

Attachment D

Technical Specifications


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SECTION 01005

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE AND INTENT

A. DESCRIPTION

1. The WORK to be completed consists of furnishing all labor, materials and equipment, and the performance of all WORK included in the AGREEMENT according to Section 01010 Summary of Work for the Phase II-III Accelerated Closure Area 1 (PROJECT).

B. WORK INCLUDED

1. The CONTRACTOR shall furnish all supervision, labor, materials, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the WORK. The CONTRACTOR shall obtain and pay for all required permits according to Section 01900 Permits. The CONTRACTOR shall perform and complete the WORK in the manner best estimated to promote rapid construction consistent with safety of life and property and to the satisfaction of the OWNER, and in strict accordance with the CONTRACT DOCUMENTS. The CONTRACTOR shall clean up the WORK and maintain it during and after construction, until accepted, and shall do all WORK and pay all costs incidental thereto. The CONTRACTOR shall repair or restore all structures and property that may be damaged or disturbed during performance of the WORK.
2. The cost of incidental WORK described in this Section, for which there are no specific CONTRACT ITEMS, shall be considered as part of the general cost of doing the WORK and shall be included in the prices for the various CONTRACT ITEMS. No additional payment will be made therefor.
3. The CONTRACTOR shall provide and maintain such modern materials, tools, and equipment as may be necessary, in the opinion of the ENGINEER, to perform in a satisfactory and acceptable manner all the WORK required by the AGREEMENT. Only equipment of established reputation and proven efficiency shall be used. The CONTRACTOR shall be solely responsible for the adequacy of his workmanship, materials and equipment, prior acceptance of the ENGINEER notwithstanding.

C. PUBLIC UTILITY INSTALLATIONS AND STRUCTURES

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the OWNER, other governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone,

sewerage, drainage, water or other public or private property which may be affected by the WORK shall be deemed included hereunder.

2. The CONTRACTOR shall protect all public utility installations and structures from damage during the WORK. Access across any buried public utility installation or structure shall be made only in such locations and by means accepted by the ENGINEER. The CONTRACTOR shall so arrange his operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the CONTRACTOR at no additional expense to the OWNER or ENGINEER. All existing public utilities damaged by the CONTRACTOR which are shown on the CONTRACT DRAWINGS or have been located in the field by the utility shall be repaired by the CONTRACTOR, at his expense, as directed by the OWNER or ENGINEER. No separate payment shall be made for such protection or repairs to public utility installations or structures.
3. The CONTRACT DOCUMENTS contain data relative to existing public utility installations and structures above and below the ground surface. This data is not guaranteed as to their completeness or accuracy and it is the responsibility of the CONTRACTOR to make investigations to fully understand the character, condition, and extent of all such installations and structures as may be encountered and as may affect WORK.
4. Public utility installations or structures owned or controlled by the OWNER or other governmental body which are indicated on the CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS to be removed, relocated, replaced, or rebuilt by the CONTRACTOR shall be considered as a part of the general cost of doing the WORK and shall be included in the prices bid for the various CONTRACT ITEMS. No separate payment shall be made therefor.
5. Where public utility installations or structures owned or controlled by the OWNER or other governmental body are encountered during the course of the WORK, and are not indicated on the CONTRACT DRAWINGS or TECHNICAL SPECIFICATIONS, and when, in the opinion of the ENGINEER, removal, relocation, replacement, or rebuilding is necessary to complete the WORK, such WORK shall be accomplished by the utility having jurisdiction, or such WORK may be ordered, in writing by the ENGINEER, for the CONTRACTOR to accomplish. If such WORK is accomplished by the utility having jurisdiction it will be carried out expeditiously and the CONTRACTOR shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as required. If such WORK is accomplished by the CONTRACTOR, it will be paid for as extra WORK as provided in the AGREEMENT.
6. The CONTRACTOR shall, at all times in performance of the WORK, employ accepted methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of public utility installations and structures; and shall, at all times in the performance of the WORK avoid unnecessary interference with, or interruption of, public utility services and shall cooperate fully with the owners thereof to that end.
7. All OWNER and other governmental utility departments and other owners of public utilities which may be affected by the WORK will be informed in writing by the

CONTRACTOR within 15 calendar days after the execution of the AGREEMENT or contracts covering the WORK. Such notice will set out, in general, and direct attention to the responsibilities of the OWNER and other governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the WORK and will be accompanied by one set of CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS covering the WORK under such contract or contracts.

8. In addition to the general notice given, the CONTRACTOR shall give written notice to the OWNER and other governmental utility departments and other owners of public utilities of the location of the proposed construction operations at least 72 hours in advance of breaking ground in any area or on any unit of the WORK.
9. The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the CONTRACTOR as herein provided, shall be done by methods approved by the utility owner.
10. The CONTRACTOR shall make provisions to avoid impacting existing facilities operation or maintenance activities. If an impact is anticipated, the CONTRACTOR shall propose a means to maintain existing activities, subject to approval by the OWNER. The OWNER will not be responsible for any costs associated with such proposed modification.

1.2 CONTRACT DRAWINGS AND TECHNICAL SPECIFICATIONS

A. CONTRACT DRAWINGS AND PROJECT MANUAL

1. When obtaining data and information from the CONTRACT DRAWINGS, figures shall be used in preference to scaled dimensions, and large scale drawings in preference to small scale drawings.

B. COPIES FURNISHED TO CONTRACTOR

1. After the AGREEMENT has been executed, the CONTRACTOR will be furnished one electronic copy of the CONTRACT DRAWINGS (24 inches by 36 inches) and one electronic copy of the project manual (CONTRACT DOCUMENTS, CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS). One electronic copy of the CONTRACT DOCUMENTS will also be provided in a .pdf format.
2. The CONTRACTOR shall furnish each of the subcontractors, MANUFACTURERS, and material suppliers such copies of the CONTRACT DOCUMENTS as may be required for their WORK. All copies of the CONTRACT DOCUMENTS shall be printed from the reproducible sets furnished to the CONTRACTOR. All costs of reproduction and printing shall be borne by the CONTRACTOR.

C. SUPPLEMENTARY CONTRACT DRAWINGS

1. When, in the opinion of the ENGINEER, it becomes necessary to explain more fully the WORK to be done or to illustrate the WORK further or to show any changes which

may be required, drawings known as SUPPLEMENTARY DRAWINGS, with TECHNICAL SPECIFICATIONS pertaining thereto, will be prepared by the ENGINEER and the CONTRACTOR will be furnished one electronic copy of the CONTRACT DRAWINGS (24 inches by 36 inches) and one electronic copy of the project manual (CONTRACT DOCUMENTS, CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS) and all addenda.

2. The SUPPLEMENTARY DRAWINGS shall be binding upon the CONTRACTOR with the same force as the CONTRACT DRAWINGS. Where such SUPPLEMENTARY DRAWINGS require either less or more than the estimated quantities of WORK, credit to the OWNER or compensation therefor to the CONTRACTOR shall be subject to the terms of the AGREEMENT.

D. CONTRACTOR TO CHECK CONTRACT DRAWINGS AND DATA

1. The CONTRACTOR shall verify all dimensions, quantities, and details shown on the CONTRACT DRAWINGS, SUPPLEMENTARY DRAWINGS, schedules, TECHNICAL SPECIFICATIONS and other data received from the ENGINEER, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the CONTRACTOR of full responsibility for unsatisfactory WORK, faulty construction, or improper operation resulting therefrom nor from rectifying such conditions at no additional expense to OWNER or ENGINEER. The CONTRACTOR will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the ENGINEER, should such errors or omissions be discovered.
2. All schedules are given for the convenience of the OWNER and the CONTRACTOR and are not guaranteed to be complete. The CONTRACTOR shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in WORK to be done under the AGREEMENT and additional WORK claimed by CONTRACTOR.

E. TECHNICAL SPECIFICATIONS

1. The TECHNICAL SPECIFICATIONS consist of three parts: General, Products, and Execution. The General Section contains General Requirements which govern the WORK. Products and Execution modify and supplement these by detailed requirements for the WORK and shall always govern whenever there appears to be a conflict.

F. INTENT

1. All WORK called for in the TECHNICAL SPECIFICATIONS applicable to the AGREEMENT, but not shown on the CONTRACT DRAWINGS in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. WORK not specified in either the CONTRACT DRAWINGS or in the TECHNICAL SPECIFICATIONS, but involved in carrying out their intent or in the complete and proper execution of the WORK, is required and shall be performed by the CONTRACTOR as though it were specifically delineated or described.

2. The apparent silence of the TECHNICAL SPECIFICATIONS as to any detail, or the apparent omission from them of a detailed description concerning any WORK to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these TECHNICAL SPECIFICATIONS shall be made upon that basis.

1.3 MATERIALS AND EQUIPMENT

A. MANUFACTURER

1. The names of proposed MANUFACTURERS, material suppliers, and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the ENGINEER for approval prior to construction. No MANUFACTURER will be accepted for any materials to be furnished under the AGREEMENT unless he shall be of good reputation and have a plant of ample capacity. The CONTRACTOR shall, upon the request of the ENGINEER, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.
2. All transactions with the MANUFACTURERS or subcontractor(s) shall be through the CONTRACTOR, unless the CONTRACTOR shall request, in writing to the ENGINEER, that the MANUFACTURERS or subcontractor(s) deal directly with the ENGINEER. Any such transactions shall not in any way release the CONTRACTOR from his full responsibility under the AGREEMENT and will not impose any liability on the OWNER or ENGINEER.
3. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same MANUFACTURER.

B. DELIVERY

1. The CONTRACTOR shall deliver materials to the site in ample quantities to ensure the most speedy and uninterrupted progress of the WORK so as to complete the WORK within the scheduled time. The CONTRACTOR shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the WORK of any other CONTRACTOR or related WORK.
2. All materials and equipment shall be properly stored on site in accordance with these TECHNICAL SPECIFICATIONS and the MANUFACTURERS' recommendations.

C. SERVICE OF MANUFACTURERS ENGINEER

1. The AGREEMENT prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the MANUFACTURER and shall assist the CONTRACTOR, when required, to install, adjust, test and place in operation, the equipment in conformity with the CONTRACT

DOCUMENTS.

2. Prior to the equipment being placed in permanent operation by the OWNER, such engineer or superintendent shall make all adjustments and tests required by the ENGINEER to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the OWNER in the proper operation and maintenance of such equipment.

1.4 INSPECTION AND TESTING

A. GENERAL

1. Inspection and testing of materials will be provided by the CONTRACTOR unless otherwise specified.
2. For tests specified to be made by the CONTRACTOR, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the CONTRACT DOCUMENTS. One electronic copy of the reports shall be submitted and authoritative certification thereof shall be furnished to the ENGINEER as a prerequisite for the acceptance of any material or equipment.
3. If, in the making of any test of any material or equipment, it is ascertained by the ENGINEER that the material or equipment does not comply with the CONTRACT DOCUMENTS, the CONTRACTOR will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the WORK and replace it with acceptable material, without cost to the OWNER or ENGINEER.
4. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
5. The CONTRACTOR shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the OWNER executes final acceptance of the WORK.

B. COSTS

1. The cost of preliminary shop and field tests of equipment and certain other tests specifically called for in the CONTRACT DOCUMENTS shall be borne by the CONTRACTOR and such costs shall be deemed to be included in the AGREEMENT price.
2. Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the CONTRACT DOCUMENTS may be tested by the OWNER for compliance. The CONTRACTOR shall reimburse the OWNER for the expenditures incurred in making such tests on materials which are rejected for non-compliance. The CONTRACTOR is responsible for providing sufficient information to allow the

ENGINEER to determine that the item of material or equipment proposed is equivalent to that specifically named and an acceptable substitute therefor. If in the sole discretion of the ENGINEER, tests of the proposed substitute items are necessary for ENGINEER'S review, the substitute items will be tested by the CONTRACTOR at no additional cost to the OWNER.

C. INSPECTION OF MATERIALS

1. The CONTRACTOR shall give notice in writing to the ENGINEER, sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement, and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the OWNER and/or ENGINEER will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or ENGINEER will notify the CONTRACTOR that the inspection will be made at a point other than the point of manufacture.
2. The CONTRACTOR must comply with these provisions before shipping any material. Such inspection shall not release the CONTRACTOR from the responsibility for furnishing materials meeting the requirements of the CONTRACT DOCUMENTS.

D. CERTIFICATE OF MANUFACTURE

1. The CONTRACTOR shall furnish to the ENGINEER authoritative evidence in the form of Certificate of Manufacture that the materials to be used in the WORK have been manufactured and tested in conformity with the CONTRACT DOCUMENTS.
2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product, where necessary, that have been made directly on the product or on similar products of the MANUFACTURER. One electronic copy are to be provided to the ENGINEER.

E. SHOP TESTS

1. Testing for pressure, duty, capacity, rating, efficiency, performance, function or special requirements which are specified shall be tested in the shop of the MANUFACTURER in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the CONTRACT DOCUMENTS.
2. No such equipment or materials shall be shipped to the WORK site until the ENGINEER notifies the CONTRACTOR, in writing, that the results of such tests are acceptable.
3. One electronic copy of the MANUFACTURERS actual test data and interpreted results thereof, accompanied by One electronic copy of a Certificate of Authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be forwarded to the ENGINEER for acceptance.

4. The cost of shop tests and of furnishing MANUFACTURERS preliminary and shop test data of operating equipment shall be borne by the CONTRACTOR.

F. PRELIMINARY FIELD TESTS

1. As soon as conditions permit, the CONTRACTOR shall furnish all labor, materials, and instruments and shall make preliminary field tests of material. If the preliminary field tests disclose any material furnished under the AGREEMENT which does not comply with requirements of the CONTRACT DOCUMENTS, the CONTRACTOR shall, prior to the acceptance tests, make all changes, adjustments, and replacements required. The furnishing CONTRACTOR shall assist in the preliminary field tests as applicable.

G. FINAL FIELD TESTS

1. Upon completion of the WORK and prior to final payment, all equipment and piping installed under the AGREEMENT shall be subjected to acceptance tests as specified or required to provide compliance with the CONTRACT DOCUMENTS. One electronic copy of a Letter of Compliance and test results shall be provided by CONTRACTOR.
2. The CONTRACTOR shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all acceptance tests, at no additional cost to the OWNER or ENGINEER. The CONTRACTOR shall assist in the final field tests.

H. FAILURE OF TESTS

1. Any defects in the materials or their failure to meet the tests, guarantees or requirements of the CONTRACT DOCUMENTS shall be promptly corrected by the CONTRACTOR by replacements or otherwise. The decision of the OWNER and ENGINEER as to whether or not the CONTRACTOR has fulfilled their obligations under the AGREEMENT shall be final and conclusive. If the CONTRACTOR fails to make these corrections or if the improved materials, when tested, shall again fail to meet the guarantees or specified requirements the OWNER, notwithstanding its partial payment for WORK, and materials, may reject the materials and may order the CONTRACTOR to remove them from the site at their own expense. In addition, the CONTRACTOR will be responsible for payment of laboratory testing costs for WORK not in compliance with the CONTRACT DOCUMENTS.
2. In case the OWNER rejects any materials, the CONTRACTOR shall replace the rejected materials within a reasonable time. If the CONTRACTOR fails to do so the OWNER may, after the expiration of a period of thirty (30) calendar days after giving notice in writing, proceed to replace such rejected materials, and the cost thereof shall be deducted from any compensation due or which may become due to the CONTRACTOR under the AGREEMENT.

I. FINAL INSPECTION

1. During such final inspections, the WORK shall be clean and functional. In no case will the final estimate be prepared until the CONTRACTOR has complied with all requirements set forth and the ENGINEER and OWNER have made their final

inspection of the entire WORK and are satisfied that the entire WORK is properly and satisfactorily constructed in accordance with the requirements of the CONTRACT DOCUMENTS.

1.5 TEMPORARY STRUCTURES

A. TEMPORARY FENCES

1. If, during the course of the WORK, it is necessary to remove or disturb any fence or part thereof, the CONTRACTOR shall provide a suitable temporary fence at no additional cost to ENGINEER or OWNER.
2. Responsibility for Temporary Structures - In executing the AGREEMENT, the CONTRACTOR assumes full responsibility for the sufficiency and safety of all temporary structures or WORK and for any damage which may result from their failure or their improper construction, maintenance, or operation and will indemnify and hold harmless the ENGINEER and OWNER from all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.6 ACCIDENT PREVENTION

A. RESPONSIBILITY

1. Precautions shall be exercised at all times for the protection of person and property. The safety provisions of applicable laws, building and construction codes shall be observed.
2. The CONTRACTOR shall comply with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596), and under Hours and Safety Standards Act Section 107 of the WORK. Hours and Safety Standards Act (PL 91-54), except where state and local safety standards exceed the federal requirements and except where state safety standards have been approved by the Secretary of Labor in accordance with provisions of the Occupational Safety and Health Act, shall be complied with. Updates of the referenced regulations also shall apply.

1.7 TEMPORARY SERVICES

A. FIRST AID

1. The CONTRACTOR shall keep upon the site, at each location where WORK is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the WORK.

1.8 LINES AND GRADES

A. GRADE

1. All WORK under the AGREEMENT shall be constructed in accordance with the lines and grades shown on the CONTRACT DRAWINGS, or as provided by the ENGINEER. The full responsibility for keeping alignment and grade shall rest upon the CONTRACTOR.
2. The OWNER will provide available information regarding bench marks and base line controlling points on the CONTRACT DRAWINGS. Reference marks for lines and grades as the WORK progresses will be located by CONTRACTOR to cause as little inconvenience to the prosecution of the WORK as possible. The CONTRACTOR shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. The CONTRACTOR shall remove any obstructions placed contrary to this provision.

B. SURVEYS

1. The CONTRACTOR shall furnish and maintain, at no additional expense to OWNER or ENGINEER, stakes, temporary benchmarks, and other such materials.
2. The CONTRACTOR shall check such reference marks by such means as he may deemed necessary and, before using them, shall provide written notification to ENGINEER regarding presumed inaccuracies.
3. The CONTRACTOR shall, at no additional expense to OWNER or ENGINEER, establish all working or construction lines and grades as required from the reference marks made available by the OWNER, and shall be solely responsible for the accuracy thereof according to Section 01050 Site Conditions Surveys.

C. SAFEGUARDING MARKS

1. The CONTRACTOR shall safeguard all points, stakes, grade marks, monuments, and bench marks made or established on the WORK, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying WORK improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes, and marks.
2. The CONTRACTOR shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the WORK and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.
3. Survey information (north, the grid, and the coordinates) is referenced to the West Zone of the Florida State Plane Coordinate System, NAD 83, 1999 Adjustment. The elevations are to the National Geodetic Vertical Datum of 1929 (NGVD1929). Refer to Section 01050 Site Conditions Surveys.

1.9 ADJACENT STRUCTURES AND LANDSCAPING

A. RESPONSIBILITY

1. The CONTRACTOR shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the WORK.
2. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the WORK, whether or not shown on the CONTRACT DRAWINGS, and the removal, relocation and reconstruction of such items called for on the CONTRACT DRAWINGS or specified shall be included in the various CONTRACT ITEMS and no separate payments will be made therefore.
3. The CONTRACTOR is expressly advised that the protection of buildings, structures, tanks, pipelines, etc. and related WORK adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility.
4. Conditional inspection of buildings or structures in the immediate vicinity of the WORK which may reasonably be expected to be affected by the WORK shall be performed by and be the responsibility of the CONTRACTOR.
5. The CONTRACTOR shall, before starting operations, make an examination of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the OWNER and ENGINEER. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be provided to the OWNER and ENGINEER.
6. Prior to the beginning of any excavations the CONTRACTOR shall advise the OWNER of all structures on which he intends to perform WORK or which performance of the WORK will affect.

B. RESTORATION OF FENCES

1. Any fence, or part thereof, that is damaged or removed during the course of the WORK shall be replaced or repaired by the CONTRACTOR and shall be left in as good a condition as before the starting of the WORK.
2. The manner in which the fence is repaired or replaced and the materials used in such WORK shall be subject to the acceptance of the OWNER and ENGINEER.
3. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate CONTRACT ITEMS, or if no specific item is provided therefor, as part of the overhead cost of the WORK, and no additional payment will be made therefor.

1.10 PROTECTION OF WORK AND PUBLIC

A. BARRIERS AND LIGHTS

1. During the prosecution of the WORK, the CONTRACTOR shall put up and maintain at all times such barriers and lights as will effectually prevent accidents.
2. The CONTRACTOR shall provide all necessary labor, materials, tools, and equipment including, but not limited, to signs, barricades, traffic drums, cones, flashers, construction fencing, flag persons, variable message boards, uniformed police officers, warning devices, temporary pavement markings, temporary sidewalk, delineators, etc., to maintain vehicular and pedestrian traffic at all places where the WORK causes obstructions to the normal traffic or constitutes in any way a hazard to the public. These measures and actions shall be taken to safely maintain the accessibility of public and construction traffic by preventing potential construction hazards. All materials, WORK, and incidental costs shall be included as part of the overhead cost of the WORK, and no additional payment will be made therefor. Refer to Section 1570 Maintenance of Traffic.

B. NOISE

1. The CONTRACTOR shall eliminate noise to as great an extent as practicable at all times. The CONTRACTOR shall strictly observe all local regulations covering noise control.

C. ACCESS TO PUBLIC SERVICES

1. Neither the materials excavated nor the materials or equipment used in the construction of the WORK shall be so placed as to prevent free access to all fire hydrants, valves, or manholes.
2. The WORK shall be so conducted to maintain existing traffic lanes in operation. Refer to Section 1570 Maintenance of Traffic.

D. DUST PREVENTION

1. The CONTRACTOR shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas dampened with water at all times or as requested by the OWNER or ENGINEER.

1.11 CUTTING AND PATCHING

- A. The CONTRACTOR shall do all cutting, fitting or patching of the WORK that may be required to make the parts thereof join and coordinate in a manner satisfactory to the ENGINEER and in accordance with the CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS.

- B. The WORK must be done by competent workmen skilled in the trade required by the restoration.

1.12 CLEANING

A. DURING CONSTRUCTION

1. During construction, the CONTRACTOR shall, at all times, keep the site of the WORK and adjacent premises as free from material, debris, and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the OWNER or ENGINEER, such material, debris, or rubbish constitutes a nuisance or is objectionable.
2. The CONTRACTOR shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops. The CONTRACTOR shall be responsible and liable for all spillage and incur all associated costs including, but not limited to, costs related to repair and maintenance resulting from damages thereof, and fines that may be levied as a result of citations given by State or local regulatory agencies.

B. FINAL CLEANING

1. At the conclusion of the WORK, all erection plant, tools, temporary structures and materials belonging to the CONTRACTOR shall be promptly removed, and shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances to a facility permitted to manage these materials.

1.13 MISCELLANEOUS

A. PROTECTION AGAINST SILTATION AND BANK EROSION

1. The CONTRACTOR shall arrange his operations and construct erosion control devices to minimize siltation and bank erosion on construction sites and on existing or proposed water course and drainage channels.
2. The CONTRACTOR, at no additional expense to OWNER or ENGINEER, shall remove any siltation deposits and correct any erosion problems as directed by the ENGINEER which results from CONTRACTOR'S construction operations.

B. PROTECTION OF WETLAND AREAS

1. The CONTRACTOR shall properly dispose of all surplus material, including soil, in accordance with local, state and federal regulations and with OWNER'S instruction.
2. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Army Corps of Engineers or the Florida Department of Environmental Protection

C. USE OF CHEMICALS

1. All chemicals used during the performance of the WORK or furnished for the WORK, whether herbicide, pesticide, disinfection, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions. The CONTRACTOR shall obtain written approval from OWNER prior to use of chemicals.

D. COOPERATION WITH OTHER CONTRACTORS AND FORCES

1. During progress of WORK under the AGREEMENT, it may be necessary for other contractors and persons employed by the OWNER to WORK in or about the PROJECT.
2. The OWNER reserves the right to put such other contractors to work and to afford such access to the WORK area to be performed at times as the OWNER deems proper.
3. The CONTRACTOR shall not impede or interfere with the work of such other contractors engaged in or about the WORK and shall so arrange and conduct the work that such other contractors may complete their work at the earliest date possible.
4. Construction shall be conducted and shall result in construction of the improvements of this PROJECT in full accordance with the conditions of the permits granted for the PROJECT.

E. OWNER'S REPRESENTATIVES

1. The OWNER will appoint a CONSTRUCTION QUALITY ASSURANCE REPRESENTATIVE (CQAR) and Project Manager (PM) as the OWNER'S representative as defined in Section 01070 Abbreviations and Definitions.

F. PRE-EXISTING CONDITIONS

1. The OWNER conducted an aerial topographic survey for the PROJECT and immediate areas. The OWNER does not guarantee or warrant the accuracy of the survey.
2. The CONTRACTOR will conduct a pre-existing conditions survey of the PROJECT areas according to Section 01050 Site Conditions Surveys. The survey shall establish the state of the property before construction as a basis for any claims of damage that may occur.
3. This survey shall include comprehensive photography and video taping of the PROJECT and immediate areas, grounds, and structures; spot elevations of grades and tops of walls; side slopes; existing spillways; perimeter swales and roads; and shall make note of any identified previously damaged areas. Photos and videotape shall be submitted to the OWNER and ENGINEER for review and acceptance prior to start of WORK.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 PROJECT COVERED BY CONTRACT DOCUMENTS

- A. The WORK for the AGREEMENT consists of constructing an approximately 162.4 acre landfill closure at the Southeast Hillsborough County located in Lithia, Florida referred to as the Phase I-VI Closure 1 (PROJECT). The WORK to be performed by the CONTRACTOR consists of, but is not limited to, furnishing all labor, materials, equipment, tools, transportation, incidentals and operations, and performing all WORK necessary to complete the PROJECT in accordance with the CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS.
- B. The WORK for the PROJECT includes, but is not limited to, excavation, filling, grading, preparation of subbase for installation of a geomembrane, geocomposite drainage layer, protective cover placement, vegetative layer, tie-ins to existing conditions, associated quality assurance testing, stormwater control structures and conveyances, gas system improvements and all related WORK as shown on the CONTRACT DRAWINGS and as specified in the CONTRACT DOCUMENTS.

1.2 WORK BY OTHERS

- A. WORK may be conducted at the PROJECT site by other contractors during the performance of the WORK under the AGREEMENT. The CONTRACTOR shall conduct its operations to minimize interference of other contractors and shall cooperate fully with such contractors and the PROJECT representatives to provide continued safe access to perform their respective contracts and normal landfill operations.

1.3 CONTRACTOR USE OF PREMISES

- A. No later than 5 calendar days after notice-to-proceed, the CONTRACTOR shall arrange with the OWNER a sequence of procedures, means of access, space for storage of materials and equipment, and use of approaches and roadways. The CONTRACTOR'S use of the premises shall be confined to the areas approved by the OWNER.
- B. The land available for the CONTRACTOR'S use during the performance of the PROJECT will be limited to the area as shown on the CONTRACT DRAWINGS and identified as "Contractors Storage/Laydown Area." The exact area will be determined during the pre-construction meeting with the coordination of the OWNER and CONTRACTOR.
- C. Smoking is prohibited at the landfill.
- D. The CONTRACTOR shall not dispose of any refuse on site without approval of the OWNER and in accordance with Section 02220 Excavation, Backfill, Fill, and Grading.

- E. Areas outside the limits of construction that have been disturbed by the CONTRACTOR shall be returned to its original condition, or better, upon completion of the WORK at no additional cost to the OWNER.
- F. The CONTRACTOR shall be aware of the nature of the activities at a landfill which may restrict access to portions of the site due to general landfill and transfer station operations.
- G. The CONTRACTOR shall enforce safety procedures to minimize hazards to workers, the public, and the environment.

1.4 WORK HOURS

- A. CONSTRUCTION QUALITY ASSURANCE (CQA) shall be the responsibility of the OWNER and CQA CONSULTANT who will act as the OWNER'S representative. The CQA CONSULTANT is a party independent of the CONTRACTOR, geosynthetics MANUFACTURER and/or INSTALLER, and is responsible for field testing, observing, and documenting activities related to the construction and/or permit documents and the CQA Plan. The CQA CONSULTANT will provide a full-time CONSTRUCTION QUALITY ASSURANCE REPRESENTATIVE (CQAR) who will observe construction activities.
- B. Regular working hours are defined as up to 10 hours per day, Monday through Friday, beginning no earlier than 7:30 a.m. and ending no later than 5:30 p.m., excluding Saturdays and Sundays and OWNER observed Holidays.
- C. Requests for approval by the CONTRACTOR to work other than regular working hours must be submitted to the OWNER and ENGINEER at least 48 hours prior to any proposed weekend WORK, OWNER observed Holidays, or extended workweek hours.
- D. Periodic unscheduled WORK hours on weekdays or weekend will be permitted provided that 24 hours notice is provided to the OWNER and ENGINEER. Maintenance and cleanup may be performed during hours other than regular working hours.
- E. The CONTRACTOR will be responsible for reimbursing the OWNER for the CQAR for all WORK hours and expenses exceeding 10 hours per day for Monday through Friday, Saturdays WORK, and WORK on observed Holidays which the CONTRACTOR works and the CQAR, CQA CONSULTANT, and/or ENGINEER are required to be present onsite or provide direction.
- F. The CONTRACTOR shall pay to the OWNER, as reimbursement of costs incurred by the OWNER, the sum of \$100 per hour and expenses for the CQAR, \$160 per hour and expenses for the CQA CONSULTANT, and \$175 per hour and expenses for the ENGINEER for each hour of WORK conducted on Saturdays and Sundays and observed Holidays which the CONTRACTOR works and the CQAR, CQA CONSULTANT, and/or ENGINEER are required to be present onsite or provide direction.
- G. At the OWNER'S option, unscheduled WORK costs may either be deducted from the CONTRACTOR'S monthly payment request or deducted from the CONTRACTOR'S retainage prior to release of final payment.

1.5 OWNER OCCUPANCY AND LANDFILL OPERATIONS

- A. The CONTRACTOR shall cooperate with the OWNER during construction operations to minimize conflicts with OWNER work and facilitate OWNER usage. The CONTRACTOR shall perform the WORK so as not to interfere with the OWNER'S operations, maintenance, environmental monitoring, and other OWNER activities at the site.

1.6 SITE CONDITIONS

- A. Existing Grades - The existing grades may vary from those indicated on the CONTRACT DRAWINGS due to landfill settlement and ongoing filling operations.
- B. Existing Features - The contours and spot elevations shown on the CONTRACT DRAWINGS reflect the best available information regarding existing site conditions at the time the design was prepared.
- C. Preconstruction Survey - The CONTRACT DOCUMENTS require the CONTRACTOR to prepare a preconstruction survey prior to beginning WORK. Refer to Section 01050 Site Conditions Surveys.

1.7 LINES, GRADES, AND ELEVATIONS

- A. All WORK shall be done to the lines, grades, and elevations shown on the CONTRACT DRAWINGS.
- B. Topographic survey information (north, the grid, and the coordinates shown) is referenced to the West Zone of the Florida State Plane Coordinate System, NAD 83, 1999 Adjustment. Elevations are to the National Geodetic Vertical Datum of 1929 (NGVD1929). Basic horizontal and vertical control points have been established. These points shall be used as the datum for the WORK. All additional survey, layout, and measurement work shall be performed by the CONTRACTOR as a part of the WORK.
- C. The CONTRACTOR shall provide experienced instrument personnel, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement WORK. In addition, the CONTRACTOR shall furnish, without additional cost to the OWNER, competent personnel from its force and such tools, stakes, and other materials as the ENGINEER may require in establishing or designating control points, checking surveys, layout, and measurement of WORK performed by the CONTRACTOR.

1.8 REFERENCE STANDARDS

- A. Reference to the standards of any technical society, organization, or association or to codes of local or state authorities shall mean the latest effective standard, code, specification, or standard adopted and published at the date of receipt of bids, unless specifically stated otherwise.

1.9 ERRORS AND/OR OMISSIONS IN PLANS AND SPECIFICATIONS

- A. The intent of the TECHNICAL SPECIFICATIONS is to outline or indicate the items of WORK, or both, which cannot be readily shown on the CONTRACT DRAWINGS and further to indicate the types and qualities of materials. The CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS shall be considered as being complimentary and items or WORK mentioned or indicated in one and not in the other shall be included as if mentioned in both.
- B. Should the CONTRACT DRAWINGS disagree in themselves or with the TECHNICAL SPECIFICATIONS the better quality or greater quantity of WORK or materials shall be estimated upon and shall be provided.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01050

SITE CONDITIONS SURVEY

PART 1 - GENERAL

1.1 SUMMARY

- A. The CONTRACTOR shall perform, or obtain other professional subcontractors to complete surveys that meet the minimum standards of Chapter 61-G17 of the Florida Administrative Code (FAC), to document elevations, grades, locations, maintain survey control during construction, and perform related field engineering as specified in the CONTRACT DOCUMENTS.
- B. Throughout this Section, all references to "SURVEYOR" shall mean a professional land surveyor licensed in the State of Florida.

1.2 SURVEY REFERENCE POINTS

- A. The CONTRACTOR shall locate survey reference points prior to starting WORK and the CONTRACTOR shall protect and preserve all permanent survey reference points during construction.
 - 1. The CONTRACTOR shall make no changes or relocate any survey reference point without prior written notice to the ENGINEER.
 - 2. The CONTRACTOR shall report to the ENGINEER when any survey reference point is lost, destroyed, or requires relocation because of necessary changes in grades or locations.
 - 3. The CONTRACTOR, at no additional cost to the OWNER, shall replace and re-survey reference points that have been lost or destroyed. The replaced survey reference point shall be surveyed by a SURVEYOR. Replacement will be based on original survey control.
- B. Prior to any WORK, the CONTRACTOR shall immediately notify the ENGINEER and OWNER of any discrepancies with the survey reference points from the coordinates and elevations provided.

1.3 RECORD DRAWINGS (AS-BUILT DRAWINGS)

- A. All survey record documents, submitted to the ENGINEER for progress review, do not require the signature and seal of a SURVEYOR; however, final Record Drawings shall be signed and sealed by a SURVEYOR.
- B. Submitted record documents shall include the following:
 - 1. As stages of the WORK are completed, the CONTRACTOR will submit surveys, signed

and sealed by a SURVEYOR. The Record Drawings information shall be submitted on 24 inch by 36 inch sheets, as well as AutoCAD Drawing files (compatible with (AutoCAD r18 or later version) on universal serial bus drive (USB). The CONTRACTOR will submit 5 original signed and sealed hard copies by a SURVEYOR and 2 USBs with the AutoCAD drawing files, shall be submitted.

2. AutoCAD Drawing File Requirements - Contour lines shall be continuous, unbroken polylines with a width of zero and an elevation (z-coordinate) assigned according to the elevation of the contour line. All spot elevations shall have horizontal controls with vertical z-coordinates. Contours shall be at one-foot intervals, with index contours at every fifth interval. Objects in the Record Drawings shall be drawn to scale. Unless otherwise stated, all surveys shall be at a scale of 1" = 50'.
 3. Survey information (north, the grid, and the coordinates) is referenced to the West Zone of the Florida State Plane Coordinate System, NAD 83, 1999 Adjustment. The elevations are to the National Geodetic Vertical Datum of 1929 (NGVD1929).
 4. All Record Drawings shall have survey control monuments shown for the purposes of orientation, both horizontally and vertically.
 5. If multiple sheets are required for the Record Drawings, each sheet shall include match lines as required.
- C. The CONTRACTOR understands and agrees that existing elevations and contours shown on the CONTRACT DRAWINGS are solely for the ENGINEER'S information. Actual quantities of soils and other materials required to complete the WORK are the CONTRACTOR'S responsibility. The CONTRACTOR shall determine existing elevations for the purpose of conducting the WORK as required by the CONTRACT DOCUMENTS. The CONTRACTOR is responsible to notify the OWNER and ENGINEER in writing of any and all discrepancies prior to beginning WORK.

1.4 SUBMITTALS

- A. The CONTRACTOR shall submit the name and address of the SURVEYOR to the ENGINEER prior to any WORK for record purposes only.
- B. The CONTRACTOR shall submit documentation signed by the SURVEYOR that elevations and locations of improvements are in conformance with the CONTRACT DOCUMENTS, or if not in conformance, certify as to variances from the CONTRACT DOCUMENTS.
- C. The CONTRACTOR shall provide and submit to the ENGINEER for approval, signed and sealed drawings representing the horizontal and vertical limits, as follows:
 1. **Preconstruction Survey** - Prior to performing any earthwork, a Preconstruction Survey of the site must be provided to the ENGINEER for review and approval. The Preconstruction Survey shall include:
 - a. Survey of the existing conditions within the limits of construction of the PROJECT and 50 feet beyond the limits of construction.

