

**SECTION 00530, Rev. 1 – EJCDC STANDARD FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR ON THE BASIS OF A STIPULATED PRICE**

THIS AGREEMENT (“Agreement” or “Contract”) dated the _____ day of _____
_____ in the year 20__ by and between Indian River County Solid Waste Disposal District, a
dependent special district of Indian River County, which is apolitical subdivision in the State of
Florida (hereinafter called OWNER) and _____. (Hereinafter called
CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree
as follows:

ARTICLE 1 WORK

CONTRACTOR as an independent contractor and not as an employee shall furnish
and complete all of the necessary labor, material, and equipment to perform the
work as specified or indicated in the Contract Documents. The work is generally
described as follows:

1. Clearing, grubbing, and/or stripping the construction area as directed by the Engineer or
Owner;
2. Use of appropriate dust control measures during earthwork operations;
3. Construction of access ramp for Cell 3 construction;
4. Furnish materials for general/structural fill that meets the Technical Specifications,
placement and compaction to the subgrade grades shown on the Construction Drawings;
5. Cleaning of the Segment 3 final cover geomembrane or liner system geomembrane for
tie-in (extrusion welding or double-track fusion welding as appropriate) to the Cell 3 –
Segment 3 Expansion geomembrane liners;
6. Proofrolling of compacted fill or prepared subgrade surface prior to placement of the liner
subbase;
7. Construction of Cell 3 – Segment 3 Expansion double liner system, including anchor
trench and temporary intercell berm/rain flap;
8. Construction of leachate detection, leachate collection, and leachate transfer systems for
Cell 3 – Segment 3 Expansion;
9. Construction of LCS manhole and LDS pump station;
10. Construction of Liner penetration boxes;

11. Construction of erosion and sediment control structures (including silt check dams, straw bale barriers in perimeter ditches, and silt fence) as necessary to facilitate construction and minimize erosion during storm events;
12. Clearing, grubbing, excavation, backfilling, compaction, grading, and proofrolling necessary to facilitate construction of previously mentioned components of Phase 2 of Cell 3 – Segment 3 Expansion.

ARTICLE 2 ENGINEER

The project has been designed by Geosyntec Consultants, Inc., hereinafter called ENGINEER, and who is to act as OWNER'S representative, assume all duties and responsibilities and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the work in accordance with the Contract Documents.

ARTICLE 3 CONTRACT TIME

3.1 The CONTRACTOR shall be substantially completed with the following timeframe

- (a) Within 30 calendar days from effective date of Notice to Proceed, Contractor shall complete the following tasks:
 1. Obtain all necessary permits.
 2. Receive approved shop drawings for all materials and equipment to be utilized in the job.
 3. Perform all photographic recording and documentation of conditions prior to construction.
 4. Locate all existing utilities in the area of work.
 5. Submit and secure approval of shop drawings.
 6. Mobilize all labor, equipment, and materials.
 7. Deliver and store all equipment and materials to the job site.
 8. Notify all utilities and other affected parties prior to initiating construction.
- (b) From 30 calendar days to 90 calendar days from the effective date of Notice to Proceed, the CONTRACTOR shall complete the following tasks:
 1. Substantially complete the Work described in these Contract Documents.
 2. Correct all deficiencies noted by Engineer.

Completion of all tasks outlined above (i.e., Subparagraphs a) and b) constitutes Substantial Completion.

- (b) From 90 calendar days to 120 calendar days from the effective date of Notice to Proceed, the CONTRACTOR shall complete the following tasks:
 1. Clean up project area.

2. Remove all equipment and material from project site.
3. Perform contract closeout procedures.

3.2 Completion of all tasks outlined above (i.e., Subparagraphs a, b, and c) constitute Final Completion.

3.3 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence in/under this Agreement and that OWNER will suffer financial loss if the work is not completed within the times specified in Paragraphs 3.1 and 3.2 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by OWNER if the work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER four-hundred and fifty dollars (\$450.00) for each day that expires after the time specified in Paragraph 3.1 for Substantial Completion from Day 91 to Day 120 , if CONTRACTOR shall neglect, refuse or fail to complete the remaining work within the Contract Time or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER eight hundred dollars (\$800.00) for each day that expires after the time specified in Paragraph 3.2 for completion and readiness for final payment (after Day 121). The liquidated damages will not be compounded.

3.3.1 The CONTRACTOR and OWNER agree that OWNER is authorized to deduct all or any portion of the above-stated liquidated damages due to the Owner from payments due to the Contractor; or, in the alternative, all or any portion of the above-stated liquidated damages may be collected from the Contractor or its Surety or Sureties. These provisions for liquidated damages shall not prevent the OWNER, in case of the CONTRACTOR's default, from exercising its right to seek other remedies including, but limited to, terminating the Contractor's right to proceed as provided in this AGREEMENT.

3.3.2 In addition to the above-stated liquidated damages, the CONTRACTOR shall be responsible for reimbursing OWNER to third party consultants in administering the Project beyond the Substantial Completion date specified in this Agreement, or beyond an approved extension of time granted to CONTRACTOR, whichever date is later.

ARTICLE 4 CONTRACT PRICE

4.1 OWNER shall pay CONTRACTOR for completion of the work in accordance with the Contract Documents in current funds in the amount of \$ _____

ARTICLE 5 PAYMENT PROCEDURES

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions and the Contract Documents.

- 5.1 Progress Payments. The OWNER shall make progress payments to the CONTRACTOR on the basis of the approved partial payment request as recommended by ENGINEER in accordance with the provisions of the Local Government Prompt Payment Act, Florida Statutes section 218.70 et. seq. The OWNER shall retain ten percent (10%) of the payment amounts due to the CONTRACTOR until fifty percent (50%) completion of the work. After fifty percent (50%) completion of the work is attained as certified to OWNER by ENGINEER in writing, OWNER shall retain five percent (5%) of the payment amount due to CONTRACTOR until final completion and acceptance of all work to be performed by CONTRACTOR under the Contract Documents. Pursuant to Florida Statutes section 218.735(8)(b), fifty percent (50%) completion means the point at which the County as OWNER has expended fifty percent (50%) of the total cost of the construction services work purchased under the Contract Documents, together with all costs associated with existing change orders and other additions or modifications to the construction services work provided under the Contract Documents.
- 5.2 Pay Requests. Each request for a progress payment shall be submitted on the application for payment form supplied by OWNER and the application for payment shall contain the CONTRACTOR's certification. All progress payments will be on the basis of progress of the work measured by the schedule of values established, or in the case of unit price work based on the number of units completed. After fifty percent (50%) completion, and pursuant to Florida Statutes section 218.735(8)(d), the CONTRACTOR may submit a pay request to the County as OWNER for up to one half (1/2) of the retainage held by the County as OWNER, and the County as OWNER shall promptly make payment to the CONTRACTOR unless such amounts are the subject of a good faith dispute; the subject of a claim pursuant to Florida Statutes section 255.05(2005); or otherwise the subject of a claim or demand by the County as OWNER or the CONTRACTOR. The CONTRACTOR acknowledges that where such retainage is attributable to the labor, services, or materials supplied by one or more subcontractors or suppliers, the Contractor shall timely remit payment of such retainage to those subcontractors and suppliers. Pursuant to Florida Statutes section 218.735(8)(c)(2005), CONTRACTOR further acknowledges and agrees that: 1) the County as OWNER shall receive immediate written notice of all decisions made by CONTRACTOR to withhold retainage on any subcontractor at greater than five percent (5%) after fifty percent (50%) completion; and 2) CONTRACTOR will not seek release from the County as OWNER of the withheld retainage until the final pay request.
- 5.3 Paragraphs 5.1 and 5.2 do not apply to construction services work purchased by the County as OWNER which are paid for, in whole or in part, with federal funds and are subject to federal grantor laws and regulations or requirements that are contrary to any provision of the Local Government Prompt Payment Act. In such event, payment and retainage provisions shall be governed by the applicable grant requirements and guidelines.
- 5.4 ACCEPTANCE AND FINAL PAYMENT: Upon receipt of written notice that the work

is ready for final inspection and acceptance, the ENGINEER will promptly make such inspection and when the ENGINEER finds the work acceptable under the terms of the Contract and the Contract fully performed, the ENGINEER will promptly issue a final completion certificate stating that the work provided for in this Contract has been completed, and acceptance by the OWNER under the terms and the conditions thereof is recommended and the entire balance found to be due the CONTRACTOR, will be paid to the CONTRACTOR by the OWNER following County Commission approval of the final Contract payment.

- 5.5 Acceptance of Final Payment as Release. The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER from all claims and all liability to the CONTRACTOR other than claims in stated amounts as may be specifically excepted by the CONTRACTOR for all things done or furnished in connection with the work under this Contract and for every act and neglect of the OWNER and others relating to or arising out of the work. Any payment, however, final or otherwise, shall not release the CONTRACTOR or its sureties from any obligations under the Contract Documents or the Payment and Performance Bonds.

ARTICLE 6 INTEREST

Not Applicable.

