

## SECTION TABLE OF CONTENTS

### SITE WORK

#### GEOTEXTILE TUBES

<b><u>PARAGRAPH</u></b>	<b><u>TITLE</u></b>	<b><u>PAGE NOS.</u></b>
<b>PART 1 - GENERAL</b>		
1.1	SCOPE OF WORK. . . . .	1
1.2	REFERENCES . . . . .	1
1.3	SUBMITTALS . . . . .	2
1.4	DELIVERY, STORAGE, AND HANDLING. . . . .	3
1.5	MEASUREMENT. . . . .	3
1.6	PAYMENT. . . . .	4
<b>PART 2 - PRODUCTS</b>		
2.1	MATERIALS . . . . .	4
2.2	MATERIALS AND MANUFACTURING REQUIREMENTS. . . . .	4
2.3	DETERMINATION OF PERCENT OF OPEN AREA . . . . .	8
2.4	TESTS, INSPECTIONS, AND VERIFICATIONS. . . . .	8
<b>PART 3 - EXECUTION</b>		
3.1	MOBILIZATIONS AND DEMOBILIZATION . . . . .	9
3.2	SURFACE PREPARATION . . . . .	9
3.3	INSTALLATION. . . . .	9
3.4	PROTECTION. . . . .	10
3.5	REPAIRS . . . . .	10
3.7	SURVEYS . . . . .	10

## **GEOTEXTILE TUBES**

### **PART 1 - GENERAL**

**1.1 SCOPE OF WORK.** The work covered by this Section consists of furnishing plant, labor, material, and equipment and performing the operations required for furnishing, testing, hauling, and placing the geotextiles and filling the anchor tubes and geotextile tubes with sand or other suitable materials as specified herein and as shown.

**1.2 REFERENCES.** The publications listed below, form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designations only.

American Society for Testing and Materials (ASTM) Publications.

D 2487-93	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D 3786-87	Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Test Method
D 3884-92	Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)
D 4354-96	Sampling of Geosynthetics for Testing
D 4355-92	Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
D 4491-96	Water Permeability of Geotextiles by Permittivity
D 4533-91 (R 1996)	Trapezoid Tearing Strength of Geotextiles
D 4595-86 (R 1994)	Tensile Properties of Geotextiles by the Wide-Width Strip Method
D 4632-91 (R 1996)	Grab Breaking Load and Elongation of Geotextiles

D 4751-95	Determining Apparent Opening Size of a Geotextile
D 4759-88 (R 1996)	Determining the Specification Performance of Geosynthetics
D 4833-88 (R 1996) (E1-1996)	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
D 4873-95	Identification, Storage, and Handling of Geotextiles
D 4884-96	Strength of Sewn or Thermally Bonded Seams of Geotextiles.

**1.3 SUBMITTALS.** Because the Government is purchasing and installing the geotextiles the required submittal are limited to geotube and scour apron specifications.

1.3.1 SD-01 Data.

1.3.1.1 Geotextile: Manufacturers data for geotube and scour apron geotextile shall be submitted by the vendors prior to delivery of the geotextiles.

1.3.1.2 Anchorage Plan: A detailed plan describing the proposed method of anchoring the edges of the scour pad will be described later.

1.3.1.3 Plan of Construction. The Plan of Construction will also be describe later.

1.3.2 SD-13 Certificates.

1.3.2.1 Geotextile: A written certificate of compliance from the vendors shall be submitted upon delivery of the geotextiles. The certificate shall state that geotextiles shipped to the site meet or exceed the minimum average roll values listed in the TABLES below.

1.3.2.2 Geotextile Seams: GA. A written certificate of compliance shall be submitted upon delivery of the geotextiles. The certificate shall state that each geotextile seam meets or exceeds the minimum average roll values listed in the TABLES below.

**1.4 DELIVERY, STORAGE, AND HANDLING.**

1.4.1 General. Geotextile for tubes shall be delivered only after the required submittals have been received and approved. Geotextiles shall be labeled, shipped, stored, and handled in accordance with ASTM D 4873 and as specified herein. Each roll shall be wrapped in an opaque and waterproof layer of plastic during shipment and storage. The plastic wrapping shall be placed around the geotextile roll in the

manufacturing facility and shall not be removed until installation. Each roll shall be labeled with the manufacturer's name, geotextile type, lot number, roll number, and roll dimensions, including length, width, or gross weight. Geotextile or plastic wrapping damaged as a result of delivery, storage, or handling shall be repaired or replaced, as directed, at no additional cost to the Government.

