregates shall be non-reactive aggregates consisting of at least 95 percent silica (dry weight basis) and containing less than 1.0 percent total carbonates (dry weight basis) determined in accordance with ASTM D 4373 on specimens ground to pass the U.S. Standard No. 60 sieve.

14.5.4 Preparation

The Contractor shall remove all debris from the areas in which concrete will be placed. To ensure proper placement and bonding of concrete, the area shall be thoroughly cleaned. Forms, if required, shall be thoroughly wet (except in freezing weather) or sprayed or brushed with a releasing agent and all standing water removed. All transporting and handling equipment shall be

thoroughly cleaned. The Engineer shall be notified at least 24 hours before concrete is placed. Concrete shall not be placed until all forms, reinforcing steel and other items to be embedded within the concrete have been observed and approved by the Engineer.

14.5.5 Placing Concrete

Concrete shall be placed in conformance with ACI 304. Concrete shall be conveyed from mixer to place of final deposit by methods that will prevent separation and loss of materials. For chuting, pumping, and pneumatically conveying concrete, only equipment of such size and design as to ensure a practically continuous flow of concrete at the delivery end without loss or separation of materials shall be used. Concrete shall be deposited as nearly as possible in its final position to avoid segregation due to rehandling and flowing. Concrete shall be placed as dry as possible consistent with good workmanship, never exceeding the maximum specified slump. Concrete shall be placed in a manner that will avoid splashing forms or reinforcing bars and shall not be dropped freely more than 4 feet. Aluminum pump lines or tools shall not be allowed for concrete pumping and placement.

Concrete shall be placed at such a rate that it is at all times plastic and flows readily between bare bars. Once concrete placement is started, it shall be a continuous operation until placement is complete. When stoppage of concrete operations occurs for any reason, construction joints shall be placed as required. Construction joints shall be provided with shear key, and/or dowels, to resist shear and moment as specified by the Engineer.

All Concrete shall be thoroughly consolidated by mechanical vibration or other suitable means during placement, working it around all embedded fixtures and into corners of forms. A vibrator shall be inserted at many locations, from 5 to 15 seconds, until vibration is sufficient to only bring a continuous film or mortar to the surface. Vibration shall stop before any segregation of the concrete occurs.

Concrete batches delivered to the job-site shall be kept as uniform as possible in consistency and strength. The following shall be considered a basis for the rejection of the concrete delivered to the site.

- Evidence that the concrete has been retempered.
- Concrete that has been contaminated with foreign material.
- Slump exceeding maximum specified.
- Percent of entrained air not within specified limits.
- Discharge from truck not within the 1-1/2 hour limitation of ASTM C 94.

14.5.6 Finishing

After concrete has been screeded to grade, it shall be floated with a metal or wooden float followed by a steel trowel finish. Unless otherwise indicated on the Drawings, the Contractor shall finish all concrete to an even and uniform appearance and, where no slope is required, level within plus or minus 1/8 inch in 10 feet.

14.5.7 Curing

All concrete shall be cured regardless of temperature, weather, or season, to protect it from premature drying, excessively hot or cold temperatures, and mechanical injury. Immediately upon finishing the concrete or removing formwork, curing procedures shall be initiated. Curing shall be continued for at least seven days. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive strength has reached 70 percent of the specified strength. If one of the curing procedures is used initially, it may be replaced by one of the other procedures any time after the concrete is one day old provided the concrete is not permitted to become surface dry during the transition.

Optional curing methods include:

1. Continuous sprinkling with fresh water.

2. Waterproof sheet materials conforming to ASTM C 171:

   A. Immediately upon finishing an area, an acceptable curing membrane shall be applied.

   B. Lap and securely join all joints.

   C. Weight membrane down to prevent wind damage.

3. Curing Compound conforming to ASTM C 309:

   A. Immediately upon finishing an area, an acceptable curing compound shall be applied to the entire area.

   B. The compound shall be applied in strict conformance to the recommendations of the manufacturer.

Moisture loss from surfaces placed against wooden or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal, the concrete shall be cured until the end of the time prescribed by one of the methods noted above. No traffic shall be allowed on concrete until it has been sufficiently cured.

14.5.8 Hot Weather Requirements

Concrete placement in hot weather shall be in accordance with ACI 305. Concrete with a placement temperature that will cause loss of slump, flash set or cold joints shall not be used. A concrete temperature during placement of less that 90EF shall be maintained. All means necessary to avoid drying the concrete prior to finishing operations shall be used. All required windbreaks, sunshades, fog sprays, evaporation retardant and other devices to protect the concrete shall be provided and used by the Contractor.

14.5.9 Cold Weather Requirements

Concrete placement in cold weather shall be in accordance with ACI 306. Concrete shall be placed with the mix temperature between 50EF and 70EF. When the mean daily outdoor temperature is at or below 40EF the concrete shall be maintained between 50EF and 70EF for the required curing period of Section 14.5.7 of this Specification. Concrete shall not be placed against or on frozen material.

