# ISSUED FOR CONSTRUCTION (IFC) SPECIFICATIONS

for

## LIVE OAK POINT SHORE PROTECTION AT THE MACKAY ISLAND NATIONAL WILDLIFE REFUGE KNOTTS ISLAND, NORTH CAROLINA W.O. No. FC123F0009 Contract No. 140F0418D0003

**Prepared for:** 



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#### SECTION 01 57 13 TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

#### 1.01 SUMMARY

- A. Contractor shall implement and maintain best management practices (BMPs) and perform other required activities as indicated on the Erosion Control Plan, which is included as a part of the Drawings. This Section shall be considered supplementary to the provisions and measures presented on the approved Erosion Control Plan.
- B. Related Sections:
  - 1. Section 31 32 20 Geotextiles

#### 1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
  - 1. AASHTO M288-22, Geosynthetic Specification for Highway Applications.
- B. ASTM International:
  - 1. ASTM D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
  - 2. ASTM D4355/D4355M, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus.
  - 3. ASTM D4491/D4491M, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
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  - 5. ASTM D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - 6. ASTM D4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
  - 7. ASTM D6241, Standard Test Method for Measuring Static Puncture Strength of Geotextiles and Geosynthetic-Related Products Using a 50 mm Probe.
  - 8. ASTM D6461/D6461M, Standard Specifications for Silt Fence Materials.
  - 9. ASTM D7238, Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus.
- C. "North Carolina Erosion and Sediment Control Planning and Design Manual", 2013 Edition.

- D. North Carolina Department of Transportation (NCDOT):
  - 1. "Standard Specifications for Roads and Structures", dated January 2018 (NCDOT Standard Specifications)

## 1.03 QUALITY ASSURANCE

A. Comply with the rules and regulations of the North Carolina Department of Environmental Quality (NCDEQ), laws and regulations of other governmental authorities having jurisdiction, and applicable permit conditions presented on the Drawings, including requirements for inspections, recordkeeping and reporting.

#### 1.04 PROJECT REQUIREMENTS

- A. Prior to land disturbance and throughout construction, the Contractor shall install BMPs as indicated on the Drawings, at a minimum. The purpose is to provide for the construction and maintenance of temporary control measures to control soil erosion and sediment transport within the Site and prevent the transport of sediment from the Site as a result of the Work.
- B. The use of temporary control measures shall be coordinated with the permanent erosion control features specified in other sections and shown on the Drawings to the extent practical to assure effective and continuous erosion control.
- PART 2 PRODUCTS
- 2.01 BMP MATERIALS GENERAL
  - A. Materials for BMPs shall be as specified in the following subsections and as indicated on the Drawings. Representative BMP materials are specified in this Section for use as required.

#### 2.02 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT

- A. Construction entrance/exit pads shall be constructed with aggregate underlain by geotextile as indicated on the Drawings and in accordance with the standards in the referenced North Carolina Manual.
- B. Aggregate shall consist of washed stone conforming to the gradation requirements of ASTM D448 for size number 1 aggregate (nominal 1-1/2 to 3-1/2 inch size).
- C. Geotextile shall be AASHTO M288 Survivability Class 1 nonwoven geotextile conforming to the specifications in Section 31 32 20.

#### 2.03 FLOATING TURBIDITY CURTAIN

A. Floating turbidity curtain system shall be Type III, conforming to the details shown on the Drawings. The turbidity curtain system shall include: marine grade flotation material, reinforced silt screen fabric curtain panels (skirts), ballast chain, and other

components as shown. Total number and depth of curtain panels shall be as required to fit site conditions.

- B. Furnish buoys with accessories if required by the local authorities having jurisdiction.
- 2.04 SEDIMENT FENCE (SILT FENCE)
  - A. Furnish silt fence conforming to the standards in the referenced North Carolina Manual and as specified in the following paragraphs.
  - B. Filter fabric shall conform to the material properties in Table 1 of ASTM D6461/D6461M, as summarized in the following table. Fabric width shall be 30 to 36 inches.

Property	Test Method	Supported Fence <sup>(1), (2)</sup>	Unsupported Fence <sup>(1)</sup>
Grab Strength, Machine Direction (MD)	ASTM D4632 / D4632M	90 lbs	124 lbs
Grab Strength, Cross-Machine Direction (XD)	ASTM D4632 / D4632M	90 lbs	101 lbs
Permittivity	ASTM D4491 / D4491M	0.05 sec <sup>-1</sup>	0.05 sec <sup>-1</sup>
Apparent Opening Size (AOS)	ASTM D4751	0.60 mm (No. 30 U.S. sieve size) max.	0.60 mm (No. 30 U.S. sieve size) max.
Ultraviolet Resistance (retained strength after 500 hrs. exposure)	ASTM D4355 / D4355M or ASTM D7238	70%	70%
Trapezoid Tearing Strength, MD and XD	ASTM D4533 / D4533M	60 lbs	60 lbs
CBR Puncture	ASTM D6241	325 lbs	325 lbs

## Notes:

<sup>(1)</sup> Minimum Average Roll Value, unless otherwise indicated

<sup>(2)</sup> Silt fence support shall consist of 14 gauge steel wire with maximum openings of 6 in. x 6 in., or prefabricated polymer mesh of equivalent strength.

C. Posts shall be steel, a minimum of five feet in length. Steel posts shall be standard "U", "T" or "C" shaped with a minimum weight of 1.25 pounds per foot and shall have projections for fastening the filter fabric to the posts

## 2.05 COMPOST SOCKS

A. As an alternate to sediment fence, furnish compost socks consisting of compost or other approved filter media enclosed in circular enclosures of 18-inch minimum

diameter. Compost shall meet the chemical, physical and biological properties specified in Practice 6.18, Compost Blankets, in the referenced North Carolina Manual. The circular enclosures shall consist of fabricated photodegradable plastic mesh or fabric tubes with maximum 3/8-inch openings.

#### 2.06 OTHER TEMPORARY CONTROLS

A. Furnish materials for other erosion and sediment controls as indicated on the Drawings and in accordance with the applicable requirements of the referenced North Carolina Manual.

## PART 3 EXECUTION

#### 3.01 GENERAL PROCEDURES

- A. Comply with the requirements indicated on the Drawings and specified in this Section. Modify and enhance erosion and sediment controls throughout the Work as necessary to address Site conditions.
- B. Install indicated BMPs, including turbidity curtain, prior to land disturbance during each phase of construction.
- C. Erosion and sediment control measures shown on the Drawings are minimal requirements. It is the responsibility of the Contractor to install additional measures as needed to control sediment, whether or not directed to add such measures by the Contracting Officer.
- D. Procedures shall include inspection, recordkeeping and reporting as indicated on the Drawings.
- E. Incorporate all permanent erosion control measures (including plantings and grass seeding as applicable) into the Project at the earliest practical time.

#### 3.02 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT

A. Construction entrance/exit pads shall be constructed in accordance with the details and requirements indicated on the Drawings.

#### 3.03 INSTALLATION OF FLOATING TURBIDITY CURTAINS

- A. Install floating turbidity curtains and accessories at the required locations, alignment and sequencing as indicated on the Drawings.
- B. Conform to manufacturer's recommendations and the requirements noted on the Drawings for assembly, deployment and maintenance of the floating turbidity curtain system.

## 3.04 INSTALLATION OF SILT FENCE

A. Prior to any land disturbance or as otherwise indicated, install silt fence in accordance with the standards in the North Carolina Manual.

- B. At a minimum, temporary silt fencing shall be installed at all locations along the construction limits where surface water can leave the construction area. This applies to all locations indicated and in other areas determined in the field to require fencing.
- C. At the time of installation, silt fence will be rejected if it has defects, deterioration or damage incurred during manufacture, transportation, storage or installation. Replace at no additional cost to the Project.

#### 3.05 INSTALLATION OF COMPOST SOCKS

- A. Install compost socks, as an alternative to sediment fence, downgradient from areas to be graded.
- 3.06 CONSTRUCTION OF OTHER TEMPORARY CONTROLS
  - A. Install and construct other required temporary erosion and sediment controls as indicated on the Drawings.
- 3.07 INSPECTION AND MAINTENANCE
  - A. Temporary erosion and sediment controls shall be inspected and maintained as indicated on the Drawings.
  - B. Remove sediment deposits that reach approximately one-third the height of sediment barriers. Sediment shall be placed in areas approved by the Contracting Officer and spread uniformly over the ground surface.
  - C. Replace or reconstruct erosion and sediment control measures when the structures no longer effectively perform.

#### 3.08 REMOVAL OF TEMPORARY CONTROLS

A. Temporary erosion and sediment controls shall not be removed until the upgradient areas are sufficiently stabilized with completed construction and permanent erosion control measures.

