**Special Note For Geomembrane Installation for**

**Geomembrane Lined Rip-Rap Ditch**

PART 1 - GENERAL

1.01 Description

1. This work shall consist of furnishing and installing a HDPE geomembrane lined ditch in accordance with this document and the project plans. Geomembranes will have a textured surface. Install the Geomembranes according to the plans or as directed by the Engineer for the purpose of better conveying surface water through the existing pipe in the embankment and offsite. The ditch shall be constructed in a manner that maintains a positive gradient.
2. The textured Geomembrane shall be constructed of high density polyethylene (HDPE). Storage and handling of the geomembrane shall be in accordance with the manufacturer’s recommendations and this special note. Torn or punctured geomembranes shall not be used.

1.02 References

1. ASTM references throughout this document refer to the latest version of the American Society of Testing Materials referenced test.

2. Portions of Specification adapted from *International Association of Geosynthetic Installers HDPE Geomembrane Installation Specifications*.

1.03 Submittals

A. Submit the following to the Engineer or Owner, for review and approval, within a two week period prior to installation so as to expedite shipment or installation of the Geomembrane:

1. Documentation of manufacturer's qualifications as specified in subsection 1.04A of this Section.

2. Manufacturer's Quality Control program manual or descriptive documentation.

3. A material properties sheet, including test methods used.

4. Sample of the material.

5. Example Material Warranty and Liner Installation Warranty complying with subsections 1.07 and 1.08 of this Section.

6. Resin Supplier's name, resin production plant identification, resin brand name and number, production date of the resin, resin Manufacturer's quality control certificates, and certification that the properties of the resin meet the requirements for the project.

C. Installation Plan

1. Submit copies of Installation Pans for engineer's approval within two weeks of the start of installation so as not to delay the start of geomembrane installation. Installation plans shall identify seams and details. Seams should generally follow the direction of the slope. Butt seams or roll-end seams should not occur on a slope unless approved by the Owner's Representative. Butt seams on a slope, if allowed, should be staggered.

2. Placement of geomembrane will not be allowed to proceed until Owner's

Representative has received and approved the Installation Plan.

1.04 Quality Control

A. Manufacturer's Qualifications: The manufacturer of geomembrane of the type specified or similar product shall have at least five years experience in the manufacture of such geomembrane. In addition, the geomembrane manufacturer shall have manufactured at least 5,000,000 FT2 of the specified type of geomembrane or similar product during the last five years.

1.05 Delivery, Storage and Handling

A. Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label shall be firmly affixed and shall clearly state the manufacturer's name, product identification, material thickness, roll number, roll dimensions and roll weight.

B. Geomembrane shall be protected from mud, dirt, dust, puncture, cutting, sunlight or any other damaging or deleterious conditions.

C. Rolls shall be stored away from high traffic areas. Continuously and uniformly support rolls on a smooth, level prepared surface.

D. Rolls shall not be stacked more than three high.

1.06 Project Conditions

A. Geomembrane should not be installed in the presence of standing water, while precipitation is occurring, during excessive winds, or when material temperatures are outside the limits specified in Section 3.03.

1.07 Material Warranty

Furnish the suppliers material warranty.

1.08 Geomembrane Installation Warranty

A. The Geomembrane Installer shall guarantee the geomembrane installation against defects in the installation and workmanship for 1 year commencing with the date of final acceptance.

1.09 Geomembrane Pre-Construction Meeting

A. A Geomembrane Pre-Construction Meeting shall be held at the site prior to installation of the geomembrane. At a minimum, the meeting shall be attended by the Geomembrane Installer, Owner, Owner’s representative (Engineer and/or CQA Firm), and the Earthwork Contractor.

B. Topics for this meeting shall include:

1. Responsibilities of each party.

2. Lines of authority and communication and resolution of any project document ambiguity.

3. Methods for documenting, reporting and distributing documents and reports.

4. Procedures for packaging and storing archive samples.

5. Review of time schedule for all installation and testing.

6. Review of panel layout.

7. Procedures and responsibilities for preparation and submission of as-built panel and seam drawings.

8. Temperature and weather limitations. Installation procedures for adverse weather conditions. Defining acceptable subgrade, geomembrane, or ambient moisture and temperature conditions for working during liner installation.

9. Subgrade conditions, dewatering responsibilities and subgrade maintenance plan.

10. Deployment techniques including allowable subgrade for the geomembrane.

11. Plan for controlling expansion/contraction and wrinkling of the geomembrane.

12. Covering of the geomembrane.

13. Measurement and payment schedules.

14. Health and safety.

C. The meeting shall be documented by a person designated at the beginning of the meeting and minutes shall be transmitted to all parties.

PART 2 - PRODUCTS

2.01 Source Quality Control

A. Manufacturing Quality Control

1. The manufacturer's geomembrane quality control certifications, including results of quality control testing of the products, as specified in subsection 2.01.A.2 of this Section, must be supplied to the Owner's Representative to verify that the materials supplied for the project are in compliance with all product and or project specifications in this Section. The certification shall be signed by a responsible party employed by the manufacturer, such as the QA/QC Manager, Production Manager, or Technical Services Manager. Certifications shall include lot and roll numbers and corresponding shipping information.

2. The Manufacturer will provide Certification that the geomembrane and welding rod supplied for the project have the same base resin and material properties.