1.4.2 Handling. No hooks, tongs, or other sharp instruments shall be used for handling the geotextiles. Geotextiles shall not be dragged along the ground. The surface upon which it may be installed shall be smooth and free of burrs or protrusions that can snag and tear the fabric.

1.4.3 Storage. Geotextiles shall be stored in areas where water cannot accumulate, elevated off the ground, and protected from conditions that will affect the properties or performance of the geotextile. Geotextile shall not be exposed to temperatures in excess of 140 degrees F or less if recommended by the manufacturer. Outdoor storage shall not be for periods which exceed the manufacturer's recommendations or 6 months, whichever is less. Prior to installation geotextile shall not be exposed to direct sunlight for more than 14 days.

## **1.5 MEASUREMENT.**

1.5.1 Mobilization and Demobilization will performed by the Government.

1.5.2 Scour Pad should be measured to verify geotextile invoice payment including material folded over or sewn for the anchor tube.

1.5.3 The Geotextile Tubes should be measured in feet to the nearest linear foot.

## **1.6 PAYMENT.**

1.6.1 Mobilization and Demobilization cost for plant and equipment required to perform this work are assumed by the Government.

1.6.2 Scour Pad. Payment for the scour pad and tubes will be made at the contract lump sum price to the vendor.

1.6.3 Geotextile Tubes. Payment will be made at the contract unit price per linear foot for the "Geotextile Tubes," to the vendor.

1.6.5 Surveys. All surveys will be performed by the Government.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS.**

2.1.1 Sand Fill Materials. Sand for filling tubes shall consist of materials classified as SM, SC, SP, or SW when classified in accordance with ASTM D 2487 and

supplied by the Government from local borrow sources.

## **2.2 MATERIALS AND MANUFACTURING REQUIREMENTS.**

2.2.1 Geotextile. The scour pad, anchor tubes, and alternative anchorage shall be a woven mono-filament or multi-filament pervious sheets of polymeric yarn. The physical properties shall equal or exceed the Minimum Average Roll Values (MARV) listed in TABLE 1 below, as determined by the standard test methods listed in the Paragraph: REFERENCES above. Acceptance the geotextile shall be in accordance with ASTM D 4759. Strength values specified in TABLE 1 below, are for the weaker principle direction.

2.2.2 Anchorage. Edges of the scour pad shall be fabricated to allow anchorage. The anchorage shall consist of continuous anchorage of 20 pounds/lineal foot of scour pad edge, or individual anchorage weights, 60 pounds for tubes 2, 3, and the back side of tube 1 and 90 pounds for the front side (facing the Channel) of tube 1. Anchorage weights shall be placed at intervals not to exceed 3 feet along the edge of the scour pad. The continuous weight can be accomplished by providing for a 3-foot or 4-foot circumference anchor tube as shown or by some other approved method. The individual weights can be concrete bags or some other smooth non-corrosive materials which are securely attached to the edge of the scour pad. Pockets sewn along the edge of the scour pad or some other approved method of ensuring the weights remain attached to the scour pad edges shall be provided. In an alternative anchorage method, other than traditional anchor tubes, is proposed for use, the Contractor shall submit details of this anchorage along with required certification of geotextile material properties for approval.

2.2.3 Geotube Geotextile. The geotube geotextile shall be the same as that use for the anchor pad and anchor tubes. The geotextile tubes shall be a woven mono-filament or multi-filament pervious sheet of polymeric yarn. The geotextile tubes may be constructed to meet the geotextile properties in Table 1. Fibers used in the manufacture of the geotextiles shall consist of long-chain synthetic polymers composed of at least 85 percent by weight polyolefins, polyesters, or polyamides. Stabilizers and inhibitors shall be added to the base polymer of the geotextiles if necessary to make the filaments resistant to deterioration by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextiles shall be formed into a network so that the filaments or yarns retain dimensional stability relative to each other. The geotextile physical properties shall equal or exceed the Minimum Average Roll Values (MARV) listed in TABLE 1, as determined by the standard test methods listed in the Paragraph: REFERENCES above. Acceptance of geotextiles shall be in accordance with ASTM D 4759.