ARTICLE 7 CONTRACTOR'S REPRESENTATIONS

In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations:

- 7.1 CONTRACTOR has familiarized itself with the nature and extent of the Contract Documents, work, site, locality, and all local conditions and laws and regulations that in any manner may affect cost, progress, performance or furnishing of the work.
- 7.2 CONTRACTOR has studied carefully all reports of explorations and tests of subsurface conditions and drawings of physical conditions which are identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions, and accepts the determination set forth in Paragraph SC-4.02 of the Supplementary Conditions of the extent of the technical data contained in such reports and drawings upon which CONTRACTOR is entitled to rely.
- 7.3 CONTRACTOR has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, reports and studies (in addition to or to supplement those referred to in Paragraph 7.2 above) which pertain to the subsurface or physical conditions at or contiguous to the site or otherwise may affect the cost, progress, performance or furnishing of the work as CONTRACTOR considers necessary for the performance of furnishing of the work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Paragraph 4.02 of the General Conditions; and no additional examinations, investigations, explorations, tests, reports,

studies or similar information or data are or will be required by CONTRACTOR for such purposes.

- 7.4 CONTRACTOR has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing underground facilities at or contiguous to the site and assumes responsibility for the accurate location of said underground facilities. No additional examinations, investigations, explorations, tests, reports, studies or similar information or data in respect of said underground facilities are or will be required by CONTRACTOR in order to perform and furnish the work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Paragraph 4.04 of the General Conditions.
- 7.5 CONTRACTOR has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.
- 7.6 CONTRACTOR has given ENGINEER written notice of all conflicts, errors or discrepancies that he has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

ARTICLE 8 CONTRACT DOCUMENTS.

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the work consist of the following:

- 8.1 This Agreement (Section 00530).
- 8.2 Public Construction Bond (Section 00610)).
- 8.3 Notice of Award and Notice to Proceed (examples in Section 00800).
- 8.4 General Conditions (Section 00700).
- 8.5 Supplementary Conditions (Section 00800).
- 8.6 Specifications bearing the title **"Phase 2 - Cell 3 Construction Class 1 Landfill - Segment 3 Expansion"** as listed in the table of contents hereof.
- 8.7 Drawings, inclusive with each sheet bearing the following general title **"Phase 2 - Cell 3 Construction Class 1 Landfill - Segment 3 Expansion."**
- 8.8 Addenda numbers _____ to _____, inclusive.
- 8.9 CONTRACTOR'S Bid (Section 00300).
- 8.10 The following, which may be delivered or issued after the effective date of the Agreement and are not attached hereto: All written amendments and other documents amending, modifying, or supplementing the Contract Documents pursuant to Paragraphs 3.04 of the General Conditions.

There are no Contract Documents other than those listed above in this Article 8. The Contract Documents may only be amended, modified or supplemented as provided in Paragraphs 3.04 of the General Conditions.

ARTICLE 9 MISCELLANEOUS

- 9.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 9.2 It is agreed that the CONTRACTOR shall not assign, transfer, convey, or otherwise dispose of the contract or its right, title, or interest in or to the same or any part thereof, or allow legal action to be brought in its name for the benefit of others, without previous consent of the OWNER and concurred to by the sureties. Any attempted assignment shall be void and may, at the option of the OWNER be deemed an event of default hereunder. Nothing herein shall be construed as creating any personal liability on the part of any officer or agent of the OWNER who may be a party hereto.
- 9.3 OWNER and CONTRACTOR each bind itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.
- 9.4 The CONTRACTOR shall be properly licensed to practice its trade or trades which are involved in the completion of this Agreement and the work thereunder.
- 9.5 This Agreement shall be governed by the laws of the State of Florida. Venue for any lawsuit brought by either party against the other party or otherwise arising out of this agreement shall be in Indian River County, Florida, or, in the event of federal jurisdiction, in the United States District Court for the Southern District of Florida.
- 9.6 CONTRACTOR agrees to indemnify and hold harmless the OWNER, together with its agents, engineers, employees, elected officers and representatives, from liabilities, damages, losses, and costs, including but not limited to, reasonable attorney's fees, to the extent caused by the negligence, recklessness or intentional wrongful misconduct of the CONTRACTOR and persons employed or utilized by the CONTRACTOR in the performance of the work under this Agreement. This indemnification and hold harmless provision shall survive the termination or expiration of this Agreement. The indemnification is limited to \$5 million per occurrence.
- 9.7 Pledge of Credit. The CONTRACTOR shall not pledge the OWNER'S credit or make it a guarantor of payment or surety for any Agreement, debt, obligation, judgment, lien or any form of indebtedness. The CONTRACTOR further warrants and represents that it has no obligation of indebtedness that would impair its ability to fulfill the terms of this Agreement.
- 9.8. Counterparts. This Agreement may be executed in one or more counterparts, but all such counterparts, when duly executed, shall constitute one and the same Agreement.

9.9. Public Records. The OWNER and the CONTRACTOR shall comply with the provisions of Chapter 119, Florida Statutes (Public Records Law) in connection with this Agreement.

IN WITNESS WHEREOF, OWNER AND CONTRACTOR have signed this Agreement the day and year first written above.

OWNER

Indian River County
Board of County Commissioners

By: _____
Joseph H. Earman, Chairman

Attest: Ryan L. Butler, Clerk of the Circuit Court

By: _____
Deputy Clerk

Approved By:

Michael C. Zito, Interim County Administrator

Approved as to Form and Legal Sufficiency:

Bill DeBraul, County Attorney

Address for giving notices

1801 27th Street

Vero Beach, Florida 32960

CONTRACTOR

By: _____

(CORPORATE SEAL)

Attest: _____

Address for giving notices

License No. _____

END OF SECTION

SECTION 01025, Rev. 1
MEASUREMENT AND PAYMENT

SECTION 01025, Rev. 1

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. This Section describes the methods for Measurement and Payment for the Work of this Contract.
- B. Measurement and Payment of Work will be made, and payment for Work will be taken to be included in, and covered by, the Contract unit prices and lump sum payment methods for the various bid items listed in Contractor's Bid Form.
- C. Contractor shall provide necessary equipment, workers, construction quality control testing, and survey (for its own use) personnel as required. Owner will provide surveying for as-built record drawings and for measurement and payment purposes.

1.02 ENGINEER'S ESTIMATE OF QUANTITIES

- A. Bid items and estimated quantities are identified in Contractor's Bid Form of the Contract Documents. The estimated quantities for unit price pay items are approximate only and are included solely for the purpose of comparison of Bids. Owner does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground, or the actual quantities of material encountered or required will correspond with the estimated quantities.

1.03 ITEMS

- A. Mobilization/Demobilization
 - 1. Measurement for payment will not be made for this item.
 - 2. Payment of the lump sum listed in the Bid Form for this Bid Item will be prorated as follows for work covered by each payment request submitted by the Contractor: 20% for the first invoice and 5% per month thereafter with 20% held and payable with Contractor's final payment in accordance with the Contract Documents.
 - 3. The lump sum price shall include and cover the furnishing of all materials, labor, tools, and equipment necessary for Contractor to mobilize the necessary operations to the project site, including: the initial movement of personnel and

equipment to the project site; application, fee payment, and acquisition for all necessary permits; the establishment of Contractor's shops, plants, storage areas, field office, temporary water, electrical, telephone, sanitary and other temporary facilities; and other expenses required for the Work included in this Contract.

4. The lump sum price shall include, but not be limited to:
 - a. preparation of Site-Specific Health and Safety Plan if required by the Contract Documents;
 - b. preparing and maintaining all project safety and other records required by this Contract;
 - c. obtaining any permits required by County in order to perform the Work included in this Contract;
 - d. the cost of Contractor's insurance requirements for the duration of the Work; and
 - e. the cost of furnishing and maintaining performance and payment bonds as required in the Contract Documents for the duration of the Work.
5. The lump sum price shall include and cover demobilizing all materials, labor, tools, and personnel and equipment from the project site; dismantling of Contractor's shops, plants, storage areas, field office, temporary water, electrical, telephone, sanitary, and all other activities required for the project closeout.
6. Mobilization/Demobilization may not be more than 10% of the total bid price.

B. Surveying

1. Measurement for payment will not be made for this item.
2. Payment of the lump sum price listed in the Bid Form for this Bid Item will be prorated based on the actual work accomplished by the Surveyor for work covered by each payment request submitted by Contractor. Contractor shall submit proof of survey work performed through survey work products.
3. The lump sum price shall include and cover the furnishing of all labor, materials, tools, supervision, transportation, and equipment necessary to perform surveying work as specified in Section 02100 necessary for Contractor to perform Work included in this Contract. Surveying for as-built record drawings and for measurement and payment purposes will be provided by the Owner.

C. Site Preparation (clearing, grubbing, stripping)

1. Measurement for payment will be made on a per acre basis.
2. Payment of the unit price listed in the Bid Form for this Bid Item will be based on the as-built area of actual work accomplished as listed in the Bid Form.
3. The per acre bid price shall include all labor, tools, equipment, supervision, materials, and testing necessary to perform clearing, grubbing, and stripping, as specified in Section 02110 of these Specifications and at the locations shown on the Construction Drawings.
4. No payment will be made until after the designated locations have been cleared, grubbed, or stripped and accepted pursuant to the Specifications and Construction Drawings. No payment will be made for stored materials.