- b. The Preconstruction Survey shall be collected on a 50 foot by 50 foot grid, at a minimum, and note all above grade structures, piping, and stormwater features which may or will be impacted by the WORK and shall include the areal extent of existing sod that must be removed in order to enable the WORK to proceed.
 - c. The existing bottom anchor trenches crest for liner tie-in shall be staked and marked every 25 feet.
- 2. **Subbase Survey** - Following completion of the Preconstruction Survey, required site clearing, grubbing, and stripping, and upon completion of the PROJECT subbase, the CONTRACTOR shall submit a Subbase Survey to the ENGINEER for review and approval before installation of geosynthetics in order to verify locations, slopes, and grades.
 - a. The CONTRACTOR will compare the Subbase Survey to the PROJECT subbase design. The CONTRACTOR will certify the subbase was constructed to the required elevation and slopes. This survey shall be representative of the top of the subbase surface prior to placement of the 40 mil textured LLDPE geomembrane liner.
 - b. A location survey of the edge of the closure area 40 mil textured LLDPE geomembrane liner. This survey shall represent the limits of the geomembrane. Spot elevations shall be taken, at a minimum, at 25 foot intervals, along the perimeter of the closure area.
- 3. **Protective Cover Layer Survey** - A topographic survey of the prepared top of Protective Cover Layer shall be collected when placement is completed to determine it was constructed to the required thickness.
 - a. The Protective Cover Layer Survey shall be completed on a 50 foot by 50 foot grid, at a minimum, and as necessary (i.e., spot elevations, grade breaks, mounds, sideslopes and top of the PROJECT area, points referenced in the control points table, etc.) so as to provide an accurate representation of the contour topography. A minimum of 18 inches, measured perpendicular to the slopes, is required above the geocomposite.
- 4. **Final Survey** - The Final Survey will include, but is not limited to, the following:
 - a. A topographic survey of the top of the final cover shall be collected on a 50 foot by 50 foot at a minimum, and as necessary (i.e., spot elevations, grade breaks, mounds, sideslopes and top of the PROJECT area, points referenced in the control points table, etc.) so as to provide an accurate representation of the contour topography. A minimum of 24 inches, measured perpendicular to the slope, is required above the geocomposite.
 - b. All features of the PROJECT installed and all existing features within the limits of construction.
 - c. The stormwater structures, downchutes, piping, limits of liner, underground piping, access roads, sod and/or seeding limits, and all other features related to the PROJECT.

- d. Pipe invert elevations and locations shall be noted, at a minimum, every 25 linear feet along each pipe and at each change in pipe size, type, direction, and elevation.
- D. **Record Drawings** - The CONTRACTOR shall submit to the ENGINEER, for review and approval, signed and sealed Record Drawings for all WORK (to include any areas outside the limits of WORK disturbed by the CONTRACTOR) as follows:
1. The CONTRACTOR shall, throughout the PROJECT, maintain a redline set of CONSTRUCTION DRAWINGS noting deviations or actual installed conditions for the PROJECT.
 2. As part of Final Completion, the CONTRACTOR must submit a complete set of 24 inch by 36 inch sheet Record Drawings based on the redlines maintained throughout the PROJECT which identify the actual constructed conditions. Record Drawings shall use the CONTRACT DRAWINGS as a base and show changes by cloud and strikethrough in electronic format (AutoCAD r18 or later version). These Record Drawings shall incorporate the surveys listed above and any other changes made to the PROJECT into the set in order to create a single Record Drawings set for the PROJECT.
 3. The CONTRACTOR shall submit 2 draft copies of the completed Record Drawings, in both hardcopy and AutoCAD format, for review at Substantial Completion.
 4. The CONTRACTOR shall submit 5 signed and sealed certified sets of final approved by the ENGINEER Record Drawings and AutoCAD files shall be submitted for final acceptance.
 5. Substantial Completion cannot be granted until a draft set of Record Drawings in both hardcopy and AutoCAD file formats are submitted to the OWNER and ENGINEER for review.
 6. Final Completion cannot be granted until the Record Drawings signed and sealed by a SURVEYOR and AutoCAD files are submitted to and approved by the OWNER and ENGINEER.
- E. **Partial Surveys** - It is understood the CONTRACTOR may elect to construct the PROJECT at different time intervals and survey each section separately. Partial Surveys must be submitted to the ENGINEER to determine the section the CONTRACTOR is requesting to continue working in meets the design requirements. The CONTRACTOR may not continue WORK until the Partial Surveys are approved. Partial Surveys are not required to be signed and sealed at the time of submittal, however, the surveys used to compile the complete survey must not deviate from the Partial Surveys submitted and the complete survey must be certified for submittal. Payment for surveys will not be made until the complete, certified survey is submitted and approved. However, Partial Surveys may be used for payment of WORK items upon review, agreement, and approval by the OWNER and ENGINEER.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

3.1 CONTRACTOR RESPONSIBILITIES

- A. The CONTRACTOR shall retain the services of a SURVEYOR to identify existing control points and maintain survey control during WORK.
- B. The CONTRACTOR shall identify all survey reference points.
- C. The CONTRACTOR shall provide civil, structural, or other professional engineering services specified or required to execute the CONTRACTOR'S construction methods.
- D. The CONTRACTOR shall be responsible for the preservation of all benchmarks, stakes, and marks. If any benchmarks, stakes, or marks are disturbed by the CONTRACTOR, the CONTRACTOR shall not proceed with any WORK until such points, marks, lines, and elevations as may be necessary for the WORK have been established.
- E. The accuracy of any method of staking shall be the responsibility of the CONTRACTOR. All engineering for vertical and horizontal control shall be the responsibility of the CONTRACTOR.
- F. The surveyors shall maintain a complete, accurate log of all control and survey WORK as it progresses. This log shall be available for periodic review by the ENGINEER.
- G. Grades, elevations, and locations will be required periodically during the prosecution of the WORK. The CONTRACTOR'S SURVEYOR will provide as-built notes and Record Drawings when construction is completed.
- H. All topographic surveys shall meet the minimum standards of Chapter 61-G17 of the Florida Administrative Code. Surveys shall include (but are not limited to) grading, elevations, structure locations, pipe inverts, piping, and other permanent structures as needed on a 50 foot by 50 foot grid.
- I. The topographic information collected shall be taken on a grid (or as specified for the identified area), at a minimum, one point directly above the previous as necessary to provide an accurate representation of the contour topography (i.e., spot elevations, grade breaks, ditches, mounds, etc.) and the thickness of the material placement from previous WORK. For ditches and piping, spot elevations shall be taken, at a minimum, every 25 linear feet to include, at a minimum, the centerline of the ditch/trench, the toe and top of ditch/trench slopes, and any grade breaks.
- J. The CONTRACTOR shall survey the limits of the installed geosynthetic materials, anchor trench turn-down point, at the specified interval for the PROJECT around the perimeter and place markers delineating the limits of geomembrane every 25 feet along the anchor trench.

- K. The elevation and grades shall be within an accuracy of 0.2 feet vertical and 0.5 feet horizontal as shown in the CONTRACT DOCUMENTS. Unless otherwise stated, all surveys shall be at a scale of 1" = 50', with contours at one-foot intervals.
- L. For thickness verifications, **NO MINOR TOLERANCES ARE ACCEPTABLE**. The thicknesses indicated on the CONTRACT DRAWINGS are minimum thickness and **CANNOT** be less than the dimensions shown on the CONTRACT DRAWINGS.

END OF SECTION

SECTION 01070

ABBREVIATIONS AND DEFINITIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Wherever in these TECHNICAL SPECIFICATIONS are made to the standards, specifications, or other published data of various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation. As a guide to the user of these TECHNICAL SPECIFICATIONS, the following acronyms or abbreviations which may appear in these TECHNICAL SPECIFICATIONS shall have the meanings indicated herein.

1.2 ABBREVIATIONS AND ACRONYMS

AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers Association
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agriculture Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials
AWPA	American Wood Protection Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association

BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturers Association
BF	Blind Flange
CBM	Certified Ballast Manufacturers Association
CEMA	Conveyors Equipment Manufacturers Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturers Institute
CMA	Concrete Masonry Association
CQAR	Construction Quality Assurance Representative
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturers Association
EIA	Electronic Industries Association
EPA	United States Environmental Protection Agency
ETL	Electrical Testing Laboratories, Inc.
FDOT	Florida Department of Transportation
HDPE	High Density Polyethylene
HVAC	Heating, Ventilation, Air Conditioning
ICBO	International Conference of Building Officials
IE	Invert Elevation
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
IOS	International Organization for Standardization
ITE	Institute of Traffic Engineers
JEC	Joint Electrical Council
LFG	Landfill Gas
LLDPE	Linear Low Density Polyethylene
MBMA	Metal Building Manufacturers Association
MSW	Municipal Solid Waste
MPTA	Mechanical Power Transmission Association
NAAM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electric Code (Now NFPA)
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NPDES	National Pollutant Discharge Elimination System
NWMA	National Woodwork Manufacturers Association (Now NWWDA)
OSHA	United States Occupational Safety and Health Administration
PCA	Portland Cement Association
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
RFI	Request for Information

RIS	Redwood Inspection Service
RWMA	Resistance Welder Manufacturers Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPR	Simplified Practice Recommendation
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
SWANA	Solid Waste Association of North America
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories
USDOT	United States Department of Transportation
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute
WWPA	Western Wood Products Association

1.3 DEFINITIONS

- A. Wherever used in the CONTRACT DOCUMENTS the following terms have the meanings indicated which are applicable to both the singular and plural thereof:
1. ADDENDA - Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the CONTRACT DOCUMENTS.
 2. AGREEMENT - The CONTRACT between the OWNER and the CONTRACTOR covering the WORK to be performed; other CONTRACT DOCUMENTS are attached to the AGREEMENT and made a part thereof as provided therein.
 3. Application for Payment - The form accepted by the ENGINEER which is to be used by the CONTRACTOR in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the CONTRACT DOCUMENTS.
 4. Asbestos - Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 5. Bid - The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the WORK to be performed.
 6. Bidding Documents - The Advertisement or Invitation to Bid, Instructions to Bidders, Bid Form, and the CONTRACT DOCUMENTS (including all ADDENDA issued prior to receipt of Bids).

7. Bidding Requirements - Advertisement or Invitation to Bid, Instructions to Bidders, and Bid Form.
8. Bonds - Performance and Payment Bonds and other instruments of security.
9. Change Order - A document recommended by the ENGINEER, which is signed by the CONTRACTOR and the OWNER and authorizes an addition, deletion or revision in the WORK, or an adjustment in the CONTRACT price or the CONTRACT times, issued on or after the Effective Date of the AGREEMENT.
10. CONSTRUCTION QUALITY ASSURANCE CONSULTANT (CQA) - Construction Quality Assurance (CQA) shall be the responsibility of the OWNER and CQA CONSULTANT who will act as the OWNER'S representative. The CQA CONSULTANT is a party independent of the CONTRACTOR, geosynthetics MANUFACTURER and/or INSTALLER, and if applicable, the DESIGN ENGINEER and is responsible for field testing, observing, and documenting activities related to the construction and/or permit documents and the CQA Plan. The CQA CONSULTANT will provide a full-time CQAR who will observe construction activities.
11. CONSTRUCTION QUALITY ASSURANCE REPRESENTATIVE (CQAR) - The Construction Quality Assurance Representative (CQAR) is a qualified individual assigned by the CQA CONSULTANT to be responsible for observing and documenting activities related to the CQA of the production and installation of the WORK on behalf of the CQA CONSULTANT and OWNER.
12. CONTRACT DOCUMENTS - The AGREEMENT, ADDENDA (which pertain to the CONTRACT DOCUMENTS), the CONTRACTOR'S Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the AGREEMENT, the Notice to Proceed, the Bonds, the General Conditions, the Supplementary Conditions, the TECHNICAL SPECIFICATIONS and the CONTRACT DRAWINGS as the same are more specifically identified in the AGREEMENT, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders and the ENGINEER'S written interpretations and clarifications issued pursuant to the General Terms and Conditions on or after the Effective Date of the AGREEMENT, Shop Drawing submittals and all reports and drawings referred to in Section 01300 Contractor Submittals.
13. Contract Price - The monies payable by the OWNER to the CONTRACTOR for completion of the WORK in accordance with the CONTRACT DOCUMENTS as stated in the AGREEMENT.
14. Contract Times - The numbers of days or the dates stated in the AGREEMENT:
 - To achieve Substantial Completion, and
 - To complete the WORK so that it is ready for Final Payment as evidenced by the ENGINEER'S written recommendation of Final Payment.
15. CONTRACTOR - The person, firm or corporation with whom the OWNER has entered into the AGREEMENT.

16. CONTRACT DRAWINGS - The CONTRACT DRAWINGS which show the scope, extent and character of the WORK to be furnished and performed by the CONTRACTOR and which have been prepared or approved by the ENGINEER and are referred to in the CONTRACT DOCUMENTS. Shop Drawings are not CONTRACT DRAWINGS as so defined.
17. Defective - An adjective which when modifying the word WORK refers to WORK that is unsatisfactory, faulty or deficient, in that it does not conform to the CONTRACT DOCUMENTS, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the CONTRACT DOCUMENTS, or has been damaged prior to the ENGINEER'S recommendation of Final Payment.
18. Effective Date of the AGREEMENT - The date indicated in the AGREEMENT on which it becomes effective, but if no such date is indicated it means the date on which the AGREEMENT is signed and delivered by the last of the two parties to sign and deliver.
19. ENGINEER - The person, firm or corporation named as such in the AGREEMENT.
20. ENGINEER'S Consultant - A person, firm, or corporation having a contract with the ENGINEER to furnish services as the ENGINEER'S independent professional associate or consultant with respect to the PROJECT.
21. OWNER'S REPRESENTATIVE - A person, firm, or corporation having a contract with ENGINEER to furnish services as the ENGINEER'S independent professional associate or consultant with respect to the PROJECT.
22. Field Order - A written order issued by the ENGINEER which orders minor changes in the WORK, but which does not involve a change in the CONTRACT price or the CONTRACT times.
23. General Requirements - Sections of Division 1 of the TECHNICAL SPECIFICATIONS.
24. Hazardous Waste - The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
25. Laws and/or Regulations - Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.
26. Liens - Liens, charges, security interests or encumbrances upon real property or personal property.
27. Milestone - A principal event specified in the CONTRACT DOCUMENTS relating to an intermediate completion date or time prior to Substantial Completion of all the WORK.
28. Minor Changes/Variations in WORK - Authorized minor variations in the WORK from the requirements of the CONTRACT DOCUMENTS which do not involve an adjustment in the CONTRACT price or the CONTRACT time and is compatible with the designed concept of the complete PROJECT.

29. Notice of Award - The written notice provided by the OWNER to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions precedent enumerated therein, within the time specified, the OWNER will sign and deliver the AGREEMENT.
30. Notice to Proceed - A written notice provided by the OWNER to the CONTRACTOR (with a copy to the ENGINEER) fixing the date on which the CONTRACT time will commence and on which the CONTRACTOR shall start to perform the CONTRACTOR'S obligations under the CONTRACT DOCUMENTS.
31. OWNER - The public body or authority, corporation, association, firm or person with whom the CONTRACTOR has entered into the AGREEMENT and for whom the WORK is to be provided.
32. Partial Utilization - Use by the OWNER of a substantially completed part of the WORK for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the WORK.
33. PCBs - Polychlorinated biphenyls.
34. Petroleum - Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute) such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other Non-Hazardous Wastes and crude oils.
35. PROJECT - The total construction of which the WORK to be provided under the CONTRACT DOCUMENTS may be the whole, or part as indicated elsewhere in the CONTRACT DOCUMENTS.
36. Radioactive Material - Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011) as amended from time to time.
37. Samples - Physical examples of materials, equipment, or workmanship that are representative of some portion of the WORK and which establish the standards by which such portion of the WORK will be judged.
38. Shop Drawings - All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for the CONTRACTOR and submitted by the CONTRACTOR to illustrate some portion of the WORK.
39. SUPPLEMENTARY DRAWINGS - When, in the opinion of the ENGINEER, it becomes necessary to explain more fully the WORK to be done or to illustrate the WORK further or to show any changes which may be required, drawings known as SUPPLEMENTARY DRAWINGS, with TECHNICAL SPECIFICATIONS pertaining thereto, will be prepared by the ENGINEER. The SUPPLEMENTARY DRAWINGS shall be binding upon the CONTRACTOR with the same force as the CONTRACT DRAWINGS.
40. TECHNICAL SPECIFICATIONS - Those portions of the CONTRACT DOCUMENTS consisting of written technical descriptions of materials, equipment, construction

systems, standards and workmanship as applied to the WORK and certain administrative details applicable thereto.

- 41. SUBCONTRACTOR - An individual, firm or corporation having a direct contract with the CONTRACTOR or with any other SUBCONTRACTOR for the performance of a part of the WORK at the site.
- 42. Substantial Completion - The WORK (or a specified part thereof) has progressed to the point where, in the opinion of the ENGINEER as evidenced by the ENGINEER'S definitive Certificate of Substantial Completion, it is sufficiently complete in accordance with the CONTRACT DOCUMENTS so that the WORK (or specified part) can be utilized for the purposes for which it is intended; or if no such Certificate is issued, when the WORK is complete and ready for Final Payment as evidenced by the ENGINEER'S written recommendation of Final Payment. The terms "Substantially Complete" and "Substantially Completed" as applied to all or part of the WORK refer to Substantial Completion thereof.
- 43. Supplementary Conditions - The part of the CONTRACT DOCUMENTS which amends or supplements the General Conditions.
- 44. Supplier - A MANUFACTURER, fabricator, supplier, distributor, materialman or vendor having a direct contract with the CONTRACTOR or with any SUBCONTRACTOR to furnish materials or equipment to be incorporated in the WORK by the CONTRACTOR or any SUBCONTRACTOR.
- 45. SURVEYOR - Shall mean a professional land surveyor licensed in the State of Florida.
- 46. Underground Facilities - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.
- 47. Unit Price Work - WORK to be paid for on the basis of unit prices.
- 48. WORK - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the CONTRACT DOCUMENTS. The WORK includes, and is the result of, performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the CONTRACT DOCUMENTS.
- 49. Work Change Directive - A written directive to the CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by the OWNER and recommended by the ENGINEER, ordering an addition, deletion or revision in the WORK, or responding to differing or unforeseen physical conditions under which the WORK is to be performed. A Work Change Directive will not change the CONTRACT price or the CONTRACT time, but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the CONTRACT price or CONTRACT time.

50. Written Amendment - A written Amendment of the CONTRACT DOCUMENTS, signed by the OWNER, ENGINEER, and CONTRACTOR on or after the Effective Date of the AGREEMENT and normally dealing with the non-engineering or non-technical rather than strictly construction-related aspects of the CONTRACT DOCUMENTS.
51. Products - Is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the project or taken from the CONTRACTOR'S stock of previously purchased products.
52. Materials - Products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of WORK.
53. Equipment - Products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.).
- B. Definitions in this paragraph are not intended to negate the meaning of other terms used in the CONTRACT DOCUMENTS, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms which are self-explanatory and have recognized meanings in the construction industry.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION MEETING

- A. Prior to the commencement of WORK at the site, a preconstruction meeting will be held at a mutually agreed time and place. The preconstruction meeting may be attended by:
 - 1. Responsible officer of the CONTRACTOR and superintendent assigned to the PROJECT.
 - 2. Principal SUBCONTRACTORS for the CONTRACTOR.
 - 3. Representatives of principal supplier(s) and MANUFACTURERS as appropriate.
 - 4. Representatives of the ENGINEER, CQA CONSULTANT, and/or the CQAR.
 - 5. Representatives of the OWNER.
 - 6. Governmental representatives as appropriate.
 - 7. Others as requested by CONTRACTOR, OWNER, or ENGINEER.
- B. The purpose of the preconstruction meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include at a minimum:
 - 1. Introduction of all personnel and review the responsibilities of each party.
 - 2. Establish PROJECT communication and delineate lines of authority and communication.
 - 3. Review the CONTRACTOR'S schedule for construction, including material shipment and working hours.
 - 4. Critical WORK sequencing.
 - 5. Discuss liquidated damages, (if any).
 - 6. Review methods for documenting and reporting, and for transmittal, distribution, review, and approval of CONTRACTOR'S submittals.
 - 7. Processing Applications for Payment.
 - 8. Field decisions and Change Orders.

- 9. Maintaining Record Documents.
- 10. Use of premises, stockpile areas, laydown areas, material storage areas, access roads, haul roads, security, housekeeping and related items, and OWNER'S needs.
- 11. Major equipment deliveries and priorities.
- 12. Establish locations for soil and geosynthetic materials stockpile.
- 13. CONTRACTOR'S assignments for health and safety.
- C. Minutes from the preconstruction meeting shall be prepared by the ENGINEER and distributed to all parties in attendance, in addition to an established distribution list, for PROJECT communications.

1.2 PROGRESS MEETINGS

- A. The ENGINEER shall schedule and conduct progress meetings on alternating weeks and at other times as required by progress of the WORK. The CONTRACTOR and all SUBCONTRACTORS active on the site shall be represented at each meeting. The CONTRACTOR may, at his discretion, request attendance by representatives of his SUPPLIERS, MANUFACTURERS, and other SUBCONTRACTORS.
- B. The purpose of the progress meetings will be to review the progress of the WORK, maintain coordination of efforts, discuss changes in scheduling, and resolve problems which may develop. Corrections, additions, or deletions to the minutes shall be noted and addressed at the following meeting.
- C. The CONTRACTOR shall submit a 2 weeks look-ahead schedule showing all activities in progress, uncompleted, or scheduled to be worked during the 2 weeks. The 2 weeks include the current week plus the following 2 weeks. The 2 weeks schedule shall list all activities from the approved baseline schedule for WORK during the period, which are currently planned to be worked even if out of sequence, and WORK which is unfinished but scheduled to be finished.
- D. Review of construction issues or questions, material test results, test failures, retests, procedures, weather conditions, working hours, holidays, communications, minutes from previous meetings, schedules, pay applications, problems and resolutions, documentation, and other PROJECT related topics.
- E. Minutes from the progress meetings shall be prepared by the CQA CONSULTANT and distributed to all parties in attendance, in addition to an established distribution list, for PROJECT communications.

1.3 CONSTRUCTION RESOLUTION MEETINGS

- A. In some cases, construction issues or problems may arise that demand specific attention outside of the regular progress meetings and may include parties not available at regular progress meetings. Such meetings shall be held as necessary to resolve construction problems or issues in a timely manner so that WORK can proceed. To the extent possible, these meetings shall be scheduled such that the key parties are available.

- B. Minutes from the construction resolution meetings shall be prepared by the ENGINEER and distributed to all parties in attendance, in addition to an established distribution list, for PROJECT communications.

1.4 GEOMEMBRANE PRE-INSTALLATION MEETING

A geomembrane pre-installation meeting shall be held at a mutually agreed upon day and time and attended by representatives of the OWNER, ENGINEER, CQAR, CONTRACTOR, and other parties that may be involved in geomembrane installation activities. The agenda will include at a minimum:

- A “Certificate of Subbase (Intermediate Cover) Acceptance” shall be co-signed by the CONTRACTOR and the CQAR prior to commencement of geomembrane installation in the area under consideration.
- As-built documents reviewed and approved by the ENGINEER prior to installation.
- All geosynthetic materials approved for use by the ENGINEER.
- Geomembrane seam properties.
- Destructive testing requirements.
- Non-destructive testing requirements.
 - 1. Vacuum testing.
 - 2. Air pressure testing.
- Equipment acceptable for use on geosynthetics.
- Trial seams.
- Adequate ballast to prevent wind uplift.
- Geonet overlap, shingling, and tying requirements.
- Panel layout orientation.
- Requirements prior to placing overlying materials.

Minutes from the geomembrane pre-installation meeting shall be prepared by the ENGINEER and distributed to all parties in attendance, in addition to an established distribution list, for PROJECT communications.

1.5 CONTRACTOR PROGRESS REPORTS

- A. A progress report shall be furnished by the CONTRACTOR to the ENGINEER with each Application for Payment. If the WORK falls behind schedule, the CONTRACTOR shall submit additional progress reports at such intervals as the ENGINEER may request.

- B. Each progress report shall include sufficient narrative to describe any current and anticipated delaying factors, their effect on the construction schedule, and proposed corrective actions. Any WORK reported complete, but which is not readily apparent to the ENGINEER must be substantiated with satisfactory evidence.
- C. Each progress report shall include a list of the activities completed with their actual start and completion dates, a list of the activities currently in progress, and the number of working days required to complete each activity.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01300

CONTRACTOR SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL

- A. Whenever CONTRACTOR SUBMITTALS are required hereunder, all such SUBMITTALS shall be provided to the ENGINEER or as designated by the ENGINEER.
- B. The CONTRACTOR shall submit to the ENGINEER for review and exception working drawings, Shop Drawings, test reports, data on materials and equipment, material samples, certificates, and affidavits as required for the proper control of WORK, including but not limited to those working drawings, Shop Drawings, data and samples for materials and equipment specified elsewhere in the TECHNICAL SPECIFICATIONS and in the CONTRACT DRAWINGS.
- C. Within 15 calendar days after the effective date of the AGREEMENT, the CONTRACTOR shall submit to the ENGINEER a complete materials list of preliminary data on items for which Shop Drawings are to be submitted. Included in this materials list shall be the names of all proposed MANUFACTURERS furnishing specified items. Review of this list by the ENGINEER shall in no way expressed or implied relieve the CONTRACTOR from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the TECHNICAL SPECIFICATIONS.
- D. Within 10 calendar days after CONTRACTOR award, and prior to the preconstruction meeting, the CONTRACTOR shall submit the following items to the ENGINEER for review and approval:
 - 1. A preliminary schedule of SUBMITTALS and target dates for the following, at a minimum:
 - a. Excavation Plan.
 - b. Construction Quality Control (CQC) Plan.
 - c. Qualifications of the geotechnical CONSTRUCTION QUALITY CONTROL CONSULTANT (CQC CONSULTANT) and CQC LABORATORY.
 - d. Borrow source materials preconstruction materials evaluation.
 - e. Material source Certificates of Compliance for each of the proposed materials.
 - f. Protective Cover Layer Installation Plan.
 - g. Subbase Survey.
 - h. Protective Cover Layer Survey.

- i. Final Survey.
 - j. Redline of the CONTRACT DRAWINGS depicting any and all field deviations.
- 2. PROJECT schedule.
- 3. Health and Safety Plan.
- 4. Temporary Erosion and Sedimentation Control Plan.
- 5. Schedule for conducting preconstruction survey.
- 6. A list of all permits and licenses the CONTRACTOR shall obtain indicating the agency required to grant the permit and the expected date of SUBMITTAL for the permit and required date for receipt of the permit.
- 7. Written confirmation the TECHNICAL SPECIFICATIONS have been received and WORK shall be performed in compliance with the TECHNICAL SPECIFICATIONS.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

3.1 CONTRACTOR SUBMITTALS

- A. When used in the CONTRACT DOCUMENTS, the term "SUBMITTAL" shall be understood to include Shop Drawings, calculations, fabrication and installation drawings, lists, graphs, operating instructions, administrative documents and similar items on how the CONTRACTOR communicates what it intends to construct or what it or its subcontractors have designed.
- B. When used in the CONTRACT DOCUMENTS, the term "Shop Drawing" shall be considered to mean the CONTRACTOR'S plans for materials and equipment which become an integral part of the PROJECT. Shop Drawings are drawings, diagrams, schedules, and other data specially prepared by the CONTRACTOR, distributor, supplier, MANUFACTURER, etc. to show some part of the WORK. Cuts, catalogs, pamphlets, descriptive literature, and performance and test data, shall be considered only as supportive to required Shop Drawings.
- C. Wherever called for in the CONTRACT DOCUMENTS, or where required by the ENGINEER, the CONTRACTOR shall furnish to the ENGINEER for review electronic SUBMITTALS (PDF format unless otherwise requested, (AutoCAD r18 or later version, Excel, etc.).
- D. Any SUBMITTAL which is not complete or does not provide the level of detail outlined in the TECHNICAL SPECIFICATIONS shall not be considered acceptable for review and may be returned for resubmittal. Unless otherwise required, said SUBMITTALS shall be provided to the ENGINEER 15 calendar days minimum prior to planned WORK activity to allow review of same by the ENGINEER, and to accommodate the rate of construction

progress required under the AGREEMENT. Should any SUBMITTAL be a part of any schedule milestone and is considered to be unacceptable by the OWNER, the appropriate milestone shall be considered as not having been met until a complete and properly detailed SUBMITTAL is received.

- E. Attach to the front of each SUBMITTAL a Transmittal Form, or other form mutually agreed upon at the preconstruction meeting, stating the pertinent product information submitted and reference the appropriate TECHNICAL SPECIFICATIONS Section and paragraph. Apply stamp, signed or initialed, certifying that all quantities, dimensions, field construction criteria, materials, catalog numbers, and specified performance criteria have been reviewed in accordance with the requirements of the WORK and the CONTRACT DOCUMENTS. SUBMITTALS shall indicate any deviations from requirements of the CONTRACT DOCUMENTS. If the CONTRACTOR takes exception to the TECHNICAL SPECIFICATIONS, the CONTRACTOR shall note the exception in the letter of transmittal to the ENGINEER.
 - 1. If this information is not provided with each SUBMITTAL, the SUBMITTAL shall be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR. Ultimate responsibility for the accuracy and completeness of the information contained in the SUBMITTAL shall remain with the CONTRACTOR.
- F. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a SUBMITTAL is required. Transmittal of a SUBMITTAL of various items using a single transmittal form will be permitted only when the items taken together constitute a MANUFACTURER'S "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page SUBMITTAL shall be collated into sets and each set shall be stapled or bound, as appropriate, prior to transmittal to the ENGINEER. SUBMITTALS shall be a complete package for each system.
- G. All CONTRACTOR SUBMITTALS shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submission to the ENGINEER. Each SUBMITTAL shall be dated, signed, and certified by the CONTRACTOR as being correct. No consideration for review by the ENGINEER of any CONTRACTOR SUBMITTALS will be made for any items which have not been so certified by the CONTRACTOR. All non-certified SUBMITTALS will be returned to the CONTRACTOR without action taken by the ENGINEER and any delays caused thereby shall be the total responsibility of the CONTRACTOR.
- H. Submit pages from MANUFACTURER'S catalog sheets, brochures, diagrams, illustrations and other standard descriptive data which are pertinent; clearly mark each copy of standard printed data to identify pertinent materials, product or models, and reference it to the TECHNICAL SPECIFICATIONS Section and paragraph number.
- I. Modify MANUFACTURER'S standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the WORK. Delete information not applicable.

- J. The CONTRACTOR shall submit a Submittal Log which lists each required SUBMITTAL and which has columns for the actual submitted date as well as the date that the review was completed.

3.2 TRANSMITTAL OF SUBMITTALS

- A. Transmit all submittals to:

Kollan Spradlin
SCS Engineers
KSpradlin@SCSEngineers.com

3.3 ENGINEER'S REVIEW OF SUBMITTALS

- A. Except as may otherwise be provided herein, the ENGINEER will return electronic responses of each SUBMITTAL to the CONTRACTOR, with comments noted therein, within a reasonable number of calendar days following receipt. It is considered reasonable the CONTRACTOR shall make a complete and acceptable SUBMITTAL to the ENGINEER. Each SUBMITTAL will be reviewed and stamped according to the following by the ENGINEER:
1. **NO EXCEPTIONS TAKEN** - If a SUBMITTAL is returned to the CONTRACTOR marked in this manner a formal revision and resubmission of said SUBMITTAL will not be required.
 2. **MAKE CORRECTIONS NOTED** - If a SUBMITTAL is returned to the CONTRACTOR marked in this manner a formal revision and resubmission of said SUBMITTAL will not be required. However, the CONTRACTOR shall address the comments/corrections in the final WORK. Revisions indicated on SUBMITTALS shall be considered as changes necessary to meet the requirements of the CONTRACT DOCUMENTS and shall not be taken as the basis of claims for extra WORK.
 3. **AMEND - RESUBMIT** - If a SUBMITTAL is returned to the CONTRACTOR marked in this manner the CONTRACTOR shall revise said SUBMITTAL per ENGINEER'S comments and shall resubmit said revised SUBMITTAL to the ENGINEER. Any delays caused thereby for tardy resubmittals (longer than 5 calendar days) shall be the total responsibility of the CONTRACTOR.
 4. **REJECTED - RESUBMIT** - If a SUBMITTAL is returned to the CONTRACTOR marked in this manner the CONTRACTOR shall revise said SUBMITTAL and resubmit said revised SUBMITTAL to the ENGINEER. Any delays caused thereby for tardy resubmittals (longer than 5 calendar days) shall be the total responsibility of the CONTRACTOR.
 5. **NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED** - Fabrication of an item shall not commence before the ENGINEER has reviewed the pertinent SUBMITTALS and returned to the CONTRACTOR marked in this manner. Revisions indicated on SUBMITTALS shall be considered as changes necessary to meet the requirements of the CONTRACT DOCUMENTS and shall not be taken as the basis of claims for extra WORK.

- B. Resubmittals will be handled in the same manner as first SUBMITTALS. On resubmittals the CONTRACTOR shall direct specific attention, in writing or on SUBMITTALS, to revisions other than the corrections requested by the ENGINEER on previous submissions. The CONTRACTOR shall make any corrections required by the ENGINEER.
- C. The ENGINEER'S review of the SUBMITTALS shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in the SUBMITTALS. Any fabrication or other WORK performed in advance of the receipt of approved SUBMITTALS shall be entirely at the CONTRACTOR'S risk and expense. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.
- D. The OWNER shall deduct from the CONTRACTOR'S compensation all costs and expenses of the ENGINEER which the OWNER incurs as a result of:
 - 1. Additional reviews or multiple reviews of SUBMITTALS. The OWNER reserves the right to withhold monies due the CONTRACTOR to cover additional cost of the ENGINEER'S review when multiple SUBMITTAL are required due to the CONTRACTOR'S failure to comply with the TECHNICAL SPECIFICATIONS. It shall be considered reasonable that if any single submittal is rejected due to not complying with the TECHNICAL SPECIFICATIONS in excess of 2 times ("multiple"), the additional reviews shall be at the CONTRACTOR'S expense and will be deducted from the monies due the CONTRACTOR.
- E. Unless otherwise authorized in writing by the ENGINEER, the substantiation of offers of substitutes or "of equal" items must be submitted within 30 calendar days after execution of the AGREEMENT. The CONTRACTOR, at the CONTRACTOR'S sole expense, shall furnish data concerning items offered as equivalent to those specified in the CONTRACT DOCUMENTS. The CONTRACTOR shall have the materials as required by the ENGINEER to determine that the quality, strength, physical, chemical, or other characteristics, including durability, finish, efficiency, dimensions, service, and suitability are such that the items will fulfill the intended function. Installation and use of a substitute item shall not be made until approved by the ENGINEER. If a substitute offered by the CONTRACTOR is found to be not equal to the specified material by the ENGINEER, the CONTRACTOR shall furnish and install the material specified in the CONTRACT DOCUMENTS.
- F. The CONTRACTOR'S attention is further directed to the requirement that failure to submit data substantiating a request for a substitution or "of equal" item within the said 30 calendar days period after execution of the AGREEMENT shall be deemed to mean the CONTRACTOR intends to furnish and install one of the specific products named in the CONTRACT DOCUMENTS, and the CONTRACTOR does hereby waive all rights to offer or use substitute products in each such case. Wherever a proposed substitute product has not been submitted within said 30 calendar days period, or wherever the SUBMITTAL of a proposed substitute product fails to meet the requirements of the CONTRACT DOCUMENTS and an acceptable resubmittal is not received by the ENGINEER within said 30 calendar days period, the CONTRACTOR shall furnish and install one of the specific products named in the CONTRACT DOCUMENTS.

3.4 PROGRESS REPORTS

- A. A progress report shall be furnished to the ENGINEER with each Application for Payment. If the WORK falls behind schedule, the CONTRACTOR shall submit additional progress reports at such intervals as the ENGINEER may request.
- B. Each progress report shall include sufficient narrative to describe any current and anticipated delaying factors, their effect on the construction schedule, and proposed corrective actions. Any WORK reported complete, but which is not readily apparent to ENGINEER, must be substantiated with satisfactory evidence.
- C. Each progress report shall include a list of the activities completed with their actual start and completion dates, a list of the activities currently in progress, and the number of working days required to complete each.
- D. Construction Photographs - The CONTRACTOR shall provide a photographic record of construction progress every 2 weeks to the OWNER in electronic format (PDF, Jpeg, etc.). The ENGINEER and CQAR shall reserve the right to select the views to be photographed. The photographs shall be of good quality as determined by the ENGINEER and CQAR, and camera date stamped. Polaroid or similar instant type photographs will not be acceptable.
- E. Construction Photographs shall be taken Weekly or during execution of individual WORK items, whichever is more frequent, beginning prior to the start of construction (preconstruction conditions) and continuing through the completion of WORK. Photographs shall be taken to document each major WORK item.

3.5 DAILY REPORT

- A. The CONTRACTOR shall submit to the ENGINEER daily reports on a Weekly basis. The reports shall be delivered no later than 10:00 a.m. of the first workday following the weekend. The daily reports shall include the following:
 - 1. Day of week, date, CONTRACTOR name, and report number.
 - 2. Summary of WORK in process (segregated by CONTRACTOR and subcontractor).
 - 3. Details for WORK accomplished including quantities of WORK installed.
 - 4. Summary of equipment working and where working.
 - 5. Summary of manpower by WORK element and subcontractor.
 - 6. Receipt of major equipment or materials.
 - 7. QC inspection report in accordance with Section 01400 Quality Control.

3.6 SAMPLES

- A. Unless otherwise specified, wherever in the TECHNICAL SPECIFICATIONS samples are

required, the CONTRACTOR shall submit no less than 2 samples of each item or material to the ENGINEER for approval at no additional cost to the OWNER.

- B. Samples, as required herein, shall be submitted for approval a minimum of 15 calendar days prior to ordering such material for delivery to the jobsite and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the WORK.
- C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and MANUFACTURER'S name for identification.
- D. Unless otherwise specified, all colors and textures of specified items will be selected by the OWNER from the MANUFACTURER'S standard colors and standard product lines.