**TABLE 1 - GEOTEXTILE PHYSICAL PROPERTIES**

<b>PROPERTY</b>	<b>TEST METHOD</b>	<b>UNIT</b>	<b>MINIMUM TEST VALUE</b>
Apparent Opening Size (U.S. Sieve)	ASTM D 4751	U.S.Sieve (mm)	#40 (0.425)
Flow Rate	ASTM D 4491	gal/min/ft <sup>2</sup> (l/min/m <sup>2</sup> )	20 (813)
Permeability	ASTM D 4491	cm/sec	0.040
Permittivity	ASTM D 4491	sec <sup>-1</sup>	0.26
Puncture	ASTM D 4833	lbs (kN)	280 (1.25)
Wide Width Tensile Ultimate Tensile Strength Machine Direction(MD)	ASTM D 4595	lbs/ft (kN/m)	4800 (70)
Wide Width Tensile Ultimate Tensile Strength Cross Direction(CD)		lbs/ft (kN/m)	6600 (96.3)
Wide Width Tensile Elongation MD	ASTM 4595	%	18
Wide Width Tensile Elongation CD		%	6
Mullen Strength	ASTM D 3786	psi (kPa)	1200 (8259)
Trapezoidal Tear Machine Direction,	ASTM D 4533	lbs (kN)	180 (0.80)
Trapezoidal Tear Cross Direction, lbs		(kN)	275 (1.22)
Ultraviolet Degradation (percent Strength retained at 500 hours)	ASTM D 4355		70% strength Retained for all classes
Seam Strength Wide Width Tests In the MD and CD	ASTM D 4884	lbs/ft (kN/m)	3600 (52.5)
Percent Open Area	Specification Paragraph:	%	4

#### 2.2.4 Fabrication.

2.2.4.1 Geotextile. The geotextile shall be manufactured to the largest loom width possible. The geotextile tubes shall be fabricated by sewing together sheets of high strength woven geotextile material to form a tubular shape. The tubes shall have the circumferences of 15 feet and 30 feet as shown in the drawings. Geotube lengths are shown on the drawings entitled Treatments a, b, c, and d. The geotextile tubes shall be delivered with tube filling ports spaced at intervals not to exceed 50 feet or other approved interval, along the crest of the tube. Each fill port shall consist of a geotextile sleeve having a length of at least 3 feet and circumference slightly greater than that of the dredge discharge pipe (minimum 10-inch diameter). In addition, a pressure relief port, consisting of a 5-foot long geotextile sleeve, shall be located not more than 5 feet from each end of each tube. The port sleeves shall be fabricated of the same geotextile as the tubes and have a "drawstring" closure system to assure a secure closure after the completion of filling. Loops or straps shall be incorporated along the sides of the tube every 20 feet to facilitate deployment and anchoring. The loops or straps shall have the same tensile strength as the tube geotextile. Seams shall be overlapped and folded. Geotextile tube seams shall be factory sewn.

2.2.4.2 Scour Blanket or Pad and Anchor or Scour Tubes. The scour pad shall have widths corresponding to those found on the drawings. The scour pad shall include a 4-foot or 6-foot circumference anchor tube located along the leading edges of the pad as shown in the drawings entitled Treatments a, b, c, and d, with filling ports as recommended by the manufacturer or an alternative anchorage fabric sewn along the leading edges of the pad. The scour pad shall be installed and the anchor tubes shall be filled prior to the filling of the larger geotextile tube.

### **2.4 TESTS, INSPECTIONS, AND VERIFICATIONS.**

2.4.1 Manufacturing, Sampling, and Testing. Geotextiles and factory seams shall meet the requirements specified in TABLES 1 above. Conformance testing shall be performed on random samples by the Manufacturer in accordance with approved Quality Control practices.

## **PART 3 - EXECUTION**

**3.1 MOBILIZATION AND DEMOBILIZATION.** The Government shall mobilize sufficient personnel and equipment at the work site to begin required operations at the site. Upon successful completion of the work required as specified herein, the Government shall remove all construction equipment, materials, and supplies from the site.

**3.2 SURFACE PREPARATION.** The underlying surface to receive the geotextile scour pad shall be leveled and prepared to a relatively smooth condition free of ruts, erosion rills, obstructions, depressions, or debris greater than 6 inches in height. A shallow "swale" or "cradle" may be constructed on the tube centerline to prevent geotextile tubes from rolling during filling operation.