D. General Fill (Supply and Install)

1. Measurement for payment will be made on an in-place, compacted cubic yard basis.
2. Payment of the unit price listed in the Bid Form for this Bid Item will be based on the as-built, placed and compacted volume of actual work accomplished as listed in the Bid Form and shall be measured based on pre- and post-construction surveys. Interim payments may be made on the basis of truck counts or other method as proposed by the Contractor and agreed by the Owner; no more than 90% of the bid price will be paid based on truck counts.
3. The per cubic yard bid price shall include all labor, tools, equipment, supervision, and materials necessary to transport (from off-site borrow sources), place, moisture condition, and compact General Fill from approved off-site borrow sources or as provided by the Contractor. The installed General Fill shall meet the requirements of Section 02200 of the Specifications and to the lines and grades shown on the Construction Drawings. The unit price includes all CQC testing required by Sections 01410 and 02200 of the Specifications.
4. No payment will be made until after the General Fill is installed pursuant to the Specifications at the locations required in the Construction Drawings. No payment will be made for stored materials.

E. Liner Protective Layer Soil

1. Measurement for this work item will be based on the in-place compacted volume of liner protective layer soil in accordance with the requirements of the Construction Drawings or as approved by the Owner. The in-place compacted volume shall be computed based on certified Contractor survey after clearing, grubbing, and stripping or after fill material placement to the lines and grades shown on the Construction Drawings.
2. Payment will be made at the unit price per cubic yard agreed in the Contract.
3. The price shall include all labor, materials, and equipment required for hauling, placing, and compacting the general fill and protective cover soil to the grades, lines, and limits indicated on the Construction Drawings. The price shall include: (i) cost of restoring areas prior to final acceptance; (ii) the cost of temporary erosion and sediment control, as needed; and (iii) dewatering as required.
4. The liner protective layer soil may be provided from an approved off-site source that has been proposed by the Contractor. No additional payment will be made for losses due to settlement, wastage, additional compaction, erosion, over-excavation, dewatering, extra handling, protection, removal of deleterious materials, re-working surface, or replacement of rejected material.

F. Granular Drainage Material

1. Measurement for this work item will be based on the in-place volume of granular drainage material (e.g., river rock) in accordance with the requirements of the Construction Drawings or as approved by the Owner. The compacted volume shall be computed based on certified Contractor survey after material placement to the lines and grades shown on the Construction Drawings.
2. Payment will be made at the unit price per cubic yard agreed in the Contract.
3. The price shall include all labor, materials, and equipment required for hauling, placing, and compacting the granular drainage material to the grades, lines, and limits indicated on the Construction Drawings.

G. Geosynthetics

1. Measurement for this work item will be based on two-dimensional (2-D) installed plan area approved by the Owner and the CQA Consultant as required in the Construction Drawings and Specifications.

2. Payment will be made at the unit price per installed square yard agreed in the Contract. Payment for this bid item will be made as follows: 100 percent will be paid for each geosynthetic component, including rain tarp, installed and approved by the Owner and CQA Consultant.
3. The price shall include all labor, materials, and equipment required to install geosynthetics and provide standard field conformance tests (as required in these Specifications such as electrical leak location testing) in the areas indicated on the Construction Drawings. No additional payment will be made for wastage, re-installation due to failed conformance tests, necessary repair, or replacement of materials damaged due to transportation, handling, or installation by Contractor.

H. HDPE Pipe

1. Measurement for this work item will be based on actual length of HDPE pipe installed.
2. Payment shall be made at the unit price per lineal foot agreed to in the Contract.
3. The price shall include all excavation, drilling, bedding, backfill, pipe materials, headwalls, endwalls, and other work as required for effective drainage. No additional payment will be made for losses due to settlement, wastage, erosion, over-excavation, compaction, replacement of rejected or damaged materials, extra handling, dewatering, or protection.

I. Leachate Collection and Leak Detection System Appurtenances

1. Measurement will not be made for these work items.
2. Payment will be made at the price agreed in the Contract for each type of appurtenance.
3. The price shall include cost of furnishing and installation of drainage structures, manholes, concrete thrust blocks, pipes, couplings, connections, fittings, geotextile, and riprap required by the Construction Drawings and Specifications. The price shall include cost of furnishing and installation of liner markers, bollard posts, marker tape, sandbags for liner system ballasting, and construction signs required by the Construction Drawings and Specifications. No additional payment will be made for losses due to settlement, wastage, erosion, over-excavation, bracing, replacement of rejected or damaged materials, extra handling, dewatering, or protection.

J. Leachate Collection System Jet Cleaning and Video Inspection

1. The price for this item includes all costs required for performing jet cleaning and video inspection of the leachate collection/detection system.
2. The lump sum price proposed shall be full compensation for performing all relevant requirements performing the jet cleaning and video inspection activities.

K. Leachate Collection and Leak Detection Sump

1. The price for this item includes all costs required for supply and installation of the leachate collection/detection sump. The work shall include, but not limited to, excavation, grading, and compaction of the leachate collection/detection sump.
2. The lump sum price proposed shall be full compensation for performing all relevant requirements to achieve successful installation of leachate collection/detection sump to the lines, grades and details as shown in the Construction Drawings.

L Liner Penetration Box

1. The lump sum price for this item includes all costs required for supply and installation of leachate collection boxes. The lump sum price shall include and cover the furnishing of all labor, materials, tools, supervision, transportation, and equipment necessary to construct and maintain the liner penetration boxes and as shown on the Construction Drawings.

M. Electrical Systems

1. The price for this item includes all work required to fully operate the control panel, lighting and electrical system. The work shall include, but not be limited to pump controls, pump connections, flow meter connection, wiring from the handhole location to the control panel, running above ground and below ground electrical conduits, pull box installation, handhole installation, site lighting, generator connection, coordination with the power company and signal/communication lines. All necessary certifications, demonstrations, QA/QC and production of record documents shall be included with this item.

2. The price proposed shall be full compensation for performing all relevant requirements to achieve successful installation and operation of entire electrical system associated with the Construction Drawings and Specifications.

N. Erosion and Sediment Control

1. Measurement for payment will not be made for this item.
2. Payment of the lump sum price listed in the Bid Form for this Bid Item will be prorated based on the contract schedule as agreed to between Owner and Contractor.
3. The lump sum price shall include and cover the furnishing of all labor, materials, tools, supervision, transportation, and equipment necessary to construct and maintain the erosion and sediment control features as described in the Section 02290 and as shown on the Construction Drawings. Work includes, but is not limited to:
 - a. temporary stormwater diversion dikes;
 - b. rock check dams;
 - c. lined sediment traps;
 - d. temporary stormwater piping;
 - e. stabilized construction entrance;
 - f. removal and disposal of accumulated sediment;
 - g. temporary seeding and mulching of stockpiles and disturbed areas;
 - h. soil amendments, fertilizer, disc harrowing, and other seedbed preparation;
 - i. permanent seeding, and mulching, and maintenance until acceptable permanent vegetation is established;
 - j. erosion control matting; and
 - k. sodding in lieu of seeding.
4. The lump sum price also includes materials supply and delivery to the site, proper protection, and storage until placement.
5. No payment will be made for stored materials.

O. Access Road

1. Measurement for payment will be made on a cubic yard/square yard basis.
2. Payment of the unit price listed in the Bid Form for this Bid Item will be based on the as-built area of actual work accomplished as listed in the Bid Schedule.

3. The per cubic yard/square yard bid price shall include and cover the furnishing of all labor, materials, tools, supervision, transportation, and equipment necessary to construct the Access Road as described in Section 02230 of the Specifications and as shown on the Drawings. Work includes, but is not limited to:
 - i. placement of the multifilament woven geotextile;
 - ii. placement and compaction of the structural fill; and
 - iii. placement and compaction of a minimum 8 inches of stabilizer material.
4. Stabilizer material may be crushed limerock, shell material, or crushed coquina. Contractor shall submit samples of stabilizer material intended for use on the Entrance Road to the Engineer for review no less than 30 calendar days prior to use. Final selection of the stabilizer material will be made by the Owner.
5. The unit price also includes materials supply and delivery to the site, proper protection, and storage until placement.
6. Payment will be made after the Perimeter Access Road is completed and accepted pursuant to the Specifications and Construction Drawings. No payment will be made for stored materials.

P. RCP Culvert

1. Measurement for this work item will be based on actual length of RCP culvert installed.
2. Payment shall be made at the unit price per lineal foot agreed to in the Contract.
3. The price shall include all excavation, drilling, bedding, backfill, pipe materials, headwalls, endwalls, and other work as required for effective drainage. No additional payment will be made for losses due to settlement, wastage, erosion, over-excavation, compaction, replacement of rejected or damaged materials, extra handling, dewatering, or protection.

Q. Vegetation/ Permanent Stabilization

1. Measurement for payment will be made on a per acre basis for this item.
2. Payment of the unit price listed in the Bid Form for this Bid Item will be based on the as-built area of actual work accomplished as listed in the Bid Form.
3. The per acre bid price shall include all labor, tools, equipment, supervision, and materials necessary to pre-qualify, procure, deliver, stockpile, and install

sodding meeting the requirements of Section 02930 of the Technical Specifications.