## END OF SECTION

## SECTION 02 41 13 SELECTIVE SITE DEMOLITION

#### PART 1 GENERAL

#### 1.01 SUMMARY

A. Section includes general requirements for demolition, removal, and off-site disposal of minor structures and debris generated from grading operations. Additional requirements for demolition activities are presented on the Drawings

#### 1.02 REFERENCES

- A. Code of Federal Regulations Publications (CFR)
  - 1. United States Department of Labor
    - a. 29 CFR 1926, Safety and Health Regulations for Construction

#### 1.03 SUBMITTALS

A. Submit written certification of proper transport and final disposal of demolition materials to a permitted disposal facility.

## 1.04 QUALITY ASSURANCE

- A. Conform to applicable local, state, and federal regulations related to operation of equipment and tools, protection of persons and property, and environmental controls.
- B. Obtain all necessary permits and licenses to accomplish the removal, transportation and disposal of all demolition materials. Furnish a copy of all applicable licenses and permits to the Owner before starting any work at the Site.

#### 1.05 PROJECT CONDITIONS

- A. Coordinate the schedule for demolition and removals with other Government contractors onsite and Refuge operations.
- B. During demolition and removal work, use all procedures necessary to assure that no portions of structures, either that to be removed or to remain, become a hazard to persons by instability or other condition.
- C. If applicable to the Work, notify all local, state, and federal agencies having jurisdiction and complete all necessary forms required for demolition and disposal.
- D. Demolition and removal work shall be performed in a manner that does not disturb existing structures and other facilities not indicated to be removed.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

#### 3.01 PREPARATION

- A. By careful study of the Drawings and these Specifications, determine the location and extent of demolition and alterations to be performed.
- B. Coordinate demolition and removal work with related construction.
- C. Barricade the work areas and provide other controls for protection of personnel in conformance with applicable regulations and the requirements of the Government. Maintain the controls for full duration of the Work, including during demolition, removals, and new construction.
- D. Coordinate with the requirements of the Government for Site usage.

## 3.02 DISPOSAL OF MATERIALS

A. Demolition debris and other removed materials classified as non-hazardous construction and debris (C&D) wastes shall be transported off-site and disposed at permitted disposal facilities in conformance with all applicable local, state and federal regulations.

## END OF SECTION

## SECTION 31 10 00 SITE CLEARING

## PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Protection of existing trees and other designated vegetation.
  - 2. Clearing and grubbing of low vegetation within designated Limits of Work defined as area between the existing gravel access drive and Currituck Sound.
  - 3. Disposal of removed vegetation.
- B. Related Sections:
  - 1. Section 01 57 13 Temporary Erosion and Sediment Control

#### 1.02 REFERENCES

- A. ASTM International:
  - 1. ASTM A 116, Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
- 1.03 QUALITY ASSURANCE
  - A. Conform to applicable local codes for clearing and disposal of vegetation.
- 1.04 PROJECT CONDITIONS
  - A. Site clearing shall be performed in a manner that does not disturb areas outside the designated Limits of Work between the existing gavel access drive and Currituck Sound, existing facilities, and the environment as specified.
- PART 2 PRODUCTS
- 2.01 TREE PROTECTION FENCING
  - A. Tree protection fencing shall be orange high-visibility safety fencing, PSF-Series Plastic Safety Fence manufactured by DGI Industries, or approved equal. Furnish metal posts and woven wire fence backing (where required) as indicated on the Drawings and as specified below.
  - B. Metal posts shall be standard steel fence T-posts, 5 feet minimum length. Furnish fence post caps.
  - C. Woven wire (hog wire) shall conform to ASTM A116, with Class 3 coating.

#### PART 3 EXECUTION

#### 3.01 PREPARATION

A. Implement temporary erosion and sediment control measures prior to clearing of vegetation in accordance with the Erosion and Sedimentation Control Plan as specified in Section 01 57 13.

## 3.02 PROTECTION OF VEGETATION

- A. Prior to commencement of clearing activities, install tree protection fencing around trees to be protected as indicated on the Drawings.
- B. Maintain the fencing as required during construction. Replace or repair damaged fencing promptly.
- C. In order to avoid damage to trees (including roots, bark, and lower branches), no trucks or other equipment shall be driven or parked within the drip line of trees to be saved.

## 3.03 CLEARING

- A. Cut and remove existing low vegetation (including grasses, brush, and other vegetation) within the Limits of Work between the existing access drive and Currituck Sound. Remove large organic debris resting on or protruding from the ground surface.
- B. Remove roots of vegetation to a minimum depth of six inches below existing grade or six inches below the proposed subgrade elevation, whichever is lower.

#### 3.04 DISPOSAL OF VEGETATION

- A. Removed woody vegetation shall be transported and disposed off-site in accordance with all applicable local, state and federal regulations.
- B. Burning of cleared vegetation will not be permitted.

## END OF SECTION

## SECTION 31 23 00 EXCAVATION AND FILL

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Grading of native soils (if required) on shore side of existing seawall
  - 2. Furnishing and placement of imported fill materials.

## B. Related Sections:

- 1. Section 01 57 13 Temporary Erosion and Sediment Control
- 2. Section 31 10 00 Site Clearing
- 3. Section 32 92 19 Seeding
- 4. Section 35 31 10 Riprap Shoreline Protection

## 1.02 REFERENCES

- A. ASTM International:
  - 1. ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
  - 2. ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- B. "Report of Geotechnical Evaluation and Preliminary Recommendations, Mackay Island Seawall Restoration, Knotts Island, North Carolina", prepared by Wood, December 12, 2019.

#### 1.03 SUBMITTALS

- A. Submit the following for review prior to commencement of the work of this Section:
  - 1. Proposed source of borrow material.
  - 2. Source quality control test results (physical and analytical testing) for proposed offsite borrow source materials as specified in this Section.
- B. Submit the following during the Work:
  - 1. "As-Built" Record Drawings as specified in this Section.

## 1.04 QUALITY ASSURANCE

A. Contractor shall retain the services of an approved independent Construction Quality Control (CQC) firm to determine conformance of earthwork materials and constructed work with the Specifications.

- B. Various tasks and documents will be used by the Government to monitor general conformance with the Drawings and Specifications. These will include, but not be limited to, the following:
  - 1. Review of the Contractor's quality control plan.
  - 2. Review of all in-place density test results, both passing and failing (if applicable).
  - 3. Review of gradation analyses for aggregate and imported fill material.
  - 4. Observation of grading activities and placement of fill accomplished by the Site Representative or a resident Construction Representative or both.
  - 5. In-progress field inspections by the Contracting Officer's Representative.
  - 6. Review of daily reports prepared by the Contractor and discussed with the Site Representative.
  - 7. Addressing unanticipated geotechnical conditions that impact the Work.
  - 8. A final inspection performed by the Site Representative or Contracting Officer's Representative or both and the Contractor's project superintendent.
- C. Record surveys shall be performed by an independent surveying firm with a Professional Land Surveyor (PLS) licensed and registered in the State of North Carolina, retained by the Contractor.

#### 1.05 DELIVERY, STORAGE AND HANDLING

A. Imported fill material to be used for placement in designated locations for shoreline protection shall be stockpiled separately from native materials and shall be adequately protected to preserve the fitness and quality of the material and prevent any mixing with on-site materials.

#### 1.06 PROJECT CONDITIONS

- A. Available Site Information:
  - 1. Descriptions of Site conditions and existing materials to be encountered are based on information presented in the "Report of Geotechnical Evaluation and Preliminary Recommendations" referenced in subsection 1.02. Copies of the referenced report will be made available to Contractor on request. The report is not part of the Contract Documents.
- B. Work shall be performed in a manner that does not disturb existing utilities, seawall, and other facilities not indicated to be removed or partially removed. Damaged facilities shall be repaired or replaced at the Contractor's expense.
- C. The existing seawall shall be abandoned in place and shall be protected from damage or disturbance for the full duration of the Project.
- D. Minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work, including the shoreline and waters of Currituck Sound, must be protected during the entire duration of this

Project. Comply with all applicable environmental Federal, State, and local laws and regulations. Any delays resulting from failure to comply with environmental laws and regulations will be the Contractor's responsibility.