The Contractor shall provide and use all required framework, cover, heating apparatus, and other devices to protect the concrete. Concrete and/or aggregates shall be protected during batching, transit and mixing, and before and after placing.

14.5.10 Defective Work

The Contractor shall inspect all concrete surfaces and patch all pour joints, voids, rock pockets, form tie holes, and other imperfections before the concrete is thoroughly dry. Defective areas shall not be patched until concrete has been observed by the Engineer. If the defects are serious or affect the strength of the structure, of if patching does not satisfactorily restore the quality and appearance of the surface, the Engineer may require the concrete be completely removed and replaced in accordance with the provisions of this section, all at no additional cost.

14.6 Quality Control Inspection and Testing

The Engineer will undertake observations and perform quality control tests to determine compliance of the materials and work with this Specification. Quality control by the Engineer will include monitoring and/or inspecting: (i) reinforcing steel placement; (ii) concrete placement, finishing and curing; and (iii) sampling and testing of the concrete for compliance with this Specification including samples for testing in accordance with ASTM C 31, ASTM C 39 and ASTM C 143.

14.7 Submittals

The following submittals are required from the Contractor as part of the requirements of this Specification: (i) shop drawings for reinforcing steel; (ii) concrete mix design; and (iii) transit-mix delivery slips.

SPECIFICATIONS

SECTION 15
GRASSING

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

15.1 **Description of Work**

This Specification section covers grassing by seeding and grassing by sodding. The Specification contains the following sections.

Section	Item	Page
15.2	Referenced Standards	1
15.3	Seeding and Sodding	2
15.4	Grassing by Sodding	4
15.5	Watering	4
15.6	Submittals	4

A 80-mil High Density Polyethylene (HDPE) liner exists beneath and along the edge of the soil being grassed by seeding or by sodding. The Contractor shall familiarize himself with the location and depth of the HDPE liner, and exercise necessary caution while performing all work to avoid damaging the exposed or buried liner. Any suspected or actual damage to the liner shall be immediately reported to the Engineer and repaired at the Contractor's expense.

15.2 **Referenced Standards**

The following Florida Department of Transportation Standard Specifications for Road and Bridge Construction are referenced in the specification.

Section 570 – Grassing by Seeding
Section 981 – Grassing and Sodding Materials

15.3 **Grassing by Seeding**

Grassing by seeding shall be completed along the center portions of the partition dike crest road to the limits shown on the Drawings.

Seeding operations, including fertilizing, soil amendment, seeding, and mulching, will not be permitted when wind velocities exceed 15 miles per hour. Seed shall be sown only when the soil is moist and in proper condition to induce growth. No seeding shall be done when the ground is unduly wet or otherwise not in a tillable condition.

15.3.1 Ground Preparation and Fertilizer Application

The ground over which the seed is to be sown shall be prepared by disk-harrowing and thoroughly pulverizing the soil to a depth of 6 inches. The prepared soil shall be loose and reasonably smooth. Harrows will not be allowed.

Fertilizer and dolomitic limestone shall be spread uniformly over the area to be grassed. The dolomitic limestone shall be spread at the rate of 2,000 pounds per acre. Fertilizer shall be applied at a rate of 700 pounds per acre. The device for spreading fertilizer and dolomitic limestone shall be capable of uniformly distributing the material at the specified rate. Immediately after the fertilizer and dolomitic limestone are spread, they shall be mixed into the soil, to a depth of approximately six inches.

Dolomitic limestone shall be a finely ground product, designated for agricultural use, and approved by the Engineer. All fertilizers shall comply with the State fertilizer laws. The chemical designation of the fertilizer shall be 16-8-8. The numerical designation (i.e., 16-8-8) indicates the minimum percentages of total nitrogen, available phosphoric acid, and water-soluble potash, respectively, contained in the fertilizer.

The Contractor shall also be responsible for an additional fertilizer application, which shall be performed, without mixing into the soil, approximately 60 calendar days after the initial application. The fertilizer shall be applied at a rate of 350 pounds per acre and shall have the same composition as described above.

15.3.2 Seeding

While the soil is still loose, the seed shall be distributed uniformly over the grassing area and immediately mixed into the seed bed to a depth of one-half inch. The seed spreader shall be an approved mechanical type of spreader. Seed shall be sown only when the soil is moist, but not unduly wet and in proper condition to induce growth. The Contractor shall water the surface, if needed, prior to seeding.

Permanent type grass seed shall be 125 pounds of common Bermuda seed per acre. Quick-growing type grass seed shall be a species which will provide an early ground cover during the particular season when planting is done and will not later compete with permanent grass. The rate of sowing quick-growing grass seed shall be 25 pounds per acre. The separate types of seed used shall be thoroughly dry-mixed immediately before sowing. Seed which has become wet shall not be used.