4. The per acre bid price shall also include all labor, tools, equipment, supervision, and materials necessary to supply and apply/place the Hydro-seeding/Vegetative Stabilization, including additional over-seeding and other work necessary to establish permanent vegetation, at the locations shown on the Construction Drawings and as described in the Specifications.
5. No payment will be made until after the Vegetation/Permanent Stabilization is installed pursuant to the Specifications at the locations required in the Construction Drawings. No payment will be made for stored materials.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 CONTRACT PRICE FORM

- A. See Contract Attachment A for Bid Form.

3.02 APPLICATION FOR PAYMENT

- A. Contractor shall use the Application for Payment Form provided in this Specification Section.

3.03 SUPPORT DOCUMENTATION FOR APPLICATIONS FOR PAYMENT

- A. Contractor is responsible to obtain and submit all documentation, including all measurement and quantity computations, required for verification of pay applications. Engineer shall verify measurements and quantities for payment.
- B. Should Engineer determine that insufficient data has been submitted to accurately verify a pay application, Engineer shall notify Contractor of deficiencies. Contractor shall address identified deficiencies prior to further review of the pay application.
- C. In the event that survey data provided by Contractor is not sufficient to determine actual pay quantity, and the status of Work prevents additional data from being obtained, Engineer shall attempt to reasonably estimate the pay quantity based upon available information. Engineer's estimate shall be final.

[END OF SECTION]

SECTION 02770, Rev. 1
GEOMEMBRANE

SECTION 02770, Rev. 1 GEOMEMBRANE

PART 1 GENERAL

1.01 SCOPE

- A. The Section includes requirements for geomembrane products and installation.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 – Surveying
- B. Section 02200 – Earthwork
- C. Section 02221 – Trenching and Backfilling
- D. Section 02740 – Geocomposite
- E. Section 02780 – Geosynthetic Clay Liner (GCL)
- F. Section 02790 – Interface Friction Conformance Testing
- G. Section 13005 – Liner Penetration Boxes
- H. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) standards:
 - 1. ASTM D 638. Standard Test Method for Tensile Properties of Plastics.
 - 2. ASTM D 746. Standard Test Method for Brittleness, Temperature of Plastics and Elastomers by Impact.
 - 3. ASTM D 792. Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
 - 4. ASTM D 1004. Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.

5. ASTM D 1204. Standard Plastics Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
6. ASTM D 1238. Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
7. ASTM D 1505. Standard Test Methods for Density of Plastics by Density-Gradient Technique.
8. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics.
9. ASTM D 1693. Standard Test Method for Environmental Stress Cracking of Ethylene Plastics
10. ASTM D 4437. Standard Test Methods for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Geomembranes.
11. ASTM D 5199. Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
12. ASTM D 5321. Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
13. ASTM D 5397. Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
14. ASTM D 5596. Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.
15. ASTM D 5994. Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
16. ASTM D 6365. Standard Practice for the Nondestructive Testing of Geomembrane Seams using the Spark Test.

17. ASTM D 6392. Standard Test Methods for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 18. ASTM D 6693. Standard Test Method for Determining Tensile Properties of Non-Reinforced Polyethylene and Non-Reinforced Flexible Polypropylene Geomembranes.
 19. ASTM E96-00. Standard Test Methods for Water Vapor Transmission of Materials (Procedure BW).
- B. Latest version of the Geosynthetic Research Institute (GRI) test methods:
1. GRI GM 5. Test Method for Ductile/Brittle Transition Time for Notched Polyethylene Specimens Under Constant Stress.
 2. GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.
 3. GRI-GM19a Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.
- C. Latest version of Federal Test Method Standard (FTMS).
1. FTMS 101/2065 Federal Test Method Standard for Puncture Resistance and Elongation Test (1/8 Inch Radius Probe Method).

1.04 WARRANTY

- A. Furnish a 20-year written warranty against defects in materials. Warranty conditions concerning limits of liability will be evaluated by, and be acceptable to, the Engineer.

1.05 SUBMITTALS

- A. Submit the following information to the Engineer for review not less than 45 calendar days prior to geomembrane use:
1. Geomembrane manufacturer capabilities, including:
 - a. daily production capacity available for this Contract; and

- b. manufacturing quality control procedures.
 2. A list of 10 completed facilities for which the manufacturer has supplied a minimum total of 10,000,000 square feet of polyethylene geomembrane. Provide the following information for each facility:
 - a. name, location, purpose of facility, and date of installation;
 - b. names of owner, project manager, design engineer, and installer; and
 - c. thickness and surface area of geomembrane provided.
 3. Origin (resin supplier's name, resin production plant) and identification (brand name, number) of the polyethylene resin used.
 4. Certification of minimum average roll values (95 percent lower confidence limit) for physical, mechanical, and environmental properties and the corresponding test procedures for the geomembrane properties listed in Table 02770-1. Submit values that are specific to the resin used in manufacture.
 5. Certification that welding rod or granules are compatible with the specifications and the resin of the geomembrane furnished for this project.
 6. Manufacturer warranty as specified in this section.
- B. Submit to the Engineer for review not less than 30 calendar days prior to geomembrane use the following documentation on the resin used to manufacture the geomembranes:
 1. Copies of quality control certificates issued by the resin supplier including the production dates and origin of the resin used to manufacture the geomembrane for this Contract.
 2. Results of tests conducted by the manufacturer to verify the quality of the resin used to manufacture the geomembrane rolls assigned to the project.
 3. Certification that no more than 10 percent reclaimed polymer is added to the resin during the manufacturing of the geomembrane to be used for this project and that all reclaimed polymer (if added) is same as the parent material.
- C. Submit to the Engineer for review the following documentation on geomembrane roll production at least 14 calendar days prior to transporting any geomembrane to the site:

1. Manufacturing certificates for each shift's production of geomembrane, signed by the manufacturer quality control manager.
 2. Certificate shall include:
 - a. roll numbers and identification;
 - b. sampling procedures; and
 - c. results of manufacturer quality control tests, including descriptions of the test methods used (the manufacturer quality control tests to be performed are given in Part 2 of this Section).
- D. Submit to the Engineer for review the following information from the installer at least 14 calendar days prior to mobilization of the installer to the site:
1. Layout drawings showing the installation layout identifying geomembrane panel configurations, dimensions, details, locations of seams, as well as any variance or additional details which deviate from the Construction Drawings. The layout drawings shall be adequate for use as a construction plan and shall include dimensions, details, etc. The layout drawings, as modified and/or approved by the Engineer, shall become part of the contract.
 2. Installation schedule.
 3. Copy of installer's letter of approval or license by the manufacturer.
 4. Installation capabilities, including:
 - a. information on equipment proposed for this project;
 - b. average daily production anticipated for this project; and
 - c. quality control procedures to include quality control organization.
 5. A list of 10 completed facilities for which the installer has installed a minimum of 5,000,000 square feet of polyethylene geomembrane. The following information shall be provided for each facility:
 - a. the name and purpose of the facility, its location, and dates of installation;

- b. the names of the owner, project manager, and geomembrane manufacturer;
 - c. name and qualifications of the supervisor of the installation crew;
 - d. thickness and surface area of installed geomembrane;
 - e. type of seaming and type of seaming apparatus used; and
 - f. duration of installation.
6. Resumes of the installer superintendent and quality control chief to be assigned to this project, including dates and duration of employment.
 7. Resumes of all personnel who will perform seaming operations on this project, including dates and duration of employment.
 8. Evidence that the installation crew has the following experience:
 - a. The superintendent shall have supervised the installation of a minimum of 2,000,000 square feet of polyethylene geomembrane.
 - b. At least one seamer shall have experience seaming a minimum of 500,000 square feet of polyethylene geomembrane using the same type of seaming apparatus to be used at this site. Seamers with such experience will be designated "master seamers" and shall provide direct supervision over less experienced seamers.
 - c. All other seaming personnel shall have seamed at least 100,000 square feet of polyethylene geomembrane using the same type of seaming apparatus to be used at this site. Personnel who have seamed less than 100,000 square feet of seams shall be allowed to seam only under the direct supervision of the master seamer or Superintendent.
- E. Submit to the Engineer for review at least 14 days prior to geomembrane placement, a certificate of calibration less than 12 months old for the field tensiometer. Tensiometer shall be calibrated within one year of date of test. Calibration shall be traceable to national or industry recognized standards where possible.
 - F. Submit subgrade acceptance certificates, signed by the installer, for each area to be covered by the geomembrane prior to that area being covered by geomembrane.