## PART 2 PRODUCTS

## 2.01 SOURCE QUALITY CONTROL

- A. Proposed materials and source of supply information shall be submitted for review by the Contracting Officer or the Contracting Officer's Representative prior to delivery and use in the construction. Conform to the requirements of Subdivision 01300 Submittals (part of the Division 1 Specifications).
- B. Physical Testing: Source quality control physical testing of soils from offsite borrow sources to be used for soil fill material shall conform to the following at a minimum rate of one test for each visible change in material:
  - 1. Soil classification (ASTM D2487)
  - 2. Sieve analysis (using ASTM C136)
- C. Chemical and Environmental Analysis:
  - 1. Soil samples shall be collected from proposed offsite borrow sources to verify that the material is free from contamination and is suitable for use at the Project Site.
  - 2. A sample shall be collected for each source and for each change in material imported to the Site. Samples shall be collected from an undisturbed section of the source material prior to excavation and loading.
  - 3. The samples shall be collected using stainless steel trowels or scoops and placed directly into containers provided by the laboratory that are appropriate for the analytical testing specified. For volatile organic compound (VOC) analysis, soil samples shall be collected using a Terracore© (or equivalent) sampler.
  - 4. Soil samples shall be analyzed for EPA priority pollutants using U.S. EPA SW-846 analytical procedures.

#### 2.02 IMPORTED FILL MATERIAL

- A. Imported fill material shall consist of suitable off-site borrow material meeting the following specifications.
- B. Material shall consist of clean, free-draining sand or fine aggregate, having characteristics consistent with GW, GP, SW or SP soils as defined by the Unified Soil Classification System (USCS). Maximum particle size shall be one inch, with less than 5 percent of material passing a No. 200 sieve.

- C. Crushed stone or slag will not be acceptable for imported fill. The material shall be free of debris, frozen materials, vegetation, hazardous or toxic material, and other deleterious matter.
- 2.03 TOPSOIL
  - A. Topsoil to be used for the top 6 inches of fill material shall conform to the specifications in Section 32 92 19.
- PART 3 EXECUTION
- 3.01 FIELD QUALITY CONTROL
  - A. Surveying shall be performed to monitor as-built graded elevations, and "As-Built" Record Drawings shall be submitted in accordance with Subdivision 01700 Contract Closeout (part of the Division 1 Specifications). Maximum survey grid spacing shall be 50 feet. In addition, at a minimum, survey points shall be established at the top, mid-point, and bottom of slope, and at other points as required to define the surfaces.
- 3.02 PREPARATION
  - A. The Contractor's surveyor shall lay out the limits and elevations for grading and placement of fill.
  - B. Do not begin any Work involving ground disturbance until erosion and sediment control measures (as specified in Section 01 57 13) are in place, inspected, and approved by the authority having jurisdiction.
  - C. Protect all existing trees and provide limited clearing of existing low vegetation within the limits of construction as specified in Section 31 10 00.

#### 3.03 SITE GRADING

- A. Grade existing soils above the water line within designated limits for construction of the riprap revetment system and placement of fill in the native shrub (Riparian Zone Vegetation) and grass planting areas as shown on the Drawings.
- B. The graded areas shall be shaped to be free from significant variations from the design grade, such as depressions or mounds exceeding 6 inches. Excess and unsuitable excavated materials shall be placed on-site where approved by the Contracting Officer or the Contracting Officer's Representative.
- C. Place imported soil fill in low areas where required to achieve finish grades on the shore side of the existing seawall (if present) and constructed riprap revetment as indicated on the Drawings and specified in subsection 3.04.
- D. During grading of existing soils and placement of imported fill material, protect and condition the materials to control fugitive dust and to limit erosion of the exposed surfaces. If the surfaces are dry and dust is observed, apply water to effectively moisture condition the materials. If moisture conditioning does not produce

satisfactory results, Contractor shall take additional measures to control airborne dust.

## 3.04 PLACEMENT OF FILL MATERIAL

- A. Fill material shall conform to the material specifications in subsection 2.02.
- B. Place fill material to fill depressions and other irregularities in the existing soil surface behind (on the shore side of) the existing seawall.
- C. Place fill material over existing surfaces and in other areas to the thicknesses and elevations indicated on the Drawings as required for shoreline protection construction and vegetation plantings.
- D. Place fill material in uniform layers as much as practicable in lifts not exceeding eight inches loose thickness.
- E. Fill material will not require compaction other than that provided by the equipment used to place the material and to provide a stable base for placement of subsequent layers of fill material.
- F. Shape the final surface of fill material to be free from irregular surface changes. Finished surface shall be graded to conform to the elevations shown on the Drawings within an allowable tolerance of plus or minus two inches from the design lines and grades.
- G. Based on the results of surveying, areas that are not constructed to the required elevations, within allowed tolerance, shall be corrected.

## 3.05 MAINTENANCE AND PROTECTION

- A. Construct riprap revetment as soon as possible after completion of fill material placement in each section of the revetment system.
- B. Protect graded surface of riprap revetment subgrade from erosion and keep free from accumulation of debris.
- C. Replace and regrade displaced and eroded areas until covered by subsequent construction, including placement of bedding stone and riprap.

## 3.06 DISPOSAL OF MATERIALS

A. Excess and unsuitable soil materials shall be placed on Government property where approved by the Contracting Officer or the Contracting Officer's Representative in accordance with applicable regulations.

## END OF SECTION

#### SECTION 31 32 20 GEOTEXTILES

#### PART 1 GENERAL

#### 1.01 SUMMARY

A. Section includes furnishing and installing woven separation geotextile where required.

#### 1.02 REFERENCES

- A. ASTM International:
  - 1. ASTM D4355/D4355M, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus.
  - 2. ASTM D4491/D4491M, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - 3. ASTM D4533/D4533M, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
  - 4. ASTM D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - 5. ASTM D4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
  - 6. ASTM D4873/D4873M, Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
  - 7. ASTM D6241, Standard Test Method for Measuring Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50 mm Probe.
  - 8. ASTM D7238, Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus.
  - 9. ASTM D8102, Standard Practice for Manufacturing Quality Control of Geotextiles.

#### 1.03 SUBMITTALS

- A. Submit the following for review and approval prior to shipment of geotextile products to the Site:
  - 1. Manufacturers' descriptive documentation (including material properties sheets) for each product to be furnished.
  - 2. Sample of each geotextile product.
  - 3. Proposed equipment and methods for underwater placement of geotextile (if applicable).

- B. Submit the following for review and approval at time of shipment of each product:
  - 1. The manufacturers' quality control certifications (including results of source quality control testing of the products) to verify that the materials supplied for the project are in compliance with all product specifications in this Section. The certifications shall be signed by a responsible party employed by the manufacturer, such as that manufacturer's QA/QC manager, production manager, or technical services manager. Certifications shall include lot and roll numbers, and corresponding shipping information.
- C. Submit the following for review during the progress of the Work:
  - 1. Inventory of geotextile rolls received onsite.

## 1.04 QUALITY CONTROL

- A. Source quality control testing shall be performed by the manufacturer or supplier as specified.
- B. Manufacturer Qualifications: Manufacturers shall have at least five years of experience in the manufacture of geotextiles of the type specified.

## 1.05 DELIVERY, STORAGE AND HANDLING

- A. Product rolls shall be marked or tagged with manufacturer's name, product identification, lot number, roll number, and roll dimensions.
- B. Procedures for storage and handling of geotextile shall conform to ASTM D4873/D4873M and the manufacturer recommendations, including the following:
  - 1. Continuously and uniformly support rolls on a prepared surface elevated above grade away from traffic areas. Cover rolls with tarp for protection from sun, dirt and other deleterious conditions if the protective wrap around the geotextile is damaged.
  - 2. No hooks, tongs, or other sharp instruments shall be used for handling the geotextile. Geotextile rolls shall not be lifted by use of cables or chains in contact with the products. Deploy geotextile using equipment and methods that minimizes dragging of the material along the ground surface.
- C. Geotextile shall be inspected upon delivery and during installation. Geotextile that is damaged by the Contractor to the extent that it is no longer usable shall be removed from the Site and replaced with new material at no additional cost to the Project.
- D. Contractor shall generate an inventory of geotextile product rolls received onsite from the manufacturer or distributor. The inventory shall be updated as required, shall include all the information appearing on the label of each roll, and all observed damage shall be noted.

## PART 2 PRODUCTS

### 2.01 SOURCE QUALITY CONTROL

- A. Quality control testing of each geotextile product shall be performed by the manufacturer prior to shipment in accordance with ASTM D8102.
- B. For manufacturer quality control testing of each geotextile product, the sample average test results (weaker principal direction for mechanical tests) for a particular property for any individual roll tested within a lot designated as first quality shall meet or exceed the Minimum Average Roll Value indicated in the manufacturer's certification.
- 2.03 GEOTEXTILE PRODUCTS GENERAL
  - A. All geotextile products shall be resistant to ultraviolet degradation and biological and chemical environments normally found in soils in the shoreline environment. In addition, the material shall be resistant to degradation in aquatic (fully submerged) environment.