3.7 PROJECT SCHEDULE

- A. The schedule shall be comprehensive, covering both activities at the site of the WORK and offsite activities such as design, procurement, and fabrication. The schedule shall be orderly and realistic and shall be revised as necessary to meet this requirement. The CONTRACTOR shall promptly advise the ENGINEER of any occurrence that may impact the schedule. No revision to the schedule can be made without the review and acceptance by the ENGINEER.
- B. The schedule and each revision thereof shall be subject to approval by the OWNER and ENGINEER for conformity with the requirements of the CONTRACT DOCUMENTS. Schedules which are not accepted and which are returned to the CONTRACTOR shall be revised to correct the defects noted and shall be resubmitted to the ENGINEER within 5 calendar days after receipt.
- C. The PROJECT Schedule shall meet the requirements of Section 01311 Construction Schedule.

3.8 SITE SURVEYS AND DATA

- A. All field books, notes, and other data developed by the CONTRACTOR in performing the surveys required for the WORK shall be available to the ENGINEER for examination throughout the construction period. All such data shall be submitted to the ENGINEER with documentation required for final acceptance of the WORK.
- B. The CONTRACTOR shall submit the site conditions survey data as required in the Section 01050 Site Conditions Surveys.

3.9 UTILITY INVESTIGATION

- A. The CONTRACTOR shall submit the findings of the utility investigation, as specified in Section 01530 Protection of Existing Facilities.

3.10 QUALITY CONTROL

- A. The CONTRACTOR shall prepare and submit a QC Plan for the WORK contained in the AGREEMENT prior to beginning the WORK. This QC Plan will indicate the actions, documentation, and responsible party or parties that will assure compliance with the TECHNICAL SPECIFICATIONS and CONTRACT DOCUMENTS, and that quality requirements for inspections and testing are implemented. The QC Plan will contain a checklist of quality related activities applicable to various construction activities for scheduling and implementation purposes.
- B. The CONTRACTOR shall submit for approval a testing log which lists all of the required quality control tests and which has columns for when the test is performed and if the test result is satisfactory. The CONTRACTOR will submit updated testing logs with each application for payment.
- C. The CONTRACTOR'S QC responsibilities shall be in accordance with Section 01400 Quality Control.

3.11 TEMPORARY EROSION AND SEDIMENTATION CONTROL PLAN

- A. The CONTRACTOR shall prepare and submit to the ENGINEER a plan for the prevention, control, and abatement of erosion and water pollution.
- B. The Temporary Erosion and Sedimentation Control Plan shall be prepared in accordance with the CONTRACTOR'S proposed sequence of operations and shall describe but not be limited to the following items or activities:
 - 1. For each phase of construction operations or activities the CONTRACTOR shall supply the following information:
 - a. Locations of all erosion control devices.
 - b. Types of all erosion control devices.
 - c. Estimated length of time erosion control devices will be in operation.
 - d. Monitoring schedules for maintenance of erosion control devices.
 - e. Methods of maintaining erosion control devices.
 - f. Methods of containment or removal of pollutants or hazardous wastes.
 - 2. The CONTRACTOR shall furnish the ENGINEER the name and telephone number of the person who will be responsible for monitoring and maintaining the erosion control devices.
 - 3. No construction activities shall commence until the Erosion and Pollution Control Plan has been reviewed and written approval received from the ENGINEER.
 - 4. The CONTRACTOR shall be responsible for compliance with the approved Erosion and Pollution Control Plan.
 - 5. Temporary drainage measures shall be addressed.

3.12 EXCAVATION PLAN

- A. The Excavation Plan shall indicate the general plan for performing excavation, grading, surveying and safety controls, control of stormwater runoff and run-on from the active landfill area, etc.
- B. The Excavation Plan is for the ENGINEER'S information only. Submission and acceptance by the ENGINEER of this information shall not relieve the CONTRACTOR from constructing the WORK in a continuous safe manner at all times and in accordance with the CONTRACT DOCUMENTS.
- C. The Excavation Plan shall meet the requirements of Section 02220 Excavation, Backfill, Fill, and Grading.

3.13 RECORD DRAWINGS

- A. The CONTRACTOR shall keep and maintain at the job site one set of Record Drawings. On these, the CONTRACTOR shall mark all PROJECT conditions, locations, configurations, and any other changes or deviations (Redlines) which may vary from the details represented on the original CONTRACT DRAWINGS, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated or which were not indicated on the CONTRACT DRAWINGS. Record Drawings shall be supplemented by any detailed sketches or typewritten changes to the TECHNICAL SPECIFICATIONS, as necessary or directed to indicate fully the WORK as actually constructed. These Record Drawings of the CONTRACTOR'S representation of as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date during the progress of the WORK.
- B. In the case of those drawings which depict the detail requirements for equipment to be assembled as wired in the factory, such as motor control centers and the like, the Record Drawings shall be updated by indicating those portions which are superseded by change order drawings or final Shop Drawings and by including appropriate reference information describing the change orders by number and the Shop Drawings by the MANUFACTURER, drawing, and revision number.
- C. Record Drawings shall be accessible to the ENGINEER at all times during the construction period and shall be delivered to the ENGINEER, upon completion of the WORK prior to final acceptance of PROJECT.
- D. Applications for Payment will not be approved if the Record Drawings are not kept current and not until the completed Record Drawings showing all variations between the WORK as actually constructed and as originally shown on the CONTRACT DRAWINGS or other CONTRACT DOCUMENTS have been inspected and accepted by the ENGINEER.
- E. The OWNER shall provide, at the preconstruction conference, a reproducible set of CONTRACT DRAWINGS. The record information shall be transferred from the CONTRACTOR'S redline drawings to the reproducible drawings.

- F. Upon substantial completion of WORK and prior to final acceptance, the CONTRACTOR shall complete and deliver 5 complete sets of Record Drawings to the ENGINEER for transmittal to the OWNER, conforming to the construction records of the CONTRACTOR. This set of Record Drawings shall consist of corrected CONTRACT DRAWINGS showing the reported location of the WORK. The information submitted by the CONTRACTOR and incorporated into the final PROJECT Record Drawings will be assumed to be reliable, and the ENGINEER will not be responsible for the accuracy of such information, nor for any errors or omissions which may appear on the final PROJECT Record Drawings as a result. All survey Record Drawings shall be signed and sealed by a SURVEYOR submitted in accordance with the requirements of Section 01050 Site Conditions Surveys.
- G. Requests for partial payments will not be approved if the Redline Drawings are not kept current and not until the completed Redline Drawings showing all variations between the WORK as actually constructed and as originally shown on the CONTRACT DRAWINGS or other CONTRACT DOCUMENTS have been inspected by the ENGINEER or OWNER.
- H. Final payment will not be approved until the CONTRACTOR prepared Record Drawings have been approved by the ENGINEER. Record Drawings will be provided in the form of a set of prints with carefully plotted information overlaid in red pencil and in electronic format compatible with AutoCAD r18 or later version.
- I. Record Drawings shall conform to the following minimum requirements:
 - 1. All as-built conditions must be noted as follows:
 - a. Horizontal and vertical locations of other public and private utilities when they are encountered during construction. Locate by station/offset.
 - 2. All changes and significant deviations from the CONTRACT DRAWINGS must be included as described below.
 - a. A significant deviation is defined as follows or as required by the ENGINEER:
 - 1) Horizontal greater than 4 inches and vertical greater than 2 inches for general fill/structural fill and grading; horizontal greater than 4 inches and vertical greater than 1 inch for piping.
 - 2) Changes in channel flow line location.
 - 3) Pipe invert elevations.
 - 3. All deviations must be highlighted on the Record Drawings using a "cloud." If any revisions to the CONTRACT DRAWINGS required a Change Order, the "cloud" shall include the Change Order number.

END OF SECTION

SECTION 01311

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. Construction shall be coordinated to assure the WORK is completed within the CONTRACT times as provided in the CONTRACT DOCUMENTS. The CONTRACTOR shall coordinate his activities with any SUBCONTRACTORS to allow the orderly and timely completion of all the WORK.
- B. All construction schedules shall be of the critical path method (CPM), bar chart type, and shall be prepared using SURETRACK, PRIMAVERA P3, Microsoft Project, or equal.
- C. Construction schedules shall show all relationships and critical paths. Backup data shall be provided as requested by the ENGINEER. This data shall include, as a minimum, relationships and float.
- D. The construction schedule shall be comprehensive, covering both activities at the site of the WORK and offsite activities such as design, procurement, and fabrication. The CONTRACTOR shall promptly advise the ENGINEER and OWNER of any occurrence that may impact the construction schedule.
- E. No revision to the approved baseline construction schedule shall be made without the review and acceptance by the ENGINEER and OWNER.

1.2 QUALIFICATIONS

- A. The CONTRACTOR shall submit evidence of CPM capability for ENGINEER'S acceptance. If not acceptable the CONTRACTOR will employ a CPM consultant who is so qualified.
- B. In-house capability shall be verified by description of construction projects to which CONTRACTOR or CONTRACTOR'S consultant has successfully applied computerized CPM and shall include at least 2 projects valued at least half the expected value of this PROJECT, and at least 1 project which was controlled throughout its duration by means of computerized, periodic, systematic review of the CPM schedule.

1.3 SUBMITTAL PROCEDURES

- A. SUBMITTAL Requirements
 - 1. Time phased logic network, computer generated.
 - 2. Computerized network analysis.
 - a. Activity sort by early start, organized by related elements.

- b. Activity sort by float, organized by related elements.
 - c. Activity sort by predecessor/successor.
- 3. Narrative description of the logic and reasoning of the schedule.
- 4. Resource allocation by activity.
- B. Time of SUBMITTALS - Within 14 calendar days after Notice to Proceed, the CONTRACTOR shall submit a network diagram describing the activities to be accomplished in the PROJECT and their dependency relationships, (predecessor/successor) as well as a tabulated schedule as herein defined. The schedule produced and submitted shall indicate milestone and completion dates identical to the milestone and completion dates specified elsewhere herein. The ENGINEER shall review the proposed plan and schedule within 7 calendar days and state his acceptance or rejection of the schedule.
 - 1. Within 10 calendar days after the conclusion of ENGINEER'S review, CONTRACTOR shall revise the network diagram as required and resubmit the network diagram and a tabulated schedule produced therefrom. The revised network diagram and tabulated schedule shall be reviewed and accepted or rejected by ENGINEER within 14 calendar days after receipt. The network diagram and tabulated schedule when accepted by ENGINEER shall constitute the WORK schedule unless a revised schedule is required due to substantial changes in the WORK or a change in contract time, delinquency by CONTRACTOR requiring a recovery schedule, or as otherwise provided for herein below. Activities not occurring as scheduled are delinquent if they begin after early start or they finish after early finish.
- C. Acceptance - The finalized schedule will be acceptable to the ENGINEER when it provides an orderly progression of the WORK to completion in accordance with the CONTRACT requirements, adequately defines the CONTRACTOR'S work plan, provides a workable arrangement for processing the SUBMITTALS in accordance with the requirements, and properly allocates resources (manpower, equipment and costs) to each activity (free of unbalances in resources). When the network diagram and tabulated schedule have been accepted, the CONTRACTOR shall submit to the ENGINEER 5 copies of the time-scaled network diagram (page size adjusted for text to be legible), 5 copies of a computerized, tabulated schedule in which the activities have been sequenced by activity numbers, 5 copies of a computerized, tabulated schedule in which activities have been sequenced by early starting date, and 5 copies of a computerized tabulated schedule in which activities have been sequenced by total float.
- D. The OWNER'S review and acceptance of the CONTRACTOR'S PROJECT schedule is for conformance to the requirements of the CONTRACT DOCUMENTS only. Review and acceptance by the OWNER of the CONTRACTOR'S PROJECT schedule does not relieve the CONTRACTOR of any of its responsibility whatsoever for the accuracy or feasibility of the PROJECT schedule, or of the CONTRACTOR'S ability to meet the interim milestone date(s) and the contract completion date, nor does such review and acceptance expressly or implied warrant, acknowledge or admit the reasonableness of the logic, durations, manpower or equipment loading of the CONTRACTOR'S PROJECT schedule.

- E. Revised WORK Schedules - The CONTRACTOR, if requested by the ENGINEER, shall provide a revised WORK schedule if, at any time, the ENGINEER considers the completion date to be in jeopardy because of "activities behind schedule." Activities behind schedule are all activities behind the accepted work plan regardless of the existence of positive float on the activity. The revised WORK schedule shall include a new diagram and tabulated schedule conforming to the requirements of this Section designed to show how the CONTRACTOR intends to accomplish the WORK to meet the completion date or milestones. The form and method employed by the CONTRACTOR shall be the same as for the original WORK schedule.
- F. Schedule Revisions - The ENGINEER may require the CONTRACTOR to modify any portions of the WORK schedule that become unfeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original or latest completion date shall be deemed to be behind schedule. No change may be made to the sequence, duration or relationships of any activity without the express written acceptance of the ENGINEER.

1.4 CHANGE ORDERS

- A. Upon approval of a change order, the approved change shall be reflected in the next schedule submittal by the CONTRACTOR.

1.5 CPM STANDARDS

- A. Definition - CPM, as required by this Section, shall comply with the standards outlined in the Associated General Contractors' publication, "The Use of CPM in Construction" unless specifically changed by this Section.
- B. WORK Schedules - WORK schedules shall include a graphic network and computerized, tabulated schedules as described below. To be acceptable the schedule must demonstrate the following:
 - 1. A logical succession of WORK from start to finish. This logical succession when accepted is the CONTRACTOR'S work plan and is only designed as early start to accommodate standard computerized systems.
 - 2. Definition of each activity.
 - 3. A logical flow of work crews/equipment (crews are to be defined by manpower category and man hours; equipment by type and hours).
 - 4. Show all WORK activities and interfaces including all submittals and major material, and equipment deliveries.
- C. Networks
 - 1. The CPM network, or diagram, shall be in the form of a time-scaled diagram of the customary activity-on-type and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Individual pages shall not exceed 24 inch by 36 inch. Notation on each activity line shall include a brief WORK description, and duration estimate, and cost of activity.

2. All construction activities and procurement including shop drawing review shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow shall be plotted so the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical activities, and float for each non-critical activity. All non-critical path activities shall show estimated performance time and float time in scaled form.
- D. Duration - The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the WORK and resources planned for the activity including time for inclement weather.
- E. Tabulated Schedules - The initial schedule shall include the following minimum data for each activity.
1. Activity numbers.
 2. Estimated duration.
 3. Activity description.
 4. Early start date (calendar dated).
 5. Early finish date (calendar dated).
 6. Status (whether critical).
 7. Float.
 8. Cost of activity.
 9. Other resources including equipment hours by type, manpower by craft or crew, and materials by units.
- F. PROJECT Information: Each tabulation shall be prefaced with the following summary data.
1. PROJECT name.
 2. CONTRACTOR.
 3. Type of tabulation (initial or updated).
 4. PROJECT duration.
 5. PROJECT schedule completion date.
 6. Projected completion date.
 7. Variance analysis per activity.

1.6 PROGRESS MEETINGS

A. Refer to Section 01200 Project Meetings.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.1 SITE INVESTIGATION AND CONTROL

- A. The CONTRACTOR shall verify all dimensions in the field and check field conditions continuously during construction. The CONTRACTOR shall be solely responsible for any inaccuracies built into the WORK due to the CONTRACTOR'S failure to comply with this requirement.
- B. The CONTRACTOR shall inspect related and appurtenant WORK and report in writing to the OWNER and ENGINEER any conditions which will prevent proper completion of the WORK. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the CONTRACTOR at CONTRACTOR'S sole cost and expense.

1.2 INSPECTION OF THE WORK

- A. All WORK performed by the CONTRACTOR shall be inspected by the CONTRACTOR and OWNER and nonconforming WORK shall be noted and promptly corrected. The CONTRACTOR is responsible for the WORK conforming to the CONTRACT DOCUMENTS.
- B. The WORK shall be conducted under the general observation of the ENGINEER and is subject to inspection by representatives of the OWNER acting on behalf of the OWNER to ensure compliance with the requirements of the CONTRACT DOCUMENTS. Such inspection may include mill, plant, shop, or field inspection, as required. The ENGINEER or any inspector(s) shall be permitted access to all parts of the WORK, including plants where materials or equipment are manufactured or fabricated.
- C. The presence of the ENGINEER or CQAR, however, shall not relieve the CONTRACTOR of the responsibility for the proper execution of the WORK in accordance with all requirements of the CONTRACT DOCUMENTS. Compliance is a duty of the CONTRACTOR and said duty shall not be avoided by any act or omission on the part of the ENGINEER or CQAR. Observation of WORK later determined to be nonconforming shall not be cause or excuse for acceptance of the nonconforming WORK. The acceptance of nonconforming WORK shall be approved by the OWNER when adequate compensation is offered and it is in the OWNER'S best interest.
- D. All materials and articles furnished by the CONTRACTOR shall be subject to inspection, and no materials or articles shall be used in the WORK until they have been inspected and accepted by the ENGINEER or other designated representative. No WORK shall be backfilled, buried, cast in concrete, hidden, or otherwise covered until it has been observed. Any WORK so covered in the absence of observation shall be subject to uncovering at the CONTRACTOR'S expense. Where unobserved WORK cannot be uncovered, such as in concrete cast over reinforcing steel, all such WORK shall be

subject to demolition, removal, and reconstruction under proper observation and no additional payment will be allowed to the CONTRACTOR.

1.3 TIME OF INSPECTION AND TESTS

- A. Any samples and test specimens required under these TECHNICAL SPECIFICATIONS shall be furnished and prepared for testing in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. The CONTRACTOR shall furnish and prepare all required test specimens at CONTRACTOR'S own expense. Whenever the CONTRACTOR is ready to backfill, bury, cast in concrete, hide, or otherwise cover any WORK under this CONTRACT, the ENGINEER shall be notified not less than 24 hours in advance to request observation before beginning any such WORK of covering. Failure of the CONTRACTOR to notify the ENGINEER at least 24 hours in advance of any such inspections shall be reasonable cause for the ENGINEER to order a sufficient delay in the CONTRACTOR'S schedule to allow time for such inspection, any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the WORK, shall be borne by the CONTRACTOR.

1.4 SAMPLING AND TESTING

- A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the OWNER reserves the right to use any generally-accepted system of inspection which, in the opinion of the ENGINEER, will ensure the OWNER that the quality of the workmanship is in full accord with the CONTRACT DOCUMENTS.
- B. Any waiver of specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the CONTRACT DOCUMENTS.
- C. Notwithstanding the existence of such waiver, the ENGINEER shall reserve the right to make independent investigations and tests as specified in the following paragraph and, upon failure of any portion of the WORK to meet any of the qualitative requirements of the CONTRACT DOCUMENTS, shall be reasonable cause for the ENGINEER to require the removal or correction and reconstruction of any such WORK.
- D. In addition to any other inspection or quality assurance provisions that may be specified, the ENGINEER shall have the right to independently select, test, and analyze, at the expense of the OWNER, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the CONTRACTOR to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the WORK is discovered, as a result of such independent testing or investigation by the ENGINEER, which fails to meet the requirements of the CONTRACT DOCUMENTS, all costs of such independent inspection and investigation and all costs of removal,

correction, reconstruction, or repair of any such WORK shall be borne by the CONTRACTOR.

1.5 RIGHT OF REJECTION

- A. The ENGINEER or designated representative, acting for the OWNER, shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the CONTRACT DOCUMENTS, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the WORK at the site. If the ENGINEER or designated representative, through an oversight or otherwise, has accepted materials or WORK which is defective or which is contrary to the CONTRACT DOCUMENTS, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected.
- B. The CONTRACTOR shall promptly remove or replace rejected articles or materials from the site of the WORK after notification of rejection.
- C. All costs of removal and replacement of rejected articles or materials, as specified herein, shall be borne by the CONTRACTOR.
- D. Failure to promptly remove and replace rejected WORK shall be considered a breach of the TECHNICAL SPECIFICATIONS and the OWNER may after 7 calendar days notice, terminate the CONTRACTOR'S right to proceed with the affected WORK and remove and replace the WORK and issue a backcharge to cover the cost of the WORK.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

3.1 QUALITY CONTROL PLAN

- A. The CONTRACTOR shall prepare and submit a Quality Control (QC) Plan to the ENGINEER for the WORK contained in the CONTRACT DOCUMENTS prior to beginning WORK. The QC Plan will indicate the actions, documentation, and responsible party or parties that will assure compliance with the TECHNICAL SPECIFICATIONS and CONTRACT DOCUMENTS and quality requirements for inspections and testing that must be implemented. The QC Plan will contain a checklist of QC related activities applicable to various construction activities for scheduling and implementation purposes.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. The CONTRACTOR shall provide temporary utilities, facilities and controls for protection of the WORK, existing facilities, and adjacent properties from damage from construction operations as described herein. The CONTRACTOR shall provide stormwater control within the limits of construction as shown on the CONTRACT DRAWINGS. The CONTRACTOR shall provide temporary petroleum storage containment as described herein and use a designated equipment maintenance area as approved by the OWNER and described herein.
- B. If the CONTRACTOR uses the designated area, indicated in the CONTRACT DRAWINGS, to stage the CONTRACTOR field office trailer, the CONTRACTOR will be responsible for coordinating with the utility provider to bring service to the trailer area from existing utilities. The CONTRACTOR is required to pay for all electrical connection services at no cost to the OWNER.

1.2 TEMPORARY ELECTRICITY

- A. The CONTRACTOR shall provide and pay for required power service from Utility source.
- B. The CONTRACTOR shall provide a temporary electric feeder from an existing electrical service. Power consumption shall not disrupt the OWNER'S need for continuous service.
- C. The CONTRACTOR shall provide power outlets for construction operations, with branch wiring and distribution boxes as required. The CONTRACTOR shall provide flexible power cords as required for his use.

1.3 TELEPHONE SERVICE

- A. The CONTRACTOR shall provide and maintain at all times during the progress of the WORK, at the CONTRACTOR'S own expense, not less than one phone number that can be reached by PROJECT personnel at any time.

1.4 TEMPORARY WATER SERVICE

- A. General - The CONTRACTOR may utilize existing, on-site sources of non-potable water, for construction purposes, following coordination with the OWNER.
- B. The CONTRACTOR shall be solely liable for any claims arising from the CONTRACTOR'S use of OWNER supplied non-potable water.
- C. Potable Water - Drinking water on the site during construction shall be furnished by the

CONTRACTOR and shall be potable water furnished in approved dispensers. Notices shall be posted conspicuously throughout the site warning the CONTRACTOR'S personnel of non-potable water sources.

- D. Water Connections - The CONTRACTOR shall not make connection to or draw water from any fire hydrant, stormwater pond, or pipeline without first obtaining permission of the authority having jurisdiction over the use of said system. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve and a meter, if required by the said authority, of a size and type acceptable to said authority and agency.
- E. Removal of Water Connections - Before final acceptance of the WORK on the PROJECT, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to their original condition or better and to the satisfaction of the ENGINEER and the agency owning the affected utility.
- F. Fire Protection - Portable fire extinguishers, hose connections, hoses, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires that occur in any portion of the WORK, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR'S fire protection program shall conform to the requirements of Subpart F of the OSHA Standards of Construction.

1.5 TEMPORARY SANITARY FACILITIES

- A. Toilet facilities - Portable chemical toilets shall be provided, and maintained, by the CONTRACTOR wherever needed for use of the CONTRACTOR employees. Existing facilities shall not be used. Toilets shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction.
- B. Sanitary and Other Organic Wastes (Municipal Solid Waste, MSW) - The CONTRACTOR shall establish a regular collection of all sanitary and organic wastes (MSW). This would be items the CONTRACTOR may generate during the construction period such as paper, plastic, food waste, beverage containers, etc. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR'S operations shall be disposed of away from the site in a manner satisfactory to the ENGINEER and in accordance with all laws and regulations pertaining thereto. Disposal of all such wastes shall be at the CONTRACTOR'S expense.

1.6 BARRIERS

- A. The CONTRACTOR shall provide barriers to prevent unauthorized entry to construction areas.
- B. The CONTRACTOR shall protect vehicular traffic, stored materials, site and structures from damage during construction.

1.7 STORMWATER CONTROL

- A. The CONTRACTOR shall grade site to drain. Excavations shall be maintained free of

water. The CONTRACTOR shall provide, operate, and maintain pumping equipment as necessary.

- B. The CONTRACTOR shall protect site from standing or flowing water. The CONTRACTOR shall provide water barriers as required to protect site from soil erosion, silt, and sediment.

1.8 PROTECTION OF INSTALLED WORK

- A. The CONTRACTOR shall protect installed WORK and provide special protection as specified in the CONTRACT DOCUMENTS.
- B. The CONTRACTOR shall provide temporary and removable protection for installed products. The CONTRACTOR shall control activity in the immediate WORK area to minimize damage to surrounding area.
- C. Traffic is prohibited in landscaped areas.

1.9 SECURITY

- A. The CONTRACTOR shall provide the security to protect WORK, existing facilities and operations from unauthorized entry, vandalism, and theft.
- B. The CONTRACTOR shall coordinate with the OWNER regarding existing security program.

1.10 ACCESS ROADS

- A. The CONTRACTOR shall extend and relocate access roads as WORK progress requires. Provide construction detours necessary for unimpeded traffic flow on site.
- B. The CONTRACTOR shall provide and maintain access to fire hydrants free of obstructions.
- C. Existing on-site roads may be used for construction traffic. The CONTRACTOR shall repair damage resulting from the WORK.

1.11 PARKING

- A. The OWNER shall provide temporary parking areas to accommodate CONTRACTOR personnel.

1.12 PROGRESS CLEANING

- A. During the progress of the WORK, the CONTRACTOR shall keep the site of the WORK and other areas used by the CONTRACTOR in a neat and clean condition and free from any accumulation of rubbish. Do not allow hazardous, dangerous or unsanitary conditions, nor public nuisances, to develop or persist on the site.
- B. The CONTRACTOR shall dispose of all rubbish and waste materials of any nature occurring at the work site and establish regular intervals of collection and disposal of all

such materials and waste.

- C. Equipment and material storage shall be confined to areas approved by the ENGINEER.
- D. Disposal of rubbish and surplus materials shall be onsite as designated by the OWNER at the CONTRACTOR'S expense.

1.13 FIELD OFFICES

- A. The CONTRACTOR'S field office shall be weather-tight with lighting, electrical outlets, heating, cooling, and ventilating equipment. It shall be equipped with sturdy furniture and drawing display table.
 - 1. During the performance of this PROJECT, the CONTRACTOR'S field office shall be the headquarters of the CONTRACTOR'S representative authorized to receive drawings, instruction, or other communications or articles. Communications given to said representative or delivered to CONTRACTOR'S field office in his absence shall be deemed to have been delivered to the CONTRACTOR.
- B. The CONTRACTOR will provide a suitable field office for the ENGINEER/CQAR on site, separate from the CONTRACTOR'S field offices. The field office shall be available for service within 10 calendar days of issuance of Notice to Proceed through the date of Final Completion. It shall be a multiple room, fully furnished, air conditioned, heated and ventilated office space for the sole use of the ENGINEER/CQAR. The CONTRACTOR shall pay all normal costs associated with this office, such as electricity, water, sewer, equipment maintenance, janitorial, and maintenance service. At a minimum, the office space configuration shall include: 1 standard size offices with lockable doors, a larger room for meetings, and a separate main entrance with new lock and 3 keys. Other minimum requirements for the office space of the ENGINEER/CQAR are:
 - 1. Minimum 720 square feet with a minimum dimension 12 feet.
 - 2. Linoleum or tile covered floor.
 - 3. Minimum of three windows with operable sash and insect screens. Locate offices to provide window views of construction area.
 - 4. Electrical distribution panel with four circuits minimum, 110 volt, 60 hz service.
 - 5. Minimum or six 110-volt duplex convenience outlets, at least one on each wall in the main area and two in each office.
 - 6. Two standard size desks, 3 ft x 5 ft with three drawers each and two swivel arm desk chairs on casters.
 - 7. One drafting table, at least 30 inches x 72 inches and a drafting table stool of proper height.
 - 8. One standard conference table with eight chairs.
 - 9. Packaged new basic first aid kit.

10. Two 5 pound nominal capacity wall mounted fire extinguishers, including one UL-rated for use on electronic (i.e., computers) equipment.
- C. After the PROJECT is completed, the CONTRACTOR shall remove or dispose of properly all furnishings listed.

1.14 DUST ABATEMENT

- A. The CONTRACTOR shall furnish all labor, equipment, and means required and shall carry out effective dust abatement measures wherever and as often as necessary and as directed by the ENGINEER or CQAR to prevent CONTRACTOR'S operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals or causing a nuisance to persons living in or occupying buildings in the vicinity.
- B. The CONTRACTOR shall be responsible for any damage resulting from any dust originating from CONTRACTOR'S operations. The dust abatement measures shall be continued until CONTRACTOR is relieved of further responsibility by the ENGINEER. No separate payment will be allowed for dust abatement measures and all costs therefore shall be included in the CONTRACTOR'S Bid Price.

1.15 PETROLEUM STORAGE CONTAINMENT

- A. The CONTRACTOR shall be responsible for abiding by and obtaining all necessary local, state, and federal codes and permits regarding storage of petroleum products.
- B. The CONTRACTOR shall provide a spill/leak containment vessel or lined containment area for above ground petroleum storage tanks used for completion of the WORK. The containment vessel or area shall have a spill/leak proof storage capacity exceeding 125 percent of the volume of the petroleum storage tank.
- C. The CONTRACTOR shall provide tie down anchors for the petroleum storage tank to prevent the flotation of an empty tank due to rain water filling the containment vessel or area.
- D. The CONTRACTOR shall provide operating fire extinguishers and no smoking signs. Fire extinguishers shall be accessible to personnel operating on or near the containment vessel or area.
- E. The CONTRACTOR shall provide a rain tarp or cover and shall cover the containment vessel or area to prevent accumulation of stormwater within the containment vessel or area. If the CONTRACTOR does not elect to cover the containment vessel or area, then the CONTRACTOR shall submit a proposed plan to the ENGINEER for approval, describing disposal methods of the collected stormwater.
- F. In the event of spills/leaks outside of the containment vessel or area and upon completion of the WORK, the CONTRACTOR shall collect and dispose of all contaminated soils and containment liners at no cost to the OWNER.
- G. The CONTRACTOR shall notify the OWNER and ENGINEER within 1 hour of discovery of any spills that could contaminate the environment.

- H. Any and all costs associated with testing of water or soils contaminated by petroleum from the CONTRACTOR'S petroleum storage containment area shall be the responsibility of the CONTRACTOR.

1.16 EQUIPMENT MAINTENANCE AREA

- A. The CONTRACTOR shall designate an equipment maintenance and repair area for completion of the WORK. The location of this area shall be approved by the OWNER. Maintenance and repair of equipment shall be conducted within this area. Petroleum and equipment fluids spilled or leaking on the soil shall be collected and disposed by the CONTRACTOR.
- B. Non-repairable equipment, leaks, or spills of petroleum or equipment fluids outside the maintenance repair area shall be completely removed by the CONTRACTOR and disposed of properly at no cost to the OWNER.
- C. The CONTRACTOR shall notify the OWNER and ENGINEER within 1 hour of discovery of any spills that could contaminate the environment.

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. The CONTRACTOR shall remove temporary above grade or buried utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.
- B. The CONTRACTOR shall clean and repair damage caused by installation or use of temporary WORK.
- C. The CONTRACTOR shall restore existing facilities used during construction to original condition and restore permanent facilities used during construction to specified condition at no cost to the OWNER.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Mobilization shall include obtaining all permits, insurance, and bonds; moving onto the site all equipment and materials as required for the proper performance and completion of the WORK. Mobilization shall include but not limited to the following principal items:
 - 1. Move onto the site all CONTRACTOR'S equipment and materials required for the PROJECT.
 - 2. Install temporary construction power, wiring and lighting facilities, as needed.
 - 3. Provide separate field office trailers for the CONTRACTOR.
 - 4. Provide on-site sanitary facilities and potable water facilities as specified.
 - 5. Arrange for and erect the CONTRACTOR'S WORK and storage yard and employees' parking facilities as directed by the OWNER.
 - 6. Submit all required insurance certificates and bonds.
 - 7. Obtain all required permits.
 - 8. Post all OSHA, EPA, Department of Labor, and all other required notices.
 - 9. Have the CONTRACTOR'S superintendent and QUALITY CONTROL REPRESENTATIVE(S) at the job site full-time.
 - 10. Provide security and facilities to protect WORK, existing facilities, and OWNER'S operations from unauthorized entry, vandalism, or theft.
 - 11. No additional payment will be made for demobilization.
- B. Demobilization shall include, but not limited to, all activities and costs for transportation of personnel, equipment, and supplies no longer required by the CONTRACTOR or included in the CONTRACT from the site; including the disassembly, removal of offices and other facilities assembled, and final cleanup and restoration of PROJECT area after successful completion of construction.
- C. The CONTRACTOR will be responsible for coordinating with the utility provider to bring service to the CONTRACTOR field office trailers from onsite existing utilities. The CONTRACTOR is required to pay for all electrical connection services at no cost to the OWNER.

1.2 PAYMENT FOR MOBILIZATION AND DEMOBILIZATION

A. See Section 01025 Measurement and Payment.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.1 GENERAL

- A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements specified herein, and in accordance with the requirements of the CONTRACT DOCUMENTS at no cost to the OWNER.
- B. The CONTRACTOR shall determine the exact locations and depths of all utilities indicated on the CONTRACT DRAWINGS which affect the WORK. In addition to those indicated, the CONTRACTOR shall make exploratory excavations of all utilities. All such exploratory excavations shall be performed as soon as practicable after award of CONTRACT and, in any event, a sufficient time in advance of construction to avoid possible delays to CONTRACTOR'S WORK. When such exploratory excavations show the utility location as indicated on the CONTRACT DRAWINGS to be in error, the CONTRACTOR shall immediately notify the OWNER and ENGINEER.
- C. The number of exploratory excavations required shall be as determined by the CONTRACTOR to be sufficient to determine the alignment and depth of the utility.
- D. The CONTRACTOR shall provide barriers to prevent unauthorized entry to construction area, to allow OWNER'S use of the site, and to protect existing facilities and adjacent properties from damage from construction operations.

1.2 RIGHTS-OF-WAY

- A. The CONTRACTOR shall not do any WORK that would affect any oil, gas, sewer, water, leachate, air, vacuum, effluent, or irrigation pipeline; any telephone, communications, fiber, or electric transmission line; any fence; or any other structure, nor shall the CONTRACTOR enter upon the rights-of-way involved until notified by the ENGINEER that the OWNER has CONTRACTOR authority therefor from the property owner. After authority has been obtained, the CONTRACTOR shall give said owner due notice of CONTRACTOR intention to begin WORK, and shall give said owner convenient access and every facility for removing, shoring, supporting, or otherwise protecting such pipeline, transmission line, ditch, fence, or structure and for replacing same.
- B. When two or more contracts are being executed at one time on the same or adjacent land in such manner that WORK on one contract may interfere with that on another, the OWNER shall decide which CONTRACTOR shall have priority to perform and in what manner. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or

any other reasonable privilege may be granted by the OWNER to the CONTRACTOR so desiring, to the extent, amount, manner, and times permitted. No such decision as to the method or time of conducting the WORK or the use of territory shall be made the basis of any claim for delay or damage.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

- A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. It shall be the CONTRACTOR'S responsibility to notify the ENGINEER of the time and location that WORK will be done. Such notification shall be sufficiently in advance of construction that there will be no delay due to waiting for survey points to be satisfactorily referenced for restoration.
- B. All survey markers or points disturbed, without proper authorization by the ENGINEER, will be accurately restored by the OWNER at CONTRACTOR'S expense after all street or roadway resurfacing has been completed.

1.4 RESTORATION OF PAVEMENT

- A. All paved areas damaged by the CONTRACTOR or SUBCONTRACTORS during the performance of the WORK shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the CONTRACT DOCUMENTS or in the requirements of the agency issuing the permit. All temporary and permanent pavements shall conform to the requirements of the affected pavement owner.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

- A. General - The CONTRACTOR shall protect all utilities and other improvements which may be impaired during construction operations. It shall be CONTRACTOR'S responsibility to ascertain the actual location of all existing utilities and other improvements indicated on the CONTRACT DRAWINGS that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines for uninterrupted service and such special protection as may be directed by the ENGINEER.
- B. Location of existing utilities are approximate and have not been verified by the OWNER or ENGINEER. The CONTRACTOR shall determine exact location of existing utilities prior to commencement of WORK, and is fully responsible for any damage or repairs which might be done by the CONTRACTOR'S failure to exactly locate and preserve any and all underground utilities.
- C. In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon proper application by the CONTRACTOR, be notified by the ENGINEER to move such property within a specified

reasonable time. The CONTRACTOR shall not interfere with said property until after the expiration of the time stipulated.