- G. Within 14 calendar days of completion of the geomembrane installation, submit to the Engineer the executed installation warranty as specified in this section.
- H. Submit to the Engineer for review, an Electrical Leak Detection Testing Work Plan for testing the primary geomembrane after placement of liner protective layer soil; include this Plan in Contractor’s Work Plan specified in Section 02200. The Electrical Leak Detection Testing Work Plan shall include, but not be limited to, the following.
 - 1. Qualification and experience of the specialty subcontractor proposed to implement the Electrical Leak Detection Testing Work Plan including the following:
 - a. the name of the specialty subcontractor company with minimum of 3 years of experience in the field of electrical leak detection testing and with a minimum of 100,000 square feet of electrical leak detection testing;
 - b. list of facilities for which the electrical leak detection testing specialty subcontractor has successfully performed electrical leak detection testing; the following shall be provided for each facility:
 - i. the names and purposes of the facility, its location, and dates of electrical leak detection testing;
 - ii. names of key parties involved during leak testing including, but not limited to, the owner, construction manager, engineer, and contractor;
 - iii. names of the leak detection supervisor and technicians;
 - iv. thickness and surface area of geomembrane tested; and
 - v. duration of testing;
 - c. resume of electrical leak detection testing supervisor proposed for this Project, who shall have at least 200,000 square feet of electrical leak detection testing experience using the means, methods, and techniques proposed in the Electrical Leak Detection Testing Work Plan; and
 - d. resumes of electrical leak detection testing technicians;

2. Leak detection testing:
 - a. description of the test methods and procedures to implement the Work Plan;
 - b. proposed voltage and grounding requirements;
 - c. methods for water management to implement the tests;
 - d. description of safe work practices as required in the Contract Documents;
 - e. description of the quality assurance procedures; and
 - f. schedule showing various activities related to the electrical leak detection testing from mobilization to submission of the Electric Leak Detection Testing Report.

- J. Submit to the CQA Consultant, within 7 calendar days following completion of the electrical leak detection testing, an Electrical Leak Detection Testing Report.

1.05 CONSTRUCTION QUALITY ASSURANCE

- A. The installation of the geomembrane component of the liner system will be monitored by the CQA Consultant as required in the CQA Plan.
- B. The CQA Consultant will perform material conformance testing of geomembrane materials and installation quality assurance testing of the geomembrane seams.
- C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the construction schedule.
- D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 RESIN

- A. Provide geomembrane manufactured from new, first-quality polyethylene resin. Do not add reclaimed polymer to the resin. The use of polymer recycled during the

manufacturing process is permitted if performed with appropriate cleanliness and if the recycled polymer during the manufacturing process does not exceed 2 percent by weight of the total polymer weight.

B. Use high density polyethylene (HDPE) resin having the following properties:

1. Specific Gravity (min.): 0.932 (ASTM D 792 Method B or ASTM D 1505)
2. Melt Index (max.): 1.0 g/10 min (ASTM D 1238)

2.02 GEOMEMBRANE PROPERTIES

A. Furnish 60-mil HDPE textured geomembranes having properties that comply with the required values shown in Table 02770-1.

B. Furnish geomembrane that meets the shear strength requirements of Section 02790 as tested by an approved testing laboratory.

C. In addition, furnish geomembrane that:

1. contains a maximum of 1 percent by weight of additives, fillers, or extenders not including carbon black;
2. does not have striations, pinholes, bubbles, blisters, nodules, undispersed raw materials, or any sign of contamination by foreign matter on the surface or in the interior;
3. is free of holes, blisters, modules, undispersed raw materials, or any sign of contamination by foreign matter; and
4. is manufactured in a single layer (thinner layers shall not be welded together to produce the final required thickness).

D. HDPE textured geomembrane shall be manufactured with a 5-inch \pm 1 inch smooth to low asperity edge on both sides of the roll. Texturing shall not be continued on the edge.

2.03 RAIN FLAP

A. The rain flap shall be constructed with 60-mil HDPE textured geomembrane in accordance with this Section.

2.04 MANUFACTURING QUALITY CONTROL

A. Resin:

1. Sample and test resin at a minimum frequency of one test per rail car to demonstrate that the resin complies with the requirements of this section. Perform tests on resin after the addition of additives to the virgin resin. Certify in writing that the resin meets the requirements of this section.
2. Do not use any noncomplying resin.

B. Rolls:

1. Continuously monitor geomembrane for inclusions, bubbles, or other defects during manufacture. Geomembrane shall be subjected to continuous spark testing by the Manufacturer at the factory.
2. Do not supply geomembrane that exhibits any defects.
3. Regular monitor for geomembrane thickness during manufacture. Geomembrane that fails to meet the specified minimum thickness will not be accepted.
4. Sample and test the geomembrane in accordance with the test frequency in Table 2 (a) of GRI GM 13 Test Method for HDPE geomembrane to demonstrate that its properties conform to the values specified in Tables 02770-1 and 02770-2. Perform the following tests at the maximum interval specified in Table 2 (a) of GRI GM 13 for the geomembrane manufactured. All tested rolls of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted.

<u>Test</u>	<u>Procedure</u>
density	ASTM D 1505
thickness	ASTM D 5994
asperity height	GRI GM 12
yield strength	ASTM D 638 Type IV or ASTM D 6693
yield elongation	ASTM D 638 Type IV or ASTM D 6693
tensile strength	ASTM D 638 Type IV or ASTM D 6693
tensile elongation	ASTM D 638 Type IV or ASTM D 6693
tear resistance	ASTM D 1004
index puncture resistance	ASTM D 4833

carbon black content	ASTM D 1603 or ASTM D 4218
carbon black dispersion	ASTM D 5596
oxidative induction time	ASTM D 3895
stress crack resistance	ASTM D 5397

5. If a geomembrane sample fails to meet the quality control requirements of this Section, sample and test rolls manufactured, in the same resin batch, or at the same time, as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply any failing rolls.
6. Provide a written certification that the geomembrane meets the GRI GM13 material requirements for the following tests using the indicated test procedures. Provide written certification that these tests have been performed on geomembrane samples representative of rolls delivered to the site.

<u>Test</u>	<u>Procedure</u>
Oven aging	ASTM D 5721
UV resistance	ASTM D 5885

C. Welding Rod:

1. Sample and test HDPE welding rod for resin density and melt flow index per Geomembrane manufacturer’s requirements. Results shall meet Geomembrane manufacturer minimum/maximum requirements and as specified in this Section.
2. Certify that HDPE welding rod is compatible with this Section and consists of the same or compatible resin used to manufacture the geomembrane.

D. Permit the CQA Consultant and/or Engineer to visit the manufacturing plant for project specific visits. If possible, such visits will be prior to, or during, the manufacturing of the geomembrane rolls for this project.

2.05 LABELING

A. Label the geomembrane rolls with the following information.

1. thickness of the material;
2. length and width of the roll;

3. name of Manufacturer;
 4. product identification;
 5. lot number; and
 6. roll number.
- B. Geomembrane rolls not labeled in accordance with this Section or on which labels are illegible upon arrival at the site will be rejected and replaced at no additional expense to the Owner.

2.06 TRANSPORTATION, HANDLING, AND STORAGE

- A. Deliver geomembranes to the site at least 14 calendar days prior to the planned deployment date to allow the CQA Consultant adequate time to perform conformance testing on the geomembrane samples as described in the CQA Plan.
- B. Provide proper handling and storage of the geomembrane at the site. Protect the geomembrane from excessive heat or cold, dirt, puncture, cutting, or other damaging or deleterious conditions. Provide any additional storage procedures required by the Manufacturer.
- C. Store geomembrane rolls on pallets or other elevated structures. Do not store geomembrane rolls directly on the ground surface. Do not store more than 3 rolls high.

2.07 EQUIPMENT

- A. Furnish equipment for the Work described in accordance with this Section and the Contractor's Work Plan.

PART 3 EXECUTION

3.01 FAMILIARIZATION

- A. Prior to implementing any of the work described in this section, the Contractor shall become thoroughly familiar with all portions of the work falling within this section.
- B. Inspection:
1. Prior to implementing any of the work in this section, the Contractor shall carefully inspect the installed work of all other sections and verify that all

work is complete to the point where the installation of this section may properly commence without adverse impact.

2. If the Contractor has any concerns regarding the installed work of other sections, the Contractor shall immediately notify the Engineer in writing. Failure to inform the Engineer in writing or continuance of installation of the geomembrane will be construed as the Contractor's acceptance of the related work of all other sections.

3.02 SUBGRADE SURFACE PREPARATION

- A. Contractor shall provide certification in writing that the surface on which the geomembrane will be installed is acceptable. Where a GCL is installed on the subgrade prior to the geomembrane, the Contractor shall inspect the subgrade prior to GCL installation. This certification of acceptance shall be given to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration.
- B. Special care shall be taken to maintain the prepared surface.
- C. No geomembrane shall be placed onto areas of standing water or hydrated GCL.
- D. Any damage to the GCL or prepared subgrade caused by installation activities shall be repaired at the Contractor's expense.

3.03 GEOMEMBRANE DEPLOYMENT

- A. General:
 1. Textured geomembrane is to be used for all liner construction indicated on the Construction drawings.
 2. The Contractor shall produce layout drawings prior to geomembrane deployment. These drawings shall indicate the geomembrane configuration, dimensions, details, locations of seams, etc. The layout drawings must be approved by the Engineer prior to the installation of any geomembranes. The layout drawings, as modified and/or approved by the Engineer, shall become part of these specifications.
 3. Do not deploy geomembrane until the layout drawings are approved by the Engineer.