All seed shall meet the requirements of the Florida Department of Agriculture and Consumer Services and all applicable State laws, and shall be approved by the Engineer before being sown. The seed shall have been harvested from the previous year's crop.

Each of the species or varieties of seed shall be furnished and delivered to the site in separate labeled bags. During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents and other causes. All permanent and temporary grass seed shall have been tested within a period of six months of the date of planting, and shall have a minimum percent of purity and germination as follows:

- Pensacola Bahia grass seed shall have a minimum pure seed content of 98 percent with a minimum total germination of 85 percent.

- Bermuda grass seed shall be of common variety with a minimum pure seed content of 95 percent with a minimum total germination of 85 percent.

- Annual quick growing Rye grass seed (for plantings between September 1 and January 31) shall have a minimum pure seed content of 95 percent with a minimum total germination of 90 percent.

- Quick growing Millet seed (for plantings between March 16 and August 31) shall be of the Brown Top variety with a minimum pure seed content of 90 percent with a minimum total germination of 85 percent.

15.3.3 Mulching

Four thousand pounds per acre of dry hay mulch material shall be applied uniformly over the seeded area, and the mulch material cut into the soil. The mulching equipment shall be of a type capable of cutting the specified materials uniformly into the soil and to the required depth. Care shall be exercised that the materials are not cut too deeply into the soil. Only undeteriorated mulch which can be readily cut into the soil shall be used.

All mulch shall be in accordance with Section 981 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

Immediately after completion of the seeding and mulching, the area shall be rolled thoroughly with a cultipacker, or other equipment approved by the Engineer. At least two trips over the entire area will be required. The mulch shall be anchored to the ground as needed to minimize loss by wind and rain, by a V-type wheel land packer or similar equipment, and in accordance with Section 570 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

15.4 **Grassing by Sodding**

Sod shall be installed along the edges of the partition dike crest access road at the locations and to the limits shown on the Drawings.

The sod shall be of common Bermuda grass and shall be matted with roots. The sod shall be at least 18 months old and taken up in commercial-size rectangles not smaller than 12 inches by 24 inches, or in rolls. The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh and uninjured at the time of planting. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be reasonably free from weeds and shall be planted as soon as possible after being cut for use in the work. No sod which has been cut for more than 72 hours shall be used. Any sod which is not

planted within 24 hours after cutting shall be stacked in an approved manner and maintained properly moistened. Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed form the work and replaced.

The sod shall be placed on a soil surface prepared and fertilized in accordance with Section 15.3.1. The sod shall be placed with no visible open joints and no overlapping joints. End joints shall be staggered by at least 12 inches. Where sodding is used in sloped areas, the setting of the pieces shall be staggered such as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offsets of individual strips shall be a minimum of 12 inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped and/or the soil graded up to the sod edge so as to produce a feather edge effect. In areas where the sod may slide, the Owner may direct the sod to be pegged, with soft pine pegs (6 to 8 inches long) driven through the sod blocks at suitable intervals. Sodded areas shall be rolled to ensure good bond between the soil and sod.

15.6 **Watering**

Newly seeded and sodded areas shall be watered as required to prevent the grass from drying out, and to maintain the necessary soil moisture for a period of 60 days following planting until acceptance of the work by the Receiver and Engineer. The moistened condition shall extend to the full depth of the rooting zone. All seeded and sodded areas shall be watered, as needed, and maintained by the Contractor for a period of 60 days following planting until final acceptance of the work by the Receiver and Engineer.

15.7 **Submittals**

The Contractor shall submit a complete description and certification of the type and quality of seed and sod to the Engineer for approval at least two weeks prior to seeding and sodding.

The Contractor’s proposed equipment and methods of construction, and description of precautions that will be taken to avoid damaging the HDPE liner shall be submitted to the Engineer for approval at least two weeks prior to the start of grassing operations.

SPECIFICATIONS

SECTION 16
ANCILLARY ITEMS AND MATERIALS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

This Specification covers ancillary material requirements and execution of ancillary items. The Specification contains the following sections:

Section	Item	Page
16.1	Stainless Steel	1
16.2	Premix Concrete Bags	1
16.3	Closed Cell Polyethylene	2
16.4	Valves	2
16.5	Flowable Fill	
16.6	Submittals	2

16.1 **Stainless Steel**

Stainless steel hardware shown on the Drawings shall consist of AISA type 316L stainless steel.

16.2 **Premix Concrete Bags**

Premix concrete bags shall be 80 pounds and shall be made of scrim-reinforced paper that shall hold the concrete mixture without leakage when handled. The sack material shall be permeable and absorptive enough to permit passage of sufficient water to provide for hydration of the cement. The paper used in the sacks shall be non-asphaltic laminated with a polyester fiber scrim reinforcement in a three-way directional pattern.