- D. OWNER'S Right of Access - The right is reserved to the OWNER and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this CONTRACT.
- E. Known Utilities - Existing utility lines that are shown on the CONTRACT DRAWINGS or the locations of which are made known to the CONTRACTOR prior to excavation that are to be retained and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired by the CONTRACTOR at CONTRACTOR'S expense.
- F. Unknown Utilities - If the CONTRACTOR damages any existing utility lines that are not shown on the CONTRACT DRAWINGS or the locations of which are not made known to CONTRACTOR prior to excavation, or were, or could not have been verified or located by the CONTRACTOR prior to starting WORK, a written report thereof shall be made immediately to the ENGINEER.
- G. Approval of Repairs - All repairs to a damaged improvement shall be inspected and approved by an authorized representative of the improvement before being concealed by backfill or other WORK. Repairs will be made by the CONTRACTOR to equal or better than existing conditions.
- H. Relocation of Utilities - Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown on the CONTRACT DRAWINGS, CONTRACTOR shall at CONTRACTOR'S own expense, remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the ENGINEER and the OWNER of the facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.
- I. When utility lines that are to be removed are encountered within the area of operations, the CONTRACTOR shall notify the ENGINEER a sufficient time in advance for the necessary measures to be taken to prevent interruptions of the service.
- J. Maintaining in Service - All oil and gasoline pipelines, power, telephone, or other communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall be maintained continuously in service during all the operations under the CONTRACT, unless other arrangements satisfactory to the ENGINEER are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, wire, or cable. The CONTRACTOR shall be responsible for and shall make good all damage due to CONTRACTOR'S operations and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.6 NOTIFICATION BY THE CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 calendar days nor more than 5 calendar days prior to excavation so that a representative of said owners or agencies can be present during such WORK if they so desire.

1.7 SUBSURFACE OBSTRUCTIONS

- A. The CONTRACTOR shall field determine, before trenching and associated excavations are begun, the depth and location of existing utilities. Utility locations indicated on the CONTRACT DRAWINGS were obtained from the records available, but have not been field verified, nor have depths been measured or observed. The CONTRACTOR shall submit descriptions, depths, and locations of subsurface obstructions to the ENGINEER for review.
- B. In excavation, backfilling, and laying pipe, care shall be taken not to remove, disturb, or damage existing pipes, conduits, or structures. If necessary, the CONTRACTOR at his own expense shall sling, shore-up, and maintain such structures in operation.
- C. The CONTRACTOR shall obtain the permission of and give sufficient notice to the proper authorities of the CONTRACTOR'S intention to remove or disturb any pipe, conduit, etc., and shall abide by their regulations governing such WORK.
- D. In the event subsurface structures are broken or damaged in the execution of the WORK, the CONTRACTOR shall immediately notify the proper authorities and, at the option of said authorities, either repair the damage at once at his own expense or pay the proper charges for repairing said damage. Repairs shall be made to the satisfaction of the ENGINEER. The CONTRACTOR shall be responsible for any damage to persons or property caused by such breaks or due to his own neglect in reporting and/or repairing such damages.
- E. The OWNER or ENGINEER will not be liable for any claims made by the CONTRACTOR based on underground obstructions that could have been reasonably identified as being different than that indicated on the CONTRACT DRAWINGS. The CONTRACTOR shall uncover subsurface obstructions in advance of construction so that the method may be determined before the WORK reaches the obstruction.

1.8 CONFLICTS WITH OTHER UTILITIES

- A. It shall be the CONTRACTOR'S responsibility to give the appropriate utility company sufficient advance notice so their representatives may verify the utility location on the job site when trenching operations begin. The CONTRACTOR shall coordinate and cooperate with these utilities companies to ensure no damages occur which would cause interruption of their services.

- B. All temporary support or minor adjustment which does not require replacement or direct by-pass connections to these existing services (such as all direct-buried telephone cables or 2 inch and smaller gas lines) will be the responsibility of the CONTRACTOR.
- C. Where it may be necessary to relocate gas mains or telephone ducts (defined here as gas lines larger than 2-1/2 inches and telephone cables within ductwork) to allow construction or where major relocation of small services requires replacement or performing connections to the existing lines, all such relocation WORK is the responsibility of and must be performed by the respective utility companies. The CONTRACTOR shall immediately notify the proper utility company and the ENGINEER in writing of the occurrence and location of such required relocations.
- D. The OWNER will not be responsible for any delay or inconvenience to the CONTRACTOR resulting from the existence, removal, or adjustment of any public or private utility that could have been reasonably identified. Additional costs incurred as a result thereof shall be borne by the CONTRACTOR and considered as included in the contract unit prices bid for the various pay items.
- E. Relocation or realignment of storm drains, leachate lines, gas lines, or sewer lines which may interfere with the construction shall be the responsibility of the CONTRACTOR.
- F. Where storm drains, leachate lines, or sewer lines are removed by the CONTRACTOR to facilitate construction and replaced in their original position, there shall be no direct payment made. All related costs shall be included in the unit price bid for the construction involved.

1.9 UTILITY POLE RELOCATION AND PROTECTION

- A. The CONTRACTOR shall take notice of the number of power and telephone support poles within or near the PROJECT limits for conflict with the construction operation. The relocation of all poles shall be the responsibility of and must be performed by the respective utility companies. The CONTRACTOR shall immediately notify the proper utility company and the ENGINEER in writing of the occurrence and location of such required relocations.
- B. For all poles, it is intended that they shall be supported with mud jacks or by other means of bracing, as required, to maintain them in a stable condition.

1.10 EXISTING FENCE

- A. At various locations along the length of the PROJECT, existing fences might conflict with or impair construction operations. The CONTRACTOR shall protect these fences in place where they do not conflict with construction operations. Where a fence may conflict with the backswing of machinery or otherwise impede construction, the CONTRACTOR shall contact the ENGINEER and arrange for the temporary removal or relocation of the fence. Any fence removed or temporarily relocated shall be restored to its original condition and location unless otherwise arranged with the owners of the fence. Where it is impossible to salvage the existing materials to reconstruct the fence, the fence shall be replaced "in kind" at no additional cost to the OWNER.

- B. All cost for such temporary removal, replacement, or “in kind” replacement shall be included in the respective bid prices. No direct payment will be made for fence replacement unless specifically noted otherwise.

1.11 UTILITY INVESTIGATION

- A. Prior to commencing with trench or other excavations required for the performance of the WORK, the CONTRACTOR shall conduct a field investigation for the purpose of determining existing locations of all underground utilities and facilities which are shown on the CONTRACT DRAWINGS. The investigation shall be made by hand or machine excavation. All such excavations shall include removal of surface material and obstructions required to perform the excavations. The CONTRACTOR shall provide sheeting, shoring, and bracing, as required, to minimize the required size of the excavation and support adjacent ground, structures, roadways, and utilities.
- B. After the data is obtained at each excavation site, the CONTRACTOR shall immediately backfill each excavation site. Backfill shall be compacted sand for the full depth. The surface shall be returned to its original grade and condition except that paved areas may be temporarily surfaced and maintained where excavations required for the performance of the WORK coincide with the location of the investigative location. The CONTRACTOR shall be responsible for all costs associated with repair of roadways, paving, structures, underground and above ground utilities, and facilities damaged in conducting the investigations.
- C. Findings of the investigation shall be reported to the ENGINEER. The CONTRACTOR shall clearly designate all found utilities and facilities discovered whether or not shown on the CONTRACT DRAWINGS. The CONTRACTOR shall provide written detailed description of any underground utility or facility conflicting with the elevation or alignment of the WORK and indicate field investigation information on the CONTRACT DRAWINGS for submission to the ENGINEER.
- D. The CONTRACTOR shall describe size, material, and location of existing underground utilities and facilities. Locations and elevations shall be referenced to PROJECT stationing, distance from base line, and PROJECT benchmarks.

1.12 PROTECTION OF EXISTING LANDFILL

- A. The CONTRACTOR shall use extreme care during construction activities on or near the landfill so as not to damage the existing groundwater monitoring wells, landfill gas system monitoring wells, stormwater management facilities, pump stations, and other existing features. Provide barricades and protection around groundwater monitoring wells at a minimum distance of 25 feet from the well, or as directed by the ENGINEER.
- B. Any damage resulting from the CONTRACTOR'S operations shall be repaired by the CONTRACTOR to original conditions or replaced with new materials at no additional cost to the OWNER. Repairs shall be as directed by the ENGINEER with approved materials.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01568

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section shall include installing and maintaining erosion and sedimentation controls as necessary or as indicated on the CONTRACT DRAWINGS for proper execution of WORK. All erosion controls shall be installed and approved by the ENGINEER prior to beginning WORK. All existing and foreseeable conditions that affect the WORK both inside and outside the limits of construction shall be the CONTRACTOR'S responsibility.
- B. Temporary erosion controls include, but are not limited to:
 - 1. Grassing, mulching, netting, seeding and watering on-site surfaces, providing interceptor ditches at those locations which will ensure erosion during construction will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.
- C. Temporary sedimentation controls include, but are not limited to:
 - 1. Silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.
- D. The erosion control features shown on the CONTRACT DRAWINGS are performance based. If the feature does not adequately control erosion and sediment control to the satisfaction of the ENGINEER, the CONTRACTOR will be required to install additional erosion and sediment control features in order to provide effective control measures during execution of WORK or until final controls become effective or until the WORK is accepted by the ENGINEER. The CONTRACTOR may, with ENGINEER'S approval, perform WORK outside the limits of construction to establish, maintain, or enhance erosion control systems.
- E. The PROJECT may require relocation or removal of limited amounts of solid waste. Note that exposure to landfill leachate and landfill gases are probable during excavation of solid waste. Any solid waste that is relocated must be placed within the active face of the landfill if needed, within the limits of the bottom liner system, so that any water that contacts solid waste will be collected as leachate and not routed through the stormwater management system.
- F. The CONTRACTOR shall be responsible for loading and transporting debris materials (asphalt, rocks, stumps, municipal solid waste, etc.) not incorporated into the PROJECT to the active face of the landfill for disposal. The OWNER will charge the CONTRACTOR a tipping fee, and the CONTRACTOR shall be responsible for all other costs such as loading, hauling the material, etc. Excavated waste materials shall be loaded into transport

vehicles and hauled by the CONTRACTOR to the OWNER'S scale facility then to the landfill working face as directed by the OWNER for disposal. At no time shall excavated debris materials be stockpiled adjacent to the excavations after normal working hours.

- G. At no time will stormwater runoff within the limits of construction be allowed to discharge to the stormwater system or offsite without proper water quality treatment. The CONTRACTOR shall plan construction activities to assure that the discharge of leachate or contaminated stormwater outside the liner and leachate collection system does not occur.
- H. The CONTRACTOR shall be solely responsible for all costs (including investigation, sampling testing, analysis engineering and remedial construction) related to the discharge of leachate or contaminated stormwater outside the liner and leachate collection system resulting from ineffective control of leachate or stormwater discharge by CONTRACTOR.
- I. The CONTRACTOR shall install additional erosion and sedimentation control measures deemed necessary by the ENGINEER as a result of variations in the CONTRACTOR'S operations, or shall repair existing system as directed by the ENGINEER. Additional controls or repairs shall be installed at no additional cost to the OWNER.
- J. All erosion and siltation control devices shall be checked regularly by the CONTRACTOR, especially after each rainfall event and will be cleaned out and/or repaired as required or requested by the ENGINEER.

PART 2 - PRODUCTS

2.1 EROSION CONTROL

- A. Netting - Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

2.2 SEDIMENTATION CONTROL

- A. Bales - Clean, seed-free cereal hay type.
- B. Netting - Fabricated of material in conformance with FDOT Erosion and Sediment Control Designer and Review Manual.
- C. Filter Stone - Crushed stone conforming to FDOT Erosion and Sediment Control Designer and Review Manual .
- D. Concrete Block - Hollow, non-load bearing type.
- E. Concrete - Exterior grade not less than one inch thick.

PART 3 - EXECUTION

3.1 EROSION CONTROL

A. Minimum procedures for grassing are:

1. Scarify slopes to a depth not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
2. Sow seed within 24 hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
3. Apply mulch loosely and to a thickness of between 3/4 inch and 1-1/2 inches.
4. Apply netting over mulched areas on sloped surfaces.
5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.2 SEDIMENTATION CONTROL

- A. Install and maintain silt fences and dams, traps, barriers, and appurtenances as shown on the CONTRACT DRAWINGS. Hay bales that deteriorate and filter stone which is dislodged shall be replaced at the CONTRACTOR'S expense.

3.3 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed by the CONTRACTOR fail to produce results which comply with the requirements of the regulatory agency having jurisdiction, the CONTRACTOR shall immediately take whatever steps are necessary to correct the deficiency at his own expense.
- B. During construction, any stripped or bare areas are to be covered immediately by mulch products or by sod or seed any mulch with temporary or permanent vegetation.
- C. All swales, ditches, channels, retention ponds and detention areas are to be sodded or seeded as required as soon as possible.

3.4 NEAR COMPLETION OF CONSTRUCTION

- A. Remove accumulated sediment from erosion and sediment control devices.
- B. Eliminate temporary basins, dikes, traps, etc.
- C. Grade to finished or existing grades.
- D. Fine grade all remaining earth areas, then seed and mulch or sod in accordance with the CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS.

END OF SECTION

SECTION 01570

MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes identifying safety hazards and furnishing all necessary labor, materials, tools, and equipment including, but not limited to, signs, barricades, traffic drums, cones, flashers, construction fencing, flag persons, variable message boards, warning devices, temporary pavement markings, temporary sidewalk, delineators, etc., to maintain vehicular and pedestrian traffic through and adjacent to the PROJECT area. These measures and actions shall be taken to safely maintain the accessibility of public and construction traffic by preventing potential construction hazards. All materials, WORK, and incidental costs related to Maintenance of Traffic will be the responsibility of the CONTRACTOR.

1.2 TRAFFIC CONTROL PLAN REQUIREMENTS

- A. Standard Specifications for Road and Bridge Construction, latest edition including all subsequent supplements issued by the Florida Department of Transportation, (FDOT).
- B. Manual on Uniform Traffic Control Devices for Streets and Highways by U.S. Department of Transportation, Federal Highway Administration.
- C. Right-of-Way Utilization Regulations, Hillsborough County, Florida, latest edition.
- D. All references to the respective agencies in the above referenced standards shall be construed to also include the municipality as applicable for this WORK.
- E. Sequence the WORK in a manner that will minimize disruption of vehicular and pedestrian access through and around the PROJECT area.
- F. Traffic planning and control for the maintenance and protection of pedestrian and vehicular traffic affected by the CONTRACTOR'S WORK includes, but is not limited to.
 - 1. Construction and maintenance of any necessary detour, equipment, and facilities.
 - 2. Providing necessary facilities for access to residences and businesses.
 - 3. Furnishing, installing, and maintenance of traffic control and safety devices (e.g. signage, barricades, barriers, message boards, etc.), and flag persons as appropriate during WORK.
 - 4. Control of water runoff, dust, and any other special requirements for safe and expeditious movement of traffic.
- G. Planning, maintenance, and control of traffic shall be provided at the CONTRACTOR'S

expense. The CONTRACTOR will bear all expense of maintaining the vehicle and pedestrian traffic throughout the PROJECT area.

- H. The CONTRACTOR will ensure all personnel involved in traffic control are capable of communicating with the public. The CONTRACTOR may be required to hire off-duty uniformed police officers, in addition to flag persons, to direct and maintain traffic. Locations and conditions requiring such uniformed police officers shall be as directed by the OWNER. The CONTRACTOR shall be required to utilize uniformed police officers for WORK within FDOT maintained ROW, road closures affecting school traffic, and during all night WORK involving a road closure or crossing on nonresidential roads.
- I. The CONTRACTOR will remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.
- J. The CONTRACTOR shall make provisions to avoid impacting existing facilities operation or maintenance activities. If an impact is anticipated, the CONTRACTOR shall propose a means to maintain existing activities, subject to approval by the OWNER. The OWNER will not be responsible for any costs associated with such proposed modification.

1.3 TRAFFIC CONTROL PLAN SUBMITTALS

- A. Submit at CONTRACTOR'S own expense a Traffic Control Plan for approval by the controlling roadway agency (FDOT, Hillsborough County Solid Waste Department or other local government) having jurisdiction over the road for approval.
- B. The Traffic Control Plan will detail procedures and protective measures proposed by the CONTRACTOR to provide for protection and control of traffic affected by the WORK consistent with the following applicable standards.
 - 1. Standard Specifications for Road and Bridge Construction, latest edition including all subsequent supplements issued by the Florida Department of Transportation.
 - 2. Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations, FDOT.
 - 3. Right-of-Way Utilization Regulations, Hillsborough County, Florida, latest edition.
- C. All references to the respective agencies in the above referenced standards shall be construed to also include the municipality as applicable for the WORK.
- D. The Traffic Control Plan will be signed and sealed by a Professional Engineer licensed in the State of Florida and shall include proposed locations and time durations of the following, as applicable.
 - 1. Pedestrian and public vehicular traffic routing.
 - 2. Lane and sidewalk closures, other traffic blockage and lane restrictions and reductions anticipated to be caused by the WORK. Show and describe the proposed location, dates, hours and duration of closure, vehicular and pedestrian traffic

routing and management, traffic control devices for implementing pedestrian and vehicular movement around the closures, and details of barricades.

3. Location, type and method of shoring to provide lateral support to the side of an excavation or embankment parallel to an open travel-way.
 4. Allowable on-street parking within the immediate vicinity of worksite.
 5. Access to buildings immediately adjacent to the PROJECT area.
 6. Driveways blocked by construction operations.
 7. Temporary traffic control devices, temporary pavement striping and marking of streets and sidewalks affected by construction.
 8. Temporary commercial and industrial loading and unloading zones.
 9. Construction vehicle reroutes, travel times, staging locations, and number and size of vehicles involved.
- E. Obtain and submit prior to erection, or otherwise impacting traffic, all required permits from all authorities having jurisdiction, including Hillsborough County Public Works, if applicable.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. The CONTRACTOR shall furnish, erect, and maintain all necessary traffic control devices, including flag person, in accordance with the Manual of Uniform Traffic Control Devices for Streets and Highways published by the U.S. Department of Transportation, Federal Highway Administration.
1. Flag Persons - All flag persons used on the PROJECT will adhere to the following requirements.
 - a. Any person acting as a flag person on the PROJECT will have attended a training session taught by a CONTRACTOR'S qualified trainer before the start of WORK.
 - b. The CONTRACTOR'S qualified trainer will have completed a "Flag person Train the Trainer Session" in the 5-years previous or before the start of WORK and will be on file as a qualified flag person trainer.
 - c. The flag person trainer's name and Qualification Number will be furnished by the CONTRACTOR at the Pre-Construction meeting. The CONTRACTOR will provide all flag persons with the Flag Person Handbook and will observe the rules and regulations contained therein. This handbook will be in the possession of all flag person while flagging on the PROJECT.

- d. Flag persons will not be assigned other duties while working as authorized flag persons.
- e. Any person replacing flag person for break shall have the same training.

PART 3 - EXECUTION

3.1 NOTIFICATIONS

- A. The CONTRACTOR will notify individual OWNER, OWNER'S agents, and tenants of buildings affected by the construction, with copies to the OWNER, 21 calendar days in advance of WORK.
- B. The CONTRACTOR shall notify residents and pedestrians via variable message boards no later than 14 calendar days prior to the closure of any road, lane or pedestrian thoroughfare.
- C. The CONTRACTOR shall notify the OWNER no less than 14 calendar days prior to such closures or whenever roads are impassable.
- D. Implement closing of vehicle or pedestrian thoroughfare in accordance with the approved Traffic Control Plan.
- E. The CONTRACTOR will immediately notify the OWNER of any vehicular or pedestrian safety or efficiency problems incurred as a result of the WORK.

3.2 GENERAL TRAFFIC CONTROL

- A. The CONTRACTOR will sequence and plan construction operations and will generally conduct WORK in such a manner as not to unduly or unnecessarily restrict or impede normal traffic.
- B. Unless otherwise provided, all roads within the limits of the WORK will be kept open to all traffic by the CONTRACTOR. The CONTRACTOR will keep the portion of the PROJECT being used by public traffic, whether it is through or local traffic, in such condition that traffic will be adequately accommodated.
- C. The CONTRACTOR will be responsible for installation and maintenance of all traffic control devices and requirements for the duration of the construction period. Necessary precautions for traffic control will include, but not be limited to, warning signs, signals, lighting devices, markings, barricades, canalizations, and hand signaling devices.
- D. The CONTRACTOR will provide and maintain in a safe condition temporary approaches or crossings and intersections with trails, roads, streets, businesses, parking lots, residences, garages and farms.
- E. The CONTRACTOR will provide emergency access to all residences and businesses at all times. Residential and business access will be restored and maintained at all times outside of the CONTRACTOR'S normal working hours.

- F. Traffic is to be maintained on one section of existing pavement, proposed pavement, or a combination thereof. Alternating one-way traffic may be utilized and limited to a maximum length of 500-feet during construction hours. Lane width for alternating one-way traffic will be kept to a minimum width of 10-feet, or as directed by the OWNER.
- G. Travel lanes and pedestrian access will be kept reasonably smooth, dry, and in a suitable condition at all times.
- H. The CONTRACTOR will make provisions at all "open cut" street crossings to allow for free passage of vehicles and pedestrians, either by bridging or other temporary crossing structures. Such structures will be of adequate strength and proper construction and will be maintained by the CONTRACTOR in such a manner as not to constitute an undue traffic hazard.
- I. The CONTRACTOR will keep all signs in proper position, clean, and legible at all times. Care will be taken so that weeds, shrubbery, construction materials, equipment, and soil are not allowed to obscure any sign, light, or barricade. Signs that do not apply to construction conditions should be removed or adjusted so that the legend is not visible to approaching traffic.
- J. The OWNER may determine the need for, and extent of, additional striping removal and restriping.
- K. Excavated material, spoil banks, construction materials, equipment and supplies will not be located in such a manner as to obstruct traffic, as practicable. The CONTRACTOR will immediately remove from the site all demolition material, exercising such precaution as may be directed by the OWNER. All material excavated shall be disposed of so as to minimize traffic and pedestrian inconvenience and to prevent damage to adjacent property.
- L. During any suspension, the CONTRACTOR will make passable and open to traffic such portions of the PROJECT and/or temporarily roadways as directed by the OWNER for accommodation of traffic during the anticipated period of suspension. Passable conditions will be maintained until issuance of an order for the resumption of construction operations. When WORK is resumed, the CONTRACTOR will replace or renew any WORK or materials lost or damaged because of such temporary use in every respect as though its prosecution had been continuous and without interferences.

3.3 TEMPORARY SHORING

- A. Use shoring to maintain traffic when it is necessary to provide lateral support to the side of an excavation or embankment parallel to an open travel-way. Provide shoring when a theoretical 2:1 or steeper slope from the bottom of the excavation or embankment intersects the existing ground line closer than 5-feet from the edge of pavement of the open travel-way.
- B. The CONTRACTOR will furnish, install, and remove sheeting, shoring, and bracing necessary to maintain traffic at locations shown on the Traffic Control Plan and other locations determined during WORK.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Products - As used herein is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the PROJECT or taken from CONTRACTOR'S stock of previously purchased products.
- B. Materials - Is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of WORK.
- C. Equipment - Is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.).
- D. The above definitions are not intended to negate the meaning of other terms used in the CONTRACT DOCUMENTS, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms which are self-explanatory and have recognized meanings in the construction industry. Where appropriate, "OWNER" may be substituted for "ENGINEER".

1.2 DESCRIPTION OF REQUIREMENTS

- A. The CONTRACTOR-furnished materials and equipment shall be new and shall not have been in service at any other installation unless otherwise provided. Material and equipment shall conform to applicable specifications unless otherwise approved in writing by the ENGINEER.
- B. Fabricated and manufactured products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges to be interchangeable.
- C. Two or more things of the same kind shall be identical, by the same MANUFACTURER.
- D. Products shall be suitable for the intended service conditions.
- E. Equipment dimensions, sizes, and capacities shown or specified shall be adhered to unless variations are specifically approved in writing by the ENGINEER.
- F. Equipment and material shall not be used for any purpose other than that for which it is specified or designed.
- G. Where equipment or material is specifically shown or specified to be reused in the

WORK, special care shall be used in removal, handling, storage, and reinstallation, to assure proper function in the completed WORK. Any items specified to be reused that are damaged by the CONTRACTOR shall be replaced with new units at no additional cost to the OWNER.

- H. The CONTRACTOR shall arrange for transportation, storage, and handling of products which require off-site storage, restoration, or renovation.
- I. Installation of all WORK shall comply with MANUFACTURER'S printed instructions. All equipment and products shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the MANUFACTURER'S instructions and specified instructions. Should specified requirements or job conditions conflict with the MANUFACTURER'S instructions, these conflicts shall be called to the ENGINEER'S attention for review and revised instructions.
- J. All materials and equipment which are furnished and/or installed by the CONTRACTOR shall be guaranteed. The guarantee shall be against manufacturing and/or design inadequacies, materials and workmanship, hidden damage, improper assembly, failure of device and/or components, excessive leakage or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for the period as specified in the CONTRACT DOCUMENTS from the date of acceptance of the materials and equipment by the OWNER. If a piece of material, equipment, device, or component fails within the CONTRACT specified term of the guarantee, it shall be replaced and installed with reasonable promptness by the CONTRACTOR without cost to the OWNER.

1.3 QUALITY ASSURANCE

- A. Source Limitations - To the greatest extent possible for each unit of WORK, CONTRACTOR shall provide products, materials, or equipment of a singular generic kind from a single source.
- B. Compatibility of Options - Where more than one choice is available as options for CONTRACTOR'S selection of a product or material, CONTRACTOR shall select an option which is compatible with other products and materials already selected (which may have been from among options for those other products and materials). Total compatibility among options is not assured by limitations within the CONTRACT DOCUMENTS but must be provided by the CONTRACTOR. Compatibility is a basic general requirement of product/material selection.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The CONTRACTOR shall deliver, handle, and store products in accordance with the MANUFACTURER'S written recommendations and by methods and means that will prevent damage, deterioration, and loss, including theft. The CONTRACTOR shall submit to the ENGINEER copies of all MANUFACTURER'S written instructions regarding the same. Delivery schedules shall be controlled to minimize long-term storage of products at the site and overcrowding of construction spaces. In particular, the CONTRACTOR shall provide delivery/installation coordination to ensure minimum holding or storage times for

products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.

1.5 TRANSPORTATION AND HANDLING

- A. Products shall be transported by methods to avoid product damage and delivered in a dry and undamaged condition in the MANUFACTURER'S unopened containers or packaging.
- B. The CONTRACTOR shall provide equipment and personnel to handle products by methods that will prevent soiling and damage. Under no condition shall the material or equipment be dropped, bumped, or dragged.
- C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.6 STORAGE AND PROTECTION

- A. Products shall be stored in accordance with the MANUFACTURER'S written instructions, with seals and labels intact and legible. Sensitive products shall be stored in weather-tight enclosures, and temperature and humidity ranges shall be maintained within required limits by the MANUFACTURER'S written instructions.
- B. For exterior storage of fabricated products, they shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering. Ventilation shall be provided to avoid condensation.
- C. Loose granular materials shall be stored on solid surfaces in a well-drained area and prevented from mixing with foreign matter.
- D. Storage shall be arranged in a manner to provide access for maintenance and inspection of stored items.
- E. The CONTRACTOR shall periodically inspect all stored products to assure these are maintained under required conditions and free from damage or deterioration.

1.7 MAINTENANCE OF STORED MATERIALS

- A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and make said log available to the ENGINEER upon request.
- B. The CONTRACTOR shall verify that storage facilities comply with the MANUFACTURER'S product storage requirements.
- C. The CONTRACTOR shall verify that manufacturer-required environmental conditions are maintained continually.

- D. The CONTRACTOR shall verify that surfaces of products exposed to the elements are not adversely affected and any weathering of finishes is acceptable under requirements of the CONTRACT DOCUMENTS.
- E. The OWNER may decrease payment when CONTRACTOR does not properly store or maintain equipment.

1.8 SUBSTITUTION “OR EQUAL” ITEMS

- A. General - Whenever materials or equipment are specified or described in the CONTRACT DOCUMENTS by using the name of a proprietary item or a particular supplier, the naming of the item is intended to establish the type, function, standard, and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other CONTRACTOR may be accepted by the ENGINEER if sufficient information is submitted by the CONTRACTOR to allow the ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named.
- B. Order of Precedence - Where a particular type or model number for an item of equipment is specified in addition to a word description of the item, it shall be understood that the word description shall take precedence, and the call out of type or model number is made solely for the convenience of the CONTRACTOR. No limit, restriction, or direction is indicated or intended thereby, nor is the accuracy or reliability of such type or model number guaranteed.
- C. Variations from TECHNICAL SPECIFICATIONS - All variations of the proposed substitute from that specified will be identified in the application, and available maintenance, repair, and replacement service will be indicated. The application shall also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which shall be considered by the ENGINEER in evaluation of the proposed substitute.
- D. Means and Methods - If a specific means, method, technique, sequence, or procedure of construction is indicated in or required by the CONTRACT DOCUMENTS, CONTRACTOR may furnish or utilize a substitute means, method, sequence, technique, or procedure of construction acceptable to the ENGINEER, if the CONTRACTOR submits sufficient information to allow the ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the CONTRACT DOCUMENTS.

1.9 REQUESTS FOR REVIEW OF SUBSTITUTIONS

- A. General - Requests for review of substitute items of material and equipment will not be accepted by the ENGINEER from anyone other than the CONTRACTOR. If the CONTRACTOR wishes to furnish or use a substitute item of materials or equipment, the CONTRACTOR shall make a written application in the form of a standard submittal to the ENGINEER for acceptance thereof, certifying that the proposed substitute will perform its functions adequately and achieve the results called for by the design, be similar and of equal substance to that specified, and be suited to the same use as that specified. The application shall state that the evaluation and acceptance of the proposed substitute will

not prejudice the CONTRACTOR'S achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the WORK will require a change in any of the CONTRACT DOCUMENTS (or in the provisions of any other direct contract with the OWNER for WORK on the PROJECT) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the WORK is subject to payment of any license fee or royalty.

- B. Form of Request - A request for substitution must be in writing in the form of a standard submittal and include descriptive literature, specifications, test report(s), or samples, as appropriate to enable the ENGINEER to determine the acceptability of the product proposed for substitution. If substitution is requested as part of the CONTRACTOR'S submittal of a proposed alternative product, the item(s) proposed for substitution shall be clearly indicated. No substitute product shall be used on the WORK until written approval has been received from the ENGINEER. Any revisions to structures, piping, or any other WORK made necessary by such substitution must be submitted for the approval of the ENGINEER and the entire cost of these revisions shall be borne by the CONTRACTOR, including such calculations as may be required to substantiate performance.
- C. Time for Review by ENGINEER - The ENGINEER shall be allowed a reasonable time within which to evaluate each proposed substitute. The ENGINEER shall be the sole judge of acceptability, and no substitute will be ordered, installed, or utilized without the ENGINEER'S prior written acceptance which will be evidenced by either a Change Order or a reviewed Shop Drawing marked either **"NO EXCEPTIONS TAKEN"** or **"MAKE CORRECTIONS NOTED."** The ENGINEER shall not unreasonably withhold approval. The OWNER may require the CONTRACTOR to furnish at the CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute, the ENGINEER will record time required by the ENGINEER for evaluating substitutions proposed by the CONTRACTOR and in making changes in the CONTRACT DOCUMENTS occasioned thereby. Whether or not the ENGINEER accepts a proposed substitute, the CONTRACTOR shall reimburse the OWNER for the charges of the ENGINEER and the ENGINEER'S Consultants for evaluating each proposed substitute.

1.10 TIME OF SUBMITTAL

- A. Unless otherwise authorized in writing by the ENGINEER, the substantiation of offers of substitutes or "of equal" items must be submitted within 30 calendar days after execution of the AGREEMENT. The CONTRACTOR, at the CONTRACTOR'S sole expense, shall furnish data concerning items offered as equivalent to those specified in the CONTRACT DOCUMENTS. The CONTRACTOR shall have the materials as required by the ENGINEER to determine that the quality, strength, physical, chemical, or other characteristics, including durability, finish, efficiency, dimensions, service, and suitability are such that the items will fulfill the intended function. Installation and use of a substitute item shall not be made until approved by the ENGINEER. If a substitute offered by the CONTRACTOR is found to be not equal to the specified material by the ENGINEER, the CONTRACTOR shall furnish and install the material specified in the CONTRACT DOCUMENTS.

- B. The CONTRACTOR'S attention is further directed to the requirement that failure to submit data substantiating a request for a substitution or "of equal" item within the said 30 calendar days period after execution of the AGREEMENT shall be deemed to mean the CONTRACTOR intends to furnish and install one of the specific products named in the CONTRACT DOCUMENTS, and the CONTRACTOR does hereby waive all rights to offer or use substitute products in each such case. Wherever a proposed substitute product has not been submitted within said 30 calendar days period, or wherever the submittal of a proposed substitute product fails to meet the requirements of the CONTRACT DOCUMENTS and an acceptable resubmittal is not received by the ENGINEER within said 30 calendar days period, the CONTRACTOR shall furnish and install one of the specific products named in the CONTRACT DOCUMENTS.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01700

CONTRACT COMPLETION, STARTUP, AND CLOSEOUT

PART 1 - GENERAL

1.1 COMPLETION PROCEDURES

- A. Substantial Completion shall be considered achieved when the CONTRACTOR has demonstrated that all final grades are met, all areas are stabilized, seeded and sodded as specified, stormwater conveyance systems are constructed as specified in the design, geosynthetic liner system installed in accordance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS, and all other items of WORK, as described in the CONTRACT DOCUMENTS, are fully operational.
- B. When the CONTRACTOR believes Substantial Completion has been achieved, CONTRACTOR shall request, in writing, to the ENGINEER that Substantial Completion be recognized as having been achieved and request that the OWNER issue a Certificate of Substantial Completion. The CONTRACTOR shall also forward a copy of this request to the OWNER. Prior to making such a request, the CONTRACTOR must have:
 - 1. Completed all WORK necessary for the safe, proper and complete use or operation of the facility as intended. At a minimum, this will include completion of all WORK in the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS necessary for the PROJECT to function as designed.
 - 2. Prepared a CONTRACTOR-generated punch list for submission with the request for issuance of a Certificate of Substantial Completion.
 - 3. Submitted and received acceptance of accurate Record Drawings for all WORK completed to date.
 - 4. Submitted and received acceptance of all specified warranties, guaranties, and operation and maintenance manuals.
 - 5. Completed all required vendor training, testing, and where required, start-up.
 - 6. Delivered all required spare parts (as applicable).
- C. Upon receipt of the request from the CONTRACTOR, the ENGINEER and designated representatives shall review the request, the WORK and the above requirements to determine whether the CONTRACTOR has achieved Substantial Completion. If this review fails to support Substantial Completion, the ENGINEER shall so notify the CONTRACTOR in writing citing the reasons for rejection. If the ENGINEER determines the CONTRACTOR has reached Substantial Completion, the following procedures will be followed:
 - 1. The ENGINEER will review the WORK and the CONTRACTOR'S punch list to assure all deficiencies are noted on a final punch list.

2. The ENGINEER will schedule and conduct a pre-final walk-through of the system with the OWNER'S representatives, the CONTRACTOR, and others, for the purpose of formally reviewing the WORK, and the final punch list. A copy of the final punch list will be provided to all participants and any additional items noted during the walk-through will be added to the list.
 3. Upon completion of the pre-final walk-through the ENGINEER shall prepare a request to the OWNER requesting they establish the date for Substantial Completion as the date of the walk-through, provided the walk-through has verified that the construction is in fact Substantially Complete. Upon approval of this request by the OWNER, the construction will be considered Substantially Complete.
- D. Final Completion will be deemed to have occurred when all WORK is completed in accordance with the CONTRACT DOCUMENTS including the following:
1. Throughout this Section, all references to "SURVEYOR" shall mean a professional land surveyor licensed in the State of Florida.
 2. All final punch list items have been corrected, signed off by the CONTRACTOR and the ENGINEER, and demonstrated to the OWNER during the final walk-through.
 3. All updates to the Record Drawings have been submitted to, and accepted by, the ENGINEER including.
 - a. Site surveys submitted on 24 inch by 36 inch sheets signed and sealed by a SURVEYOR and as an AutoCAD drawing file (AutoCAD r18 or later version) on USB. The CONTRACTOR will submit 5 original signed and sealed hard copies by a SURVEYOR and 2 USBs with the AutoCAD drawing files as required in Section 01050 Site Conditions Survey.
 - b. The CONTRACTOR shall submit 2 draft copies of the completed Record Drawings, in both hardcopy and AutoCAD format, for review at Substantial Completion as required in Section 01050 Site Conditions Survey.
 4. Demobilization and site cleanup are complete.
 5. The ENGINEER has issued a Certificate of Final Completion.
 6. All facilities have been properly demonstrated to be functioning as required and vendor training for major equipment components has been performed, if applicable, with the OWNER.
 7. Seeded and sodded areas are established and growing.
- E. Beneficial Occupancy will normally not occur before Substantial Completion but can occur for a discrete element of a PROJECT when desired by the OWNER. When Beneficial Occupancy is requested, the same procedure specified above will be used except no notice or request will be forwarded to the OWNER. Upon completion of the procedure, the OWNER will accept occupancy of that element of WORK.

1.2 START-UP PROCEDURES

- A. The CONTRACTOR is responsible for the complete test, checkout, and start-up preparation of the PROJECT. The CONTRACTOR shall verify these activities through daily inspection reports, test records, on-site vendor certifications, and by other appropriate means.
 - 1. Component test and check out is the verification that each component of the WORK is in compliance with the CONTRACT DOCUMENTS and is ready to perform its intended function.
 - 2. Start-up preparation is preparing the entire PROJECT to be placed into service.
- B. The CONTRACTOR shall conduct all test, check out, and start-up requirements specified in the CONTRACT DOCUMENTS and provide documentation of same to the ENGINEER prior to start-up. Where vendor on-site inspections are required prior to or during start-up, the CONTRACTOR shall require each vendor to provide a written statement that the installation and check out is complete and proper and that the item(s) are ready for start-up.