4. Do not deploy a geomembrane panel in an area until the CQA Consultant has been provided with a certificate of subgrade acceptance for that area.
 5. Do not deploy geomembranes until CQA Consultant completes conformance evaluation of the geomembrane and performance evaluation of previous work, including evaluation of Contractor's survey results for previous work.
 6. Deploy each geomembrane panel in accordance with the approved layout drawings.
- B. Field Panel Identification:
1. A geomembrane field panel is a roll or a portion of roll cut in the field.
 2. Give each field panel an identification code (number or letter-number). This identification code shall be agreed upon by the CQA Consultant and the Installer.
- C. Field Panel Placement:
1. Place each geomembrane panel one at a time and seam each panel immediately after its placement.
 2. Use temporary rub sheets as required to prevent displacement or damage to underlying geosynthetics. High spots in geomembrane-backed geosynthetic clay liners shall be covered by a temporary rub sheets during placement of geomembrane.
 3. Do not place geomembrane panels when the ambient temperature is below 40° Fahrenheit (F), unless authorized in writing by the Engineer. For cold weather (< 40°F) deployment, use the additional procedures authorized in writing by the Engineer.
 4. Do not place geomembranes during any precipitation, in the presence of heavy fog or dew, in an area of ponded water, or in the presence of high wind.
 5. Ensure that:
 - a. No vehicular traffic drives directly on the geomembrane;
 - b. Equipment used does not damage the geomembrane by handling, trafficking, or leakage of hydrocarbons (i.e., fuels);

- c. Personnel working on the geomembrane do not smoke, bring glass onto the geomembrane, or engage in other activities that could damage the geomembrane;
 - d. The method used to unroll the panels does not scratch or crimp the geomembrane and does not damage lower geosynthetics or the supporting soil;
 - e. The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels). The method used to place the panels results in intimate contact with the geosynthetic clay liner. Adjust or repair any area of geomembrane wrinkles where the wrinkle height, measured perpendicular to the slope during the hottest portion of the day, is more than 4 inches;
 - f. The method used to place the panels does not cause the panels to lift up or trampoline during the coolest portion of the day; and
 - g. The geomembrane is anchored or weighted with sandbags, or the equivalent, to prevent damage or uplift from wind. Install sufficient anchoring or weighting to prevent uplift and maintain such system until overlying material is placed.
6. Replace any field panel or portion thereof that becomes damaged (torn, twisted, or crimped). Remove from the work area damaged panels or portions of damaged panels.
- D. Do not install geomembrane between one hour before sunset and one hour after sunrise unless approved by the Engineer.

3.04 FIELD SEAMING

- A. Personnel shall be experienced as specified in this section. Do not perform seaming unless a "master seamer" and the CQA Consultant are on-site.
- B. Orient seams parallel to the line of maximum slope (i.e., oriented down, not across, the slope). Minimize the number of seams in corners and at odd-shaped geometric locations. No horizontal seam shall be less than 10 feet from the toe of the slope, except where approved by the Engineer. Do not locate seams at an area of potential stress concentration.
- C. Weather Conditions for Seaming:

1. Do not seam geomembrane at ambient temperatures below 40 °F or above 104 °F, unless authorized in writing by the Engineer. For cold (< 40 °F) or hot (> 104 °F) weather seaming, use the additional procedures authorized in writing by the Engineer.
2. Measure ambient temperatures between 0 to 6 inches above the geomembrane surface.
3. In all cases the geomembrane seam areas shall be dry and protected from wind.

D. Overlapping and Temporary Bonding:

1. Sufficiently overlap geomembrane panels for welding and to allow peel tests to be performed on the seam. Any seams that cannot be destructively tested because of insufficient overlap are failing seams.
2. Control the temperature of the air at the nozzle of heat bonding apparatus such that the geomembrane is not damaged.

E. Seam Preparation:

1. Prior to seaming, clean the seam area and ensure that area to be bonded is free of moisture, dust, dirt, debris of any kind, and foreign material.
2. If seam overlap grinding is required, complete the process according to the Manufacturer's instructions or within 60 minutes of the seaming operation. Do not grind to a depth that exceeds ten percent of the geomembrane thickness. Grinding marks shall not appear beyond 0.25 inch of the extrudate after it is placed.
3. Align seams with the fewest possible number of wrinkles and "fishmouths".

F. General Seaming Requirements:

1. Extend seams to the outside edge of panels to be placed in the anchor trench.
2. If required, place a firm substrate such as a flat board or similar hard surface directly under the seam overlap to achieve proper support.
3. Cut fishmouths or wrinkles at the seam overlaps along the ridge of the wrinkle to achieve a flat overlap. Seam the cut fishmouths or wrinkles and patch any portion where the overlap is less than 6 inches with an oval or round patch of

geomembrane that extends a minimum of 6 inches beyond the cut in all directions.

4. Place the electric generator used for power supply to the welding machines outside the area to be lined or mount it on soft tires such that no damage occurs to the geomembrane. Properly ground the electric generator. Place a smooth insulating plate or fabric beneath the hot welding apparatus after use.

G. Seaming Process:

1. Approved processes for field seaming are extrusion welding and fusion welding. The primary method of welding shall be fusion. Seaming equipment shall not damage the geomembrane. Use only geomembrane Manufacturer-approved equipment.
2. Extrusion Equipment and Procedures:
 - a. Maintain at least one spare operable seaming apparatus on site.
 - b. Equip extrusion welding apparatus with gauges giving the temperature in the apparatus and at the nozzle.
 - c. Prior to beginning a seam, purge the extruder until all heat-degraded extrudate has been removed from the barrel. Whenever the extruder is stopped, purge the barrel of all heat-degraded extrudate.
3. Fusion Equipment and Procedures:
 - a. Maintain at least one spare operable seaming apparatus on site.
 - b. Fusion-welding apparatus shall be automated self-propelled devices equipped with gauges giving the applicable temperatures and pressures.
 - c. Fusion-welding apparatus shall produce a double-track seam.
 - d. Abrade the edges of cross seams to a smooth incline (top and bottom) prior to extrusion welding.

H. Trial Seams:

1. Make trial seams on excess pieces of geomembrane to verify that seaming conditions are adequate. Conduct trial seams on the same material to be installed and under similar field conditions as production seams. Conduct trial

seaming at the beginning of each seaming period, and at least once each five hours, for each seaming apparatus used that day prior to seaming. Also, each seamer shall make at least one trial seam each day, for each day that seaming is performed by that seamer. Conduct trial seaming under the same conditions as the actual seaming. Prepare trial seams that are at least 15 feet long by 1 foot wide (after seaming) with the seam centered lengthwise for fusion equipment and at least 3 feet long by 1 foot wide for extrusion equipment. Prepare seam overlap as indicated in the "Overlapping and Temporary Bonding" Article of this Part.

2. Cut four specimens, each 1.0 inch wide, from the trial seam sample. Test two specimens in shear and two in peel, using a field tensiometer. The test specimens shall not fail in the seam. If a specimen fails, repeat the entire operation. If the additional specimen fails, do not accept the seaming apparatus or seamer until the deficiencies are corrected and two consecutive successful trial seams are achieved. A seamer may start production seaming prior to testing of the trial seams. In the event the trial seam fails, all production seams by the seamer are failed seams.

I. Nondestructive Seam Continuity Testing:

1. Nondestructively test field seams for continuity over their full length. Perform continuity testing as the seaming work progresses, not at the completion of field seaming. Complete any required repairs in accordance with the "Defects and Repairs" Article of this Part. Apply the following procedures:
 - a. use vacuum testing for extrusion welds; and
 - b. use air pressure testing for double-track fusion seams.
2. Vacuum Testing:
 - a. Use the following equipment:
 - i. A vacuum box assembly consisting of a stiff housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.
 - ii. A system for applying 5 pound per square inch (psi) gauge suction to the box.
 - iii. A bucket of soapy solution and applicator.

- b. Follow these procedures:
 - i. Energize the vacuum pump and reduce the tank pressure to 5 ±1 psi gauge.
 - ii. Wet an area of the geomembrane seam larger than the vacuum box with the soapy solution.
 - iii. Place the box over the wetted area.
 - iv. Close the bleed valve and open the vacuum valve.
 - v. Ensure that a leak tight seal is created.
 - vi. Examine the geomembrane through the viewing window for the presence of soap bubbles for not less than 20 seconds.
 - vii. If no bubbles appear after 20 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inch overlap, and repeat the process.
 - viii. Mark all areas where soap bubbles appear with a marker that will not damage the geomembrane and repair in accordance with the "Defects and Repairs" Article of this Part.
3. Air Pressure Testing:
 - a. Use the following equipment:
 - i. an air pump (manual or motor driven) or air reservoir, equipped with a pressure gauge, capable of generating and sustaining a pressure between 25 and 30 pounds per square inch;
 - ii. a rubber hose with fittings and connections; and
 - iii. a hollow needle, or other approved pressure feed device..
 - b. Follow these procedures:
 - i. Seal both ends of the seam to be tested.
 - ii. Insert needle, or other approved pressure feed device, into the tunnel created by the fusion weld.