#### 2.04 SEPARATION GEOTEXTILES

A. Separation geotextile to be placed at base of stone sill and riprap revetment structures shall be a woven geotextile meeting or exceeding the specifications in the following table.

Property	Test Method	Test Value <sup>(1)</sup>
Grab Tensile Strength	ASTM D4632/D4632M	335 lbs
Grab Tensile Elongation	ASTM D4632/D4632M	15%
Trapezoid Tear Strength	ASTM D4533/D4533M	125 lbs
CBR Puncture Strength	ASTM D6241	1250 lbs
Permittivity	ASTM D4491/D4491M	1.50 sec <sup>-1</sup>
Apparent Opening Size (AOS)	ASTM D4751	0.60 mm (No. 30 U.S. sieve size) max.
UV Resistance (retained strength after 500 hrs. exposure)	ASTM D4355/D4355M or ASTM D7238	90%

#### Notes:

<sup>(1)</sup> Minimum Average Roll Value (unless otherwise noted) in weakest principal direction

- B. Acceptable Products:
  - 1. Mirafi® FW300, manufactured by Solmax (formerly TenCate Geosynthetics), or approved equal.

#### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Prepare subgrade for geotextile as specified in applicable sections and as shown on the Drawings. Surfaces to receive geotextile shall be free of litter, sharp protrusions, and large stones.
- B. Proceed with geotextile installation only after unsatisfactory conditions have been corrected.

#### 3.02 GEOTEXTILE INSTALLATION

- A. Installation of geotextile shall be in compliance with this Specification and with the manufacturer's recommendations. For placement of geotextile in submerged conditions (underwater), conform to the recommended procedures presented on the Drawings.
- B. After unwrapping each geotextile product from its opaque cover, the geotextile shall not be left exposed for a period in excess of 20 days unless a longer exposure period is demonstrated by the Contractor that the geotextile is stabilized against U.V. degradation for the proposed period of exposure.
- C. Geotextile shall not be deployed until the required submittals specified in subsection 1.03 are submitted in accordance with Subdivision 01300 Submittals (part of the Division 1 Specifications). If the material does not meet project specifications, it shall be removed and replaced at no additional cost to the Project.
- D. The appropriate type of geotextile shall be placed where shown on the Drawings or as otherwise determined necessary based on site conditions.
- E. Subgrade shall be relatively uniform and free of sharp protrusions (including large stones) prior to geotextile placement. Geotextile shall be installed on the subgrade so that placement of overlying materials does not stretch or tear the fabric.
- F. Install woven separation geotextile on subgrade surfaces prior to placement of bedding stone for riprap revetment. Place geotextile to the full width and length of the revetment plus any additional overlap for bridging as shown on plans.
- G. Install woven separation geotextile on bottom subgrade surfaces prior to placement of bedding stone for construction of stone sills. Place geotextile to the full width and length of the stone sill base plus any additional overlap for bridging as shown on plans.
- H. Overlapping of panels without seaming will be allowed for installation of separation and stabilization geotextiles on this Project. Overlap adjacent sections or rolls of geotextile from side to side and end-to-end one to three feet. Where geotextile is placed on shoreline or other unsubmerged areas, bury the upper edges of geotextile a minimum of twelve inches below grade at tops of slopes or edges of placement, as applicable.

## 3.03 PROTECTION OF FINISHED WORK

- A. The Contractor shall use all means necessary to protect the installed geotextile from damage.
- B. Placement of cover soil, rock or aggregate (as applicable) shall proceed immediately following placement and inspection of the geotextile.
- C. The cover material shall be placed on the geotextile in such a manner that:
  - 1. The geotextile and underlying materials are not damaged.
  - 2. Minimal slippage occurs between the geotextile and underlying layers.
  - 3. Wrinkling of geosynthetics is minimized.
- D. Construction equipment shall not be allowed to travel directly on the geotextile.

## 3.04 GEOTEXTILE REPAIR

- A. Holes or tears in the geotextile shall be repaired with a patch of the same material.
- B. Geotextile patch shall be sized to cover a minimum of 36 inches in all directions beyond the edges of each defective area.
- C. Care shall be taken to remove any soil or other material, which may have penetrated the torn geotextile.

## END OF SECTION

#### SECTION 32 92 19 SEEDING

#### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section includes seedbed preparation and establishment of permanent native grasses within designated areas.
- B. Related Sections:
  - 1. Section 01 57 13 Temporary Erosion and Sediment Control
  - 2. Section 31 23 00 Excavation and Fill

#### 1.02 REFERENCES

- A. ASTM International:
  - 1. ASTM D2974, Standard Test Methods for Determining the Water (Moisture) Content, Ash Content, and Organic Material of Peat and Other Organic Soils.
  - 2. ASTM D4972, Standard Test Methods for pH of Soils.
  - 3. ASTM D5268, Standard Specification for Topsoil Used for Landscaping and Construction Purposes.
- B. North Carolina Department of Transportation (NCDOT):
  - 1. "Standard Specifications for Roads and Structures", dated January 2018 (NCDOT Standard Specifications)

#### 1.03 SUBMITTALS

- A. Submit the following for review and approval prior to scheduled delivery of materials to the Site:
  - 1. Soil sample analysis results and recommendations for soil amendments.
  - 2. Proposed grass seed mixes.
  - 3. Certification of grass seed from seed vendor for each grass seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination and weed seed.
  - 4. Manufacturer's certification for agricultural lime and fertilizer.
  - 5. Certification from topsoil vendor indicating source and results of testing showing compliance with the Specifications.
- B. Submit the following for review and approval at time of shipment of materials to the Site:

1. Bag tags, receipts, truck weight tickets, and other information necessary to confirm application rates and types for all seed, agricultural lime, fertilizer, and mulch.

#### 1.04 QUALITY ASSURANCE

- A. Contractor shall retain the services of an independent testing laboratory to perform analysis of soil samples as specified in this Section. The testing laboratory shall have documented experience with the type of testing specified.
- B. Seeding shall be accomplished according to standard local practice and as indicated on the Drawings.
- 1.05 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver packaged materials in original, unopened, labeled and undamaged containers. Packaging shall show weight, analysis and name of manufacturer or supplier
  - B. Protect materials from deterioration during delivery and while stored at the Site.
- 1.06 PROJECT CONDITIONS
  - A. Perform seedbed preparation and seeding as soon as possible after completion of grading in each area.
  - B. Seeding shall be performed only during the appropriate growing season for the grass seed mixes as indicated on the Drawings, unless otherwise recommended by the local agricultural extension office.
- PART 2 PRODUCTS
- 2.01 TOPSOIL
  - A. Topsoil shall be natural soil classified as loam, sandy loam or silt loam, and possessing characteristics of representative topsoil in the vicinity that produces heavy growth. The materials shall be free from deleterious materials (including objectionable weeds, stiff clay, rocks, roots, trash, or any other material which may be harmful to plant growth or hinder planting operations). Composition of topsoil material shall be in accordance with ASTM D5268, including the following:
    - 1. Organic Material: 2 to 10 percent by mass (as determined using ASTM D2974).
    - 2. pH: 5.5 to 7.5 (as determined using ASTM D4972).

#### 2.02 FERTILIZER

A. Fertilizer shall be a standard commercial fertilizer, in dry or liquid form, complying with the requirements of subsection 1060-2 of the NCDOT Standard Specifications and as indicated on the Drawings.

- B. The grade of fertilizer shall be as indicated on the Drawings or as otherwise determined based on soil test results.
- 2.03 LIME
  - A. Lime shall be agricultural grade ground dolomitic or calcitic limestone comply with the requirements of subsection 1060-3 of the NCDOT Standard Specifications and as indicated on the Drawings.
- 2.04 SEED
  - A. Temporary and permanent seed shall consist of native coastal plain grass seed mix(es) indicated on the Drawings. Seed shall be fresh, clean, new-crop seed mixed in the proportions specified for species and variety. Seed shall comply with the quality requirements of subsection 1060-4 of the NCDOT Standard Specifications and as indicated on the Drawings.
  - B. The indicated grass species may be added, deleted or substituted as appropriate to take advantage of proven varieties and mixtures and to account for changes of season and weather conditions. Proposed changes to the grass species and mixtures shall be submitted to the Contracting Officer or the Contracting Officer's Representative for approval prior to use.
- 2.05 MULCH
  - A. Mulching material for temporary and permanent seeding shall comply with the requirements of subsection 1060-5 of the NCDOT Standard Specifications as modified in the following paragraphs. Mulch materials are presented in the order of preference.
  - B. Straw:
    - 1. Straw shall consist of thoroughly threshed wheat, rye, oat, or barley and reasonably bright in color. Straw shall be free of noxious weeds and shall not be musty, moldy, caked, decayed or excessively dusty.
    - 2. All straw mulch shall be reasonably free from mature seedbearing stalks, roots or bulblets of Johnson Grass, Nutgrass, Sandbur, Wild Garlic, Wild Onion, Crotalaria, Witchweed and an excessive amount of restricted noxious weeds as defined by the North Carolina Board of Agriculture at the time of use of the mulch.
    - 3. Asphalt emulsions shall not be used for mulch tackifier (binding material).
  - C. Wood Cellulose Fiber Mulch (WCFM):
    - 1. WCFM shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state.
    - 2. WCFM shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry.