The sacks shall be uniform in size and dimensions, in order to provide uniformity of the lines of the completed work. They shall be free from holes and strong enough to stand handling without ripping or splitting. Only one size and type of sack shall be used in the work.

Portland cement and fine aggregate within the bags shall meet the requirements of Section 530-Rip-Rap of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

After installation, the bags of Premix concrete shall be wetted by the Contractor with fresh water to hydrate the concrete.

16.3 **Closed Cell Polyethylene**

Closed cell polyethylene used in the inlet structure and as expansion joint material shall be 1-inch thick Standard Polyplank Polyethylene Foam, Class 1, Grade A, Type I, supplied by Pactiv Corporation or equivalent approved by the Engineer.

16.4 **Valves**

Valves shall be installed on the downstream end of the 18-inch diameter SDR 11 outlet pipe from the inlet structure as shown on the Drawings. The valves shall be 18-inch diameter wafer-type (butterfly) valves with AISA type 316L stainless steel disc and stem with EPDM gaskets (ITT Brighten Series 8000, or equivalent approved by the Engineer). The valves shall be installed in accordance with the Manufacturer's recommendations, subject to approval of the Engineer.

16.5 **Flowable Fill**

Flowable fill (controlled low strength material) shall be used, as indicated on the Drawings, for two-phased backfilling of the existing 36-inch diameter reinfoced concrete outlet pipe of the existing spillway structures.

16.5.1 Material Requirements

Flowable fill shall consist of a mixture of Type I Portland Cement (ASTM C150), fine aggregate (ASTM C33), Class C or Class F Fly Ash (ASTM C 618), and potable water. No air entraining admixtures shall be used. Other chemical admixtures may be used if approval by the Engineer.

The flowable fill mix shall have a minimum compressive strength of 200 psi, and a minimum combined cement and fly ash content of 1,000 pounds by dry weight per cubic yard. The mix shall contain the minimum amount of water necessary to produce a flowable mixture without causing either segregation or bleeding. The mixture shall be capable of readily flowing from the base of the spillway risers to the end of the pipe at the seepage ditch, as shown on the Drawings.

Flowable fill shall be transit-mixed in accordance with ASTM C 94, unless otherwise approved by the Engineer. Flowable fill batches delivered to the job-site shall be kept as uniform as possible in consistency and strength. Flowable fill shall be discharged from the truck within the one and one-half (1-1/2)-hour limitation of ASTM C 94.

The Contractor shall submit his proposed flowable fill mix design to the Engineer for approval at least two weeks prior to delivery of flowable fill to the site.

16.5.2 Placement

The outlet pipe of the spillway structures shall be backfilled with flowable fill in two phases. During the initial phase, the outlet pipe shall be backfilled by placement of flowable fill into the OGS-N and OGS-S compartment spillway riser structures. Second-phase backfilling shall be undertaken in the same manner as the fist phase in order to fill the void between the top of the flowable fill and the crown of the pipe that may develop as the fill settles, consolidates and begins to harden.

Prior to backfilling, the discharge end of the existing pipe at the seepage ditch shall be capped and provided with an elevated vent pipe attached either to the top of the end cap or to the crown of the pipe. The end of the vent pipe shall be secured at a level at least 10 feet above the crown of the pipe. The vent pipe will be used to allow process water and air in the pipe to be displaced during placement of flowable fill. The initial phase of the backfilling operation will be considered complete when the quantity of flowable fill placed in the pipe section is greater than the pipe's theoretical volume and when undiluted, uncontaminated flowable fill is observed discharging from the vent pipe. The vent pipe shall be flushed with clean water for future use during the second backfilling phase. Flow meters shall be provided within the pumping system to accurately measure the quantity of flowable fill placed.

Flowable fill shall be placed in such a manner as to totally fill the pipe, leaving no voids, air pockets or water pockets within the pipe. During each backfilling phase, flowable fill shall be placed in a continuous pour and at such a rate that it is at all times plastic and flows readily.

The Contractor shall submit detailed flowable fill installation methods and procedures to the Engineer for approval at least two weeks prior to placement.

16.5.3 Inspection and Testing by the Engineer

The Engineer will undertake observations and perform quality control tests to determine compliance of the materials and work with this Specification. Quality control by the Engineer will include monitoring and/or inspecting: (i) flowable fill placement, and (ii) sampling and testing of the flowable fill for compliance with this Specification including samples for testing in accordance with ASTM C 31, ASTM C 39 and ASTM C 143.

16.6 **Submittals**

The Contractor shall submit the Manufacturer's specifications and product data sheets for all ancillary materials to the Engineer for approval at least two weeks prior to installation.