- iii. Insert a protective cushion between the air pump and the geomembrane.
 - iv. Energize the air pump to a pressure between 25 and 30 pounds per square inches, close valve, and sustain the pressure for not less than 5 minutes.
 - v. If loss of pressure exceeds 3 pounds per square inches, or does not stabilize, locate faulty area and repair in accordance with the "Defects and Repairs" Article of this Part.
 - vi. Cut opposite end of air channel from pressure gauge and observe release of pressure to ensure air channel is not blocked.
 - vii. Remove needle, or other approved pressure feed device, and seal both ends in accordance with the "Defects and Repairs" Article of this Part.
4. Electrical Leak Detection Testing:
- a. Implement electrical leak detection testing program on primary geomembrane after placement of liner protective layer soil in accordance with the Electrical Leak Detection Testing Work Plan specified in this Section. Electrical leak detection testing shall include:
 - i. Provision of materials as required by the Electrical Leak Detection Testing Work Plan to implement the electrical leak detection testing program;
 - ii. Identify areas requiring repair by field marking, verbally, in writing, and on a field sketch, to the CQA Consultant, Engineer or designated representative, and the Installer's Supervisor; and
 - iii. Submission of electrical leak detection testing report for the primary geomembrane liner that is tested; at a minimum the report shall contain information on the methods and procedures used and location of all detected leaks.
 - b. Perform electric leak detection testing after performance testing of geomembrane is completed by the CQA Consultant and placement and tracking of liner protective layer soil.

J. Destructive Testing:

1. Destructive testing of field seam shall be performed on samples collected from selected locations to evaluate seam strength and integrity to comply with the requirements of Table 02770-2. Destructive test shall be carried out as the geomembrane installation progresses, not at the completion of all field seaming.
2. Sampling and Testing:
 - a. Field seam samples shall be collected for destructive testing at a minimum average frequency of one test location per 500 feet of seam length per seamer and/or seaming equipment. Test locations shall be determined during seaming, and may be prompted by suspicion of excess crystallinity, contamination, offset seams, or any other potential cause of imperfect seaming. The CQA Consultant will be responsible for choosing the locations. The geosynthetic installer shall not be informed in advance of the locations where the seam samples will be taken. The owner reserves the right to increase the sampling frequency.
 - b. Samples of the field seams shall be cut with rounded corners by the geosynthetic installer at the locations designated by the CQA consultant as the seaming progresses. Passing laboratory test results must be obtained before the field seams are covered by another material. Each sample shall be numbered and the sample number and location identified on the panel layout drawing. All holes in the geomembrane resulting from the field seam sampling shall be immediately repaired in accordance with the repair procedures described in this Section. The continuity of the new seams in the repaired areas shall be tested as specified in this Section.
 - c. Two strips, 1 inch wide and 12 inch long with the seam centered parallel to the width, shall be taken. The strips shall be spaced a clear distance of 42 inches apart. These samples shall be tested in the field using the field tensiometer in accordance with this Section. If these samples pass the field test, then a laboratory sample shall be taken. The laboratory sample shall be at least 1 foot wide by 3.5 feet long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:
 - i. one 1-ft long portion to the geosynthetic installer;

- ii. one 1-ft long portion to the owner for its archives; and
 - iii. one 1.5-ft long portion to the CQA Consultant for laboratory testing.
3. If any field test sample fails to meet the required seam strength properties presented in Table 02770-2 then the procedures outlined in this Section and the CQA Plan shall be followed.
4. Samples shall be tested in the laboratory in accordance with the requirements of this Section and the CQA Plan.
5. Destructive Test Failure:
 - a. The following procedures shall apply whenever a sample fails a destructive test, whether the test is conducted by the CQA laboratory, the geosynthetic installer's laboratory, or by a field tensiometer. The geosynthetic installer shall have two options as described below.
 - b. The geosynthetic installer can reconstruct the seam (e.g., remove the old seam and reseam) between any two passed test locations. The welding path of the seaming apparatus shall be tracked (in each direction).
 - c. The geosynthetic installer can trace the welding path to an intermediate location, a minimum of 10 feet from the location of the failed test (in each direction) and take a small sample for an additional field test at each location. If these additional samples pass the tests, then full laboratory samples shall be taken. If these laboratory samples pass the tests, then the seam shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam should be reconstructed. In any case, all acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases where the length of reconstructed seam exceeds 150 feet, a destructive sample taken from within the reconstructed zone must pass destructive testing. Whenever a sample fails, the CQA Consultant may require additional tests for seams that were performed by the same seamer and/or seaming apparatus or seamed during the same time shift.

K. Defects and Repairs:

1. All seams and non-seam areas of the geomembrane will be examined by the CQA Consultant and the geosynthetic installer for evidence of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be swept or washed by the geosynthetic installer if surface contamination inhibits examination. The geosynthetic installer shall ensure that this examination of the geomembrane precedes any seaming of that section. Review results of electrical leak detection testing and repair in accordance with this Section.
2. Each suspect location, both in seam and non-seam areas, shall be nondestructively tested using the methods described this Section, as appropriate. Each location that fails nondestructive testing shall be marked by the CQA Consultant and repaired by geosynthetic installer. Work shall not proceed with any materials that will cover the defective area until the suspect location is repaired and passing nondestructive test are obtained. In addition, passing destructive test results shall be achieved prior to placing any material over geomembrane.
3. When seaming of a geomembrane is completed (or when seaming of a large area of a geomembrane is completed) and prior to placing overlying materials, the CQA Consultant shall identify all excessive geomembrane wrinkles. The geosynthetic installer shall cut and reseam all wrinkles so identified. The seams thus produced shall be tested like any other seams.
4. Repair Procedures:
 - a. Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the geosynthetic installer. Several repair procedures are specified below. The final decision as to the appropriate repair procedure shall be agreed upon between the CQA Consultant and the geosynthetic installer. The procedures available include:
 - i. patching, used to repair holes, small tears, undispersed raw materials, and contamination by foreign matter;
 - ii. abrading and reseaming, used to repair small sections of extruded seams;

- iii. spot seaming, used to repair minor localized flaws and surface damage;
 - iv. capping, used to repair lengths of failed seams; and
 - v. removing failed seam lengths and replacing with a strip of new material seamed into place (used with long lengths of fusion seams and/or extrusion seams).
- b. In addition, the following shall be satisfied:
- i. surfaces of the geomembrane which are to be repaired shall be abraded no more than 20 minutes prior to the repair;
 - ii. all surfaces must be clean and dry at the time of repair;
 - iii. all seaming equipment used in repair procedures must be approved by the engineer and/or the CQA Consultant;
 - iv. the repair procedures, materials, and techniques shall be approved in advance, for the specific repair, by the CQA Consultant and geosynthetic installer;
 - v. patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of holes and patches shall be rounded with a radius of at least 3 inches; and
 - vi. the geomembrane below large caps shall be appropriately cut to avoid water or gas collection between the two sheets.

5. Repair Verification:

- a. Each repair shall be numbered and logged and shall be nondestructively tested using the methods described in this Section, as appropriate. Repairs that pass the nondestructive test shall be taken as an indication of an adequate repair. Failed tests will require the repair to be redone and retested until a passing test results. At the discretion of the CQA Consultant, destructive testing may be required on large caps.
- b. Final verification of geomembrane primary liner and cap repair shall be performed using electrical leak detection testing on the exposed geomembrane.

3.05 ANCHORAGE SYSTEM

- A. The anchor trench shall be excavated prior to geomembrane placement to the lines, grades, and configuration indicated on the Construction Drawings.
- B. Where anchor trenches are required, locate them at the distance back from the crest of the slope to be covered as shown on the Construction Drawings.
- C. Slightly rounded corners shall be provided in the trench where the geomembrane adjoins the trench to avoid sharp bends in the geomembrane.
- D. Temporarily anchor each geomembrane panel in the anchor trench at the crest of the slope as soon as the panel is deployed or positioned.
- E. Do not entrap loose soil, sand bags, or other materials between or beneath the geosynthetic layers.
- F. Do not backfill the anchor trench until all geosynthetic layers are installed in the anchor trench as shown on the Construction Drawings. Do not install geomembrane in anchor trench if standing water is present. Backfill the anchor trench in accordance with the Construction Drawings and Section 02215.
- G. Do not damage any geosynthetic layer when backfilling the anchor trench.

3.06 MATERIALS IN CONTACT WITH THE GEOMEMBRANE

- A. The Installer shall take necessary precautions to ensure that the geomembrane is not damaged during its installation or during the installation of other components of the liner system or by other construction activities. Installation on rough surfaces, such as concrete, shall be performed carefully.
- B. Do not drive equipment directly on the geomembrane. Only use equipment above the geomembrane that meets the following ground pressure requirements.

<u>Maximum Allowable Equipment Ground Pressure (pounds per square inches)</u>	<u>Minimum Thickness of Overlying Material (inches)</u>
<5	12
<10	18
<20	24
>20	36

In heavily trafficked areas such as access ramps, and in areas trafficked by rubber-tired vehicles, the thickness of overlying compacted soil shall be at least 3 feet, unless otherwise shown on the Construction Drawings or approved by the Engineer.

- C. Install the geomembrane at liner penetrations and connect the geomembrane to liner penetration boxes, in accordance with the Construction Drawings, Section 13005, and this Section. Take extreme care while seaming around penetrations and appurtenances since neither nondestructive nor destructive testing may be feasible in these areas. The Installer shall ensure that the geomembrane has not been visibly damaged while making connections to penetrations and appurtenances. Because of the difficulty of vacuum testing seams in the penetrations area, fusion seams shall be made wherever possible.
- D. Do not place soils or aggregate above the geomembrane at an ambient temperature below 32°F or above 104°F unless otherwise authorized by the Engineer.