- 3. WCFM, including dye, shall contain no germination or growth-inhibiting factors.
- 4. WCFM materials shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with seed, fertilizer and other additives to form a homogeneous slurry. The mulch material shall form a blotter-like ground cover, on application, having moisture absorption and percolation properties, and must cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.
- 5. WCFM material shall not contain elements or compounds at concentration levels that will be phyto-toxic.
- 6. WCFM shall conform to the following physical requirements: fiber length of approximately 10 mm; diameter of approximately 1 mm; pH range of 4.0 to 8.5; ash content of 1.6 percent maximum; and water holding capacity of 90 percent minimum.

## PART 3 EXECUTION

## 3.01 SOIL SAMPLING FOR NON-AQUATIC LOCATIONS

A. An independent testing firm shall obtain at least one sample (minimum 10-ounce sample) per acre of soil to be seeded, analyze the samples to determine amounts of nitrogen, phosphorus, potassium, and pH value in the soil, and provide recommendations on fertilizer and lime to be used.

#### 3.02 PREPARATION

- A. Maintain temporary erosion and sediment control measures as specified in Section 01 57 13 and as indicated on the Drawings until a satisfactory stand of grass has been established.
- B. Fill placement and grading shall be completed as specified in Section 31 23 00. Remove foreign materials, weeds and undesirable plants.
- C. Uniformly place topsoil over excavated areas to a depth of approximately four inches.
- D. Fine grade to a smooth, uniform surface to provide a loose, fine texture. Roll and rake surface, remove ridges and fill depressions to meet finish grades. Limit fine grading to areas that can be seeded in the immediate future.
- E. Finish surface shall be reasonably smooth and free of litter, large clods, roots, sticks, stones larger than one inch in any dimension, and other extraneous matter.

#### 3.03 APPLICATION OF FERTILIZER AND LIME

A. Uniformly apply fertilizer and lime for native grass seed areas at the rates based on soil test results. Fertilizer and lime shall be used sparingly, as needed only, to protect natural resources.

## 3.04 APPLICATION OF SEED

- A. Uniformly apply seed mix for permanent vegetation in conformance with the application rates and procedures indicated on the Drawings.
- B. Seeding shall be performed during the first optimum planting season following completion of work in an area. Optimal planting time for various seed mixes are as indicated on the Drawings

#### 3.05 PROTECTION OF SEEDED AREAS

- A. Immediately after completion of seeding operations in each area (within 24 hours), protect seeded areas as indicated on the Drawings, including the following requirements.
- B. Application of Mulch:
  - 1. Apply mulch to all seeded areas immediately after seeding.
  - 2. When straw mulch is used, spread it over all seeded areas at the rate of 2 tons per acre to a uniform loose depth of 1 to 2 inches. Apply mulch to achieve a uniform distribution and depth so that the soil surface is not exposed. When using a mulch anchoring tool, increase the application rate to 2.5 tons per acre.
  - 3. WCFM shall be applied at a net dry weight of 100 pounds per acre. Mix the wood cellulose fiber with water to attain a mixture with a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
- C. Anchoring:
  - 1. Perform mulch anchoring immediately following application of mulch to minimize loss by wind or water. This may be accomplished by one of the methods presented in the following paragraph (listed by order of preference), depending upon the size of the area and erosion hazard.
  - 2. Mulch Anchoring Tool: This is a tractor drawn implement designed to punch and anchor mulch into the soil surface a minimum of two inches. This practice is most effective on large areas but is limited to flatter slopes where equipment can operate safely. If used on sloping land, this practice should follow the contour.
  - 3. Wood cellulose fiber may be used for anchoring straw. Apply the fiber binder at a net dry weight of 750 pounds per acre. Mix the wood cellulose fiber with water at a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
  - 4. Synthetic binders such as Acrylic DLR (Agro-Tack), DCA-70, Petroset, Terra Tax II, Terra Tack AR, or approved equal may be used. Follow application rates as specified by the manufacturer. Application of liquid binders must be heavier at the edges where wind catches mulch, such as in valleys and on crests of banks. Use of asphalt binders is strictly prohibited.

5. Lightweight plastic netting may be stapled over the mulch according to the manufacturer's recommendations. The netting is usually available in rolls 4 to 15 feet wide and 300 to 3,000 feet long.

## 3.06 ESTABLISHMENT OF NATIVE SEED MIX

- A. Install signs and caution tape around seeded areas to limit traffic during the maintenance period.
- B. Begin maintenance of seeded areas for establishment of grass immediately after seed placement. Water, repair eroded or bare areas, and otherwise protect and maintain the seeded areas for a minimum of one month after seed placement has been completed and until date of Substantial Completion.
- C. Watering:
  - 1. Water required to promote a satisfactory growth shall be furnished and applied by the Contractor until final acceptance of seeded areas and will not be measured for payment.
  - 2. Install and maintain temporary piping, hoses, and equipment to convey water from sources and to keep seeded areas uniformly moist.
  - Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly seeded areas.
  - 4. Apply water as required to supplement rainfall to provide approximately one inch of water per week over the seeded areas.
- D. Final acceptance of seeded areas shall not be recommended to the Contracting Officer until a satisfactory stand of native grass is obtained in all areas seeded. A satisfactory stand of native grass is defined as a cover of healthy plants in which gaps larger than one square foot do not occur. Bare spots shall be scattered, and the total bare areas shall not comprise more than ten percent of the total seeded area.
- E. During the establishment period, re-seed bare and eroded areas to meet the requirement for a satisfactory stand. Repair of washed or eroded areas and re-seeding of bare areas shall be performed at no additional cost to the Project.

## END OF SECTION

## SECTION 32 93 10 NATIVE PLANTINGS

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Excavation and preparation of planting pits and beds
  - 2. Planting of shrubs and other plants
  - 3. Maintenance of plantings
- B. Related Sections:
  - 1. Section 32 92 19 Seeding

## 1.02 REFERENCES

- A. American Horticultural Industry Association d/b/a AmericanHort:
  - 1. "American Standard for Nursery Stock" (ANSI Z60.1), 2014 Edition.

## 1.03 SUBMITTALS

- A. Submit the following for review prior to scheduled shipment of materials to the Site:
  - 1. Proof from plant suppliers of a valid North Carolina Nursery License (or comparable certification for out-of-state nurseries).
  - 2. For all shipments of nursery stock, submit a valid certificate of inspection in accordance with the requirements specified in paragraph 1.04.B.
  - 3. Certificates of Conformance or Compliance: Before delivery, submit notarized certificates attesting that plants to be furnished meet the requirements specified.
  - 4. Digital photographs of all plants to be furnished.
- B. Submit the following for review at time of shipment of materials to the Site:
  - 1. Certification tags from furnished plants, verifying type and purity in conformance with all applicable laws and regulations.
- C. Coordinate anticipated delivery dates of planting materials to be furnished. Submit legible copy of invoice or other delivery documentation showing kinds and sizes of materials included in each shipment.
- D. At completion of the Work, submit written material and installation warranty as specified in subsection 1.08.

## 1.04 QUALITY ASSURANCE

- A. Condition of new plants furnished by the Contractor shall be the responsibility of Contractor from the time of purchase until the initiation of the warranty period. Plants are subject to inspection and rejection at any time and place.
- B. All shipments of nursery stock into North Carolina shall be accompanied by a valid certificate of inspection issued at the state of origin and acceptable to the North Carolina Department of Agriculture Plant Industry Division.
- C. Planting shall be performed only by experienced workers familiar with planting procedures under the supervision of a qualified supervisor. Install all plant materials in accordance with local codes and ordinances.
- 1.05 DELIVERY, STORAGE AND HANDLING
  - A. Deliver fertilizer and other packaged materials in original, unopened, labeled and undamaged containers. Packaging shall show weight, analysis and name of manufacturer or supplier.
  - B. Cover plants transported to the Project Site in open vehicles with tarpaulins or other suitable covers securely fastened to body of vehicle to prevent injury to plants. Closed vehicles shall be adequately ventilated to prevent overheating of plants.
  - C. Plants shall be kept moist, fresh, and protected. Such protection shall encompass the entire period during which plants are in transit, being handled, or are in temporary storage. Evidence of inadequate protection following digging at the place of growth (source), carelessness while in transit, or improper handling or storage shall be cause for rejection.
  - D. Coordinate schedule for delivery of required plants. Contractor shall maintain plants beginning at time of delivery, and shall perform planting work as specified in this Section.