1.3 CLOSE-OUT PROCEDURE

- A. The ENGINEER and CONTRACTOR shall meet and resolve all outstanding issues including, but not limited to:
 - 1. Claims and adjustments for time or costs.
 - 2. Outstanding, unused allowances.
 - 3. Procedures for handling warranty issues.
- B. A Final Change Order shall be processed if required. Final payment and close out procedures shall comply with all requirements of the CONTRACT DOCUMENTS.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01800

HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

- A. The CONTRACTOR shall comply with all federal, state, and local safety codes, ordinances, and regulations, including the requirements of the United States Occupational Safety and Health Administration (OSHA), and other such safety measures as may be required by the above-mentioned regulatory agencies as required for WORK being performed.
- B. The CONTRACTOR shall comply with the requirements of 29 CFR 1910.132 for worker personal protection equipment requirements.
- C. The CONTRACTOR shall review and comply with the safety information and requirements presented in "A Compilation of Landfill Gas Field Practices and Procedures" prepared by the Landfill Gas Division of the Solid Waste Association of North America (SWANA) dated August 2011.
- D. All WORK shall be performed in strict accordance with the CONTRACTOR'S Health and Safety Plan, as described below in this Section.
- E. The CONTRACTOR is advised that decomposing refuse produces landfill gas (LFG) which is approximately 50 percent methane by volume. LFG is colorless, can be odorless or odorous, may contain hydrogen sulfide, is combustible, and may contain no oxygen. Landfill gas can also migrate through soil on or near the landfill. The CONTRACTOR is therefore advised of the need for precautions against fire, explosion, and asphyxiation when working in or near excavations which are in or near refuse fill areas.
- F. The CONTRACTOR will use a Health and Safety Officer for construction oversight that is currently trained in accordance with OSHA regulations 29 CFR 1910.120. The Health and Safety Officer must have completed the 8-hour Management and Supervisor Training, 40-hour Health and Safety Training course and necessary refresher courses, and Medical Monitoring. Copies of current training certificates will be provided to the ENGINEER for the Health and Safety Officer prior to the start of the WORK. The Health and Safety Officer shall be on-site during all intrusive activities and shall inspect ongoing activities on a daily basis. The Health and Safety Officer shall conduct a weekly site safety meeting for all on-site personnel.
- G. No smoking will be allowed on the landfill or WORK areas within the landfill property.
- H. Actions that potentially endanger workers should be stopped immediately and brought to the OWNER or ENGINEER'S attention. Health and Safety for the CONTRACTOR'S and subcontractor's forces is the responsibility of the CONTRACTOR.

1.2 DESCRIPTION OF HEALTH AND SAFETY PLAN

- A. The CONTRACTOR shall submit a Health and Safety Plan to the ENGINEER. The Health and Safety Plan shall include descriptions of the methods, equipment and safety procedures to be used during construction activities, including excavating, trenching, backfilling, and other construction activities. In preparing the Health and Safety Plan, the CONTRACTOR shall consider the various materials such as municipal solid waste (MSW), industrial waste, solvents, petroleum hydrocarbons, caustics, animal carcasses, asbestos, etc. that may be encountered while conducting all operations necessary to complete the WORK.
- B. At a minimum, the Health and Safety Plan shall address the following:
1. Organizational Structure - To include general supervision, Health and Safety officer, lines of authority, and responsibility and communication. The Health and Safety Officer shall be a worker who will be present at all times during site construction, in addition to his/her other site duties.
 2. Comprehensive Work Plan - To include the work tasks and objectives, resources needed, and training requirements for workers (health and safety, machine operations license, etc.). This shall also include a section on safety procedures to be followed for excavation and well drilling.
 3. Asbestos Work Plan - To include approach for workers to excavation and in environments possibly containing asbestos material. Plan shall include the WORK tasks and objective and resources needed.
 4. Health and Safety - To include identification of possible site hazards, training levels for each category of site workers, personal protective equipment and medical surveillance needed, site control measures, and confined space entry procedures.
 5. Emergency Response Plans - To include all emergency telephone numbers, a highlighted map showing the quickest route to the nearest emergency care facility, and directions to such facility.
 6. Air/Gas Monitoring Procedures - To include frequency and type of air/gas monitoring of exposed refuse and site worker areas, calibration of air/gas monitoring equipment, and action levels of air/gas contaminants for site worker protection. All equipment calibration and field gas measurements shall be recorded with the date and time of sample, and the sampler's name. Sampling shall be done by a CONTRACTOR worker trained in the use of the gas sampling equipment. These trained workers shall be designated in the CONTRACTOR'S Plan.
 7. Respiratory Protection Program - To include written documentation of the CONTRACTOR'S respiratory program.
 8. A signature page for all site workers covered by the Plan (CONTRACTOR and SUBCONTRACTOR site workers).

- C. In addition to addressing issues related to activities associated with construction activities in landfills, the Health and Safety Plan shall address issues including trench safety, operations adjacent to heavy equipment, traffic safety, first aid, heat stress and environmental monitoring, site security (including security of open excavations), and other PROJECT specific topics.
- D. The review of the Health and Safety Plan by the ENGINEER shall be for method and content only, and to inform the ENGINEER of the health and safety procedures which must be followed by the ENGINEER and OWNER. The CONTRACTOR shall retain responsibility and liability for the application, adequacy and safety of the methods and monitoring. However, the WORK shall not begin until the Health and Safety Plan has been submitted and reviewed by the ENGINEER.
- E. The CONTRACTOR'S duties and responsibilities for safety in connection with the WORK shall continue until such a time WORK is complete and the OWNER has released CONTRACTOR from WORK.

1.3 SAFETY EQUIPMENT

- A. At a minimum, the CONTRACTOR shall have the following equipment on site:
 - 1. Hard hats, work gloves, reflective work vests and safety-toe shoes for all personnel, and 4 Gas Meters.
 - 2. First aid kit.
 - 3. Fire extinguishers, two 50-pound dry chemical type.

1.4 SUBMITTALS

- A. The CONTRACTOR shall submit 2 copies of the site-specific Health and Safety Plan to the ENGINEER at the preconstruction meeting. The ENGINEER will review the plan for information purposes only. It is the CONTRACTOR'S responsibility to prepare and implement a Health and Safety Plan appropriate for the WORK to be conducted at the landfill.

1.5 GENERAL SAFETY REQUIREMENTS

- A. One person, to be present at all times during the construction, shall be designated to assure observance of the safety procedures. This person shall be trained in the use of all of the recommended safety equipment.
- B. Smoking or open flame shall be prohibited on the landfill property.
- C. No worker shall be allowed to work alone at any time in or immediately near an excavation and/or construction area. Another worker shall be present outside the area possibly affected by LFG.
- D. Site operations will take place in conditions of adequate light only.

- E. Areas of open refuse (i.e., excavations and trenches) will be monitored for combustible gases, methane, volatile organics, hydrogen sulfide and oxygen through the use of field gas meters or Drager-type colorimetric tubes. Respiratory protection for acid gases and organic vapors will be used by the worker while monitoring gas levels. Appropriate respiratory protection will be taken by other workers as necessary.
- F. No workers will be allowed in any trench or excavation while excavation of the area is in progress. Entry into the excavation shall be made only after the CONTRACTOR has monitored the air in the excavation and determined the appropriate level of personal protection required for entry into the excavation. Site workers in excavations must be supervised at all times.
- G. Site workers will limit their dermal exposure to excavated refuse. Minimal skin protection includes safety-toe boots, long pants, long-sleeved shirts, safety glasses, and rubber gloves to be used when handling refuse.
- H. All heat or torch welding or joining with solvents should take place in areas away from exposed refuse when possible. When WORK must take place in an excavation, appropriate ventilation measures shall be taken, as addressed in the CONTRACTOR'S Health and Safety Plan.
- I. All personnel must wear hard hats.
- J. Start-up and shutdown of equipment shall not be done in areas of exposed refuse.
- K. The CONTRACTOR shall comply with all provisions of state, federal, or local codes regarding WORK in confined spaces, including the need for monitoring, safety harnesses, and documentation of confined space activity. The atmospheric condition within confined spaces shall be monitored for oxygen, combustible gas, and hydrogen sulfide before entry. No confined spaces shall be entered without first verifying the safety of the environment.
- L. When construction and/or working in a manhole, vault, or other subgrade enclosure in and/or adjacent to the landfill site, the interior atmosphere shall be tested for the presence of oxygen, hydrogen sulfide, and combustible gas before entry and continuously when occupied. The person entering should wear a parachute-type safety harness with attached tether secured to the surface. A SCBA shall be available for use if needed. Forced air ventilation fans shall be used to provide a fresh air stream.
- M. In addition to conforming to the safety rules and regulations of governmental authorities having jurisdiction, the CONTRACTOR is advised of the presence of methane gas emanating from the natural decomposition of refuse buried at the job site and shall take precautions to ensure the safety of workers and the public.
- N. The CONTRACTOR shall demonstrate to the ENGINEER on a daily basis that all safety equipment is functioning properly, that all monitoring instruments are calibrated, and that the instrument operators are sufficiently knowledgeable in the use of the safety equipment.

1.6 ACCIDENT PREVENTION

- A. Precaution shall be exercised by the CONTRACTOR at all times for the protection of persons (including employees) and property. The safety provisions of applicable laws and of building and construction codes shall be observed. Machinery, equipment, and other hazards shall be guarded or eliminated. First aid kits shall be provided in a readily accessible location or locations.
- B. The CONTRACTOR shall make all reports as are, or may be, required by any authority having jurisdiction, and permit all safety inspections of the WORK being performed under this CONTRACT. Before proceeding with any construction WORK, the CONTRACTOR shall take the necessary action to comply with all provisions for safety and accident prevention.

1.7 PAYMENT FOR SAFETY REQUIREMENTS

- A. Payment for complying with the safety requirements for construction on the WORK site shall be included in the contract unit price paid for the various items of WORK wherein it is required and no separate payment will be made therefore.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 01900

PERMITS

PART 1 - GENERAL

1.1 GENERAL

- A. The OWNER has obtained the necessary solid waste and environmental resource permits for the WORK included in the PROJECT from State regulatory agencies having jurisdiction over such activities.
- B. Copies of these permits have been provided along with the bid package. The CONTRACTOR shall conduct his operations to conform to the requirements of the permits, if applicable.
- C. Where permits require that certain WORK is to be performed only in the presence of a representative of the permitting entity, the CONTRACTOR shall provide all coordination and notification required to assure the permit conditions are not violated.

1.2 PERMITS

- A. All other permits and licenses required to perform the WORK included in the CONTRACT are the responsibility of the CONTRACTOR.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

This Section is Not Applicable.

END OF SECTION

SECTION 02095

FABRIC FORMED CONCRETE REVETMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required and perform all operations in connection with the installation of the Fabric Formed Concrete Revetment (FFCR) erosion control lining systems in accordance with the lines, grades, design, and dimensions shown on the CONTRACT DRAWINGS and as specified herein.

1.2 DESCRIPTION

- A. The WORK shall consist of installing unreinforced concrete lining by positioning specially woven, double layer synthetic forms on the surface to be protected and filling them with a pump-able fine aggregate concrete (structural grout) in such a manner as to form a stable lining of the required thickness, weight, and configuration.

1.3 REFERENCED DOCUMENTS

- A. The following American Society of Testing and Materials (ASTM) test methods shall be incorporated into this TECHNICAL SPECIFICATION in their entirety, subject to the indicated test modifications.
- ASTM D5261-10(2018) Test Method for Measuring Mass per Unit Area of Geotextiles
 - ASTM D5199-12(2019) Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 - ASTM D4595-17 Test Method for Tensile Properties of Geotextiles by the Wide Width Strip Method
 - ASTM D4632/D4632M-15a Test Method for Grab Breaking Load and Elongation of Geotextiles
 - ASTM D4533/D4533M-15 Standard Test Method for Trapezoidal Tearing Strength of Geotextiles
 - ASTM D4751-20b Test Method for Determining Apparent Opening Size for a Geotextile
 - ASTM D4491/D4491M-21 Standard Test Methods for Water Permeability of Geotextiles by Permittivity

- ASTM D4759-11(2018)e1 Practice for Determining the Specification Conformance of Geotextiles
- ASTM D4354-12(2020) Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing
- ASTM D4884/D4884M-14a Standard Test Method for Strength of Sewn or Bonded Seams of Geotextiles
- ASTM D4873/D4873M-17(2021) Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
- ASTM C939/C939M-16a Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
- ASTM C31/C31M-21a Standard Practice for Making and Curing Concrete Test Specimens in the Field
- ASTM C39/C39M-21 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- ASTM C150/C150M-20 Standard Specification for Portland Cement
- ASTM C33/C33M-18 Standard Specification for Concrete Aggregates
- ASTM C618-19 Standard Specification for Coal Fly Ash and Calcined Natural Pozzolan for Use in Concrete
- ASTM C494/C494M-19 Standard Specification for Chemical Admixtures for Concrete
- ASTM C260/C260M-10a(2016) Standard Specification for Air-Entraining Admixtures for Concrete
- ASTM D4833/D4833M-07(2020) Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
- ASTM D6241-14 Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

1.4 SUBMITTAL

- A. The CONTRACTOR shall submit to the ENGINEER all MANUFACTURER'S full-scale flume hydraulic testing and calculations in support of the proposed FFCR lining system and geotextile.
- B. The CONTRACTOR shall furnish the MANUFACTURER'S certificates of compliance for the FFCR lining. The CONTRACTOR shall also furnish the MANUFACTURER'S specifications, literature, Shop Drawings for the layout of the lining, and any recommendations, if applicable, that are specifically related to the PROJECT.

- C. Alternative materials may be considered. Such materials must be pre-approved in writing by the ENGINEER prior to ordering materials. Alternative material packages must be submitted to the ENGINEER a minimum of 15 calendar days prior to ordering materials. Submittal packages must include, as a minimum, the following:
- Full-scale laboratory testing and associated engineering calculations quantifying the hydraulic capacity of the proposed FFCR lining system in similar conditions to the specified PROJECT.
 - Material testing reports prepared by a certified geotextile laboratory attesting to the alternative material's compliance with this TECHNICAL SPECIFICATION.

TABLE 02095-1 FILTER POINT (FFCR) CONCRETE LININGS

PHYSICAL PROPERTIES	VALUE (MINIMUM)
Average Thickness (in)	3
Mass Per Unit Area (lb/ft ²)	34
Filter Point Spacing (in)	6
Area Per Filter Point (in ²)	2
Perimeter Per Filter Point (in)	6.5
HYDRAULIC DESIGN PROPERTIES	VALUE (MINIMUM)
Shear Resistance (lb/ft ²)	15

PART 2 - PRODUCTS

2.1 FABRIC FORMED CONCRETE LINING

- A. FFCR lining(s) shall be Filter Point (FP) type and shall meet or exceed the minimum property values listed in TABLE 02095-1 FILTER POINT (FFCR) CONCRETE LININGS.

2.2 FABRIC FORMS

- A. The fabric forms for casting the concrete lining(s) shall be as:
- HYDROTEX® Filter Point
 - ENGINEER approved equal
- B. The fabric forms shall be composed of synthetic yarns formed into a woven fabric. Each layer of fabric shall conform to the physical, mechanical, and hydraulic requirements listed in TABLE 02095-2 FILTER POINT (FP) FABRIC. The fabric forms shall be free of defects or flaws which significantly affect their physical, mechanical, or hydraulic properties.

TABLE 02095-2 FILTER POINT (FP) FABRIC

TEST METHOD/PROPERTY	VALUE (MINIMUM)
Composition of Yarns	Polyester
ASTM D5261-10(2018) Test Method for Measuring Mass per Unit Area of Geotextiles	10 oz/SY
ASTM D5199-12(2019) Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes	25 mils
Mill Width	80 in
ASTM D4595-17 Test Method for Tensile Properties of Geotextiles by the Wide Width Strip Method <ul style="list-style-type: none"> • Machine • Cross 	195 lbf/in 145 lbf/in
ASTM D4533/D4533M-15 Standard Test Method for Trapezoidal Tearing Strength of Geotextiles <ul style="list-style-type: none"> • Machine • Cross 	125 lbf 105 lbf
<ul style="list-style-type: none"> • ASTM D4751-20b Test Method for Determining Apparent Opening Size for a Geotextile 	16 US Std. Sieve

Notes:

1. Conformance of fabric to specification property requirements shall be based on ASTM D4759-11(2018)e1 Practice for Determining the Specification Conformance of Geotextiles.
 2. All numerical values represent minimum average roll values (i.e., average of test results from any sample roll in a lot shall meet or exceed the minimum values). Lots shall be sampled according to ASTM D4354-12(2020) Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing.
- C. Fabric forms shall consist of double-layer woven fabric joined together by spaced, interwoven filter points to form a concrete lining with a deeply cobbled surface appearance. Filter points shall be formed by interweaving the double-layer fabric to form water permeable drains and attachment points for the control of concrete lining thickness. The interweaving of the fabric layers shall form an area of double density, high strength, single-layer fabric with area and perimeter given in TABLE 02095-1 FILTER POINT (FFCR) CONCRETE LININGS.
- D. All seams sewn in the factory shall be not less than 100 lbf/in when tested in accordance with ASTM D4884/D4884M-14a. All sewn seams and zipper attachments shall be made using a double line of U.S. Federal Standard Type 401 stitch.
- E. Baffles shall be installed at predetermined mill width intervals to regulate the distance of lateral flow of fine aggregate concrete. The baffle material shall be nonwoven filter fabric.

The grab tensile strength of the filter fabric shall be not less than 90 lbf when tested in accordance with ASTM D4632/D4632M-15a.

- F. The fabric forms shall be kept dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light. The fabric forms shall be labeled as per ASTM D4873/D4873M-17(2021) Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
- G. The CONTRACTOR shall submit a MANUFACTURER'S certificate that the supplied fabric forms meet the criteria of these TECHNICAL SPECIFICATIONS, as measured in full accordance with the test methods and standards referenced herein. The certificates shall include the following information about each fabric form delivered:
 - MANUFACTURER'S name and current address
 - Full product name
 - Style and product code number
 - Form number(s)
 - Composition of yarns
 - MANUFACTURER'S certification statement

2.3 FINE AGGREGATE CONCRETE

- A. Fine aggregate concrete shall consist of a proportioned mixture of Portland cement, fine aggregate (sand), and water. The consistency of the fine aggregate concrete delivered to the concrete pump shall meet MANUFACTURER specifications. The mix shall exhibit a compressive strength of 2,000 lb/in² at 28 days, when made and tested in accordance with ASTM C31/C31M-21a and C39/C39M-21.
- B. Portland cement shall conform to ASTM C150/C150M-20 Type I or Type II.
- C. Fine aggregate shall conform to ASTM C33/C33M-18, except as to grading. Aggregate grading shall be reasonably consistent and shall not exceed the maximum size which can be conveniently handled with available pumping equipment.
- D. Water for mixing shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter or other deleterious substances.
- E. Pozzolan, if used, shall conform to ASTM C618-19 Class C, F or N.
- F. Plasticizing and air entraining admixtures, if used, shall conform to ASTM C494/C494M-19 and ASTM C260/C260M-10a(2016), respectively.

2.4 FILTER FABRICS

- A. The geotextile filter fabrics shall be composed of synthetic fibers or yarns formed into a woven fabric. Fibers and yarns used in the manufacture of filter fabrics shall be composed of at least 85% by weight of polypropylene, polyester or polyethylene. The materials shall conform to the physical requirements listed in TABLE 02095-3 FILTER FABRIC. The geotextile shall be free of defects or flaws which significantly affect its mechanical or hydraulic properties.
- B. The geotextile filter fabric must be permitted to function properly by allowing relief of hydrostatic pressure; therefore fine soil particles shall not be allowed to clog the geotextile.
- C. The geotextile filter fabric shall be kept dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light. The fabric forms shall be labeled as per ASTM D4873/D4873M-17(2021) Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples.

TABLE 02095-3 FILTER FABRIC

TEST METHOD/PROPERTY	VALUE (MINIMUM)
ASTM D4632/D4632M-15a Test Method for Grab Breaking Load and Elongation of Geotextiles	90 lbf/in (in any principal direction)
ASTM D4632/D4632M-15a Test Method for Breaking Load and Elongation of Geotextiles	50% max. (in any principal direction)
ASTM D4533/D4533M-15 Standard Test Method for Trapezoidal Tearing Strength of Geotextiles	40 lbf (in any principal direction)
ASTM D4833/D4833M-07(2020) Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products	55 lbs (in any principal direction)
ASTM D6241-14 Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe	250 lbs (in any principal direction)
ASTM D4751-20b Test Method for Determining Apparent Opening Size for a Geotextile	60 US Std. Sieve max
ASTM D4491/D4491M-21 Standard Test Methods for Water Permeability of Geotextiles by Permittivity	1 sec-1
ASTM D4491/D4491M-21 Standard Test Methods for Water Permeability of Geotextiles by Permittivity	50 gal/min/ft ²

Notes:

1. Conformance of fabric to TECHNICAL SPECIFICATION property requirements shall be based on ASTM D4759-11(2018)e1 Practice for Determining the Specification Conformance of Geotextiles.
2. All numerical values represent minimum average roll values (i.e., average of test results from any sample roll in a lot shall meet or exceed the minimum values). Lots shall be sampled according to ASTM D4354-12(2020) Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Areas on which fabric forms are to be placed shall be constructed to the lines, grades, contours, and dimensions shown on the CONTRACT DRAWINGS. All obstructions such as roots and projecting stones shall be removed. Where such areas are below the allowable grades, they shall be brought to grade by placing compacted layers of clean fill. Soft and otherwise unsuitable subgrade soils shall be identified, excavated, and replaced with select materials in accordance with the CONTRACT.
- B. Excavation and preparation of aprons as well as anchor, terminal, or toe trenches shall be done in accordance with the lines, grades, contours, and dimensions shown on the CONTRACT DRAWINGS.
- C. Immediately prior to placing the fabric forms, the prepared area shall be inspected by the CQA CONSULTANT, and no forms shall be placed thereon until the area has been approved.

3.2 FABRIC FORM PLACEMENT

- A. A filter fabric shall be placed on the graded surface approved by the CQA CONSULTANT.
- B. Fabric forms shall be placed over the filter fabric and within the limits shown on the CONTRACT DRAWINGS. Anchoring of the fabric forms shall be accomplished through the use of anchor, terminal, and toe trenches.
- C. Adjacent fabric forms shall be joined before filling with fine aggregate concrete by field sewing or zippering the two bottom layers of fabric together and the two top layers of fabric together.
- D. When conventional joining of fabric forms is impractical or where called for on the CONTRACT DRAWINGS, adjacent forms may be overlapped a minimum of 3 feet to form a lap joint, pending approval by the ENGINEER. Based on the predominant flow direction, the downstream edge of the form shall overlap the upstream edge of the next form. In no case shall simple butt joints between forms be permitted.
- E. Immediately prior to filling with fine aggregate concrete, the assembled fabric forms shall be inspected by the CQA CONSULTANT, and no fine aggregate concrete shall be pumped

therein until the fabric seams have been approved. At no time shall the unfilled fabric forms be exposed to ultraviolet light (including direct sunlight) for a period exceeding 5 days.

3.3 FINE AGGREGATE CONCRETE PLACEMENT

- A. Following the placement of the fabric forms, small slits shall be cut in the top layer of the fabric form to allow the insertion of the filling pipe at the end of the fine aggregate concrete pump hose. These slits shall be of the minimum length to allow proper insertion of the filling pipe. Fine aggregate concrete shall be pumped between the top and bottom layers of fabric, filling the forms to the recommended thickness and configuration.
- B. Fine aggregate concrete shall be pumped in such a manner that excessive pressure on the fabric forms and cold joints are avoided. A cold joint is defined as one in which the pumping of the fine aggregate concrete into a given form is discontinued or interrupted for an interval of forty-five or more minutes.
- C. Holes in the fabric forms left by the removal of the filling pipe shall be temporarily closed by inserting a piece of non-woven fabric or similar material. The non-woven fabric shall be removed when the concrete is no longer fluid and the concrete surface at the hole shall be cleaned and smoothed by hand. Foot traffic on the filled form shall not be allowed for 24 hours after filling.
- D. After the fine aggregate concrete has set, all anchor, terminal, and toe trenches shall be backfilled and compacted.

END OF SECTION

SECTION 02110

SITE CLEANING, GRUBBING, AND STRIPPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes removal of materials by clearing, grubbing, stripping, and removing above-grade or below-grade materials which are understood by generally accepted practice not to be suitable for construction of the WORK as shown on the CONTRACT DRAWINGS and specified herein.
 - 1. Clearing is the removal of vegetative materials found on the surface of the ground such as trees, brush, etc.
 - 2. Grubbing is the removal of materials at, or protruding from, the surface of the ground such as grass, stumps, roots, rocks, etc.
 - 3. At the time of grading startup, all areas within the limits of grading for the PROJECT shall be stripped of existing grass and roots to a depth of 6 inches. Removal of roots with a fine toothed rake may be required.
- B. The CONTRACTOR shall provide necessary protection as required to prevent damage to existing improvements indicated to remain in place, (i.e., monitoring wells, geomembrane liner systems, leachate collection/detection system piping, etc.) as noted on the CONTRACT DRAWINGS.
- C. The CONTRACTOR shall control fugitive dust in accordance with local and state requirements.
- D. Prior to site clearing operations, the CONTRACTOR shall implement appropriate temporary erosion and sedimentation controls.
- E. Open burning shall not be allowed.
- F. Refer to Section 01568 Temporary Erosion and Sedimentation Control.

1.2 SUBMITTALS

- A. The CONTRACTOR shall submit the name and location of all proposed disposal sites for the clearing, grubbing, and stripping debris to the OWNER for approval prior to transporting any materials off-site.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

3.1 SITE CLEARING, GRUBBING, AND STRIPPING

- A. Prior to site clearing operations, the CONTRACTOR shall implement the appropriate provisions of Section 01568 Temporary Erosion and Sedimentation Control.
- B. Site clearing and grubbing activities shall be conducted to minimize interference with roads, streets, walks, and other adjacent facilities. The CONTRACTOR shall not close or obstruct access to the landfill, streets, walks, or other facilities.
- C. Grubbing shall include removal of grass and other vegetation from the surface of the ground within the limits of construction.
- D. Stripped material suitable for topsoil shall be stockpiled and shall be protected until it is replaced. Any topsoil remaining after all WORK is in place, shall be disposed of by the CONTRACTOR unless directed otherwise by the OWNER.
- E. Exposed waste, or soil containing waste materials, shall not be allowed to remain exposed overnight. At the end of each workday, the CONTRACTOR shall cover exposed waste, or soil containing waste materials, in a temporary or permanent manner by the means of a compacted 6 inch earthen cover or tarp suitable for odor control and protection from rain, birds, and other hazards. At no time shall water exposed to waste be allowed to enter the stormwater management system. Water exposed to waste shall be considered leachate and handled accordingly.
- F. Depressions caused by clearing and grubbing operations shall be filled with General Fill material per Section 02220 Excavation, Backfilling and Compaction of the CONTRACT DOCUMENTS, unless further excavation or earthwork is indicated.
- G. Refer to Section 02220 Excavation, Backfilling and Compaction.

3.2 DISPOSAL OF SITE CLEARING MATERIALS

- A. The CONTRACTOR shall transport and dispose of all land clearing debris as directed by the OWNER. No materials shall be removed from the PROJECT site or disposed of by the CONTRACTOR except as directed by the ENGINEER. Disposal shall conform to all OWNER, State and Federal regulations. Open burning shall not be allowed.
- B. All land clearing soil materials shall be segregated during excavation and the ENGINEER or CQAR shall direct locations for segregated materials. Material shall be transported to stockpile areas designated by the OWNER for surplus or unsuitable materials.
- C. All surplus soils shall be stockpiled as directed by the OWNER.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. The WORK required to be performed under this Section shall include furnishing all equipment and labor necessary to control erosion and sedimentation, remove storm and subsurface waters from excavations, and backfill areas during completion of the WORK.
- B. All WORK in this Section shall be done in accordance with the requirements of the Environmental Resource Permit as issued by the Florida Department of Environmental Protection (FDEP).

1.2 RELATED SECTIONS

- A. Section 01568 Temporary Erosion and Sedimentation Control.
- B. Section 02220 Excavating, Backfill, Compaction, Fill and Grading.
- C. Section 02315 Trenching and Backfilling.

1.3 SUBMITTALS

- A. Within 15 calendar days of receiving the notice to proceed and prior to any construction, the CONTRACTOR shall submit to the Florida Department of Environmental Protection a Dewatering Plan outlining methods, equipment, layout, duration of dewatering, proposed discharge points, and any other necessary features required to complete the WORK.
- B. The CONTRACTOR shall submit the Dewatering Plan to the ENGINEER for record purposes only.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 - EXECUTION

3.1 DEWATERING

- A. Design of the dewatering system shall be the sole responsibility of the CONTRACTOR. The CONTRACTOR shall be responsible for performing whatever investigations they see necessary, prior to bidding, to design, construct, and operate the dewatering system. Inaccuracies in this information shall not be the basis for a claim by the CONTRACTOR as it is the CONTRACTOR'S responsibility to verify this information with their own investigations.

- B. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure of this system.
- C. The CONTRACTOR shall be responsible for the following:
 - 1. Shall at all times during WORK provide and maintain proper equipment and facilities to remove water entering excavations. The CONTRACTOR shall keep such excavations dry so as to obtain a satisfactory foundation condition for all WORK.
 - 2. Dewatering all construction areas to allow for proper excavation and construction. Dewatering shall include removal of all groundwater and stormwater that may accumulate within the construction area.
 - 3. Development and management of erosion and sedimentation control during construction. The controls shall minimize the amount of sedimentation flowing from the construction area into the stormwater management system.
 - 4. Dewater in such a manner as to prevent damage to existing WORK. Any damage resulting from the dewatering activities of the CONTRACTOR shall be repaired or replaced, as approved by the ENGINEER, at no additional cost or time to the OWNER.
 - 5. The CONTRACTOR shall establish and maintain temporary drainage ditches, diversions outside excavation limits, or other acceptable methods as determined by the CONTRACTOR and approved by the ENGINEER to convey surface water and water removed from excavations to collecting or runoff areas as deemed necessary. The CONTRACTOR shall not use trench excavations as temporary drainage ditches.
- D. Water that enters excavations with waste shall be considered leachate and shall not be discharged to the ground or other means that are typical for stormwater. Water determined to be leachate by the ENGINEER shall be pumped into sealed tanks, hauled, and disposed of by the CONTRACTOR or as directed by the ENGINEER.
- E. If stormwater or subsurface waters are encountered or inhibit construction operations or compaction, the CONTRACTOR shall utilize equipment properly sized and specifically designed, for removal of the water.
- F. The dewatering method shall consist of lowering and maintaining the water levels and hydrostatic pressures of the groundwater a minimum of 2 feet below the lowest elevation of construction when dewatering activities occur outside of waste.
- G. If construction activities bring water to the surface or the ground exhibits pumping during compaction, water levels shall be lowered to an elevation to achieve the TECHNICAL SPECIFICATIONS outlined in the CONTRACT DOCUMENTS.
- H. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick", or otherwise unsuitable for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by suitable materials as approved by the ENGINEER at the CONTRACTOR'S expense. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

- I. Construction operations, to include backfilling and compaction, shall be performed in moisture levels within the soils to achieve the TECHNICAL SPECIFICATIONS outlined in the CONTRACT DOCUMENTS.
- J. Dewatering shall at all times be conducted in such a manner as to not adversely affect constructed slopes, preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of the excavation, and to preserve the integrity of adjacent structures.
- K. The CONTRACTOR shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the specified WORK. The dewatering system shall stay in full operation until not less than 90% of the total load is applied, as will be determined by the ENGINEER, or until excavations and trenches have been backfilled and compacted.

3.2 DISPOSAL OF WATER REMOVED BY DEWATERING

- A. Water conveyed away from excavations which has not contacted waste materials shall be discharged within the PROJECT area as approved by the ENGINEER.
- B. The CONTRACTOR shall not cause flooding by overloading or blocking up the flow in drainage facilities, and shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the OWNER or the authority having jurisdiction, at no cost to the OWNER.
- C. Dispose of water by procedures approved by the ENGINEER in such a manner as to cause no inconvenience to the OWNER, the ENGINEER, or others involved in WORK about the site.

3.3 WATER LEVELS

- A. Subsurface (groundwater) elevations and stormwater runoff vary with time of year and rainfall amounts across the limits of construction as defined in the CONTRACT DOCUMENTS. Neither the ENGINEER nor the OWNER can accurately estimate the water elevations that may be encountered during construction.
- B. Stormwater measures shall be controlled by the CONTRACTOR to minimize erosion and flooding within and outside of the construction area.

3.4 QUALITY CONTROL

- A. The CONTRACTOR'S supervising personnel of the dewatering system shall maintain adequate supervision and control to ensure stability of the excavated slopes, the construction area is not adversely affected by water, erosion is controlled, flooding of the excavation and downstream area does not occur, and sedimentation and turbidity is maintained within local, state, and federal guidelines (less than 29 NTUs above background water quality or approximately 34 NTUs total).
- B. The CONTRACTOR'S supervising personnel of the dewatering system shall dispose of the waters in strict accordance with the latest revisions of all local, state and federal rules and regulations.

- C. The CONTRACTOR shall be responsible for all permit violations that are the result of CONTRACTOR'S activities and shall pay all penalties and/or fines that result from any violations at no additional cost to OWNER.

3.5 CLEANUP

- A. Upon completion of dewatering work elsewhere on the PROJECT, the CONTRACTOR shall remove all equipment and leave the PROJECT site in a neat, clean, and acceptable condition, satisfactory to the OWNER. Wellpoint holes, observation wells, or any other excavation shall be adequately backfilled and compacted to prevent settlement.

END OF SECTION

SECTION 02220

EXCAVATION, BACKFILL, FILL, AND GRADING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes excavating, trenching, transporting, stockpiling, placing, backfilling, compacting, grading, disposing of materials, field testing, Construction Quality Control (CQC) and Construction Quality Assurance (CQA) laboratory services required for the WORK as shown on the CONTRACT DRAWINGS and as specified herein.
- B. All WORK shall be performed in strict accordance with the TECHNICAL SPECIFICATIONS, CONTRACT DRAWINGS, and current industry standards.
- C. CQC field and laboratory testing specified in this Section is the CONTRACTOR'S responsibility and all costs shall be included in the Bid Price.
- D. CQA field and laboratory testing specified in this Section will be performed by a designated CQA CONSULTANT retained by the OWNER. The CQA CONSULTANT, or his Construction Quality Assurance Representative (CQAR), shall observe all geotechnical activities and conduct CQA testing at random frequencies and locations.
- E. Excavated soil that does not contain waste, as determined by the CQAR, may be reused and incorporated into the PROJECT if it meets the requirements of this Section.
- F. Excavation, backfilling, sampling, and testing shall be performed by the CONTRACTOR only when the ENGINEER or CQAR is present. A minimum of 48 hours prior notice shall be provided to the ENGINEER or CQAR.
- G. The CONTRACTOR shall be responsible for controlling stormwater runoff from adjacent landfill slopes through the use of berms, dikes, swales, or other acceptable methods as determined by the CONTRACTOR to direct stormwater away from construction areas to areas where the CONTRACTOR shall remove stormwater through the use of temporary pumps or other means and methods as determined by the CONTRACTOR.
- H. Throughout this Section, all references to CQC CONSULTANT and the requirement to submit a final report, signed and sealed by a "PROFESSIONAL ENGINEER" shall mean a professional engineer licensed in the State of Florida.
- I. Throughout this Section, all references to "SURVEYOR" shall mean a professional land surveyor licensed in the State of Florida.

1.2 PROJECT CONDITIONS

- A. Existing PROJECT conditions are shown on the CONTRACT DRAWINGS or otherwise described herein. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the

CONTRACTOR. The CONTRACTOR shall explore ahead of required excavation to determine the exact location of all existing structures, utilities, etc.

- B. Upon identification, the CONTRACTOR shall notify the ENGINEER in writing if site conditions encountered during WORK differ from that indicated on the CONTRACT DRAWINGS. Notification by the CONTRACTOR shall include an explicit description of the differences.
- C. Any damage to existing utilities, systems, structures, or facilities indicated to remain in place shall be restored to their original condition as directed by the ENGINEER at the CONTRACTOR'S expense. Repair of damaged features or structures shall be approved by the ENGINEER and OWNER.

1.3 CONSTRUCTION QUALITY CONTROL

- A. CQC will be performed by an independent geotechnical consultant retained by the CONTRACTOR. The CQC CONSULTANT cannot be the same CONSULTANT retained by the OWNER for the CQA CONSULTANT.
- B. The CQC CONSULTANT shall observe all geotechnical activities and the QC testing as specified herein to be performed by the CONTRACTOR.
- C. The CQC CONSULTANT and their CQC LABORATORY shall perform CQC testing of on and off-site material borrow sources to demonstrate the material proposed by the CONTRACTOR to be used for the PROJECT meets the TECHNICAL SPECIFICATIONS.
- D. Refer to this Section for the information to be submitted for the qualifications of the CQC CONSULTANT.
- E. Testing shall be performed by the CQA LABORATORY during the course of the WORK to verify continued material compliance with the CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS.