3.07 SURVEY CONTROL

- A. Survey the installed geomembrane liner seams, rain flap, repairs, and destructive sample locations in accordance with Section 02100.
- B. Locate panel seams and intersections as requested by the Engineer to support production of as-built Panel Layout Drawings.

3.08 GEOMEMBRANE ACCEPTANCE

- A. The Contractor shall retain all ownership and responsibility for the geomembrane until accepted by the Owner.
- B. The geomembrane shall be accepted by the Owner when:
 - 1. the installation is finished;

2. all documentation of installation is completed including the CQA Consultant's final report; and
3. verification of the adequacy of all field seams and repairs, including associated testing, is complete.

3.09 PROTECTION OF WORK

- A. The Contractor shall use all means necessary to protect all prior work and all materials and completed work of other sections.
- B. In the event of damage, the Contractor shall make all repairs and replacements necessary at no additional cost to Owner.

TABLE 02770-1

REQUIRED HDPE GEOMEMBRANE PROPERTIES

Properties	Qualifiers	Units ⁽¹⁾	Specified Values Textured	Test Method
<u>Physical Properties</u>				
Thickness	Nominal Minimum	mils	60 54	ASTM D 5199 (S) ASTM D 5994 (T)
Asperity Height	Min. Avg.	mils	16	GRI-GM13
Specific Gravity	Minimum	N/A	0.94	ASTM D 792 (Method B) or ASTM D 1505
Carbon Black Content	Range	%	2-3	ASTM D 1603 or 4218
Carbon Black Dispersion	N/A	none	9 of 10 in Category 1 or 2 and all in Category 1, 2, or 3	ASTM D 5596
<u>Mechanical Properties</u>				
Tensile Properties				
1. Tensile Strength at Yield	Minimum	lb/in	126	ASTM D 6693
2. Tensile Strength at Break	Minimum	lb/in	90	ASTM D 6693
3. Elongation at Yield	Minimum	%	12	ASTM D 6693
4. Elongation at Break	Minimum	%	100	ASTM D 6693
Tear Resistance	Minimum	lb	42	ASTM D 1004 Die C Puncture
Puncture Resistance	Minimum	lb	90	ASTM D 4833
<u>Environmental Properties</u>				
Stress Crack Resistance	Minimum	hrs	500 ⁽²⁾	ASTM D 5397 (Appendix)
Oxidative Induction Time (OIT)	Minimum	min	100 / 400	ASTM D 3895 / 5885

Notes:

1. % = percent
- hrs = hours
- min = minutes
- lb/in = pounds per inch
- lb = pound
- N/A = Not Applicable

2. For textured geomembrane, test is conducted on smooth geomembrane from the same resin lot (batch) as the textured geomembrane furnished.

TABLE 02770-2
REQUIRED HDPE GEOMEMBRANE SEAM PROPERTIES

Properties	Qualifiers	Units ⁽³⁾	Specified Values	Test Method
<u>Shear Strength⁽¹⁾</u>				
Fusion	minimum	lb/in	120	ASTM D 6392
Extrusion	minimum	lb/in	120	ASTM D 6392
<u>Peel Adhesion</u>				
FTB ⁽²⁾				
Fusion	minimum	lb/in	91	ASTM D 6392
Extrusion	minimum	lb/in	78	ASTM D 6392

Notes:

1. Also called "Bonded Seam Strength." Value is at material yield point
2. FTB = Film Tear Bond. (Maximum 10 percent seam separation).
3. lb/in = pounds per inch.
4. All dual track seams shall be tested in accordance with ASTM D 5820. All extrusion seams shall be tested in accordance with ASTM D 5741.

[END OF SECTION]

**SECTION 02930, Rev. 1
VEGETATION**

SECTION 02930, Rev. 1 VEGETATION

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes the requirements for sodding, seeding, liming, fertilizing, and maintaining vegetation until established and accepted. Areas to be vegetated include areas noted on the Construction Drawings and any other areas as directed by the CQA Consultant.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 – Surveying
- B. Section 02200 – Earthwork
- C. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

- A. Standard Specifications for Road and Bridge Construction (SSRBC), Florida Department of Transportation, 2001 Edition (FDOT Specifications)

1.04 SUBMITTALS

- A. Submit the following to the Construction Manager not less than 30 calendar days prior to use for review:
 - 1. proposed type and source of sod and seed; and
 - 2. manufacturer's product data for commercial fertilizer and lime and the recommended methods of application.
- B. Submit a plan for handling and storage of materials to prevent damage by moisture, heat, or exposure. Include all recommendations of manufacturers and suppliers.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Sod shall be live, thriving, and meet the requirements of Florida Department of Agriculture and Consumer Services.
- B. Seeds shall be live seed and meet the requirements of Florida Department of Agriculture and Consumer Services.
- C. The seeds should have been harvested from the previous year's crop.
- D. All seed bags shall have a label attached stating the date of harvest, LOT number, percent purity, percent germination, noxious weed certification, and date of test.
- E. Use fertilizer that is dry or liquid commercial grade fertilizer uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists. Deliver fertilizer to the site in original, properly labeled, unopened, clean, containers each showing the manufacturer's guaranteed analysis conforming to applicable fertilizer regulations and standards. Use fertilizer that is 16-4-8 or as modified by the Construction Manager based on testing of the topsoil by the Contractor. Apply fertilizer to all sodded areas.
- F. Use lime that is agricultural ground limestone with a minimum total neutralizing power of 90 percent. The lime shall have a gradation of at least 40 percent passing the U.S. Standard Number 100 sieve, and at 95 percent passing the U.S. Standard Number 8 sieve.

PART 3 EXECUTION

3.01 PLANTING AND APPLICATION OF FERTILIZER

- A. Do not commence vegetation until the Construction Manager reviews the results of soil analyses.
- B. Notify the Construction Manager 24 hours prior to laying sod, seeding, or fertilizing.
- C. The seed and fertilizer shall be placed by hydro seeding, or other method approved by the Construction Manager.
- D. On slopes steeper than 3H:1V, sod shall be staked or pegged with pieces of lath or small stakes 12 in. in length at an 18- to 36-in. spacing along the longitudinal axis of the sod strip.

- E. The underlying soil layer should be graded to the lines and limits as indicated on the Construction Drawings. The soil layer surface shall be scarified and damp immediately prior to the seed or sod placement.
- F. Repair all gullies, washes, or disturbed areas that develop subsequent to final dressing of the prepared surface.
- G. Seeded areas shall be watered after germination as necessary until the vegetation is well established.
- H. Apply fertilizer and lime to all vegetated areas unless otherwise indicated by the Construction Manager.
- I. Apply fertilizer and lime at the specified rates. If not applied hydraulically, thoroughly rake the fertilizer and lime into the prepared surface to a minimum depth of 2 inches.
- J. Application rates:
 - 1. Application rates for seeding shall be according to manufacture/supplier recommendations or as directed by the Construction Manager.
 - 2. Application rates for fertilizer and lime in this section may be adjusted after the results of the site soil test results performed by the Contractor are available.
 - 3. Base contract price on application rates for fertilizer and lime specified in this section. Contract price will be adjusted for any variations either decreasing or increasing the application rates
- K. For areas to be covered with seed or sod:
 - 1. Apply fertilizer at a uniform rate of 1,200 pounds per acre or as otherwise directed by the Construction Manager.
 - 2. Apply agricultural lime at a rate of two tons per acre or as otherwise directed by the Construction Manager.

3.02 MAINTENANCE

- A. Maintain seeded and sodded areas immediately after placement until vegetation is well established and exhibits a vigorous growing condition.
- B. The Contractor shall supply and apply supplemental irrigation for the maintenance period following the placement of the seed or sod. All seeded and sodded areas should receive a minimum of 1½ in. of water per week either by precipitation or supplemental irrigation.

- C. Maintain the seeded and sodded areas in satisfactory condition. Maintenance of the seeded and sodded areas includes repairing eroded areas, revegetating, watering, and mowing (if applicable). A satisfactory condition of a seeded or sodded area is defined as a 10,000 square feet section of turf that has no bare spots larger than three square feet.
- D. The inspection will be performed by the Construction Manager, who will determine whether repair of sodded areas or revegetation is required. The Contractor shall make the repair or revegetation at the Contractor expense.

3.03 ACCEPTANCE

- A. The vegetated areas shall be accepted at the end of the warranty period if a satisfactory condition as defined in this Section exists or if accepted by the Construction Manager.

3.04 WARRANTY PERIOD

- A. Vegetated areas shall be subject to a warranty period of not less than 60 days from the issuance of the Construction Manager's final completion notice to the Contractor for the Contract over 100 percent of the areas seeded and sodded.
- B. At the end of the warranty period, the Construction Manager will perform an inspection upon written request by the Contractor. Vegetated areas not demonstrating satisfactory condition of vegetation as outlined above, shall be repaired, resodded, and maintained to meet all requirements as specified herein at the Contractor's expense. All unaccepted areas requiring repair, replacement of sod and/or reseeded shall be subject to a 60-day warranty period commencing at the completion of the reworking.
- C. After all necessary corrective work has been completed, the Construction Manager will certify in writing the final acceptance of the vegetated areas.

[END OF SECTION]