#### 1.06 PROJECT CONDITIONS

- A. If so requested, notify Contracting Officer at least seven working days prior to installation of plant materials.
- B. Native plantings shall be performed as soon as possible after finish grades are established in each area.
- C. Contractor shall inspect existing soil conditions in areas of the Site where planting operations are to be performed prior to commencement of the planting work. Correct any conditions that could affect the survivability of plant material to be installed.

## 1.07 MAINTENANCE

- A. Maintain plants immediately after planting as specified in this Section.
- B. Furnish service and maintenance of plantings until date of acceptance of the Work.

#### 1.08 MATERIAL AND INSTALLATION WARRANTY

- A. Provide a written one-year material and installation warranty for all plants purchased and installed by the Contractor. Warranty period shall extend for one year after final inspection and acceptance. Warranty shall include replacement of dead or unhealthy plants within the one-year warranty period in accordance with the requirements of subsection 3.08.
- PART 2 PRODUCTS

## 2.01 PLANTS

- A. Furnish plants as indicated on the Drawings. All plants shall conform to applicable standards set forth in ANSI Z60.1, including the following specified requirements.
- B. Furnish plants typical of their species or variety, with normal, densely developed branches and vigorous, fibrous root systems. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation. All plants shall have a fully developed form without voids and open spaces.
- C. Plants shall have been grown under climatic conditions similar to those in the vicinity of the Site or have been acclimated to such condition for at least two years.
- D. Plants shall be sound, healthy, vigorous, well-branched, and densely foliated when in leaf. No pruning wounds shall be present with a diameter of more than one inch and such wounds must show vigorous bark on all edges.
- E. Plants designated as ball and burlap shall be moved with root systems as solid units. Balls of earth shall be firmly wrapped with burlap, and shall comply with the following requirements:
  - 1. Diameter and depth of balls of earth shall be sufficient to encompass fibrous root feeding systems necessary for healthy development of plant.
  - 2. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken prior to or during process of planting. Balls shall remain intact during all operations.
  - 3. Hemp burlap and twine is preferable to treated burlap. If treated burlap is used, twine shall be cut from around trunk and burlap shall be removed.

- F. Deciduous Shrubs:
  - 1. Thickness (including number of canes), height and other characteristics of shrubs shall conform to applicable standards set forth in ANSI Z60.1.
  - 2. Single stemmed or thin plants shall not be accepted. Side branches shall be generous, well-twigged, and plant as whole well-branched to ground.
  - 3. Plants shall be in moist condition, free from dead wood, bruises, or other root or branch injuries.
- G. Container-grown nursery stock shall conform to the following requirements:
  - 1. Plants shall be grown in containers for sufficient length of time for the root system to have developed to hold its soil together, firm and whole. Plants shall not be loose in the containers and shall not be root bound.
  - 2. The measurements for height shall be taken from the ground level to the average height of the top of each plant and not the longest branch.
  - 3. Single stemmed or thin plants will not be accepted. Side branches shall be generous and well twigged, and the plant shall be well bushed to the ground.
  - 4. Plants shall be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.
- 2.02 PLANTING SOIL MIX
  - A. Planting Soil Mix shall be a mixture of native soil and decomposed organic matter (compost).
  - B. Decomposed organic matter shall be commercially prepared compost which has been composted sufficiently to be free of all woody fibers, seeds, and leaf structures, and free of toxic and nonorganic matter.
- 2.03 PLANTING MULCH
  - A. Planting mulch shall consist of compost conforming to the requirements of paragraph 2.02.B.
- 2.04 WATER
  - A. Contractor shall furnish water, watering truck, hose and other appropriate watering equipment.
- PART 3 EXECUTION
- 3.01 PREPARATION FOR PLANTING
  - A. Complete site grading and other related construction in the area prior to commencement of landscape planting work.

- B. Individual planting locations shall be staked on the Project Site by the Contractor. Plant material locations may be adjusted to meet field conditions without additional cost to the Project.
- C. Prepare planting areas as specified in Section 32 92 19.
- D. If obstructions are encountered that are not indicated, do not proceed with planting operations until alternative plant locations have been selected. Where location or spacing dimensions are not clearly shown, request clarification.
- E. Protect roots or balls of plants at all times from sun, drying wind and freezing. Ball and burlap plants that cannot be planted immediately upon delivery shall be set on ground and protected with soil, wet moss, or other acceptable material. Heel-in bare rooted plants that cannot be planted immediately upon delivery. Plant root balls shall be kept moist.
- F. Open bundles of plants and separate the plants before roots are covered. Take care to prevent air pockets among roots. During planting operations, cover bare roots with canvas, hay, or other suitable material. No plant shall be bound with wire or rope at any time so as to damage bark or break branches.

## 3.02 SHRUB PLANTING

- A. Perform planting at steady rate of work unless weather conditions make it impossible to work. No plant material shall be planted in frozen ground. Planting times other than those indicated must be acceptable to the Contracting Officer or the Contracting Officer's representative.
- B. Excavated planting pits shall be round, with slanted sides. Depth of each pit shall accommodate the root system. Provide 4-inch high undisturbed mound (soil pedestal) at bottom of pit.
- C. Cut all bindings and remove all wrappings from the top half of each root ball. Nonbiodegradable materials shall be totally removed.
- D. For container shrub planting, make three one-inch deep cuts in the sides of the root ball. Loosen and untangle any circling roots on bottom.
- E. Shrubs shall be planted in center of holes and at the required depths. Set plants upright, plumb and faced to give the best appearance or relationship to each other or adjacent structure. Set top of each root ball three inches above adjacent ground surface to allow for settlement.
- F. Planting Soil Mix shall be placed in layers of not more than eight inches and each layer shall be watered sufficiently to settle before the next layer is put in place. Tamp Planting Soil Mix under and around balled and burlapped and container stock plants to fill all voids and up to finish grade. No filling will be permitted around trunks or stems.

## 3.03 PLANTING OF SEEDLINGS AND OTHER PLANTS

- A. Set out plants in each area, arranged and spaced as indicated on the Drawings.
- B. Dig holes and place plants using one or more of the planting techniques shown on the Drawings (including slit and side-hole methods). Plant at required spacing.
- C. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- 3.04 PLANT MULCHING
  - A. Place planting mulch (compost) to cover soil surface around container stock shrubs to form a perimeter edge.
  - B. Thoroughly water mulched areas. Mulch shall not touch trunks of shrubs.

#### 3.05 MAINTENANCE

- A. Begin maintenance immediately after planting. Plants shall be watered, mulched, weeded, pruned, sprayed, fertilized, cultivated, and otherwise maintained and protected until final acceptance of the Project.
- B. Settled plants shall be reset to proper grade and position, planting saucer restored, and dead material removed. Correct defective work as soon as possible after it becomes apparent and weather and season permit.
- C. When high winds or other conditions, which may affect plant survival or appearance, occur during the warranty period, the Contractor shall immediately make repairs or replace plants as required.

#### 3.06 WATERING

- A. Responsibilities and procedures for water supply for plant maintenance shall be assumed by the General Contractor. Water for plant maintenance shall be obtained and applied by the General Contractor until Substantial Completion.
- B. Contractor shall furnish portable tanks, pumps, hoses, nozzles, and any other equipment required to transport water and apply it to new plants.

## 3.07 REPAIR AND REPLACEMENT OF DEFECTIVE WORK

A. If a substantial number of plants are sickly or dead at time of final inspection, acceptance will not be granted and Contractor's responsibility for maintenance of plants shall be extended until replacements are made.

- B. Remove and replace dead, defective and damaged plants as required before final acceptance of the Project. However, if seasonal restrictions apply, dead plants shall be replaced during the first optimum planting season within the one-year warranty period. Replacements shall be plants of same kind and size as specified. Replacement of plant materials that may be necessary shall be at no additional cost to the Project.
- C. Areas damaged during process of landscape planting work shall be repaired as specified in applicable specification sections.
- D. Remove fencing, signs, barriers, or other temporary protective devices upon final completion and acceptance of the Work.