SPECIFICATIONS

SECTION 17
DAILY AND FINAL CLEANUP

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

17.1 House Keeping and Refuse Disposal

The Contractor shall clean-up the work site and install barricades as needed at the end of each work day to maintain the site in a clean and safe condition. The Contractor shall dispose of all trash, debris, waste, and excess materials resulting from all construction operations. Uncontaminated trash, waste and debris shall be removed from the premises by the Contractor, and disposed of properly in accordance with applicable state and local requirements.

Unused materials may be stockpiled and left on site, if approved by the Receiver, in areas designated by the Program Manager. If not approved by the Receiver, the Contractor shall remove all unused materials from the site.

17.2 Phosphogypsum Contaminated Materials

At no time shall contaminated water, phosphogypsum, or phosphogypsum contaminated materials be removed from the Piney Point Phosphates Stack System. Phosphogypsum contaminated geotextile, HDPE geonet, liner and pipe scraps, and any other phosphogypsum contaminated construction materials shall be decontaminated before being removed from the premises, or disposed of by the Contractor in an on-site disposal area designated by the Program Manager. Materials contaminated with phosphogypsum can be cleaned by washing with fresh water. The wash water shall be disposed of in the process water system at a location and in a manner approved by the Program Manager.

Construction equipment contaminated with phosphogypsum (i.e., dozer tracks, tire threads, truck beds, scraper bowls, etc.) shall be cleaned of phosphogypsum prior to removing the equipment from the premises.

17.3 Restoration of Disturbed Areas

Areas disturbed by construction shall be cleaned and/or graded as directed by the Engineer to restore the conditions that existed prior to construction.

SPECIFICATIONS

SECTION 18
SITE LIMITATIONS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

18.1 Program Manager's Activities and Other Construction

Gypsum stack and cooling pond maintenance activities by the Emergency Response Contractor (i.e., Program Manager) may occur on and around the Old Gypsum Stack throughout the period of construction. Such activities may include maintenance of roads, drainage ditches, pump systems and process water pipelines. All activities of the Contractor must be coordinated with the Engineer and Program Manager to avoid conflicts with the activities of others.

Construction by other contractors will be on-going throughout the period of construction as part of earthwork with phosphogypsum, liner installation, pipeline installation, and as otherwise needed to complete the work, as well as for operation and maintenance of the stack system. The activities of each contractor must be approved by and coordinated with the Engineer to avoid conflicts with other contractors.

The construction area and prepared surfaces will be released by the Earthwork Contractor to the Liner Contractor in progressive stages, i.e., at least in three phases. When the Liner Contractor accepts the fine graded liner base in a given area, he shall then become responsible for dewatering and monitoring and restoring the condition of the prepared base in that area.

18.2 Contact with Phosphogypsum and Gypsum Saturated Water

Gypsum saturated water extracted from phosphogypsum, surface water pools on the gypsum stack, and rainfall runoff from the gypsum stack are acidic, and are characterized by a pH as low as 2 and elevated dissolved solids concentrations. Appropriate PPE must be used by all personnel contacting phosphogypsum or gypsum saturated water. Material Safety Data Sheets for phosphogypsum and gypsum saturated water will be provided by the Program Manager.

18.3 Existing Facilities

Process water pipelines are located on the gypsum surface near the northwest corner of the Old Gypsum Stack. The Contractor shall verify the location of these existing pipelines prior to construction near the pipelines. The vertical riser sections of the former OGS-S and OGS-N compartment decant spillway structures are located on existing finger dikes that extend from the existing partition dike, as shown on the Drawings. A common outlet pipe from these structures reportedly is situated at the base of the gypsum stack, and extends from the structures to the

seepage ditch along the west toe of slope of the OGS-S compartment. The Contractor shall verify the locations of the riser structure and discharge end of the outlet pipe prior to construction near these locations.

There are piezometers located on the OGS-S and OGS-N compartments. The Contractor shall locate the piezometers prior to construction and protect them from damage during construction, or until such time as the piezometers are abandoned by the Engineer.

Any damage to existing facilities by the Contractor shall be repaired by the Contractor at his expense and as directed by the Engineer or Program Manager.

SPECIFICATIONS

SECTION 19
GENERAL PROVISIONS

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

This Specification presents general provisions covering work performed for Phase II closure construction of the two Old Gypsum Stack compartments. The General Provisions include the following sections.

Section	Title	Page
19.1	General	1
19.2	Drawings and Specifications	3
19.3	Engineering Data	3
19.4	Right to Change Location and Drawings	4
19.5	As-Built Drawings	4

19.1 **General**

19.1.1 Scheduling and Coordination

The Contractor shall keep the Engineer and Program Manager informed, a reasonable time in advance, of the times and places at which he intends to do work. All work shall be scheduled and coordinated through the Engineer with the Program Manager as outlined in Section 18.1 and Section 22.5 of these Specifications.