1.4 SUBMITTALS

- A. Health and Safety Plan
 - 1. The CONTRACTOR shall prepare and submit a Health and Safety Plan to the ENGINEER. The review of the Health and Safety Plan by the ENGINEER shall be for method and content only and to inform the ENGINEER of the health and safety procedures which must be followed by the CONTRACTOR, ENGINEER, and OWNER.
 - 2. The CONTRACTOR shall retain complete responsibility for the application, adequacy, and safety of the methods chosen. However, construction shall not begin until the Health and Safety Plan has been submitted and reviewed by the ENGINEER.
 - 3. The Health and Safety Plan shall include descriptions of the methods, equipment, and safety procedures to be used during construction activities including excavating, backfilling, and compacting. In preparing the Health and Safety Plan, the CONTRACTOR shall consider the various materials that may be encountered while conducting all operations necessary to complete the WORK.

4. The CONTRACTOR shall be responsible for vehicle traffic safety and shall coordinate with the OWNER to determine site-specific safety concerns.
5. Refer to Section 01800 Health and Safety Requirements.

B. Excavation Plan

1. The CONTRACTOR shall be responsible for having determined to his satisfaction, prior to the submission of his Bid, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of groundwater conditions, the prosecution of WORK, the general and local conditions, and all other matters which may in any way affect the WORK for this PROJECT.
2. Prior to beginning WORK, the CONTRACTOR shall provide a detailed Excavation Plan to the ENGINEER for review and approval for addressing excavation, soil segregation, backfilling, compacting, grading, equipment and methods, etc. that are addressed in this Section. The prices established in the Bid for the WORK to be done will reflect all costs pertaining to the WORK. No claims for extras based on sub-strata or groundwater table conditions will be allowed. The Excavation Plan shall include, at a minimum, the following:
 - a. Procedures for handling excavated refuse as a result of the WORK. Excavated refuse or soil mixed with refuse is classified as material to be removed and disposed of at the active face of the landfill, or as directed by the ENGINEER and OWNER, and not to be used for backfill.
 - b. Methods of excavation, stormwater run-on and runoff control, slope stabilization, shoring, stockpiling, stormwater removal, and backfilling techniques.
 - c. Temporary controls for stormwater runoff and erosion control in full conformance with all permits. The CONTRACTOR is responsible for directing, controlling, and managing stormwater runoff from all areas surrounding the PROJECT including runoff from the landfill slopes.
 - d. A breakdown of each of the soil types and quantities specified for backfill, possible sources of each, and show that sufficient quantity is available from the borrow sources identified to complete the PROJECT.
 - e. Address excavation for liner exposure for tie-in, liner protection, erosion protection, and waste management.
3. Excavation may be made without sheeting and bracing within the limitations and requirements of the governmental agencies having jurisdiction. Failure of the ENGINEER or CQAR to order the use of bracing or sheeting and shoring or direct changes to systems in place, shall not in any way or to any extent relieve the CONTRACTOR of any responsibility concerning the condition of excavations or of his obligations under the CONTRACT. The CONTRACTOR shall be responsible for the condition of all excavations. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances that they may occur.
4. All excavations shall comply with the applicable requirements as stated in the

following:

- a. OSHA excavation safety standards 29 CFR, 1926-650, Subpart P.
 - b. State (Trench Safety Act Section 553.60-553.64 Florida Statutes) and County construction safety regulations.
5. The CONTRACTOR shall sweep or wash paved roadways which become covered with soil. The CONTRACTOR shall provide all equipment, water, and personnel necessary to clear the paved roads.

C. Qualifications of the Geotechnical CQC CONSULTANT and CQC LABORATORY

1. The qualifications of the geotechnical CQC CONSULTANT and CQC LABORATORY retained by the CONTRACTOR shall be submitted to the ENGINEER at least 15 calendar days prior to conducting any geotechnical field testing or laboratory services related to the PROJECT. The submittal shall include, at a minimum, the following information:
 - a. The resumes of key personnel involved in the geotechnical testing and observation activities. Key personnel shall include field personnel, laboratory personnel, and immediate supervisors. The CQC CONSULTANT and CQC LABORATORY shall have a minimum experience of 5 prior similar projects (landfills only) within the last 5 years.
 - b. Written confirmation the CQC CONSULTANT and CQC LABORATORY has sufficient personnel and equipment available to meet the PROJECT schedule.
 - c. Written confirmation the TECHNICAL SPECIFICATIONS have been received and WORK shall be performed in compliance with the TECHNICAL SPECIFICATIONS.

D. CQC Plan

1. The CONTRACTOR shall provide a detailed CQC Plan signed by the CONTRACTOR addressing procedures and schedules for material source certifications, testing soils, submitting test results to the ENGINEER for review, and retesting failed tests.

E. CQC Submittals

1. During construction, the CONTRACTOR shall submit CQC test reports and documentation generated by the CQC CONSULTANT and CQC LABORATORY, signed and sealed by a PROFESSIONAL ENGINEER for review. Electronic copies shall be submitted to the ENGINEER within 72 hours after sampling or testing for each test required. Hard copy signed-and-sealed test reports shall be submitted to the ENGINEER within 7 calendar days of sampling or testing for each test required.
2. CQC test reports for different material types or standards shall receive a unique submittal number and shall not be combined with other material types on any pages in the report.
3. After construction the CQC CONSULTANT shall prepare and submit to the ENGINEER a final report, signed and sealed by a PROFESSIONAL ENGINEER, certifying the

geotechnical activities performed on the PROJECT were in accordance with the TECHNICAL SPECIFICATIONS. The final report shall include at a minimum:

- a. Summary of test results from qualifying the products.

F. Protective Cover Material Installation Plan

1. The CONTRACTOR shall provide a detailed Protective Cover Material Installation Plan addressing placement methods.
2. The Protective Cover Material Installation Plan shall include, at a minimum, the following:
 - a. Demonstrate the underlying geosynthetic materials will be protected and safeguarded from damage during placement of the overlying materials.
 - b. Material types, minimum thickness of each lift of material during placement, description of thickness markers, methods for measuring material thicknesses, and methods for removing markers. The marker shall be free standing and shall not be sharp or pointed so it cannot damage the geosynthetic materials if hit by equipment.
 - c. A method for removing markers without disturbing in-place materials.

G. Borrow Source Materials - Preconstruction Materials Evaluation

1. The CONTRACTOR shall conduct preconstruction material evaluation testing as specified in this Section meeting the requirements as listed in the following to determine suitability of all onsite and off-site borrow material proposed to be used:
 - a. TABLE 02220-1 EXCAVATED INTERMEDIATE COVER SOIL QUALIFICATION TESTING.
 - b. TABLE 02220-4 GENERAL FILL SOIL QUALIFICATION TESTING
 - c. TABLE 02220-7 STRUCTURAL FILL SOIL QUALIFICATION TESTING
 - d. TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS.
 - e. TABLE 02220-11 PROTECTIVE COVER MATERIAL QUALIFICATION TESTING.
2. Preconstruction material evaluation testing shall be performed on samples from all potential soil borrow sources by the CONTRACTOR'S CQC LABORATORY prior to incorporation into construction to ascertain their acceptability as construction materials.
 - a. Testing shall be performed by the CQA LABORATORY during the course of the WORK to verify continued material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.

3. For any off-site material borrow sources, the CONTRACTOR shall notify the ENGINEER in writing of the material source for each soil type at least 15 calendar days prior to the date of anticipated use of such material. Notification shall include at a minimum:
 - a. Supplier's name.
 - b. Borrow location.
 - c. Documentation confirming adequate quantities are available to complete the WORK.
 - d. A representative sample of the proposed material consisting of 1 5-gallon sealed container(s).
4. The CONTRACTOR shall submit Material Source Certificates of Compliance signed by the CONTRACTOR for each of the proposed materials, General Fill, General Fill, Protective Cover Material, Toe Drain Collection System Gravel, and Limerock from each of the proposed sources to the ENGINEER. The Material Source Certificates of Compliance shall include at a minimum, the following:
 - a. PROJECT title.
 - b. PROJECT location.
 - c. Soil type, source name and description, proposed use, test identification number, and laboratory test results.
5. The CONTRACTOR shall submit to the ENGINEER the CQC LABORATORY test results for each soil type specified within this Section at least 21 calendar days prior to the date of anticipated use of such material. Materials shall not be incorporated into the PROJECT until approved by the ENGINEER.

H. Submittal Review

1. The CONTRACTOR shall schedule all WORK to allow at least 14 calendar days for submittal review and approval by the ENGINEER. There shall be no additional compensation to the CONTRACTOR for any construction delays caused by the CONTRACTOR'S failure to plan, obtain approval, or schedule WORK to include all CQC/CQA testing.
2. Refer to Section 01300 Contractor Submittals.

1.5 SITE ACCESS

- A. WORK shall be performed so as to not block or hinder site access, except as authorized by the OWNER.

1.6 DEFINITIONS

- A. Maximum Density - Maximum weight in pounds per cubic foot of a specific material.

- B. Optimum Moisture - Percentage of water in a specific material at maximum density.
- C. Topsoil - A fertile, natural or amended soil, typical of locality, free from large stones, roots, sticks, clay, weeds, and sod, and suitable for use as a growing medium for vegetation.
- D. Suitable Soil - Soil that meets the requirements as specified in Part 2 of this Section.
- E. Unsuitable Soil - Soil that does not meet the requirements as specified in Part 2 of this Section.
- F. Existing Intermediate Cover Soils - Existing onsite soil within the PROJECT area. Existing Intermediate Cover Soils shall be compacted to meet the specified requirements contained within this Section.
- G. General Fill - Suitable soil that is placed back into the PROJECT area and compacted after unsuitable soils are excavated and removed. General Fill shall be compacted to meet the specified requirements contained within this Section.
- H. Structural Fill - Soil that is called out in specific locations for the PROJECT which are required as opposed to General Fill. The Structural Fill shall be compacted to meet the specified requirements contained within this Section.
- I. CQC CONSULTANT - Independent geotechnical consultant retained by the CONTRACTOR to perform the CQC field and laboratory testing of the proposed materials.
- J. CQA CONSULTANT - CQA will be performed by a designated CQA CONSULTANT retained by the OWNER. The CQA CONSULTANT, or his CQAR, shall observe all geotechnical activities and conduct CQA field and laboratory testing at a random frequencies and locations.

PART 2 - PRODUCTS

2.1 Excavated Intermediate Cover Soil

- A. Insitu material that does not contain waste, as determined by the CQAR, and meets the TECHNICAL SPECIFICATIONS, may be reused and incorporated into the PROJECT. No excavated material shall be wasted without permission, and where necessary to waste such material it shall be at the direction of the ENGINEER and OWNER.
- B. All waste excavated material shall be considered property of the OWNER and disposed of by the CONTRACTOR as directed by the OWNER.
- C. Excavated Intermediate Cover Soil - Prior to being reused or incorporated into the WORK, the CONTRACTOR shall provide the CQC LABORATORY test results to the ENGINEER to ascertain the acceptability as construction material in accordance with TABLE 02220-1 EXCAVATED INTERMEDIATE COVER SOIL QUALIFICATION TESTING. The following shall apply:
 - 1. Composite soil samples are not allowed.

2. No soil containing or contaminated by solid waste or other similar material will be allowed for use.
3. Soil shall be non-organic, free of debris, sticks, roots, stones, and sharp materials greater than 1/2-inch in any dimension.
4. ASTM D2487-17e1 Soil Classification Groups ML, MH, OH, OL, PT, SW, SP, SP-SC, SP-SM, SW-SC, SW-SM, and SC or other soil as approved by the ENGINEER. For soils with Atterberg Limits, Liquid Limits shall be $LL < 50$ and $PI < 20$.

TABLE 02220-1 EXCAVATED INTERMEDIATE COVER SOIL QUALIFICATION TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D2216-19 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	1 test per source or change in material
ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))	1 test per source or change in material
ASTM D2487-17e1 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	1 test per source or change in material
ASTM D422-88(2019) Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)	1 test per source or change in material
ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1 test per source or change in material
ASTM D6141-18 Standard Guide for Screening Clay Portion and Index Flux of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids	1 test per source or change in material

5. Testing shall be repeated by the CQC LABORATORY each time there is a visual change in the material or upon direction of the ENGINEER.
 - a. Preconstruction Material Evaluation - Prior to incorporation into the WORK by the CONTRACTOR the CQA LABORATORY shall conduct tests of the material in accordance with TABLE 02220-2 EXCAVATED INTERMEDIATE COVER SOIL CONFORMANCE TESTING to verify material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.

- b. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense.
6. During placement, the material shall be tested by the CQA LABORATORY in accordance with the following to verify continued material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS:
- a. TABLE 02220-2 EXCAVATED INTERMEDIATE COVER SOIL CONFORMANCE TESTING.
 - b. TABLE 02220-3 EXCAVATED INTERMEDIATE COVER SOIL IN-PLACE DENSITY TESTING.
 - c. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense.

TABLE 02220-2 EXCAVATED INTERMEDIATE COVER SOIL CONFORMANCE TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D2216-19 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	1,500 CY
ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))	1,500 CY
ASTM D2487-17e1 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	1,500 CY
ASTM D422-88(2019) Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)	1,500 CY
ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1,500 CY
ASTM D6141-18 Standard Guide for Screening Clay Portion and Index Flux of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids	1,500 CY

TABLE 02220-3 EXCAVATED INTERMEDIATE COVER SOIL IN-PLACE DENSITY TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)	VALUE
ASTM D6938-17a Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 1	2/Acre/Lift	90% Standard Proctor

Note:

1. Placed in 6 inch loose lifts, rolled into place.
7. Unsuitable Subgrade Soil
 - a. ASTM D2487-17e1 Soil Classification Groups ML, MH, OH, OL, and PT.
 - b. Soil excessively wet or dry at time of compaction. Allow such material to dry, or moisten, as required, to bring material generally within 3 percent of optimum moisture content range for specified compaction.
 - c. Soil which yields or exhibits pumping due to excessive moisture.

2.2 GENERAL FILL

- A. General Fill – Prior to being incorporated into the WORK, the CONTRACTOR shall provide the CQC LABORATORY test results to the ENGINEER to ascertain the acceptability as construction material in accordance with TABLE 02220-4 GENERAL FILL SOIL QUALIFICATION TESTING. The following shall apply:
 1. Composite soil samples are not allowed.
 2. Shall be non-organic, free of debris, sticks, roots, stones, and sharp materials greater than 1/2-inch in any dimension.
 3. ASTM D2487-17e1 Soil Classification Groups SW, SP, SP-SC, SP-SM, SW-SC, SW-SM, and SC or other soil as approved by the ENGINEER. For soils with Atterberg Limits Liquid Limits shall be, LL < 50 and PI < 20.
 4. Testing shall be repeated by the CQC LABORATORY each time there is a visual change in the material, borrow source, or upon direction of the ENGINEER.
 - a. Preconstruction Material Evaluation - Prior to incorporation into the WORK by the CONTRACTOR the CQA LABORATORY shall conduct tests of the material in accordance with TABLE 02220-4 GENERAL FILL SOIL QUALIFICATION TESTING to verify material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.

- b. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense.

TABLE 02220-4 GENERAL FILL SOIL QUALIFICATION TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D2216-19 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	1 test per source or change in material
ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))	1 test per source or change in material
ASTM D2487-17e1 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	1 test per source or change in material
ASTM D422-88(2019) Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)	1 test per source or change in material
ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1 test per source or change in material
ASTM D6141-18 Standard Guide for Screening Clay Portion and Index Flux of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids	1 test per source or change in material

5. During placement, the material shall be tested by the CQA LABORATORY in accordance with the following to verify continued material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS:
- a. TABLE 02220-5 GENERAL FILL CONFORMANCE TESTING.
 - b. TABLE 02220-6 GENERAL FILL DENSITY TESTING DURING PLACMENT.
 - c. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense.

TABLE 02220-5 GENERAL FILL CONFORMANCE TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D2216-19 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	1,500 CY
ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))	1,500 CY
ASTM D2487-17e1 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	1,500 CY
ASTM D422-88(2019) Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)	1,500 CY
ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1,500 CY
ASTM D6141-18 Standard Guide for Screening Clay Portion and Index Flux of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids	1,500 CY

TABLE 02220-6 GENERAL FILL DENSITY TESTING DURING PLACMENT

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)	VALUE
ASTM D6938-17a Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2	2/Acre/Lift	90% Standard Proctor

Notes:

1. Backfill and drainage conveyance.
2. Placed in 6 inch loose lifts, rolled into place.

6. Unsuitable General Fill

- a. ASTM D2487-17e1 Soil Classification Groups ML, MH, OH, OL and PT.

- b. Soils also include suitable soils not maintained within 3 percent of optimum moisture content at the time of compaction. Allow such material to dry, as required, to bring material generally within 3 percent of optimum moisture content range for specified compaction.

2.3 Structural Fill

- A. Structural Fill - Prior to being incorporated into the WORK, the CONTRACTOR shall provide the CQC LABORATORY test results to the ENGINEER to ascertain the acceptability as construction material in accordance with TABLE 02220-7 STRUCTURAL FILL SOIL QUALIFICATION TESTING. The following shall apply:
 - 1. Composite soil samples are not allowed.
 - 2. Shall be non-organic, free of debris, sticks, roots, stones, and sharp materials greater than 1/2-inch in any dimension.
 - 3. ASTM D2487-17e1 Soil Classification Groups SW, SP, SP-SC, SP-SM, SW-SC, SW-SM, and SC or other soil as approved by the ENGINEER. For soils with Atterberg Limits, Liquid Limits shall be, $LL < 50$ and $PI < 20$.
 - 4. Testing shall be repeated by the CQC LABORATORY each time there is a visual change in the material, borrow source, or upon direction of the ENGINEER.
 - a. Preconstruction Material Evaluation - Prior to incorporation into the WORK by the CONTRACTOR the CQA LABORATORY shall conduct tests of the material in accordance with TABLE 02220-8 STRUCTURAL FILL SOIL CONFORMANCE TESTING to verify material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
 - b. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense.

TABLE 02220-7 STRUCTURAL FILL SOIL QUALIFICATION TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D2216-19 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	1 test per source or change in material
ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))	1 test per source or change in material
ASTM D2487-17e1 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	1 test per source or change in material

ASTM D422-88(2019) Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)	1 test per source or change in material
ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1 test per source or change in material

5. During placement, the material shall be tested by the CQA LABORATORY in accordance with the following to verify continued material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
 - a. TABLE 02220-8 STRUCTURAL FILL SOIL CONFORMANCE TESTING.
 - b. TABLE 02220-9 STRUCTURAL FILL IN-PLACE DENSITY TESTING.
 - c. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense.

TABLE 02220-8 STRUCTURAL FILL SOIL CONFORMANCE TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1,500 CY
ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft ³ (600 kN-m/m ³))	1,500 CY
ASTM D2487-17e1 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	1,500 CY
ASTM D2487-17e1 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	1,500 CY
ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1,500 CY

TABLE 02220-9 STRUCTURAL FILL IN-PLACE DENSITY TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)	VALUE
ASTM D6938-17a Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2	2/Acre/Lift (Cell Bottom)	90% Standard Proctor

Notes:

1. Embankments and beneath structures.
2. Placed in 6 inch loose lifts, rolled into place.
3. Embankments at every 300 linear feet.
4. Around structures use light rubber-tired or vibratory plate compactors.

6. Unsuitable Structural Fill
 - a. ASTM D2487-17e1 Soil Classification Groups ML, MH, OH, OL, and PT.
 - b. Soils also include suitable soils not maintained within 3 percent of optimum moisture content at the time of compaction. Allow such material to dry, as required, to bring material generally within 3 percent of optimum moisture content range for specified compaction.

2.4 PROTECTIVE COVER MATERIAL LAYER

- A. Protective Cover Material - Prior to being incorporated into the WORK, the CONTRACTOR shall provide the CQC LABORATORY test results to the ENGINEER to ascertain the acceptability as construction material in accordance with TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS and TABLE 02220-11 PROTECTIVE COVER MATERIAL QUALIFICATION TESTING. The following shall apply:
 1. Composite soil samples are not allowed.
 2. Shall be non-carbonate, non-organic, free of debris, waste, sticks, roots, organics, or other deleterious materials, and stones larger than 1/4-inch in any dimension.
 3. Protective Cover Material shall meet the following gradation requirements of TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS.

TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS

SIEVE SIZE	PERCENT PASSING (MAXIMUM)
No. 4	100
No. 30	95
No. 50	65
No. 70	20

4. The above gradation may be modified by the ENGINEER if the Protective Cover Material gradation varies from the gradation curve but still meets the following:
 - a. Geotextile requirements refer to Section 02940 Geotextile.
 - b. Interface shear strength requirements refer to Section 02931 Geocomposite.
5. Testing shall be repeated by the CQC LABORATORY each time there is a visual change in the material or upon direction of the ENGINEER.
 - a. Preconstruction Material Evaluation - Prior to incorporation into the WORK by the CONTRACTOR the CQA LABORATORY shall conduct tests of the material in accordance with TABLE 02220-12 PROTECTIVE COVER MATERIAL CONFORMANCE TESTING to verify material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
 - b. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense.

TABLE 02220-11 PROTECTIVE COVER MATERIAL QUALIFICATION TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)	VALUE (RANGE)
ASTM D422-88(2019) Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)	1 test per source or change in material	See note ¹
ASTM D2434-19 Standard Test Method for Permeability of Granular Soils (Constant Head) ²	1 test per source or change in material	1X10 ⁻⁴ to 5X10 ⁻⁴ cm/sec

Notes:

1. Refer to TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS.
2. Sample compacted in lab to 90% Standard Proctor.
6. During placement, the material shall be tested by the CQA LABORATORY in accordance with the following to verify continued material compliance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
 - a. TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS.
 - b. TABLE 02220-12 PROTECTIVE COVER MATERIAL CONFORMANCE TESTING.
 - c. Re-testing of materials failing to meet TECHNICAL SPECIFICATIONS requirements will be at the CONTRACTOR'S expense

TABLE 02220-12 PROTECTIVE COVER MATERIAL CONFORMANCE TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)	VALUE (RANGE)
ASTM D422-88(2019) Standard Guide for Selection of Methods of Particle Size Analysis of Fluvial Sediments (Manual Methods)	1,500 CY	See note ¹
ASTM D2434-19 Standard Test Method for Permeability of Granular Soils (Constant Head)	3,000 CY	1X10 ⁻⁴ to 5X10 ⁻⁴ cm/sec

Notes:

1. Refer to TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS.
2. Sample compacted in lab to 90% Standard Proctor.

2.5 TOPSOIL

- A. Topsoil - The topsoil will be capable of promoting the growth of vegetation. Shall be organic, natural or amended soil, typical of the locality, free of debris, waste, large stones, roots, sticks, clay, peat, weeds and sod, and obtained from naturally well drained areas.
- B. Topsoil shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth. The source of the topsoil shall be approved by the ENGINEER prior to placement by the CONTRACTOR.
- C. Upon request by the ENGINEER, the CONTRACTOR shall submit representative samples for use in sodding and seeding operations and results of analysis by a private laboratory to determine nutrient content.
- D. The material shall comply with the requirements of FDOT's Standard Specifications for Road and Bridge Construction (Current Edition), Section 987 for Topsoil.
- E. If necessary, nutrients (including agricultural lime and fertilizer) shall be added to the topsoil to enhance its ability to promote vegetation growth. The ENGINEER shall be consulted prior to use of nutrients.

2.6 OTHER MATERIAL

- A. All other material, not specifically described, but required for proper completion of the WORK shall be selected by the CONTRACTOR and reviewed by the ENGINEER to ascertain the acceptability as construction materials.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The CONTRACTOR is responsible for the layout of all excavations and establishment of grades as shown on the CONTRACT DRAWINGS. The CONTRACTOR shall replace existing survey markers to the original location if disturbed or destroyed at no additional cost to the OWNER. Layout WORK shall be performed by a SURVEYOR.
- B. The CONTRACTOR shall provide protection as required to prevent damage to existing improvements indicated to remain in place.
- C. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed Subbase foundation condition until the fills, structures, or pipes to be built thereon have been completed to such extent they will not be floated or otherwise damaged by allowing water levels to return to natural levels.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. The CONTRACTOR shall provide temporary erosion and sedimentation control methods in accordance with requirements of authorities having jurisdiction, as specified in the CONTRACT DOCUMENTS.
- B. The CONTRACTOR shall protect excavated/graded areas against action of the elements. Re-establish grades where settlement, washouts, or erosion damage occurs. Any erosion that takes place during the construction of the PROJECT shall be repaired by the CONTRACTOR at no additional cost to the OWNER as per the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
- C. Refer to Section 01568 Temporary Erosion and Sedimentation Control.

3.3 CLEARING, GRUBBING, AND STRIPPING

- A. Prior to clearing, grubbing, and stripping of the PROJECT area the CONTRACTOR shall have performed and submitted to the ENGINEER the required topographic surveys.
- B. Clear areas required for access to the site and execution of the WORK. Clearing and grubbing shall consist of the complete removal and disposal of all trees, brush, stumps, roots, grass, weeds, rubbish and all other obstructions resting on or protruding through the surface of the existing ground and the surface of the areas to be excavated which are understood by generally accepted practice not to be suitable for construction.
- C. Clearing and grubbing shall be accomplished in all areas designated for site grading. Areas to be excavated or filled upon shall be stripped of grass and roots to a depth of 4 inches. Stripped materials suitable for topsoil shall be stockpiled in areas for later use as designated by the OWNER and all other unsuitable material shall be disposed of onsite by the CONTRACTOR.

- D. Where clearing, grubbing, or excavation is conducted within the area where the liner system will be installed, all stumps, roots and other debris protruding through or appearing at the ground surface shall be removed to a depth of not less than 18 inches below the ground surface and the voids replaced with General Fill and compacted with equipment suitable for the WORK to bring the material to the required density and grade as specified in this Section.
- E. Refer to Section 02110 Site Clearing, Grubbing, and Stripping.
- F. Refer to Section 01050 Site Conditions Survey.

3.4 DEWATERING

- A. The CONTRACTOR shall at all times during WORK provide and maintain proper equipment and facilities to remove water entering excavations. The CONTRACTOR shall keep such excavations dry so as to obtain a satisfactory foundation condition for all WORK.
- B. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure of this system.
- C. Water that enters excavations with waste shall be considered leachate and shall not be discharged to the ground or other means that are typical for stormwater. Water determined to be leachate by the ENGINEER shall be pumped into sealed tanks, hauled, and disposed of by the CONTRACTOR or as directed by the ENGINEER.
- D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of the excavation and to preserve the integrity of adjacent structures.
- E. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick", or otherwise unsuitable for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by suitable materials as approved by the ENGINEER at the CONTRACTOR'S expense. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- F. The CONTRACTOR shall establish and maintain temporary drainage ditches, diversions outside excavation limits, or other acceptable methods as determined by the CONTRACTOR and approved by the ENGINEER to convey surface water and water removed from excavations to collecting or runoff areas as deemed necessary. The CONTRACTOR shall not use trench excavations as temporary drainage ditches.
- G. Disposal of Water Removed by Dewatering
 - 1. Water conveyed away from excavations which has not contacted waste materials shall be discharged within the PROJECT area as approved by the ENGINEER.

2. The CONTRACTOR shall not cause flooding by overloading or blocking up the flow in drainage facilities, and shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the OWNER or the authority having jurisdiction, at no cost to the OWNER.
 3. Dispose of water by procedures approved by the ENGINEER in such a manner as to cause no inconvenience to the OWNER, the ENGINEER, or others involved in WORK about the site.
- H. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system shall be removed by the CONTRACTOR.
- I. Refer to Section 02140 Dewatering.

3.5 DISPOSAL OF WASTE MATERIAL

- A. The CONTRACTOR shall be responsible for loading and transporting waste and waste materials not incorporated into the PROJECT to the active face of the landfill or other area as directed by the OWNER for disposal. The OWNER will not charge the CONTRACTOR a tipping fee, but the CONTRACTOR shall be responsible for all other costs.
- B. At no time shall waste material be stored outside the permitted landfill boundary and in landfill areas with installed intermediate or final cover systems.
- C. Exposed waste, or soil containing waste materials, shall not be allowed to remain exposed overnight. At the end of each workday, the CONTRACTOR shall cover exposed waste, or soil containing waste materials, in a temporary or permanent manner by the means of a compacted 6 inch earthen cover or tarp suitable for odor control and protection from rain, birds, and other hazards. At no time shall water exposed to waste be allowed to enter the stormwater management system. Water exposed to waste shall be considered leachate and handled accordingly.

3.6 STOCKPILE OF MATERIALS

- A. Excavated material shall be transported to stockpile areas designated by the OWNER for material that will be incorporated into the WORK, surplus, or unsuitable materials. No materials shall be removed from the site or disposed of by the CONTRACTOR except as directed by the ENGINEER. Excavated materials may be segregated during excavation and the ENGINEER or CQAR shall direct locations for segregated materials. The CONTRACTOR shall coordinate disposal activities with the ENGINEER and OWNER to not interfere with on-going landfill operations activities.
- B. The CONTRACTOR shall be responsible for vehicle traffic safety and shall coordinate with the ENGINEER and OWNER to determine site-specific safety concerns.
- C. The CONTRACTOR shall sweep or wash paved roadways that become covered with soil. The CONTRACTOR shall provide all equipment, water, and personnel necessary to clear the paved roads. This activity shall be performed at a minimum of 3 times per week or as the OWNER directs.

3.7 EXCAVATION

- A. Layout all excavations and establish grades as shown on the CONTRACT DRAWINGS.
- B. The CONTRACTOR shall excavate soil as required to the lines, grades, and elevations indicated on the CONTRACT DRAWINGS as needed to construct the Subbase. If encountered, the CONTRACTOR shall excavate Unsuitable Subbase Soil to 12 inches vertically and 6 inches horizontally around the unsuitable area only within the limits of the bottom liner system area as shown on the CONTRACT DRAWINGS. Unsuitable Subbase Soil that has been excavated shall be backfilled with suitable Excavated Intermediate Cover Soil (if available) or General Fill that meets the TECHNICAL SPECIFICATIONS and compacted with equipment suitable for the WORK to bring the material to the required density and grade.
- C. If the bottom of any excavation is removed below the limits shown on the CONTRACT DRAWINGS, it shall be backfilled at the CONTRACTOR'S expense with material approved by the ENGINEER at no additional cost to the OWNER.
- D. Excavation and backfilling shall be performed only when the CQAR is present. A minimum of 72 hours prior notice shall be given to the ENGINEER and CQAR.
- E. Excavating for Structures/Utilities - Excavations for structures and utilities must be carefully executed in order to avoid interruption of the existing operations.
 - 1. Excavation WORK shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other WORK required.
 - 2. Excavation for precast or prefabricated structures shall be carried to an elevation 18-inches lower than the proposed outside bottom of the structure to provide space for the select backfill material.
 - 3. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction.
- F. All excavations shall conform to the Excavation Plan submitted by the CONTRACTOR.

3.8 INTERMEDIATE COVER PREPARATION

- A. Conduct Intermediate Cover excavation activities, perform grading improvements, and construct embankments to the lines and grades shown on CONTRACT DRAWINGS in preparation for the installation of the geomembrane. Smooth finish surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades. The ENGINEER reserves the right to make adjustments or revisions in lines or grades as the WORK progresses while still achieving the intent of the grading plan.
- B. Compact the Intermediate Cover to a minimum of 90% relative compaction as determined by ASTM D698-12e2 Standard Test Methods for Laboratory Compaction

Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)). The exposed Subbase shall be proof-rolled a minimum of 3 complete passes with a vibratory steel drum roller (with vibratory action turned on) or other equipment approved by the ENGINEER.

- C. Areas that cannot be made to compact readily, deflect, pump, or rut under this operation shall be removed and replaced with suitable Excavated Intermediate Cover Soil (if available) or General Fill and compacted to a minimum of 90% relative compaction as determined by ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
 - 1. Care shall be taken when selecting construction equipment sizes and the amount of traffic on the Subbase.
- D. In cuts, all loose or protruding rocks on the excavated sideslopes shall be loosened and removed to line or finished grade of slope. All cut and fill slopes shall be as shown on the CONTRACT DRAWINGS or as directed by the ENGINEER.
- E. For areas of the prepared Intermediate Cover which do not achieve the lines and grades shown on CONTRACT DRAWINGS, the CONTRACTOR shall place suitable Excavated Intermediate Cover Soil (if available) or General Fill and compacted to a minimum of 90% relative compaction as determined by ASTM D698 Standard Proctor in accordance with this Section to achieve the lines and grades.
- F. Within the area where the geosynthetics will be placed, remove any debris, sticks, roots, stones and sharp materials greater than 1/2-inch in any dimension from the finished Intermediate Cover surface. Smooth finished Intermediate Cover surface to remove rutting and tire marks. The CONTRACTOR shall avoid sharp turns, sudden starts or stops, spinning and digging of tracks, or any other operation that could damage the surface.
- G. Grade the prepared Intermediate Cover to the required vertical tolerance. By survey methods, verify all grades, slopes, and elevations conform to specified requirements. Record elevations of each component in accordance with Section 01050 Site Conditions Survey. If there is a discrepancy, immediately notify the ENGINEER. Do not proceed with installation in an area of discrepancy until the ENGINEER gives approval.
- H. Maintain proper drainage during grading operations until final acceptance. Repair any fill or grading materials which may be lost or displaced as a result of natural causes such as storms, squalls, etc., with acceptable material. Repair shall be performed at no additional cost to the OWNER. The additional survey or documentation necessary to conduct the repairs shall be at no additional cost to the OWNER.
- I. Placement of the geosynthetics on the completed Intermediate Cover shall not begin until the following has occurred:
 - 1. The Intermediate Cover Survey has been submitted by the CONTRACTOR and approved by the ENGINEER. Refer to Section 01050 Site Conditions Survey.
 - 2. "Certificate of Subbase (Intermediate Cover) Acceptance" has been co-signed by the INSTALLER along with the CQAR certifying the Intermediate Cover was constructed in accordance with the approved CONTRACT DOCUMENTS and TECHNICAL

SPECIFICATIONS. Refer to Section 02700 Linear Low Density Polyethylene (LLDPE) Geomembrane Liner.

3.9 CONFORMANCE TESTING DURING PLACEMENT

- A. During material placement, testing shall be performed by the CQA LABORATORY in accordance with the following during the course of the WORK to verify continued material compliance with the CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS:
 - 1. TABLE 02220-2 EXCAVATED INTERMEDIATE COVER SOIL CONFORMANCE TESTING.
 - 2. TABLE 02220-5 GENERAL FILL CONFORMANCE TESTING.
 - 3. TABLE 02220-8 STRUCTURAL FILL SOIL CONFORMANCE TESTING.
 - 4. TABLE 02220-10 PROTECTIVE COVER LAYER GRADATION REQUIREMENTS.
 - 5. TABLE 02220-12 PROTECTIVE COVER MATERIAL CONFORMANCE TESTING.

3.10 PLACEMENT OF SOIL FILL AND COMPACTION

- A. Place designated soil fill materials, perform grading improvements, compact, and construct embankments to the lines and grades shown on the CONTRACT DRAWINGS. Smooth finish surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades. The ENGINEER reserves the right to make adjustments or revisions in lines or grades as the WORK progresses while still achieving the intent of the grading plan.
- B. During material placement, testing shall be performed by the CQA LABORATORY in accordance with the following during the course of the WORK to verify continued material compliance with the CONTRACT DRAWINGS and TECHNICAL SPECIFICATIONS:
 - 1. TABLE 02220-3 EXCAVATED INTERMEDIATE COVER SOIL IN-PLACE DENSITY TESTING.
 - 2. TABLE 02220-6 GENERAL FILL DENSITY TESTING DURING PLACMENT.
 - 3. TABLE 02220-9 STRUCTURAL FILL IN-PLACE DENSITY TESTING
- C. Each loose lift shall be compacted to the required density and frequency based on the type and location of soil fill material.
 - 1. Suitable Excavated Subgrade Soil - Compact each 6 inch loose lift to a minimum of 90% relative compaction as determined by ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. General Fill - Compact each 6 inch loose lift to a minimum of 90% relative compaction as determined by ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).

3. Structural Fill - Compact each 6 inch loose lift to a minimum of 90% relative compaction as determined by ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
- D. Compaction equipment used is at the discretion of the CONTRACTOR.
 1. Areas that deflect, pump, or rut under this operation shall be reworked by the CONTRACTOR.
 - E. Within the areas where geosynthetics will be placed, remove any debris, sticks, roots, stones and sharp materials greater than 1/2-inch in any dimension from the finished Subbase surface. Smooth finished Subbase surface to remove rutting and tire marks. The CONTRACTOR shall avoid sharp turns, sudden starts or stops, spinning and digging of tracks, or any other operation that could damage the surface.
 - F. Grade the prepared area to the required vertical tolerance. By survey methods, verify that all grades, slopes and elevations conform to specified requirements. Record elevations of each component in accordance with Section 01050 Site Conditions Survey. If there is a discrepancy, immediately notify the ENGINEER. Do not proceed with installation in an area of discrepancy until the ENGINEER gives approval.
 - G. Maintain proper drainage during grading operations until final acceptance. Repair any fill or grading materials which may be lost or displaced as a result of natural causes such as storms, squalls, etc., with acceptable material. Repair shall be performed at no additional cost to the OWNER. The additional survey or documentation necessary to conduct the repairs shall be at no additional cost to the OWNER.