**3.3 INSTALLATION.** The WES shall submit the Plan of Construction specified in the Paragraph: SUBMITTALS above. The Plan shall incorporate the requirements specified herein with respect to tube and associated components including scour pad and anchor tubes, geometry, orientation, fabrics, fabrication, installation, anchoring, and filling procedures. Fabrication details or installation techniques that differ from those specified herein may be documented in the Plan of Construction and submitted for consideration by the Government. However, rejection of alternative methods suggested by the vendor shall not constitute a basis for claim against the Government. The Government shall visually inspect the geotextiles, prior to installation, for damage and imperfections. Defective geotextiles shall be marked and repaired. Trimming shall be performed using only an upward cutting hook blade. The geotextile shall be placed at the locations shown on the drawings.

3.3.1 Scour Pad Placement. The geotextile scour pad shall be installed by positioning it into place, slitting the pre-sewn anchor tube, and filling the tube with sand to settle the apron into place or other method as approved. The geotextiles shall be laid smooth to minimize tension, stress, folds, wrinkles, or creases, except as specifically shown. The seams shall be overlapped a minimum of 3 feet. Uplifted geotextile shall be approved prior to reuse. The scour pad shall extend 15 feet beyond the ends of the geotextile tubes with continuous anchorage along the edges and end of the scour pad. Continuous anchorage shall consist of anchor tube filled with sand along the edges and end of the scour pad or individual anchorage sights placed at intervals not to exceed 3 feet along the edge and end of the scour pads as specified in the Paragraph: MATERIALS AND MANUFACTURING REQUIREMENTS above. The scour pad and anchor tubes must extend 6 feet to 8 feet beyond the end of the geotube.

3.3.2 Geotextile Tube Placement. The geotextile tubes shall be so placed on the scour pad as to produce a smooth plane surface in continuous contact with the scour pad.

3.3.3 Filling Anchor and Geotextile Tubes. Sand for filling the anchor and tubes, using materials as specified in the Subparagraph: Sand Fill Materials above, may be obtained from the bank at the location shown; Channel sediments; Placement Area; or other source and shall be approved. Before and during filling, the geotextile tubes shall be prevented from rolling or shifting from the alignment shown. The geotextile tubes shall be filled and excess water allowed to drain, until the required elevations have been achieved. The inlet sleeve shall be secured to the injection pipe prior to pumping fill material. The tubes shall be monitored for settlement and deterioration for 2 weeks after initial filling is complete. Failed seams or ruptures in the tubes shall be repaired and tubes filled to the required elevation. The filling ports shall remain open during filling and shall be folded and sewn in accordance with the manufacturer's recommendations upon completion of filling the geotextile tube.

**3.4 PROTECTION.** The geotextile shall be protected during installation from blinding, clogging, penetrations, tears, or other damage and shall not be subjected to sunlight for more than 14 days. Damaged geotextile shall be repaired or replaced.

**3.5 REPAIRS.** Damaged or defective geotextiles shall be replaced or repaired. Repair shall be made by placing a patch of the same type of geotextile which extends a minimum of 18 inches beyond the edge of the damage or defect. Patches shall be continuously fastened using a sewn seam or other approved methods recommended by the manufacturer. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextiles which cannot be repaired shall be replaced, at no additional cost to the Government.

**3.6 SURVEYS.** Cross sections and a centerline profile along each tube centerline shall be taken before placement of the scour pad and no later than 5 calendar days following completion of filling the geotextile tubes. Cross sections shall be taken at both ends of each tube and along the tube at each fill port or at 50-foot intervals along the profile line for the before construction surveys. Centerline profile shall extend beyond the end of the geotextile tube. XY coordinance shall be recorded to locate the end points of each profile and the Station 0 plus Station 0 of each cross section. The cross sections shall extend a minimum of 30 feet beyond the scour pad anchor tubes. An elevation profile along the center of each geotextile tube shall be taken no later than 5 calendar days following completion of filling the geotextile tubes. Elevations shall be established using mean low tide data at 3-foot intervals. The cross section readings shall be taken at the same points for both surveys. The data shall be submitted within 7 calendar days of data collection.

**3.6 SAFETY REQUIREMENTS.** The proposed Geotube foundation must be leveled in the cross direction prior to filling because the mostly water filled Geotube has a tendency to roll down very shallow slopes of one to two percent during initial filling. Construction of a window row of material that prevents the Geotube from rolling can control rolling of Geotube during filling. During initial filling of Geotube personnel should be warned to stay up hill from the Geotube to prevent entrapment under the Geotube if it happens to become unstable and roll. The Geotube may also become unstable underwater and divers should all be warned as to possibilities of the Geotube rolling during initial filling.