2.02 Geomembrane

1. The textured geomembrane shall consist of new, first quality products designed and manufactured specifically for the purpose of this work which shall have been satisfactorily demonstrated by prior testing to be suitable and durable for such purposes. The geomembrane rolls shall be seamless, high density polyethylene containing no plasticizers, fillers or extenders and shall be free of holes, blisters or contaminants, and leak free. The geomembrane shall be supplied as a continuous sheet with no factory seams in rolls. The geomembrane will meet the property requirements as shown in the following table.

|  |  |  |
| --- | --- | --- |
| Property | Test method | Min Value or Requirement |
| Thickness | ASTM D5994 | 60 mils  |
| Density | D 1505/D 792 | 0.940 g/cc |
| Yield Strength | D 6693 | 110 lb/in  |
| Break Strength | D 6693 | 85 lb/in |
| Yield Elongation | D 6693 | 12% |
| Break Elongation | D 6693 | 100% |
| Puncture Resistance | D 4833 | 70 lb  |
| Tear Resistance | D 1004 | 35 lb  |
| UV Resistance | D 7238D 3895 | UV Resistant |
| Oxidative Induction Time | D 3895 | 100 min. |

C. Seaming shall be performed in the field using a welding system and quality control testing in strict accordance with the manufacturer’s specifications. The weld seam shall provide the same physical and chemical resistance properties as the HDPE sheet.

PART 3 –

EXECUTION

3.01 Subgrade Preparation

A. The subgrade shall be prepared in accordance with the project specifications. The geomembrane subgrade shall be uniform and free of all sharp or angular objects that may damage the geomembrane prior to installation of the geomembrane.

B. The Geomembrane Installer and Owner’s Representative shall inspect the surface to be covered with the geomembrane on each day's operations prior to placement of geomembrane to verify suitability.

C. The Geomembrane Installer and Owner’s Representative shall provide daily written acceptance for the surface to be covered by the geomembrane in that day's operations. The surface shall be maintained in a manner, during geomembrane installation, to ensure subgrade suitability.

D. All subgrade damaged by construction equipment and deemed unsuitable for geomembrane deployment shall be repaired prior to placement of the geomembrane. All repairs shall be approved by the Owner's Representative and the Geomembrane Installer. This damage, repair, and the responsibilities of the contractor and Geomembrane Installer shall be defined in the preconstruction meeting.

3.02 Geomembrane Placement

A. No geomembrane shall be deployed until the applicable certifications and quality control certificates listed in Subsection 1.03 are submitted to and approved by the Owner's Representative. Should geomembrane material be deployed prior to approval by the Owner's Representative it will be at the sole risk of the Geomembrane Installer and/or Contractor. If the material does not meet project specifications it shall be removed from the work area at no cost to the owner.

B. The geomembrane shall be installed to the limits shown on the project drawings and essentially as shown on approved panel layout drawings.

C. No geomembrane material shall be unrolled and deployed if the material temperatures are lower than 32 degrees F unless otherwise approved by the Owner's Representative. The specified minimum temperature for material deployment may be adjusted by the Owner’s Representative based on recommendations by the manufacturer. Temperature limitations should be defined in the preconstruction meeting. Typically, only the quantity of geomembrane that will be anchored and seamed together in one day should be deployed.

D. No vehicular traffic shall travel on the geomembrane other than an approved low ground pressure All Terrain Vehicle or equivalent.

E. Sand bags or equivalent ballast shall be used as necessary to temporarily hold the geomembrane material in position under the foreseeable and reasonably - expected wind conditions. Sand bag material shall be sufficiently close- knit to prevent soil fines from working through the bags and discharging on the geomembrane.

F. Geomembrane placement shall not be done if moisture prevents proper subgrade preparation, panel placement, or panel seaming. Moisture limitations should be defined in the preconstruction meeting.

G. Damaged panels or portions of the damaged panels which have been rejected shall be marked and their removal from the work area recorded.

H. The geomembrane shall not be allowed to "bridge over" voids or low areas in the subgrade. In these areas, the geomembrane shall be to allow the geomembrane to rest in intimate contact with the subgrade.

I. Wrinkles caused by panel placement or thermal expansion should be minimized in accordance with section 1.09 B11.

J. Considerations on Site Geometry: In general, seams shall be oriented parallel to the line of the maximum slope. In corners and odd shaped geometric locations, the total length of field seams shall be minimized. Seams shall not be located at low points in the subgrade unless geometry requires seaming at such locations and if approved by the Owner's Representative.

K. Overlapping: The panels shall be overlapped prior to seaming to whatever extent is necessary to effect a good weld. In no case shall this overlap be less than 3 inches for welded seams.

3.03 Seaming Procedures

A. Seams shall be continuously welded.

B. No geomembrane material shall be seam welded when liner temperatures are less than 32 degrees F unless allowed by the Engineer.

C. Blisters, larger holes, and contamination by foreign matter shall be repaired by patches and/or extrusion weld beads as required. Each patch shall extend a minimum of 6 inches beyond all edges of the defect.

3.04 Liner Acceptance

A. Geomembrane liner will be accepted by the Owner's Representative when:

1. The entire installation is finished or an agreed upon subsection of the installation is finished;

2. All Installer’s QC documentation is completed and submitted to the owner

3. Verification of the adequacy of all field seams and repairs and associated geomembrane installation is complete.

3.05 Anchor Trench

A. Construct as specified on the project drawings.

3.06 Disposal of Scrap Materials

A. On completion of installation, the Geomembrane Installer shall dispose of all trash and scrap material in a location approved by the Owner, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner. No scrap material shall be allowed to remain on the geomembrane surface.

PART 4 - MEASUREMENT AND PAYMENT

4.01 Payment

All actions and materials required for construction of the Geomembrane Lined Rip-Rap ditch are incidental to the pay item.

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| --- | --- | --- |
| CODE  | PAY ITEM | PAY UNIT |
|  | Geomembrane Lined Rip-Rap Ditch | Square Yards |