## END OF SECTION

#### SECTION 35 31 10 RIPRAP SHORELINE PROTECTION

## PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section includes furnishing and placement of aggregate and riprap for construction of stone sill structures and riprap revetment for shoreline protection as indicated on the Drawings.
- B. Related Sections:
  - 1. Section 31 23 00 Excavation and Fill
  - 2. Section 31 32 20 Geotextiles

## 1.02 REFERENCES

- A. American Association of State Highway and Transportation Official (AASHTO):
  - 1. AASHTO T104, Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
- B. ASTM International:
  - 1. ASTM C136/C136M, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - 2. ASTM C535, Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion in the Los Angeles Machine.
  - 3. ASTM D75/D75M, Standard Practice for Sampling Aggregates.
  - 4. ASTM D4992, Standard Practice for Evaluation of Rock to be Used for Erosion Control.
  - 5. ASTM D5240/D5240M, Standard Test Method for Evaluation of Durability of Rock for Erosion Control Using Sodium Sulfate or Magnesium Sulfate.
  - 6. ASTM D5312/D5312M, Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions.
  - 7. ASTM D5313/D5313M, Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions.
  - 8. ASTM D5779/D5779M, Standard Test Method for Determination of Rapid Specific Gravity of Rock and Manmade Materials for Erosion Control.
  - 9. ASTM D6473, Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control.
- C. North Carolina Department of Transportation (NCDOT):
  - 1. "Standard Specifications for Roads and Structures", dated January 2018 (NCDOT Standard Specifications).

- D. Federal Highway Administration (FHWA):
  - 1. "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects", FP-14 (FHWA Standard Specifications).
- E. U.S. Army Corps of Engineers (USACE):
  - 1. COE CRD-C 144-92, Standard Test Method for Resistance of Rock to Freezing and Thawing.
  - 2. COE CRD-C 169-97, Standard Test Method for Resistance of Rock to Wetting and Drying.

#### 1.03 SUBMITTALS

- A. Proposed materials and source of supply information shall be submitted in accordance with Subdivision 01300 Submittals for review by the Contracting Officer or the Contracting Officer's Representative prior to shipment of materials to the Site:
  - 1. Proposed sources of aggregate and riprap.
  - 2. Proposed equipment and methods to be used for riprap placement.
  - 3. Written documentation (including gradation and quality test results) signed by the material producers or suppliers, indicating that aggregate and riprap meet or exceed the specified requirements.
- B. Proposed materials and source of supply information shall be submitted in accordance with Subdivision 01300 Submittals for review by the Contracting Officer or the Contracting Officer's Representative prior to use of materials in the construction:
  - 1. Results of specified aggregate and riprap verification testing.
- C. Submit the following at completion of the Work in accordance with Subdivision 01700 Contract Closeout:
  - 1. "As-Built" Record Drawings of completed riprap revetment and stone sill structures.

#### 1.04 QUALITY ASSURANCE

- A. Aggregate and riprap shall be of suitable quality, as defined in this Section, to ensure permanence in the structure and in the climate in which it is to be used. The stone shall be free from cracks, blast fractures, bedding, seams and other defects that would tend to increase its deterioration from natural causes.
- B. Riprap shall be obtained from approved sources. Each source shall be an active quarry which has produced stone materials of acceptable quality from satisfactory geological formations. The approved source shall have previously demonstrated effective quality control programs at the source and the test results of the materials furnished have been verified that materials are of satisfactory quality.

- C. It is the Contractor's responsibility to determine that the source or combination of sources selected is capable of providing the quality, quantities and gradation needed and at the rate needed to maintain the scheduled progress of the Work.
- D. The Contracting Officer or Contracting Officer's Representative will determine general conformance of the materials and constructed work with the Specifications.
- E. Record surveys shall be performed by an independent surveying firm with a Professional Land Surveyor (PLS) licensed and registered in the State of North Carolina, retained by the Contractor.
- F. The Contracting Officer or Contracting Officer's Representative will perform on-site review of stone sill and riprap revetment construction operations to monitor general conformance with the Specifications.
- 1.05 DELIVERY, STORAGE, HANDLING AND PAYMENT
  - A. Each gradation of aggregate and riprap shall be stockpiled separately and shall be adequately protected to preserve the fitness and quality of the materials.
  - B. Additional payment will not be made for riprap furnished, transported, and placed in excess of the lines shown on the contract plans. Additionally, payment will not be reduced for riprap furnished, transported, and installed within the tolerance allowed for minus deviation from the lines shown on the contract plans.

#### 1.06 PROJECT CONDITIONS

- A. Refer to Section 31 23 00 for available site information.
- B. Work shall be performed in a manner that does not disturb existing seawall as much as practicable.
- C. Riprap shoreline protection system construction shall be accomplished using approved equipment and methods that will minimize damage to the shoreline (including the existing soils and vegetation on the banks and adjacent waters of Currituck Sound) in accordance with all applicable regulations as stated in the Contract Documents.

## PART 2 PRODUCTS

#### 2.01 SOURCE QUALITY CONTROL

- A. Proposed materials and source of supply shall be submitted for review by the Contracting Officer or Contracting Officer's Representative prior to delivery and use in the construction.
- B. Riprap and aggregate shall meet specified gradation prior to placement. All processing shall be completed at the source.
- C. Verification Testing of Stone Aggregate:

- 1. Verification testing samples shall be taken upon delivery of aggregate to the Site, at a minimum rate of one for each visible change in material. Sampling shall be in conformance with ASTM D75/D75M.
- 2. The following tests shall be performed:
  - a. Sieve analysis (using ASTM C136/C136M)
- D. Verification Testing of Riprap:
  - 1. Verification testing of rock proposed to be supplied for the Project shall be performed as specified in the following paragraphs. This testing will be required prior to approval of the source if written documentation signed by the material producer has not been submitted.
  - 2. Samples shall be taken at the source. Sampling procedures shall be in accordance with ASTM D4992 and as specified in the following paragraphs.
  - 3. Samples of stone for testing shall be taken by a representative of the quarry for testing and acceptance prior to delivery of any rock from the source to the Site.
  - 4. The following tests shall be performed:
    - a. Bulk Specific Gravity (saturated surface dry (SSD)): ASTM D6473 or ASTM D5779/D5779M.
      - b. Absorption: ASTM D6473.
      - c. Soundness using Sodium Sulfate: ASTM D5240/D5240M or AASHTO T104.
      - d. Resistance to Abrasion (Los Angeles Abrasion): ASTM C535.
      - e. Resistance of Rock to Wetting and Drying Conditions: ASTM D5313/D5313M or COE CRD-C169-97.
      - f. Resistance of Rock to Freezing and Thawing Conditions: ASTM D5312/D5312M or COE CRD-C144-92.
  - 5. Documentation, including test results, for the above listed verification testing shall be provided prior to placement of riprap.
- E. Failure of tests will be considered cause for rejection of the quarry and/or quarry process, and all aggregate or riprap represented by the failed tests shall be set aside and not incorporated into the Work.

## 2.02 GEOTEXTILE

A. Specified in Section 31 32 20.

## 2.03 BEDDING STONE AGGREGATE

A. Aggregate for use as bedding stone under riprap revetment and stone sill shall consist of coarse aggregate conforming to the general requirements for aggregate quality in Sections 1005 and 1008 of the NCDOT Standard Specifications. Gradation shall conform to the requirements of Table 1005-1 for standard size number 57, as summarized in the following table.

Sieve Size	Percent Passing, by Weight
1 1/2 inch	100

Sieve Size	Percent Passing, by Weight
1 inch	95 – 100
1/2 inch	25 - 60
No. 4	0 – 10
No. 8	0 - 5

## 2.04 SIZE NO. 4 AGGREGATE

A. Aggregate for placement where required on the Drawings shall consist of coarse aggregate conforming to the general requirements for aggregate quality in Sections 1005 and 1008 of the NCDOT Standard Specifications. Gradation shall conform to the requirements of Table 1005-1 for standard size number 4, as summarized in the following table.

Sieve Size	Percent Passing, by Weight
2 inch	100
1 1/2 inch	90 – 100
1 inch	20 – 55
3/4 inch	0 – 15
3/8 inch	0 - 5

## 2.05 RIPRAP

- A. Quality: Rock shall consist of hard, durable, rock that is resistant to weathering and water action, substantially free of organic or other unsuitable material, and conform to the following quality criteria:
  - 1. Bulk Specific Gravity (SSD) (as determined using ASTM D6473 or ASTM D5779/D5779M): 2.5 minimum.
  - 2. Absorption (as determined using ASTM D6473): 5.0 percent maximum.
  - 3. Soundness using Sodium Sulfate (as determined using ASTM D5240/D5240M or AASHTO T104): 12 percent loss maximum.
  - 4. Resistance to Abrasion (as determined using ASTM C535): 50 percent loss maximum.
  - 5. Resistance of Rock to Wetting and Drying (as determined using ASTM D5313/D5313M or COE CRD-C169-97): maximum 1 percent loss for 30 cycles with no progressive cracking.
  - 6. Resistance of Rock to Freezing and Thawing (as determined using ASTM D5312/D5312M or COE CRD-C144-92): less than 10 percent loss for 12 cycles.
- B. Riprap for construction of stone sill and revetment (not including toe protection) shall consist of rock with a mid-range ( $D_{50}$ ) size of 18 inches and shall conform to the gradation requirements specified in one of the following paragraphs.
  - 1. Rock shall conform to the gradation requirements for Class 5 riprap in Subsection 705.02 of the FHWA Standard Specifications, as summarized in the following table.