19.1.2 Inspection and Sampling of Materials

All materials furnished by the Contractor shall be subject to the examination and approval of the of the Engineer at any and all times during the progress of the work and until final completion of the same. As soon as the materials are examined and tested, the Contractor shall immediately remove all rejected materials from the work to a point such distance therefrom as the Engineer may require. No material shall be used before being examined and approved by the Engineer, but the failure on the part of the Engineer to condemn or reject inferior materials or work shall not be construed to imply an acceptance of the same should their inferiority become evident at any time prior to final acceptance of the work.

The Contractor shall make necessary arrangements so that the Engineer may secure sample specimens of materials on the job for testing to ascertain whether materials included, or to be included, in the work meet the requirements of the Specifications.

19.1.3 Access To Work

The Program Manager and Engineer shall have free access to the work at all times. The Contractor shall furnish the Engineer with tools, equipment, manpower and samples, as needed, for ascertaining whether the work being performed, or the work which has been completed, is in accordance with the requirements of the Specifications, even to the extent of uncovering, testing, or removing portions of finished work, if such is necessary.

19.1.4 Suspension of Work

The Receiver or Engineer may order the Contractor to suspend any work that may be affected, damaged, or endangered by climatic conditions. Further, the Engineer may temporarily suspend any work at any time when acceptable results as defined in the Specifications cannot be obtained due to inclement weather or other unsatisfactory field conditions.

The work is divided in two phases. The first phase, designated Phase II-A, will involve all work related to closure construction within the OGS-S compartment. The Program Manager will continue to use the OGS-N compartment for process water storage, as needed, while earthwork and liner installation is undertaken in the OGS-S compartment. At least two weeks prior to releasing the OGS-N compartment for Phase II-B construction, the Program Manager will remove most of the surface water from the OGS-N compartment. In the event that facility surge storage requirements at that time dictate continued process water storage in the OGS-N compartment, Phase II-B construction will be suspended (possibly until November 2004) and the contingency relief drain will be required to enable completion of the Phase II-A work.

19.1.5 Utilities and Contractors Facilities

Utilities will not be available atop the Old Gypsum Stack. Utilities, electricity and fuel as may be required for construction and other purposes shall be secured and purchased by the Contractor. The Program Manager will make space available for Contractor's facilities in the vicinity of the chemical plant area. The Program Manager will also make space available for Contractor's material storage near the construction site as shown on the Drawings. The main access to the site will be secured at the guard gate, or at another location in the vicinity of the guard gate, by the Program Manager. The Contractor will, nevertheless, be responsible for all equipment, materials and supplies stored on-site.

Fresh water (for non-potable use) will be provided by the Program Manager at a location near the guard shack which is situated on the construction entrance road. Electricity will be provided by the Program Manager at a location adjacent to the area assigned for the Contractor's facilities. Chemical toilets are to be provided by the Contractor. Phone service is not readily available. However, the Contractor is permitted to secure their own phone service with the phone company. Cell phones are permitted.

Process water for use in wetting gypsum, as needed, may be obtained from one of the nearby phosphogypsum stack system process water ponds, as directed by the Program Manager. Process water can also be obtained at a filling station located in the chemical plant on the main access road

through the plant which is capable of providing approximately 1,000 gallons per minute. Well water for use in construction will be made available by the Program Manager. There are numerous well water supply locations on the property, including a 2-inch diameter line on the New Gypsum Stack - North Compartment capable of providing approximately 200 gallons per minute.

19.2 **Drawings and Specifications**

The Drawings and Specifications are intended to be coordinated. Anything shown on the Drawings but not mentioned in the Specifications, or vice-versa, or anything not expressly set forth in either, but which is reasonably implied, shall be furnished as though specifically shown and mentioned in both without any extra charge. Should anything be omitted from the Drawings, which is the subject of the Contract between the Receiver and the Contractor, it shall be the duty of the Contractor to so notify the Receiver before signing the Contract.

The Contractor shall furnish such detailed plans and drawings as may be required for the execution of the work and which are not included in the Drawings furnished by the Engineer on behalf of the Receiver. They shall include shop details. Shop drawings for the HDPE liner shall be prepared and submitted to the Engineer at least two weeks prior to installation, for approval. Shop drawings prepared by a subcontractor or supplier shall first be checked by the Contractor for compliance with the Specifications, and shall be initialed by the Contractor, prior to submittal to the Engineer for review and approval.

The Contractor shall submit all drawings and schedules with the supporting information for the bid and again sufficiently in advance of construction requirements to allow ample time for checking, correcting, resubmitting, and rechecking. No claim by the Contractor for delays, arising from his failure in this respect, shall be allowed.