3.11 PLACEMENT OF PROTECTIVE COVER MATERIAL LAYER

- A. Placement of the Protective Cover Material layer will only occur after the underlying geosynthetic material installations are complete and approved in accordance with the TECHNICAL SPECIFICATIONS.
- B. Placement of the Protective Cover Material shall be conducted in accordance with the Protective Cover Material Installation Plan submitted by the CONTRACTOR.
- C. Place Protective Cover Material to the lines and grades shown on the CONTRACT DRAWINGS. The CONTRACTOR shall place a minimum of 18 inches of Protective Cover Material and 6 inches of Topsoil for a total depth of 24 inches (measured perpendicular to the slope) meeting the requirements specified in this Section.
- D. Equipment placing fill material over the synthetic liner system must operate on an initial layer of fill of sufficient thickness to protect the underlying material from damage. The equipment shall be no larger than a Caterpillar D-4 or a Caterpillar D-6 with low ground pressure tracks, until sufficient cover material is in place to protect the underlying material from damage by equipment with higher ground pressures. The bulldozer movement shall be forward and backward, no turning will be allowed until a minimum of 18 inches of cover is placed above the synthetic liner system. Protective Cover shall be pushed up the slope from bottom to top, no bridging above areas without protective cover. All turning of equipment will be off the area underlain by synthetic liner system. A

minimum thickness of 18 inches of granular material is specified between rubber-tired vehicles and the synthetic liner system. In areas of heavy traffic, such as access ramps, granular material thickness should be at least 36 inches. Any damage to the geosynthetic liner system shall be repaired by the CONTRACTOR at no additional cost to OWNER.

- E. Place Protective Cover Material in a manner to not cause wrinkles and undue stresses to the underlying geosynthetic liner system.
- F. The CONTRACTOR shall provide and maintain a means of continuously observing the installed depth of the Protective Cover Material as indicated in the Protective Cover Material Installation Plan on the required grid intervals. If temporary markers are used, the marker shall be free standing and shall not be sharp or pointed so it cannot damage the geosynthetic liner materials if hit by equipment. Markers shall be removed after use and shall not be abandoned in-place after Protective Cover Material installation.
- G. Maintain proper drainage during grading operations until final acceptance. Repair any fill or grading materials which may be lost or displaced as a result of natural causes such as storms, squalls, etc., with acceptable material. Repair shall be performed at no additional cost to the OWNER. The additional survey or documentation necessary to conduct the repairs shall be at no additional cost to the OWNER.
- H. By survey methods, verify that all grades, slopes, and elevations conform to specified requirements. Record elevations in accordance with Section 01050 Site Conditions Survey. If there is a discrepancy, immediately notify the ENGINEER. Do not proceed with installation in an area of discrepancy until the ENGINEER gives approval.

3.12 SODDING/REVEGETATION

- A. Grass seeding and mulching shall be required in the entire area of the CONTRACTOR'S construction staging/laydown area, regardless of the approximate limits that may be indicated on the CONTRACT DRAWINGS.
- B. The CONTRACTOR shall maintain the seeded and sodded areas in accordance with Section 02900 Seeding and Sodding.
- C. Refer to Section 02900 Seeding and Sodding.

3.13 TOLERANCES

- A. The CONTRACTOR shall bring final grading to within the tolerances specified in Section 01050 Site Conditions Survey.
- B. After other outside WORK has been finished, and backfilling completed and settled, all areas on the site of the WORK which are to be graded shall be graded with the tolerance in Section 01050 Site Conditions Survey of the indicated cross section thicknesses and slopes. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage.
- C. Refer to Section 01050 Site Conditions Survey.

SECTION 02221

DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. The CONTRACTOR shall furnish all labor, materials, equipment and incidental WORK necessary for the removal and disposal of structures, foundations, piping, roadway materials, or any part thereof including masonry, steel, reinforced concrete, plain concrete, asphalt, electrical facilities, and any other material or equipment shown or specified to be removed on the CONTRACT DRAWINGS.
- B. The CONTRACTOR shall carry out demolition so that adjacent structures, which are to remain, are not endangered.
- C. All Demolition efforts will be coordinated with the OWNER and the ENGINEER.
- D. The OWNER may wish to retain ownership of some of the materials and will direct the CONTRACTOR to a designated stockpile area if this is the case.
- E. Provide dust control and make provisions for safety. The CONTRACTOR shall comply with applicable Occupational Safety and Health Administration (OSHA) regulations, Federal, State and local safety requirements.

1.2 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Permits - Submit one copy of each permit as required by Federal, State, and local jurisdictions for all phases and operations of the WORK (if applicable).

1.3 QUALITY ASSURANCE

- A. Permits - Before the WORK of this Section is started, the CONTRACTOR will be responsible for obtaining all permits required by Federal, State, and local jurisdictions for all phases and operations of the WORK.
- B. Demolition Plan - Before the WORK of this Section is started, the CONTRACTOR will prepare a detailed Demolition Plan. The Demolition Plan shall include, but not be limited to, detailed outline of intended demolition and disposal procedures. The Demolition Plan will not relieve the CONTRACTOR of complete responsibility for the successful performance of the WORK in accordance with all applicable Federal, State, and local codes and restrictions.

PART 2 - PRODUCTS

This Section is Not Applicable

PART 3 - PRODUCTS

3.1 PROTECTION

- A. General Safety - The CONTRACTOR shall provide warning signs, protective barriers, and warning lights as necessary adjacent to the WORK as approved or required. The CONTRACTOR shall maintain these items during the demolition period as required.
- B. Existing Services - Undertake no demolition WORK until all mechanical and electrical services affected by the WORK have been properly disconnected. Cap, reroute or reconnect interconnecting piping or electrical services that are to remain in service either permanently or temporarily. The CONTRACTOR shall locate, identify and protect utilities, benchmarks, piping, and structures that are not to be removed from damage during demolition activities.
- C. Hazards - Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected and eliminate the hazard before demolition is started.

3.2 DEMOLITION REQUIREMENTS

- A. Explosives - The use of explosives will not be permitted.
- B. Protection - Carefully protect all mechanical and electrical equipment against dust and debris.
- C. Access - Provide safe access to, and egress from, all working areas at all times with adequate protection from falling material.

3.3 CONTROL

- A. Survey tolerances shall be in accordance with Section 01050 Field Engineering and Survey.

3.4 DISPOSAL OF MATERIALS

- A. All debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition shall not be removed from the site or disposed of by the CONTRACTOR except as directed by the OWNER or ENGINEER. The OWNER will designate an on-site disposal area for demolition materials.
- B. The CONTRACTOR shall transport demolition materials, excess soils, etc. to an on-site disposal area as directed by the OWNER as soon as practical. The CONTRACTOR will not be required to pay a disposal fee for the demolition materials. The cost for hauling demolition materials, excess soils, etc. shall be included in the Bid Price.

END OF SECTION

SECTION 02315

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, equipment, and incidentals to excavate and trench designated areas, install pipe and appurtenances, install backfill material, compact backfill, and regrade disturbed areas as shown on the CONTRACT DRAWINGS and as specified herein.
- B. The WORK specified in this Section includes the trenching and trench backfilling activities associated with installation of materials requiring excavation, trenching, trench backfilling, or grading.
- C. No classification of type of excavated materials will be made. Excavation includes all soil and refuse materials regardless of type, character, composition, moisture, or condition.
- D. Any damage to existing features shall be repaired as directed by the ENGINEER, at the CONTRACTOR'S expense.
- E. Throughout this Section, all references to "SURVEYOR" shall mean a professional land surveyor licensed in the State of Florida.

1.2 PROJECT CONDITIONS

- A. Existing PROJECT conditions are shown on the CONTRACT DRAWINGS or otherwise described herein.
- B. Site information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the CONTRACTOR. The CONTRACTOR shall explore ahead of the required excavation to determine the exact location of all structures, utilities, etc.
- C. Structures shall be supported and protected from damage by the CONTRACTOR. If structures are broken or damaged, the CONTRACTOR shall restore structures, utilities, etc. to their original condition at no additional cost to the OWNER. Repair of damaged features or structures shall be approved by the ENGINEER and OWNER.

1.3 SITE ACCESS

- A. WORK shall be performed so as to not block or hinder site access, except as authorized by the OWNER.

1.4 SAFETY

- A. All WORK shall be performed in strict accordance with the Health and Safety requirements set forth in the General Conditions of the CONTRACT DOCUMENTS and the CONTRACTOR'S Health and Safety Plan.
- B. All WORK shall be performed in strict accordance with all local, State, U.S. Occupational Safety and Health Administration (OSHA) and other applicable Federal regulations regarding trenching operations and trench safety.
- C. Excavation may be made without sheeting and bracing within the limitations and requirements of the governmental agencies having jurisdiction. Failure of the ENGINEER to order the use of bracing or sheeting and shoring or direct changes to systems in place, shall not in any way or to any extent relieve the CONTRACTOR of any responsibility concerning the condition of excavations or of his obligations under the CONTRACT. The CONTRACTOR shall be responsible for the condition of all excavations. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances that they may occur.
- D. All excavation shall comply with the applicable requirements as stated in the following:
 - 1. OSHA excavation safety standards 29 CFR, 1926-650, subpart P.
 - 2. State (Trench Safety Act Section 553.60-553.64 Florida Statutes) and the OWNER construction safety regulations.
 - 3. Trench safety guidelines as specified by the Landfill Gas Division of the Solid Waste Association of North America (SWANA).
- E. The CONTRACTOR shall include for any excavation, temporary controls for stormwater runoff and erosion control in full conformance with all existing permits and/or applicable regulations.

1.5 SUBMITTALS

- A. Health and Safety Plan as described in Section 01800 Health and Safety Requirements.
- B. Pipe slope calculations and survey notes for pre-construction layout, including proposed alignment.
- C. Pipe survey notes for installed pipe pursuant to this Section.
- D. Proposed stationing and pipeline identification procedures. Prior to the start of any pipe installation, the CONTRACTOR shall supply an example layout drawing showing how the piping will be marked with stations for the conformance surveys.
- E. The CONTRACTOR daily logs detailing length of trench excavated and backfilled, with reference to pipe stationing and details sufficient to properly describe the WORK completed to date.
- F. The CONTRACTOR shall notify the ENGINEER in writing of the material source for each of the soils specified within this Section at least 15 calendar days prior to the date of

anticipated use of such material in accordance with Section 02220, Excavation, Backfill, Fill, and Grading.

- G. Excavated Intermediate Cover Soil Qualification Test Results - Prior to being reused or incorporated into the WORK, the CONTRACTOR shall provide the CQC LABORATORY test results to the ENGINEER to ascertain the acceptability as construction material in accordance with Section 02220, Excavation, Backfill, Fill, and Grading.
- H. General Fill Qualification Test Results – Prior to being reused or incorporated into the WORK, the CONTRACTOR shall provide the CQC LABORATORY test results to the ENGINEER to ascertain the acceptability as construction material in accordance with Section 02220, Excavation, Backfill, Fill, and Grading.
- I. Structural Fill Qualification Test Results – Prior to being reused or incorporated into the WORK, the CONTRACTOR shall provide the CQC LABORATORY test results to the ENGINEER to ascertain the acceptability as construction material in accordance with Section 02220, Excavation, Backfill, Fill, and Grading.
- J. Toe Drain Collection System Gravel – Prior to being used or incorporated into the WORK, the CONTRACTOR shall provide the Certified Gradation Analysis by the gravel supplier.
- K. All other material, not specifically described, but required for proper completion of the WORK shall be selected by the CONTRACTOR and reviewed by the ENGINEER to ascertain the acceptability as construction materials.

PART 2 - PRODUCTS

2.1 CLEAN SOIL BACKFILL MATERIALS

- A. Excavated Intermediate Cover Soil - Soil material may be reused and incorporated into the PROJECT for clean soil backfill provided it does not contain waste, as determined by the ENGINEER, and meets the TECHNICAL SPECIFICATIONS in accordance with Section 02220, Excavation, Backfill, Fill, and Grading. The following shall apply:
 - 1. Shall be non-organic, free of debris, sticks, roots, stones, and sharp materials greater than 1/2-inch in any dimension.
 - 2. ASTM D2487-17e1 Soil Classification Groups ML, MH, OH, OL, PT, SW, SP, SP-SC, SP-SM, SW-SC, SW-SM, and SC or other soil as approved by the ENGINEER. For soils with Atterberg Limits the LL < 50 and PI < 20.
- B. General Fill - The material shall meet the following in accordance with Section 02220, Excavation, Backfill, Fill, and Grading:
 - 1. Shall be non-organic, free of debris, sticks, roots, stones, and sharp materials greater than 1/2-inch in any dimension.
 - 2. ASTM D2487-17e1 Soil Classification Groups SW, SP, SP-SC, SP-SM, SW-SC, SW-SM, and SC or other soil as approved by the ENGINEER. For soils with Atterberg Limits the

LL < 50 and PI < 20.

3. General Fill shall be used in any location on the CONTRACT DRAWINGS that calls for "General Fill" or "clean soil backfill" (same as General Fill) if excavated material is waste or is otherwise not suitable for reuse.
- C. Structural Fill - The material shall meet the following in accordance with Section 02220, Excavation, Backfill, Fill, and Grading:
 1. Shall be non-organic, free of debris, sticks, roots, stones, and sharp materials greater than 1/2-inch in any dimension.
 2. ASTM D2487-17e1 Soil Classification Groups SW, SP, SP-SC, SP-SM, SW-SC, SW-SM, and SC or other soil as approved by the ENGINEER. For soils with Atterberg Limits the LL < 50 and PI < 20.

2.2 TOE DRAIN COLLECTION SYSTEM GRAVEL

- A. Prior to placement the CONTRACTOR shall certify the toe drain collection system gravel meets the requirements of this Section. Gravel may be obtained from an approved borrow source if it meets these requirements.
 3. Shall be non-carbonate (< 5%), non-organic (< 5%), free of debris, waste, vegetation, sticks, roots, organics, or other deleterious materials, and stones larger than 2-inches in any dimension.
 4. Shall be rounded to well-rounded quartz or granite-based gravel.
 5. Shall be of sound, hard, and durable quality that will be free of open or incipient cracks, soft seams or other structural deficiencies. It shall not contain any soapstone, shale, or other material that easily disintegrates.
 6. Certified gradation analysis shall be provided by the gravel supplier.
- B. The gradation shall comply with TABLE 02315-1 TOE DRAIN COLLECTION SYSTEM GRAVEL, or other materials as approved by the ENGINEER.

TABLE 02315-1 TOE DRAIN COLLECTION SYSTEM GRAVEL

SIEVE SIZE	PERCENT PASSING (MAXIMUM)
1/2-inch	0 - 5
1-inch	10 - 30
2-inch	20 - 50
No. 4	100

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities from damage.
- C. Protect benchmarks, survey control points, monitoring wells, existing structures, and fences from excavating equipment and vehicular traffic.
- D. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed Subgrade foundation condition until the fills, structures, or pipes to be built thereon have been completed to such extent they will not be floated or otherwise damaged by allowing water levels to return to natural levels.
- E. The CONTRACTOR shall protect excavated/graded areas against action of the elements. Re-establish grades where settlement, washouts, or erosion damage occurs. Any erosion that takes place during the construction of the PROJECT shall be repaired by the CONTRACTOR at no additional cost to the OWNER as per the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
- F. Refer to Section 01568 Temporary Erosion and Sedimentation Control.

3.2 PRE-CONSTRUCTION LAYOUT

- A. Prior to trenching and pipe installation, the CONTRACTOR shall stake out the entire proposed trench alignment. The proposed alignment must be approved by the ENGINEER prior to the CONTRACTOR beginning excavation activities.
- B. Survey notes with proposed pipe slope calculations shall be submitted to the ENGINEER for approval prior to pipe installation. Notes of pre-construction survey shall identify conflicts between the proposed WORK and existing features.

3.3 EXCAVATION

- A. Refuse materials shall be handled as directed in Section 02220, Excavation, Backfill, Fill, and Grading.
- B. Excavate to lines, grades, and dimensions necessary to complete the WORK.
- C. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.
- D. Trenching Tolerances
 - 1. Excavate to install pipes in straight runs at a uniform grade, without sags or humps, between vertical and horizontal control points in accordance with the CONTRACT

DRAWINGS.

2. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment.
 3. Maintain thickness of soil cover over the top of the pipe, as shown on the CONTRACT DRAWINGS, or approved by the ENGINEER.
 4. Whenever so identified by the ENGINEER, the CONTRACTOR shall excavate to such depth below grade as the ENGINEER may direct and the trench bottom shall be brought to grade with such material as the ENGINEER may identify installed.
- E. The CONTRACTOR may not excavate more trench daily than can be completely backfilled after installation of the pipe the same day. Excavations shall not be left open overnight. In the event that a trench must be left open overnight the CONTRACTOR must get permission from the OWNER to leave trench open and trench must be encircled in safety/warning tape attached to stakes placed along the perimeter on all edges of the trench. In the event that the trench has exposed refuse, all refuse must be covered with a tarp or other cover material as approved by the OWNER, which is secured on all corners and along its perimeter.
- F. The CONTRACTOR shall use appropriate survey/level instrumentation during excavation to ensure required trench slope. Verification of installed pipe slope shall be as specified in this Section.

3.4 DEWATERING

- A. Water that enters excavations with waste shall be considered leachate and shall not be discharged to the ground or other means that are typical for stormwater. Water determined to be leachate by the ENGINEER shall be pumped into sealed tanks, hauled, and disposed of by the CONTRACTOR or as directed by the ENGINEER.
- B. The CONTRACTOR shall establish and maintain temporary drainage ditches, diversions outside excavation limits, or other acceptable methods as determined by the CONTRACTOR and approved by the ENGINEER to convey surface water and water removed from excavations to collecting or runoff areas as deemed necessary. The CONTRACTOR shall not use trench excavations as temporary drainage ditches.
- C. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick", or otherwise unsuitable for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by suitable materials as approved by the ENGINEER at the CONTRACTOR'S expense. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- D. Disposal of Water Removed by Dewatering System

1. Water conveyed away from excavations which has not contacted waste materials shall be discharged within the PROJECT area as approved by the ENGINEER.
 2. The CONTRACTOR shall not cause flooding by overloading or blocking up the flow in drainage facilities, and shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the OWNER or the authority having jurisdiction, at no cost to the OWNER.
 3. Dispose of water by procedures approved by the ENGINEER in such a manner as to cause no inconvenience to the OWNER, the ENGINEER, or others involved in WORK about the site.
- E. If pipe trench becomes watered-in after placement of pipe, but before backfilling, CONTRACTOR shall dewater the trench, demonstrate that the pipe trench and pipe slope remain satisfactory, and upon approval by the ENGINEER, backfill the pipe with clean dry soil in accordance with this Section.
- F. Refer to Section 02140 Dewatering.

3.5 PIPE SURVEY

- A. The CONTRACTOR shall verify that pipe slope meets the requirements specified in this Section and on the CONTRACT DRAWINGS at 25 foot intervals along the toe drain collection pipe, stormwater downchute pipes, and any other pipes installed for the PROJECT and record such information in the PROJECT notes. Station numbering shall be used and marked on the pipe, as approved by the ENGINEER.
1. The CONTRACTOR shall measure each length of installed pipe and mark the 25 foot stations.
 2. Survey equipment shall be used to measure the change in relative elevation between each 25 foot station prior to burial of any pipe.
 3. The surveyed elevations and calculated change in elevation and slope for each 25 foot section shall be recorded in the CONTRACTOR'S PROJECT notes.
 4. A trench laser will not be considered acceptable survey equipment for the purpose of verifying pipe slope.
- B. The PROJECT notes detailing the required pipe slope confirmation shall be provided daily to the ENGINEER.
- C. A conformance survey shall be conducted on all installed pipe prior to backfilling the trench.
1. The survey shall document the horizontal and vertical location of the top of the horizontal vent trench at minimum 25 foot intervals and at each change in pipe direction, ground surface grade break, change in pipe grade, fitting, and connection.

2. The survey shall also document the type of pipe, location (horizontal and vertical coordinate) of structures and appurtenances such as, but not limited to, pipe crossing and tie-ins.
3. This surveying shall be sealed by a SURVEYOR as described in Section 01050 Site Conditions Survey.

3.6 BACKFILLING

- A. The CONTRACTOR shall notify the ENGINEER 72 hours prior to beginning backfilling. The CQAR shall inspect all pipe, fittings and connections prior to approving backfilling. If the CONTRACTOR backfills pipe without observation of the pipe while pipe is installed in the open trench, the CONTRACTOR shall uncover all uninspected buried pipe so that it may be properly inspected. This shall be done at no additional cost to the OWNER or ENGINEER.
- B. Backfilling procedures shall be modified as necessary as approved by the ENGINEER in order to not displace (either horizontally or vertically) piping installed in the trench during backfill placement.
- C. Place soil backfill in maximum 12 inch lifts to the existing grade. The CONTRACTOR shall compact soil backfill in 12 inch lifts with a mechanical compaction device such as a walk-behind vibratory compactor. Compaction shall be to a density where subsequent passes with the mechanical compaction device will not reduce the surface elevation of the trench backfill material by more than three-quarters of an inch.

3.7 PLACEMENT OF TOE DRAIN COLLECTION TRENCH GRAVEL

- A. Placement of the Toe Drain Collection System materials will only occur after the underlying geosynthetic material installations are complete and approved in accordance with the TECHNICAL SPECIFICATIONS.
- B. Placement of the Toe Drain Collection System materials shall be conducted in accordance with the Drainage Material Installation Plan submitted by the CONTRACTOR.
- C. Place Toe Drain Collection System gravel around the toe drain collection pipes wrapped with geotextile to the lines and grades shown on the CONTRACT DRAWINGS.
- D. Refer to Section 02940 Geotextile.

3.7 REFUSE DISPOSAL

- A. The CONTRACTOR shall be responsible for loading and transporting refuse to the working face as specified in Section 02220, Excavation, Backfill, Fill, and Grading. No excavated waste shall be left overnight at any excavation at any time.

3.8 GRADING DISTURBED AREAS

- A. The CONTRACTOR shall regrade and return to their original condition, as determined by the ENGINEER, all areas disturbed by CONTRACTOR'S WORK. This includes but is not limited to ruts caused by construction equipment, soil stockpile areas, and landfill benches and terraces used for access.

3.9 TESTING REQUIREMENTS DURING PLACEMENT

- A. The CONTRACTOR shall place backfill and fill materials to achieve an equal or "higher" degree of compaction than undisturbed materials adjacent to the WORK; however, in no case shall the degree of compaction fall below minimum compaction specified in Section 02220, Excavation, Backfill, Fill, and Grading.
- B. The location of field moisture-density tests for this Section shall be selected and approved by the ENGINEER.
- C. Where laboratory or field testing is specified herein to verify that the constructed, in-place WORK meets the TECHNICAL SPECIFICATIONS and quality control requirements herein, the OWNER shall employ and bear the expense for an independent testing laboratory to conduct such tests. The CONTRACTOR shall pay for the costs of all retests required due to the initial testing not passing the requirements herein.

END OF SECTION

SECTION 02400

REFUSE HANDLING, STORAGE, AND DISPOSAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes removal of waste materials after completing any grading or drilling for Landfill Gas (LFG) extraction wells. This waste material is not suitable for construction of the WORK as shown on the CONTRACT DRAWINGS and specified herein.
- B. The CONTRACTOR shall notify the OWNER in advance of planned excavation or drilling activities.
- C. Excavated or drilled waste material shall be removed from the immediate excavation or dilled area and properly disposed of by the CONTRACTOR except as specified below and approved by the OWNER.

PART 2 - PRODUCTS

This Section is Not Applicable.

PART 3 – REFUSE HANDLING AND DISPOSAL

3.1 REQUIREMENT

- A. The CONTRACTOR shall be responsible for loading and transporting waste and waste materials not incorporated into the PROJECT to the active face of the landfill or other area as directed by the OWNER for disposal. The OWNER will not charge the CONTRACTOR a tipping fee, but the CONTRACTOR shall be responsible for all other costs.
- B. At no time shall waste material be stored outside the permitted landfill boundary and in landfill areas with installed intermediate or final cover systems.
- C. Exposed waste, or soil containing waste materials, shall not be allowed to remain exposed overnight. At the end of each workday, the CONTRACTOR shall cover exposed waste, or soil containing waste materials, in a temporary or permanent manner by the means of a compacted 3 inch earthen cover or tarp suitable for odor control and protection from rain, birds, and other hazards. At no time shall water exposed to waste be allowed to enter the stormwater management system. Water exposed to waste shall be considered leachate and handled accordingly.
- D. The CONTRACTOR shall include all costs for the determination of tonnage and all other costs associated for loading, hauling, and dumping waste at the active face of the landfill or other area as directed by the OWNER, and included in the respective Waste Removal

and Relocation bid item.

- E. The CONTRACTOR is responsible for the proper disposal and associated processing fees for any CONTRACTOR generated waste and shall be at no additional cost to the OWNER.

END OF SECTION

SECTION 02500

LFG EXTRACTION WELLS AND WELLHEADS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes the labor, equipment, materials, appurtenances, drilling, CONSTRUCTION QUALITY CONTROL (CQC), testing, and installation of LANDFILL GAS (LFG) EXTRACTION WELLS as part of the PROJECT as shown on the CONTRACT DRAWINGS and as specified herein.
- B. All materials shall conform to the requirements of this Section and shall be of new stock of the highest grade available, free from defects, and recently manufactured.
- C. All WORK shall be performed in strict accordance with the TECHNICAL SPECIFICATIONS, CONTRACT DRAWINGS, conformance with the MANUFACTURER'S recommendations, and with current industry standards.
- D. The perforated pipe, gravel stone, geotextile, bentonite, and soil backfill shall be set at depths and thicknesses shown on the CONTRACT DRAWINGS or as designated in the field by the ENGINEER. It is expected that combustible and asphyxiant gases will be venting from boreholes drilled in to waste within the footprint of the landfill. The CONTRACTOR'S bid price shall include provision for all equipment and procedures necessary to safely install wells and borings under this condition. All WORK shall be performed by qualified workers in accordance with the best standards and practices available.
- E. Upon completion of each new extraction well or boring, CONTRACTOR shall dispose of all construction and drilling refuse materials as specified in Section 02400 Refuse Handling, Storage, and Disposal or as directed by the OWNER.

1.2 REFERENCED DOCUMENTS

- A. The following American Society of Testing and Materials (ASTM) test methods shall be incorporated into this TECHNICAL SPECIFICATIONS in their entirety, subject to the indicated test modifications.
 - 1. ASTM D420-98 Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes
 - 2. ASTM D422-63 Standard Method for Particle-Size Analysis of Soils
 - 3. ASTM D1452-80 Standard Practice for Soil Investigation and Sampling by Auger Borings
 - 4. ASTM D2487-00 Standard Classification of Soils for Engineering Purposes

5. ASTM D2488-00 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
- B. Related Work Described Elsewhere:
 1. Section 02400 Refuse Handling, Storage, and Disposal
 2. Section 02220 Excavation, Backfilling and Compaction
 3. Section 02315 Trenching and Backfilling
 4. Section 335110 Pipe and Pipe Fittings

1.3 SUBMITTALS

- A. The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval, Certificates of Compliance on materials furnished, and MANUFACTURER'S brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished as described in CONTRACTOR Submittals.
- B. The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval, Shop Drawings showing dimensions, materials, and MANUFACTURER'S information for pipe, pipe perforations, fittings, and bentonite.
- C. One week prior to well drilling, CONTRACTOR shall submit an example well boring log and construction log. The example log shall be completed with all of the required descriptions and pertinent information required under Part 3.3 of this Section.
- D. At least two weeks prior to construction, the CONTRACTOR shall submit to the ENGINEER for review and approval, results of the sieve analysis for the soil backfill, samples of all well backfill materials (if requested), the name of the vendor(s), and source of backfill materials furnished.
- E. At the end of each day, CONTRACTOR shall provide copies of the handwritten well boring and completion logs for each well drilled on that day. Information to be included on the well logs is listed in Part 3.3 of this Section.
- F. Final boring logs based on field information shall be typewritten and submitted with the Record Documents. Description of the boring and excavated material shall be according to the attached well boring log template at the end of this Section.

1.4 CONSTRUCTION QUALITY ASSURANCE

- A. CQA will be performed by an independent profession retained by the OWNER who is experienced in installation of LFG wells and shall be responsible for observing and documenting information related to all boring and installation activities.

- B. The CQA inspector will verify well materials for cleanliness, deformations, and imperfections, and ensure conformance with the TECHNICAL SPECIFICATIONS prior to use
- C. Presence of a CQA inspector shall not in any way or to any extent relieve the CONTRACTOR of any responsibility concerning the condition of drilling activities, LFG well installation, or of his obligations under the CONTRACT.

PART 2 - PRODUCTS

2.1 CLEAN SOIL BACKFILL

- A. Clean soil backfill material shall be granular material free of clay, sticks, roots, organic material, MSW, and stones larger than 1-inch in any dimension. Clean soil shall be used in any location on the CONTRACT DRAWINGS that calls for “clean soil backfill”.

2.2 STONE

- A. Stone backfill shall be hard, durable non-calcareous rock. Stone shall be washed as a component of the manufacturing process and be free of organics, lumps or balls of clay, and other deleterious materials.
- B. Stone shall be FDOT No. 4 and conform to the following gradation requirements:

SIEVE SIZE	% PASSING (BY WEIGHT)
2-inch	100
1 ½-inch	90
1-inch	35
¾-inch	5
⅜-inch	0

2.3 BENTONITE

- A. “Bentonite Plug” as used on the CONTRACT DRAWINGS, shall refer to a well seal comprised of hydrated sodium bentonite pellets or chips of a thickness as indicated on the CONTRACT DRAWINGS. Bentonite material shall consist of clay greater than 85% sodium montmorillonite, without additives.
- B. Bentonite shall be hydrated per MANUFACTURER'S instructions prior to backfilling with soil. Bentonite shall be hydrated in 6-inch lifts as per Part 3.5 C of this Section.
- C. Under no circumstances will the use of granular bentonite be permitted for the vertical extraction wells.

2.4 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- A. Pipe for LFG extraction wells shall be 8-inch Standard Dimension Ratio (SDR) 9 High Density Polyethylene (HDPE) pipe as shown on the CONTRACT DRAWINGS and conforming to the requirements of Section 15090 LFG Pipe and Pipe Fittings. The perforations in the extraction well piping shall be as specified on the CONTRACT DRAWINGS.

2.5 WELLHEAD MATERIALS

- A. Wellheads shall be Precision Quick-Change™ orifice plate wellheads provided by QED Environmental.

2.6 MONITORING PORTS

- A. Monitoring ports shall be Easy Port™ ¼ inch male NPT screw-capped “long” barb fittings.

2.7 WELL IDENTIFICATION

- A. Upon completion of well drilling and piping installation, CONTRACTOR is to install one (1) printed yellow well identification label on each of the PHASE III well casings (existing and new/re-drilled):
- B. Identification labels must be outdoor, UV resistant, waterproof, and permanently adhered around the well casing.
- C. Identification label shall contain the following information: The words “**Southeast County Landfill**” Well identification “**EW-X**” and “**Landfill Gas Extraction Well**” like the example shown below. Lettering by any other means is not be permitted.
- D. Identification label shall be 6-inch tall and safety yellow with black lettering. Lettering size (EW-X) to be 2-inch tall. Other text ¾-inch tall. CONTRACTOR to provide template before ordering labels.



2.8 GEOCOMPOSITE “DONUT”

- A. Geocomposite ring or donut to be placed between stone and clean soil backfill in well shall be a 36-inch diameter 250 mil biplane Geocomposite manufactured by GSE or approved equal.

2.9 SAFETY GRATE

- A. A 5-ft by 5-ft (min.) square steel safety grate centered on the center of the borehole shall be installed by the CONTRACTOR. The safety grate shall be fabricated from welded wire reinforcement, and installed at least 6 inches below ground surface. The grate must be able to support the weight of a person when the grate is spanning the borehole with no additional support. CONTRACTOR shall not attempt to piece together smaller pieces of welded wire reinforcement to make the grate.

PART 3 – EXECUTION

3.1 PRE-CONSTRUCTION SERVICES

- A. The CONTRACTOR shall survey and stake the well boring locations prior to drilling. Pre-construction layout surveying shall be performed by a professional land surveyor licensed in the State of Florida.
- B. CONTRACTOR shall supply surveyed ground elevations of the proposed new extraction wells to the ENGINEER so that the design well depths may be confirmed at least one week prior to drilling.
- C. Extraction well and boring locations must be approved and may be adjusted by the ENGINEER prior to beginning drilling.

3.2 DRILLING

- A. The CONTRACTOR shall coordinate the start of drilling with the ENGINEER.
- B. The CONTRACTOR shall provide at all times a thoroughly experienced, competent driller during all operations at the drill site.
- C. The CONTRACTOR must use dry drilling equipment.
- D. Wells are to be drilled to the depth and diameter as shown on the CONTRACT DRAWINGS. The boring depths shown on the Drawings may be adjusted in the field by the ENGINEER. Under no circumstances are the drilling depths from the well schedule on the CONTRACT DRAWINGS to be exceeded unless approved by the ENGINEER in advance.
- E. Wet Borings:
 - 1. The ENGINEER shall be notified of wet boring conditions.

2. If water is encountered in a boring, the CONTRACTOR may be directed by the ENGINEER to drill beyond the point at which it was encountered. If wet conditions remain, at the direction of the ENGINEER, the boring may be terminated (after driller has attempted to advance boring for 2 hours) and the length of perforated pipe adjusted by the ENGINEER. If wet conditions cease (e.g., due to a perched water layer), then drilling will continue to the design depth.
3. If water is encountered in a boring at a shallow depth, the ENGINEER may decrease the well depth and length of perforated pipe, or relocate the well.

F. Abandoned Borings:

1. If, in the opinion of the ENGINEER, the borehole has not reached a sufficient depth to function as an effective extraction well, the CONTRACTOR shall abandon this borehole by backfilling it with clean soil. Soil shall be backfilled and compacted to ground surface. CONTRACTOR shall supply additional soil backfill to refill any settlement within the abandoned borehole, as approved by the ENGINEER.
2. Compensation for abandoned borings shall be at the unit price for boring refusal.
3. Cuttings removed during drilling will be disposed in accordance with Section 02400 Refuse Handling, Storage, and Disposal

G. The bore for the well shall be straight and the well pipe shall be installed in the center of the borehole.

1. The CONTRACTOR shall take all necessary precautions to maintain the well pipe vertically plumb during the entire backfill operation of the borehole to the satisfaction of the ENGINEER.
2. The grate over the borehole that is used to keep the well casing plumb shall not be removed until the borehole is backfilled to within 2 feet of ground surface.
3. If the pipe is installed out of plumb, as determined by the ENGINEER, the CONTRACTOR, at his own expense, shall correct the alignment.
4. The well casing shall extend above ground surface as shown on the CONTRACT DRAWINGS. No pipe couplings shall be installed above grade or within 10 feet of ground surface below grade.

3.3 WELL LOGS

- A. CONTRACTOR shall keep detailed well logs for all wells drilled. Information recorded on the well logs shall include the following:

1. Total depth of well.
 2. Visual description of refuse at 5-foot intervals:
 - a. Type of refuse encountered including the estimated percentage of the following components (by volume) on visual inspection:
 - Paper/Cardboard
 - Plastic
 - Yard refuse
 - Construction debris
 - Textiles
 - Tires
 - Sludge
 - Dirt
 - b. Moisture content (in percentages) based on the guidelines attached to the end of this Section.
 - c. State of decomposition based on the guidelines attached to the end of this Section.
 - d. Temperature of excavated refuse
 3. Occurrence, depth, and thickness of water-bearing zones
 4. Length of slotted pipe and solid pipe below grade.
 5. Thickness, description and depth from ground surface of backfill layers.
 6. Length of above ground riser stick-up pipe.
- B. CONTRACTOR shall use the well borings description sheet provided at the end of this Section as a guideline for describing excavated materials.
- C. Field copies of the well logs shall be provided to the ENGINEER at the end of each day.
- D. Typed final copies of the well logs shall be submitted with the Record Drawings. Handwritten logs will not be acceptable for submittal with the Record Drawings.

3.4 JOINING OF PIPES

- A. Pipes shall be joined as specified in Section 335110 Pipe and Pipe Fittings.
- B. Heat fusion joints shall be made in accordance with MANUFACTURER'S step-by-step procedures and recommendations.
- C. Mechanical joining shall be accomplished with HDPE flange adapters, neoprene gaskets,

and ductile iron back-up flanges, and shall be used only where shown on the CONTRACT DRAWINGS.

- D. At the end of each day, CONTRACTOR shall cap the ends of all joined pipes longer than 20 feet to prevent entry by animals and debris.

3.5 BACKFILLING

- A. Backfilling of the well shall commence immediately after well drilling is completed and the well piping has been installed in the borehole.
 - 1. Backfill materials shall be placed carefully within the wells to the dimensions shown on the CONTRACT DRAWINGS and as approved by the ENGINEER.
 - 2. Tire chip and soil backfill containing foreign material may be rejected by the ENGINEER on the basis of a visual examination.
- B. Both well piping and backfill shall be installed with a safety grate installed over the boring. The safety grate shall remain in place until backfill is within 2 feet of existing ground surface.
- C. Bentonite Plug shall be backfilled and hydrated in 6-inch lifts. The CONTRACTOR shall soak each lift according to the MANUFACTURER'S instructions prior to filling the next one. A minimum of 6 bags of bentonite shall be poured into the center of the borehole per 6-inch lift.
- D. Soil backfill shall be rodded in the boring to provide even distribution and compaction.