Range of Intermediate Dimensions <sup>(1)</sup> , inches	Range of Rock Mass <sup>(2)</sup> , pounds	Percent Equal or Smaller, by Count
33 to 39	2900 to 4850	100
23 to 28	990 to 1800	85
17 to 20	400 to 650	50
11 to 15	110 to 270	15

<sup>(1)</sup> The intermediate dimension is the longest straight-line distance across the rock that is perpendicular to the rock's longest axis on the rock face with the largest projection plane.
<sup>(2)</sup> Rock mass is based on a specific gravity of 2.65 and 85 percent of the cubic volume as calculated using the intermediate dimension.

- 2. Alternate rock gradation meeting the required mid-range  $(D_{50})$  size of 18 inches.
- C. Riprap for toe protection where indicated shall consist of rock with a mid-range (D<sub>50</sub>) size of 24 inches and shall conform to the gradation requirements specified in one of the following paragraphs.
  - 1. Rock shall conform to the gradation requirements for Class 6 riprap in Subsection 705.02 of the FHWA Standard, as summarized in the following table.

Range of Intermediate Dimensions <sup>(1)</sup> , inches	Range of Rock Mass <sup>(2)</sup> , pounds	Percent Equal or Smaller, by Count
39 to 45	4850 to 7400	100
28 to 32	1800 to 2650	85
20 to 23	650 to 990	50
13 to 17	180 to 400	15

Refer to footnotes at bottom of table in paragraph 2.05.B.1.

2. Alternate rock gradation meeting the required mid-range  $(D_{50})$  size of 24 inches.

## PART 3 EXECUTION

- 3.01 FIELD QUALITY CONTROL
  - A. Perform check surveys of riprap revetment and stone sill construction as specified below.
    - 1. Contractor's surveyor shall perform surveys to verify that riprap is placed to the lines, grades and thicknesses established for the Work.
    - 2. At least one check survey shall be made for each 100-foot section of riprap revetment and stone sill constructed as much as practicable.
    - 3. Following completion of each section of riprap placement, the cross-section shall be submitted to the Contracting Officer or Contracting Officer's Representative before proceeding with the next section of riprap placement. Approval of cross-sections based upon check surveys shall not necessarily constitute final acceptance of the Work.

- 4. Cross-sections shall be taken on lines 100 feet apart, measured along the alignment of the construction reference line, with readings at 5-foot intervals and at breaks in grade along each cross-section.
- 5. Should rework be required to establish the stone sill or revetment crosssection, take additional measurements at no additional cost to the Contract.
- 6. The surveys shall be conducted during normal operating hours.
- 7. Use appropriate survey instruments and methods to provide survey accuracy meeting required standards of precision.
- 8. Shots shall be taken at locations that represent the average top of the riprap layer.
- 9. Submit "As-Built" Record Drawings prepared by the Contractor's PLS in accordance with Subdivision 01700 Contract Closeout.

## 3.02 PREPARATION OF SUBGRADE

- A. Areas above the water line on which bedding stone and riprap for revetments are to be placed shall be graded to conform to the cross-sections shown on the Drawings as specified in Section 31 23 00. Subgrade preparation work includes placement and compaction of fill material over existing surfaces as required.
- B. Install woven separation geotextile over subgrade to the full width and length of the stone sill and revetment structures as indicated on the Drawings and specified in Section 31 32 20.
- C. For stone sill subgrade and underwater potions of revetment, grading of existing soils at base of structures will not be required.

#### 3.03 PLACEMENT OF BEDDING STONE

- A. Place and uniformly spread aggregate for bedding stone layer to a nominal thickness of 12 inches and to the limits indicated on the Drawings.
- B. Bedding stone placement shall be performed using equipment and methods that will not significantly damage or displace the installed geotextile. Make corrections as required to provide full coverage of the subgrade.
- C. Place the bedding stone from lowest to highest elevations for revetment construction if practicable. Bedding stone may be placed from the top using a backhoe, with final shaping by suitable equipment.
- D. The bedding stone will not require compaction other than that provided by the equipment used to spread the material and as necessary to provide a stable base for riprap.
- E. Thickness of installed bedding stone layer shall be checked as much as practicable during construction using suitable measurement methods. Variations in installed thickness are allowed. However, the bedding stone layer shall not be deficient in

thickness by more than approximately three inches as determined based on thickness measurements.

F. Based on the results of check measurements, areas of the bedding stone layer that are not constructed to the required thickness, within allowed tolerance, shall be adjusted.

#### 3.04 PLACEMENT OF RIPRAP

- A. Riprap shall be placed in a manner that will produce a well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed, within the specified tolerances, to the thickness, lines and grades indicated on the Drawings.
- B. Haul rock to the construction area on access routes using transport vehicles selected by the Contractor. Within Refuge property, the Contracting Officer or the Contracting Officer's Representative shall designate the route.
- C. Riprap Revetment Placement:
  - 1. Place rock by means of crane-operated skip-pan (box), dragline bucket, clamshell, rock bucket, hydraulic excavator, trackhoe, or other mechanized equipment.
  - 2. No rock shall be dropped through the air from a height greater than three feet.
  - 3. Rock heavier than 500 pounds shall not be dropped from a height greater than two feet unless an extra cushioning layer is placed or other methods are taken to prevent damage to bedding stone and geotextile.
  - 4. Place rock from the lowest to highest elevations (from the bottom to top of slope), and in a manner to minimize shifting and displacement of the underlying bedding stone.
  - 5. Place subsequent loads of rocks up the slope against previously placed material in such a manner that a relatively homogeneous mass is constructed.
  - 6. Place 18-inch D<sub>50</sub> size rock to the required limits and elevations for revetment. Place riprap on both the shore side and water (Sound) side of the existing seawall in lifts not more than 18-inch thickness. Use procedures and methods that will prevent unbalanced forces against the structure by placing riprap to approximately the same elevation in each lift. Shape revetment structure to the required cross-sections and finish elevations as indicated on the Drawings.
  - 7. Place indicated 24-inch  $D_{50}$  rock for toe protection at the required locations and to the limits and total thickness indicated on the Drawings.
  - 8. Refer to subsequent paragraph D.2 for placement of rock underwater.
- D. Rock and Aggregate Placement for Stone Sill Structures:

- 1. Prior to starting the Work, submit the proposed methods for placing rock outside the seawall for construction of stone sill structures, including beneath water level.
- 2. Rocks placed underwater onto bedding stone may be dropped from a position at or above the water surface, provided the total depth of drop (including submerged depth) is not greater than two feet.
- 3. Rock shall be deposited evenly at a rate sufficient to ensure proper distribution of rock at final placement. The total quantity of rock placed shall be as needed to provide the design final dimensions and elevations.
- 4. Shape installed rock to the required cross-sections and finish elevations for construction of the stone sill structures as indicated on the Drawings.
- 5. Place and uniformly spread layer of aggregate over the indicated faces of the constructed stone sill structures to a thickness of 12 inches and to the elevations indicated on the Drawings
- E. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Placement of riprap by dumping into chutes or similar methods which are likely to cause segregation of the various sizes shall not be permitted.
- F. The desired distribution of the various sizes of rocks throughout the mass shall be obtained by: selective loading of the material at the quarry or other source; by controlled dumping of successive loads during final placing; or by other methods of placement which will produce the specified results.
- G. Rearranging of individual rocks may be performed to the extent necessary to obtain a well-graded distribution of rock sizes meeting the specifications.
- H. The finished surface and riprap layer thickness shall not deviate from the lines and grades shown on the Drawings by more than the following specified tolerances:
  - 1. A tolerance of plus 1/2 of average stone size and minus 1/4 of average stone size is allowed, except that the extreme of this tolerance shall not be continuous over an area greater than 200 square feet.
- I. No equipment shall be operated directly on the completed riprap shoreline protection structures.
- J. Based on the results of surveying, areas of riprap revetment and stone sill structures that are not constructed to the required thickness, lines and grades shown on the Drawings, within allowed tolerance specified above, shall be adjusted.
- K. Maintain the riprap shoreline protection structures until acceptance by the Contracting Officer or Contracting Officer's Representative. Any material displaced by any cause shall be replaced to the required lines and grades without additional cost to the Project.

END OF SECTION