All drawings submitted by the Contractor must bear the stamp of approval by the Contractor as evidence that the drawings have been checked by the Contractor. The approval by the Engineer of drawings submitted by the Contractor shall be only for conformance with the design of the project and shall not relieve the Contractor from the responsibility for adherence to the Contract, nor shall it relieve him of the responsibility for any error which may exist.

19.3 **Engineering Data**

The results of standard penetration test borings (ASTM D 1586) conducted on the Old Gypsum Stack (OGS) are provided in Attachment VI. Reported moisture contents were determined general accordance with ASTM D 2216 using a drying temperature of 40EC. Standard Proctor compaction test results for typical Piney Point phosphogypsum in Attachment VI are provided for information only. Standard Proctor compaction tests for compaction control will be performed by the Engineer on samples of phosphogypsum obtained from the Old Gypsum Stack during construction.

The geotechnical information provided in Attachment VI are for informational purposes only, and the data should be reviewed in conjunction with the accompanying notes and disclaimers. While the borings are deemed representative of the phosphogypsum at their respective locations and for their respective vertical reaches, variations characteristic of cast and sedimented phosphogypsum should be anticipated. The boring logs and related information are based on the driller's logs and visual examination of samples in the laboratory. The descriptions of the phosphogypsum, and moisture contents and standard penetration test resistance values, are representative of conditions within the Old Gypsum Stack at the designated boring locations and on the particular dates drilled.

Available water level data at the time the borings were performed are shown on the boring logs in Attachment VI. Fluctuations in water table levels within the gypsum stack should be anticipated in response to pre-construction water level elevations, dewatering activities and rainfall.

The Contractor must form his own opinion of the character of the work and of the earthen and phosphogypsum materials, and must satisfy himself with his own investigations, explorations, tests or studies, of the conditions affecting the work to be done. The Contractor must assume all responsibility for deductions and conclusions as to the nature or condition of the in-place phosphogypsum, borrow soils, subsurface water conditions, the difficulties of making and maintaining the top of the gypsum stack dewatered, and doing any work affected by the nature of the phosphogypsum and process water conditions atop and within the gypsum stack.

19.4 **Right to Change Location and Drawings**

When additional information regarding the topography, subsurface or pore water, or other conditions become available as a result of excavation, testing, data, or other work, the Engineer may find it desirable to change alignment, dimensions, or design of a portion of the work to conform to the newly disclosed conditions. Toward this end the Receiver reserves the right to make any such reasonable changes and the Contractor's operations shall be conducted so as to accommodate reasonable changes without additional expense.

19.5 **As-Built Drawings**

The Contractor shall maintain one set of prints on the job site at all times for the preparation of As-Built Drawings. This set will be in addition to any sets needed and used in the actual construction operation. The As-Built Drawings are to be kept up to date by the Contractor, as approved by the Receiver or Engineer, on a daily basis. The plans shall show the actual as-built condition.

SPECIFICATIONS

SECTION 20
CONSTRUCTION SCHEDULE

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

20.1 **Construction Schedule**

Phase II-A closure construction of the lined pond atop the Old Gypsum Stack - South (OGS-S) compartment must be completed to the extent that on-site Emergency Operations personnel can store process water in the lined OGS-S pond within 140 calendar days after award of the Contract. Earthwork and liner installation in the OGS-S compartment in the vicinity of the partition dike, just east of the relief ditch, shall not be performed within the first 90 days after award of the Contract. The Contractor shall mobilize labor, material and equipment as needed to ensure substantial completion of construction within 140 calendar days after award of the Contract to the Earthwork Contractor, and full completion of the project within 160 calendar days after award of the Contract to the Earthwork Contractor. The Liner Contractor must mobilize and begin work in the OGS-S compartment within 14 days of receipt of notice that the first area or construction stage can be released for lining by the Earthwork Contractor. The Liner Contractor must complete all phases of his portion of the work within 50 calendar days, and no later than June 15, 2004.

Phase II-B closure construction of the lined pond atop the Old Gypsum Stack - North (OGS-N) compartment must be completed to the extent that on-site Emergency Operations personnel can store process water in the lined OGS-N pond within 150 calendar days after the area is released for construction, which is tentatively planned for mid-March 2004. The Contractor shall mobilize labor, material and equipment as needed to ensure substantial completion of construction within 150 calendar days after the OGS-N compartment is released to the Earthwork Contractor, and full completion of the project within 170 calendar days after the area is released to the Earthwork Contractor. The Liner Contractor must mobilize and begin work in the OGS-N compartment within 14 days of receipt of notice that the first area or construction stage can be released for lining by the Earthwork Contractor. The Liner Contractor must complete all phases of his portion of the work within 60 calendar days, and no later than August 16, 2004.

The proposed schedule for completion of all work phases shall be subject to approval by the Receiver. Weekly updating of the construction schedule will be required as the work progresses.

20.2 **Work Hours**

The Contractor shall perform construction operations a minimum of 10 hours per day, 6 days per week.

20.3 **Schedules**

The Contractor shall submit with the supporting information for the Bid, and again at the first construction meeting, the anticipated rate of progress of earthwork with phosphogypsum (yd^3 per day) and liner installation (ft^2 per day), and a detailed construction schedule for the project in the form of a bar chart. The schedule shall be submitted in Microsoft Project scheduling software, software that is 100 percent compatible with Microsoft Project 98, or other software approved by the Receiver. The schedule shall include the specific period of each work task. In addition, the schedule shall include submittals requiring Receiver or Engineer approval before delivery to the site (e.g., shop drawings, product specification sheets, product samples, etc.), and shall also include order placement and delivery of construction materials.

SPECIFICATIONS

SECTION 21
FINAL INSPECTION AND ACCEPTANCE

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

21.1 Final Inspection

Upon completing each of Phase II-A and Phase II-B, including all clean-up operations, the Contractor shall advise the Receiver and Engineer he is ready for final inspection of the corresponding compartment. The Receiver will then set a specific date and time for the final inspection of that compartment. The Receiver, Engineer and Contractor will jointly inspect the project phase area to verify that all work associated with that phase has been completed in accordance with the Drawings and Specifications. Any work found lacking in any way shall be corrected by the Contractor and reinspected.

21.2 Letter of Acceptance

The Receiver will issue a Letter of Acceptance for each phase of the work (i.e., Phase II-A and Phase II-B) to the Contractor once all work associated with each phase has been satisfactorily completed and inspected. Final payment, including the release of any retainage, can be requested by the Contractor after receipt of the Letter of Acceptance.

21.3 Material and Workmanship Warranties

Warranties for HDPE liner material and workmanship shall take effect from the date of the Letter of Acceptance for the liner.

SPECIFICATIONS

SECTION 22
SCHEDULING AND COORDINATION

GYPSUM STACK SYSTEM CLOSURE
PHASE II CONSTRUCTION
OLD GYPSUM STACK COMPARTMENTS

PINEY POINT PHOSPHATES STACK SYSTEM
MANATEE COUNTY, FLORIDA

22.1 Pre-Construction Coordination Meeting

There will be at least one coordination meeting with all contractors and subcontractors, the Engineer, and the Program Manager after the work is awarded and before construction is started.

Each contractor shall submit a construction schedule to the Receiver at the first coordination meeting. The schedule shall be in the form of a bar chart showing all construction activities, and shall be updated weekly and provided to the Engineer as the work progresses. Each contractor shall also designate a project manager at the first coordination meeting. Each contractor's designated site supervisor shall also attend the coordination meeting.

22.2 Correspondence with Receiver

All correspondence with the Receiver shall be directed to the following address:

Mailing Address: Mr. Louis J. Timchak, Jr., Receiver
18810 Place Antibes
Lutz, Florida 33549-5341
Telephone: 813-948-6624

Delivery Address: 13300 U.S. Highway 41 North
Palmetto, Florida 34221
Telephone: 941-722-4555

22.3 Correspondence with Engineer

All questions and correspondence regarding the Drawings and Specifications shall be directed to the Engineer, Ardaman & Associates, Inc., at the following address:

Ardaman & Associates, Inc.
Post Office Box 593003
Orlando, Florida 32859-3003

Attention: Dr. Nadim F. Fuleihan, P.E., or

Mr. Robert J Werner, P.E.

Telephone: 407-855-3860
FAX: 407-859-8121
E-mail: nfuleihan@ardaman.com
rwerner@ardaman.com

22.4 **Correspondence with Program Manager**

All correspondence with the Program Manager shall be directed to the following address:

Shaw Environmental, Inc.
13300 U.S. Highway 41 North
Palmetto, Florida 34221

Attention: Mr. Bruce Scott
Telephone: 941-722-4555; Ext. 277 (Office)
863-581-3863 (Mobile)
Facsimile: 941-729-3589

22.5 **Coordination with Other Contractors and Suppliers**

Gypsum stack and cooling pond maintenance activities by the Emergency Response Contractor (i.e., the Program Manager) may occur on and around the Old Gypsum Stack (OGS) throughout the period of construction. Such activities may include maintenance of roads, drainage ditches, pump systems and process water pipelines. All activities of the Contractor must be coordinated through the Engineer with the Program Manager to avoid conflicts with the activities of others.

Construction by other contractors will be on-going throughout the period of construction as part of earthwork with phosphogypsum, liner installation, pipeline installation, and as otherwise needed to complete the work, as well as for operation and maintenance of the stack system. The activities of each contractor must be coordinated with the Engineer to avoid conflicts with other contractors.

22.6 **Weekly Construction Meetings**

The Receiver and Engineer will hold a weekly construction meeting at the project site on a day of the week and time to be specified. All contractors shall be present at the weekly construction meetings.