3.6 REFUSE DISPOSAL

- A. The CONTRACTOR shall dispose of excavated refuse as specified in Section 02400 Refuse Handling, Storage, and Disposal.

3.7 TEMPORARY CAP

- A. The CONTRACTOR shall temporarily cap the riser pipe of the vertical extraction well immediately after well pipe installation to prevent venting of LFG into the atmosphere. The CONTRACTOR shall remove this cap during the installation of the wellheads. Lag screws may be necessary due to the internal gas pressure within the well.

3.8 WELLHEAD INSTALLATION

- A. Vertical extraction well and toe drain tie-in wellheads shall be installed in accordance with MANUFACTURER'S recommendations. All pipe sections of the wellhead shall be air-tight. Any leaks shall be repaired by CONTRACTOR at no additional cost to the OWNER.

- B. Install QED Solarguard flex hose on all wells so that hose has no sags, as shown on the CONTRACT DRAWINGS. However, flexible hose shall not be taut. Provide enough slack to accommodate minor pipe settlement, as approved by the ENGINEER.

END OF SECTION

ATTACHMENT 02500A Well Boring Log Template

ATTACHMENT 02500A - WELL BORING LOG TEMPLATE

Site Name:	Well Number:
Project #:	Coordinates:
Start Date:	Surface Elevation:
Completed:	Top of Casing Elevation:

Contractor:	Boring Diameter:
Inspector:	Pipe Material Diameter:
Driller:	Total Depth Drilled:
Completion:	

	5
	10
	15
	20
	25
	30
	35
	40
	45
	50

COMPLETION LOG	
RISER STICK UP	
RISER BELOW	
PERF. PIPE	
BACKFILL	
BENTONITE #1	
SILICA SAND 20/30	
BENTONITE #2	
BACKFILL	
GRAVEL PACK	
BACKFILL LOG	
Stone	
Structural fill	
Bentonite fill	
MATERIALS LIST	
TOP CAP	
SOLID PIPE	
PERF PIPE	
BOTTOM CAP	
BENTONITE	
BACKFILL	
STONE	

ATTACHMENT 02500B Landfill Borehole and Well Logging Guidance

ATTACHMENT 02500B - LANDFILL BOREHOLE AND WELL LOGGING GUIDANCE

Moisture Content Scale

15% Dry Refuse	20-25% Normal	25-35% Damp	35-50% Wet	50% Saturated
Rock, dirt, etc; no trace of moisture paper will be fuzzed up	Newspaper, etc; still not noticeably wet but normal moisture	Paper shows dampness lawn clippings, tree branches, stiff & hold together	Paper saturated but no free water, just getting sloppy; water emanates when squeezed	Mud or free water present

Decomposition Scale

Little	Some	Moderate	Much	Severe
Newspaper readable; refuse looks new		Newspaper not legible; branches intact		Newspaper not legible; crumble; black/brown mucky material

Log the following (in 5' intervals):

- Note apparent Intermediate cover thickness and presence of intermediate cell cover
- Ratio of refuse to cover soil
- Degree of compaction (i.e., loose, moderate, tight)
- Composition description (i.e., household, garden, commercial, demolition, sludge, medical, or other)
- Percent of refuse components (plastic, metal, yard waste, etc.)
- Note color and unusual odors or appearances
- Degree of decomposition
- Percent of moisture
- Approximate dates of refuse as an indicator (only) of dates of placement (i.e., newspaper, etc.)
- Refuse temperature
- Gas presence and relative pressure and temperature
- Presence of perched or free liquid
- Note elevations and observations of changes in refuse/soil/liquid conditions

SECTION 02700

LINEAR LOW DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE LINER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes the manufacture, fabrication, testing, and installation of 40 mil textured Linear Low Density Polyethylene (LLDPE) geomembrane liner. The CONTRACTOR shall furnish all materials, labor, supervision, administration, management, Construction Quality Control (CQC), and equipment necessary for unloading, on-site handling, storage, installation, seaming, repairing, and CQC testing of 40 mil Textured LLDPE Geomembrane Liner (textured on both sides) as part of the PROJECT as shown on the CONTRACT DRAWINGS and as specified herein.
- B. All materials shall conform to the requirements of this Section and shall be of new stock of the highest grade available, free from defects, and recently manufactured.
- C. All WORK shall be performed in strict accordance with the TECHNICAL SPECIFICATIONS, CONTRACT DRAWINGS, conformance with the MANUFACTURER'S recommendations, and with current industry standards.
- D. Quality Control (QC) testing specified in this Section is the CONTRACTOR'S responsibility and all costs shall be included in the Bid Price. The OWNER is responsible for the Quality Assurance (QA) testing.
- E. Throughout this Section, all references to CQA CONSULTANT and the requirement to submit a final report, signed and sealed by a "PROFESSIONAL ENGINEER" shall mean a professional engineer licensed in the State of Florida.
- F. Throughout this Section, all references to "SURVEYOR" shall mean a professional land surveyor licensed in the State of Florida.

1.2 CONSTRUCTION QUALITY CONTROL/QUALITY ASSURANCE

- A. CQC shall be performed by the geomembrane INSTALLER. The INSTALLER'S responsibilities shall include, but is not limited to the following:
 - 1. Supervise all geomembrane installation activities.
 - 2. Perform and document CQC testing as specified herein.
 - 3. Certify geomembrane materials and installation as meeting requirements of the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
- B. Construction Quality Assurance (CQA) will be performed by a designated CQA

CONSULTANT and OWNER retained by the OWNER.

- C. The CQA CONSULTANT or OWNER'S REPRESENTATIVE shall obtain samples and perform conformance testing of the geomembrane as indicated in this Section.
- D. The CQA CONSULTANT, or his Construction Quality Assurance Representative (CQAR), shall observe and monitor the geomembrane installation activities and obtain and perform CQA testing at random frequencies and locations.
- E. Based upon review of the CQC and CQA final reports, the CQA CONSULTANT will provide certification to the regulatory agencies the geomembrane was installed in accordance with the TECHNICAL SPECIFICATIONS.
- F. The CONTRACTOR shall schedule WORK to provide sufficient time as required to complete CQC and CQA field testing and documentation prior to placing any overlying layers above the geomembrane and shall keep the CQA CONSULTANT'S QA TESTING LABORATORY informed of the construction progress to provide sufficient time for laboratory testing.
- G. The CQA CONSULTANT shall submit a final report, signed and sealed by a "PROFESSIONAL ENGINEER" shall mean a professional engineer licensed in the State of Florida certifying the test results.

1.3 SUBMITTALS

- A. The CONTRACTOR shall submit in writing to the ENGINEER documentation on the following:
 - 1. MANUFACTURER'S qualifications showing the following:
 - a. A qualified MANUFACTURER shall be a company, corporation, or firm regularly engaged in the development, manufacture, and a history of successful production of geomembrane. The geomembrane rolls shall be manufactured by a single MANUFACTURER. A company other than a MANUFACTURER may supply the geomembrane, however, the MANUFACTURER of the geomembrane shall be required to submit and meet the requirements of this Section.
 - b. Verification the MANUFACTURER has successfully supplied geomembrane for a minimum of 5 projects in the United States, during the last 5 years, of similar size and scope totaling to a minimum of 1,000,000 SF of installed geomembrane. Projects shall be considered similar only if the MANUFACTURER had total manufacturing responsibility for geomembrane production and the installed geomembrane has successfully fulfilled its primary function for a minimum of 10 years. The MANUFACTURER shall submit written information as follows:
 - 1) Name and location of project and date of installation.
 - 2) Contact name and phone number for each project.
 - 3) Geomembrane thickness and surface area of geomembrane installed

- c. The MANUFACTURER shall submit written information on the following:
 - 1) Information on plant size (square feet of geomembrane produced daily), number of shifts, and capacity of each shift.
 - 2) Daily production quantity shall be sufficient to meet the demands of the schedule for this WORK.
 - 3) QC Program Manual of descriptive documentation for production. The manual shall define sampling procedures, test frequencies, and methods.
 - 4) A statement from the MANUFACTURER indicating the QC measures specified for this WORK will be followed, at a minimum, and the manufactured geomembrane will meet or exceed the product TECHNICAL SPECIFICATIONS for this WORK.
- 2. FABRICATOR'S qualifications showing the following (if a FABRICATOR is used):
 - a. A qualified FABRICATOR shall be a company, corporation, or firm regularly engaged in the seaming and fabrication of geomembrane products, under factory-controlled conditions, for the installation of geomembrane under field conditions. The FABRICATOR usually seams together combinations of smaller rolls of geomembrane into larger factory panels for deployment in the field. The geomembrane shall be fabricated by a single FABRICATOR. The FABRICATOR shall submit written information on the following:
 - 1) Information on plant size (square feet of geomembrane fabricated daily), number of shifts, and capacity of each shift.
 - 2) Daily production quantity shall be sufficient to meet the demands of the schedule for this WORK.
 - 3) QC Program Manual of descriptive documentation for fabrication. The manual shall define sampling procedures, test frequencies, methods, and include FABRICATOR'S QC Certificates and Material Certification. The FABRICATOR shall, at a minimum, comply with the QC SPECIFICATIONS for this WORK.
 - 4) A statement from the FABRICATOR indicating the fabrication QC measures specified for this WORK will be followed and the fabricated geomembrane products will meet or exceed the product TECHNICAL SPECIFICATIONS for this WORK.
 - b. The FABRICATOR shall have successfully fabricated geomembrane products for at least 3 projects, during the last 3 years, of similar size and function, totaling a minimum of 5,000,000 SF of installed geomembrane. Projects shall be considered similar only if the FABRICATOR had total fabrication responsibility for geomembrane production and the installed geomembrane has successfully fulfilled its primary function for a minimum of 10 years. The FABRICATOR shall submit written information as follows:
 - 1) Name and location of project and date of installation.

- 2) Contact name and phone number for each project.
 - 3) Geomembrane thickness and surface area geomembrane installed.
3. INSTALLER'S qualifications showing the following:
- a. A qualified INSTALLER shall be a company, corporation, or a single INSTALLER. The INSTALLER shall submit written information on the following:
 - 1) Installed a minimum of 1,000,000 SF of LLDPE geomembrane during the last 5 years or otherwise demonstrate they are qualified to perform the WORK.
 - 2) Worked in a similar capacity on at least 5 projects similar in complexity to the project described in the CONTRACT DOCUMENTS.
 - 3) A minimum of 1 Field Installation Supervisor(s) for WORK on the PROJECT.
 - a) The Field Installation Supervisor qualifications to be assigned to this WORK shall have directly supervised the installation of a minimum of 1,000,000 SF of geomembrane. No geomembrane shall be installed without the presence of the Field Installation Supervisor.
 - 4) Ability to provide a minimum of 1 Master Seamer(s) for WORK on the PROJECT.
 - a) All personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests. At least 1 seamer(s) shall have experience seaming a minimum of 2,000,000 linear feet of geomembrane seams using the same type of seaming apparatus to be used for this WORK. No seaming shall be carried out without the presence of the Master Seamer within the immediate vicinity.
 - 5) Installation QC testing personnel in the field with a minimum of 2,000,000 SF of geomembrane QC testing. Only the actual square footage that the personnel have directly performed QC testing on shall be counted as fulfillment of the minimum square footage.
- B. The CONTRACTOR shall submit in writing to the ENGINEER for approval 14 calendar days prior to delivery of the geomembrane to the PROJECT site, documentation on the following:
1. Geomembrane Resin - MANUFACTURER QC Certificates demonstrating compliance with Section 2. Any geomembrane manufactured from resin not meeting the TECHNICAL SPECIFICATIONS shall be rejected and not be delivered to the PROJECT site.
 2. Material Properties Sheet - Geomembrane MANUFACTURER material properties sheet, including at a minimum all properties specified in GRI GM17, including test methods used and QC Certificates.
 3. Geomembrane accessories.

4. Extrudate rod resin information.
5. MANUFACTURER QC Certificates - The MANUFACTURER QC Certificates, written on the MANUFACTURER'S company letterhead, for each roll of geomembrane, including roll identification numbers, and the results (listed individually) of QA/QC testing performed by the MANUFACTURER.
6. MQC Test Reports - See Part 2 of this Section for tests and test frequencies to be provided within 48 hours of completion of the test and prior to material shipment.
7. Geomembrane Shipment - Prior to shipment of the geomembrane from the MANUFACTURER to the PROJECT site notice shall be provided so sufficient time is available to perform conformance sampling and receive laboratory test results.
8. Recommended storage, loading, unloading, and handling equipment (include model number or load capacity).
9. Installation Plan - The Plan will include documentation on the following:
 - a. Installation layout drawings drawn to scale.
 - 1) Proposed geomembrane panel layout including field seams and details, panel location, orientation, identification, sequence, and installed square footage of geomembrane.
 - a) Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
 - b. INSTALLER'S Geosynthetic Field Installation QA/QC Plan.
 - 1) The INSTALLER shall, at a minimum, comply with the TECHNICAL SPECIFICATIONS for this WORK. The QA/QC Field Installation Plan shall provide for recording all inspection and testing of all WORK to ensure conformance to the applicable CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS with respect to materials, workmanship, construction, functional performance and identification. If differences exist between the INSTALLER'S QC procedures and the QC procedures specified by the ENGINEER or CQA CONSULTANT the procedures specified for the WORK shall govern installation. The QA/QC Field Installation Plan shall be subject to approval by the ENGINEER and include:
 - a) Proposed equipment to be driven over geomembrane.
 - b) Storage and handling (equipment).
 - c) Panel identification.
 - d) Panel inspection.
 - e) Panel layout drawings/shop drawings.

- f) Seam identification.
- g) Seaming process and equipment.
- h) Seaming inspection.
- i) Non-destructive test methods (seams, repairs, geomembrane boots).
- j) Destructive tests.
- k) Laboratory tests.
- l) Methods for testing and calibration of field testing equipment.
- m) Corrective actions (i.e., addition of geomembrane, reduction of geomembrane, topography changes).
- n) Procedures for development of Record Drawings.
- o) Weather contingencies.
- p) Record keeping.
- q) Description of welding equipment, techniques, and materials.
- r) Complete set of forms used to record installation QA/QC data.
- s) If the INSTALLER proposes to conduct seaming operations outside of the approved conditions as specified herein (i.e., outside the weather parameters or night operations), written information and supporting data verifying seam quality can be maintained shall be submitted to the ENGINEER for review and approval. Alternate seaming operations will not be allowed without prior approval from the ENGINEER.
- t) Resumes of key geomembrane installation personnel (Field Installation Supervisor, Master Seamer, and QC personnel shall be clearly identified).
- u) Proposed INSTALLER'S warranty (workmanship).
- v) A statement from the INSTALLER stating the installation QC measures specified for this WORK will be followed and the installed geomembrane products will meet or exceed the TECHNICAL SPECIFICATIONS for this WORK.

10. Direct Shear Test (Interface Shear Resistance) - Direct Shear Test results demonstrating compliance with Section 2.

- C. The CONTRACTOR shall submit in writing to the ENGINEER for approval 3 calendar days prior to geomembrane installation, documentation on the following:

1. Survey Drawings - The CONTRACTOR shall supply the ENGINEER signed and sealed

survey drawings by a SURVEYOR that clearly indicates the grades and elevations meet the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.

2. Certificate of Subbase Acceptance - Certifying the subgrade was constructed in accordance with the approved CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS. The acceptance certificate shall be co-signed by the CONTRACTOR along with the INSTALLER and reviewed and approved by the ENGINEER prior to the installation of the geomembrane.
- D. The CONTRACTOR/INSTALLER will submit the following to the ENGINEER upon completion of geomembrane installation:
1. Certificate stating the geomembrane has been installed in accordance with the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
 2. Material and installation warranties.
 3. Daily Log - Including the daily record that summarizes panels deployed, seams completed, seam testing, seam repair, personnel on site, weather conditions, and equipment on site.
 4. Panel Log - Provides geomembrane roll number used and subbase acceptance for each panel deployed.
 5. Seam Testing Log - A complete record of all non-destructive and destructive testing performed as part of the INSTALLER'S QC program.
 6. Seam/Repair Log - Provides a complete record of all repairs and vacuum box testing of repairs made to defective seams and panels.
 7. Panel Layout Drawings - A panel layout drawing reflecting as-built conditions and related installation details (i.e., panel layout, penetrations, boots, connections, seam type) of the actual geomembrane lining system. The panel layout drawings shall:
 - a. Be at the same scale as the CONTRACT DRAWINGS and use applicable drafting standards including a border identifying the INSTALLER, OWNER, PROJECT name and drawing name.
 - b. Indicate the installed field panel and seam numbering, configuration and dimensions, geomembrane penetrations, and berms. The CONTRACTOR/INSTALLER shall correlate the identification numbers for each roll of material to the installation field panel.
 - c. Include the installed area, in square feet, of installed geomembrane.
 - d. Include the locations of destructive samples and repairs with the correct corresponding sample number.

1.4 MATERIAL AND INSTALLATION WARRANTY

- A. Material shall be warranted, on a pro-rata basis against MANUFACTURER'S defects for a period of 5 years from the date of final acceptance.
- B. Installation shall be warranted by the CONTRACTOR against defects in workmanship for a period of 1 years from the date of final acceptance.
- C. Warranty conditions proposed by the MANUFACTURER / FABRICATOR / INSTALLER concerning limits of liability will be submitted by the CONTRACTOR and will be evaluated upon receipt and must be acceptable to the OWNER prior to installation of the geomembrane.

1.5 DEFINITIONS

- A. Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- B. CQA CONSULTANT - Party, independent from the MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to QA during the lining system construction.
- C. ENGINEER - The person, firm, or corporation named as such in the Agreement.
- D. Geomembrane MANUFACTURER - The party responsible for manufacturing the geomembrane rolls.
- E. Geomembrane FABRICATOR - The party responsible for fabricating the geomembrane rolls.
- F. Geosynthetic QA TESTING LABORATORY - Party, independent from the CONTRACTOR, MANUFACTURER, and INSTALLER responsible for conducting laboratory tests on samples of geosynthetics obtained during manufacturing, usually under the direction of the OWNER and CQA CONSULTANT.
- G. INSTALLER - Party responsible for field handling, storing, deploying, seaming, and testing of the geomembrane seams.
- H. Panel - Unit area of a geomembrane that will be seamed in the field that is larger than 100 SF.
- I. Patch - Unit area of a geomembrane that will be seamed in the field that is less than 100 SF.

PART 2- PRODUCTS

2.1 GENERAL

- A. For general information purposes only, geomembrane MANUFACTURER'S are the following:
- Agru/America, Inc.
 - Solmax GSE
 - ENGINEER approved equal
- B. The geomembrane for the PROJECT shall conform to the physical properties requirements, at a minimum, as shown in TABLE 02700-6 GEOMEMBRANE MATERIAL PROPERTIES or the most current GRI standard for this product. Values presented in TABLE 02700-6 GEOMEMBRANE MATERIAL PROPERTIES are based upon standard GRI GM13 established by the Geosynthetics Research Institute (GRI) for HDPE.

2.2 GEOMEMBRANE

- A. Material shall be 40 mil Textured LLDPE Geomembrane Liner (textured on both sides) as shown on the CONTRACT DRAWINGS and specified herein.
- B. Geomembrane Rolls
1. Do not exceed a combined maximum total of 1% by weight of additives other than carbon black.
 2. Geomembrane shall be free of holes, blisters, undispersed raw materials, nicks, and cuts on roll edges or any sign of contamination by foreign matter. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation in accordance with the MANUFACTURER'S recommendations.
 3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating the information required in this Section.

2.3 EXTRUDATE ROD OR BEAD

1. Extrudate material shall be made from same type resin as the geomembrane.
2. Additives shall be thoroughly dispersed.
3. Materials shall be free of contamination by moisture or foreign matter.

TABLE 02700-1 EXTRUDATE TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D1505-18 or ASTM D792-20 Density	1
ASTM D4218-20 Carbon Black Content	1

2.4 MANUFACTURING QUALITY CONTROL TESTING

- A. Testing during manufacturing shall be accomplished by the MANUFACTURER'S laboratory.
- B. The MANUFACTURER shall provide MANUFACTURER'S QC Certificates, written on the MANUFACTURER'S company letterhead, for the raw resin material used to produce each roll of geomembrane.
- C. The MANUFACTURER shall provide a statement certifying no recycled polymer and no more than 10% rework of the same type of material was added to the resin (product run may be recycled).
- D. The frequency of the testing of the resin batches shall be per MANUFACTURER'S QC Plan and TABLE 02700-2 RESIN REQUIREMENTS, at a minimum, of this Section. A resin lot is defined as 180,000 pounds or less of raw resin material.
- E. The MANUFACTURER QA/QC test procedures and results shall be performed at a frequency of material per lot that conforms to TABLE 02700-3 LLDPE LINER MANUFACTURING QUALITY CONTROL TESTING, at a minimum, of this Section.

TABLE 02700-2 RESIN MQC REQUIREMENTS

TEST METHOD/PROPERTY	VALUE	FREQUENCY (MINIMUM)
ASTM D1505 Polymer Density	0.932 to 0.950 (g/cm ³)	not less than 1 test per resin lot
ASTM D1238 Polymer Melt Flow Index	≤ 1.0 g/10 min.	not less than 1 test per resin lot
ASTM D3895 Oxidation Induction Time	> 100 min.	not less than 1 test per resin lot

TABLE 02700-3 LLDPE LINER MQC TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D7466/D7466M-10(2015)e1 Asperity Height	1 per 100,000 SF
ASTM D1505-18 Polymer Density	1 per 100,000 SF
ASTM D5994/D5994M-10(2015)e1 Thickness	1 per 50,000 SF

ASTM D6693/D6693M-20 Tensile Property (each direction)	1 per 100,000 SF
ASTM D6693/D6693M-20 Yield Stress	1 per 100,000 SF
ASTM D6693/D6693M-20 Yield Elongation	1 per 100,000 SF
ASTM D6693/D6693M-20 Break Stress	1 per 100,000 SF
ASTM D6693/D6693M-20 Break Elongation	1 per 100,000 SF
ASTM D4218 Carbon Black Content	1 per 100,000 SF
ASTM D5596-03(2021) Carbon Black Dispersion ¹	1 per 100,000 SF

Note:

1. Carbon black dispersion for 10 different views: All 10 views in categories 1, 2.

2.5 CQA CONFORMANCE TESTING

- A. In-Plant Conformance Sample Testing Services - The OWNER'S REPRESENTATIVE and CQA CONSULTANT have qualified personnel to collect conformance samples directly at the following facilities:
- Solmax GSE - Houston, Texas
 - AGRU America - Kingwood, Texas
 - Poly-Flex, Inc. - Grand Prairie, Texas
1. Conformance sample(s) of the geomembrane will be collected by the OWNER'S REPRESENTATIVE or CQA CONSULTANT prior to shipment to the PROJECT site.
 2. Conformance sample(s) of the geomembrane will be tested by the CQA CONSULTANT prior to shipment to the PROJECT site.
 3. The CONTRACTOR shall coordinate with the MANUFACTURER, CQA CONSULTANT, and OWNER to schedule the date of delivery of the geomembrane to the PROJECT site.
 4. The CONTRACTOR shall inform, in writing, the ENGINEER and CQA CONSULTANT 14 calendar days prior to the actual date of shipment from the MANUFACTURER. Geomembrane shall not be shipped prior to testing without the ENGINEER'S and CQA CONSULTANT'S approval.
 5. Geomembrane products shipped to the PROJECT site without approved conformance test results shall be sampled and tested upon delivery to the PROJECT site by the CQA CONSULTANT. All costs associated with collecting and shipping samples from the PROJECT site will be the CONTRACTOR'S responsibility. The CONTRACTOR shall allow a minimum of 14 calendar days for sampling and testing of geomembrane upon delivery to the PROJECT site prior to installation.

6. Once sampled at the MANUFACTURER'S plant geomembrane products shall not be added or removed from the shipment. Upon addition or removal of products the following conditions shall prevail:
 - a. Geomembrane products added shall be sampled for conformance testing at the CONTRACTOR'S expense.
 - b. Individual geomembrane products removed from the shipment, which have been previously sampled or tested - Additional samples that have identical lot or batch numbers shall be sampled for conformance testing at the CONTRACTOR'S expense.
- B. Conformance Sample Test Frequency - The geomembrane shall be randomly sampled and tested by the OWNER'S REPRESENTATIVE or CQA CONSULTANT. The initial conformance testing shall be at the OWNER'S expense.
1. The initial conformance tests shall include one sample per lot but at a rate of not less than that indicated in TABLE 02700-4 REQUIRED CONFORMANCE TESTING of installed material from consecutively numbered rolls, whichever is smaller. A lot is defined as a group of consecutively numbered rolls manufactured from the same resin batch or production line.
 2. Samples shall be taken across the entire width of the rolls and shall not include the first 4 feet if stored outside or damaged. The test results of the geomembrane samples shall meet or exceed the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
 3. Samples that do not satisfy the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS shall be cause to reject applicable rolls. If a geomembrane sample fails to meet CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS, subsequent tests shall be performed at random on additional geomembrane samples produced from the same resin batch to determine whether all rolls produced from the same batch shall be considered as unsatisfactory and therefore rejected. The additional testing, borne by the CONTRACTOR, may be performed to more closely identify the rolls which do not comply with the TECHNICAL SPECIFICATIONS. Rejected rolls will not be installed and shall be removed from the PROJECT site as directed by the ENGINEER or CQA CONSULTANT at no additional cost to the OWNER.

TABLE 02700-4 REQUIRED CONFORMANCE TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D7466/D7466M - 10(2015)e1 Asperity Height	1 per 100,000 SF
ASTM D5994/D5994M - 10(2015)e1 Thickness	1 per 100,000 SF
ASTM D4218-20 Carbon Black Content	1 per 100,000 SF
ASTM D5596-03(2021) Carbon Black Dispersion	1 per 100,000 SF
ASTM D1505-18 or ASTM D792-20 Density	1 per 100,000 SF

ASTM D6693/D6693M-20 Type IV Tensile Properties	1 per 100,000 SF
ASTM D5321/D5321M-20 Interface Friction Angle Geomembrane/Subbase	1 per 200,000 SF
ASTM D5321/D5321M-20 Interface Friction Angle Geocomposite/Geomembrane	1 per 200,000 SF
ASTM D5321/D5321M-20 Interface Friction Angle Soil/Geocomposite	1 per 200,000 SF

Notes:

1. Each direction.
2. Required test results shall be in conformance with TABLE 02700-6 GEOMEMBRANE MATERIAL PROPERTIES.
3. Direct Shear Test (Interface Shear Resistance) protective cover soil and geocomposite - The CQA CONSULTANT will perform testing at the rate indicated in TABLE 02700-4 REQUIRED CONFORMANCE TESTING on samples of the protective cover soil and geocomposite. The following testing parameters will be followed with the results submitted to the ENGINEER or CQA CONSULTANT:
 - a. Testing conducted under fully saturated (water) conditions. Geosynthetics shall be oriented such that the shear force is parallel to the downslope orientation in the field. The testing laboratory shall confirm these criteria with the ENGINEER or CQA CONSULTANT prior to performing the tests.
 - b. Three Normal Loads = 200 psf, 500 psf, and 1,000 psf.
 - c. Strain Rate = 1 mm/min (0.04 in/min).
 - d. Continue testing to ensure a full 3 inches of displacement.
 - e. Plot and report (Peak and Residual values) for the best fit line through each of the three test results.
 - f. A minimum PEAK value of 0 psf adhesion and 20.5 degrees for the interface friction angle is required for this PROJECT (based upon the best fit line).
 - g. Adhesion may be considered by the ENGINEER to determine equivalent stability for this PROJECT.
4. Direct Shear Test (Interface Shear Resistance) geocomposite and geomembrane - The CQA CONSULTANT will perform testing at the rate indicated in TABLE 02700-4 REQUIRED CONFORMANCE TESTING on samples of the geocomposite and geomembrane. The following testing parameters will be followed with the results submitted to the ENGINEER or CQA CONSULTANT:

- a. Testing conducted under fully saturated (water) conditions. Geosynthetics shall be oriented such that the shear force is parallel to the downslope orientation in the field. The testing laboratory shall confirm these criteria with the ENGINEER or CQA CONSULTANT prior to performing the tests.
 - b. Three Normal Loads = 200 psf, 500 psf, and 1,000 psf.
 - c. Test Configuration = geocomposite clamped to top box
 geomembrane clamped to bottom box
 - d. Strain Rate = 1 mm/min (0.04 in/min).
 - e. Continue testing to ensure a full 3 inches of displacement.
 - f. Plot and report (Peak and Residual values) for the best fit line through each of the three test results.
 - g. A minimum PEAK value of 0 psf adhesion and 20.5 degrees for the interface friction angle is required for this PROJECT (based upon the best fit line).
 - h. Adhesion may be considered by the ENGINEER to determine equivalent stability for this PROJECT.
5. Direct Shear Test (Interface Shear Resistance) geomembrane and subbase - The CQA CONSULTANT will perform testing at the rate indicated in TABLE 02700-4 REQUIRED CONFORMANCE TESTING on samples of the geomembrane and subbase. The following testing parameters will be followed with the results submitted to the ENGINEER or CQA CONSULTANT:
- a. Testing to be conducted under fully saturated (water) conditions. Geosynthetics shall be oriented such that the shear force is parallel to the downslope orientation in the field. The testing laboratory shall confirm these criteria with the CQA prior to performing the tests.
 - b. Three Normal Loads = 200 psf, 500 psf, and 1,000 psf.
 - c. Strain Rate = 1 mm/min (0.04 in/min).
 - d. Continue testing to ensure a full 3 inches of displacement.
 - e. Plot and report (Peak and Residual values) for the best fit line through each of the three test results.
 - f. A minimum PEAK value of 0 psf adhesion and 20.5 degrees for the interface friction angle is required for this PROJECT (based upon the best fit line).
 - g. Adhesion may be considered by the ENGINEER to determine equivalent stability for this PROJECT.

6. The CQA CONSULTANT will conduct testing on the actual extrudate welding rod used in the field for seaming and repairing the geomembrane panels to verify the material is compatible with the geomembrane according to TABLE 02700-1 EXTRUDATE TESTING.

PART 3 - EXECUTION

3.1 MATERIAL PROTECTION

- A. It is the CONTRACTOR'S responsibility to provide all labor and materials for protection of the product during the period of time prior to installation of overlying materials. The CONTRACTOR'S protection method is subject to the approval of the ENGINEER.

3.2 MATERIAL LABELING, DELIVERY, STORAGE, AND HANDLING

A. Labeling

1. Each roll of material shall have a MANUFACTURER'S identification label. Each roll shall be labeled to provide product identification adequate for inventory and QC purposes. At a minimum each roll label shall identify the following characteristics per ASTM D4873/D4873M-17(2021) Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples:
 - a. Product identification information (MANUFACTURER name and address, brand name, product code).
 - b. Product lot number and individual roll number.
 - c. Date of fabrication.
 - d. Roll length and width

B. Delivery

1. The MANUFACTURER typically assumes responsibility for initial loading and shipping of the geomembrane. Unloading, on-site handling, and storage shall be the responsibility of the CONTRACTOR.
2. Rolls of geomembrane will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading according the MANUFACTURER'S recommendations.
3. A visual inspection of each roll should be made by the CONTRACTOR and CQAR as it is unloaded to identify to determine if any packaging or material has been damaged during transit. Rolls with damaged packaging should be repaired prior to being placed in storage.
4. Rolls of geomembrane exhibiting damage shall be marked and set aside for closer examination during deployment. Damaged materials will be identified and repaired or rejected at the discretion of the ENGINEER. Materials to be repaired as specified herein.

5. The CONTRACTOR shall contact the MANUFACTURER prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment to be utilized.
6. The CONTRACTOR assumes all liability with regards to shipping, transport, and unloading of the geomembrane required to complete the WORK. The OWNER shall not be responsible for damaged, lost or miss-stocked shipments, or mishandled or damaged materials.

C. Storage

1. The MANUFACTURER shall identify, in writing, the proper equipment and methods for unloading materials and storage procedures for the products delivered to the PROJECT site.
2. Storage of the geomembrane rolls shall be the responsibility of the CONTRACTOR. The materials shall be unloaded by the CONTRACTOR in areas designated by the OWNER. The CONTRACTOR shall provide the proper equipment and labor necessary to unload the material upon delivery to the PROJECT. The materials shall not be stored or unloaded in areas that will impair the operations of the landfill facility or be deleterious to the materials. At a minimum, the storage location for geomembrane material shall provide protection from punctures, abrasions, excessive dirt and moisture, and shall have the following characteristics:
 - a. Rolls shall be fully supported on pallets or other devices to be prevented from contacting the ground.
 - b. Water shall be prevented from accumulating beneath the rolls.
 - c. Rolls shall not be stacked upon one another to the extent that deformation of the core or flattening of the rolls occurs.
 - d. Outdoor storage should not be allowed to exceed 6 months.
 - e. Protected from theft and vandalism.
 - f. Sufficiently close to the WORK area to minimize handling.

D. Handling

1. Each roll of geomembrane delivered to the site shall inspected by the CONTRACTOR, at a minimum, as follows:
 - a. The CONTRACTOR shall provide transportation, labor, and handling for delivery of the geomembrane to the PROJECT site. Special transportation or handling requirements for the geomembrane shall be provided by the CONTRACTOR.
 - b. The equipment for transportation, handling, loading, and unloading the geomembrane shall be of sufficient size and capacity to safely and efficiently handle geomembrane materials without damage or personnel injury occurring. The type, size and capacity shall be according to the MANUFACTURER and

INSTALLER requirements.

- c. The CONTRACTOR shall provide all equipment, labor, unloading, on-site handling, and installation of the geomembrane.
- d. No off-loading shall be performed unless the OWNER or CQAR is present.
- e. Upon delivery to the PROJECT site, the geomembrane material shall be inspected by the CONTRACTOR to confirm that proper labeling, transportation, handling, and storage procedures are followed. Damage to geomembrane rolls caused by the CONTRACTOR during unloading, on-site handling, and installation will be repaired at no additional cost to the OWNER. Rejected materials will be identified and removed from the PROJECT site as directed by the OWNER and CQA CONSULTANT at no additional cost to the OWNER.

3.3 GEOMEMBRANE SUBBASE (INTERMEDIATE COVER)

- A. Surface to be lined shall be smooth and tested in accordance with Section 02220 Excavation, Backfill, Fill, and Grading for Intermediate Cover material. The area shall be free of all rocks (greater than 1/2-inch in any dimension), sticks (greater than 1/2-inch in diameter), roots, grass, refuse, sharp objects, or debris of any kind. The surface shall provide a firm, unyielding foundation for the geomembrane with no sudden, sharp, or abrupt changes or breaks in grade. No standing water or excessive moisture shall be allowed.
- B. All areas that have been subject to erosion shall be repaired as required in Section 02220 Excavation, Backfill, Fill, and Grading. The repaired surface for geomembrane placement shall be even with no abrupt changes or breaks in grade. No standing water or excessive moisture shall be allowed.

3.4 EQUIPMENT

- A. Welding equipment and accessories shall meet the following requirements:
 - 1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
 - 2. An adequate number of welding apparatus shall be available to avoid delaying WORK.
- B. Power source must be capable of providing constant voltage under combined line load.

3.5 PANEL IDENTIFICATION

- A. The ENGINEER shall verify each field panel is given a unique identification code (number or letter-numbered) consistent with the layout plan. This identification code shall be agreed upon by the ENGINEER and INSTALLER. The ENGINEER and INSTALLER shall establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code shall be used for all CQA documentation.

- B. The CQAR shall verify field panels are installed at the location indicated in the INSTALLER layout plan, as approved or modified, and that the INSTALLER has marked the identification code and roll number on each installed panel. The CQAR and INSTALLER shall also verify the condition of the supporting soil has not changed detrimentally during installation. The CQAR shall record the identification code, location, and date of installation of each field panel.

3.6 PANEL DEPLOYMENT

- A. The product shall be installed in accordance with the MANUFACTURER'S recommendations and the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS. In case of a conflict between these documents, the more stringent requirements shall apply. Any deviations from these procedures must be reviewed and accepted by the ENGINEER prior to construction.
- B. All activities by personnel and equipment in the vicinity of the geomembrane during and after geomembrane placement shall be monitored by the CONTRACTOR to insure the geomembrane and geomembrane foundation are not damaged.
- C. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval by the ENGINEER and CQA CONSULTANT and shall be determined at the PROJECT site.
- D. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas. Field panels shall not be placed if any of following conditions exists: inadequate geomembrane foundation, precipitation, presence of excessive moisture (i.e. fog, dew), ponded water, or presence of excessive winds.
- E. Prior to welding, deploy panels in a "shingle" manner, wherein the upgradient panel overlays the downgradient panel.
- F. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 - 1. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket, etc.).
 - 2. Place ballast (sandbags) on the geomembrane which will not damage geomembrane to prevent wind uplift. The CONTRACTOR shall have sufficient sand bags or other appropriate anchoring materials on site to secure the geomembrane. The CONTRACTOR shall replace or repair all geomembrane damaged (as determined by the ENGINEER) by wind or insufficient anchoring at no additional cost to the OWNER.
 - 3. Personnel walking on the product shall not engage in activities or wear footwear that could damage the material. Smoking shall not be permitted on or near the geosynthetics.
 - 4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 2 psi.

5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- G. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material. The geomembrane shall be installed so as to conform to the contours and grade breaks. The geomembrane shall remain in contact with the underlying geosynthetics. Sand bags or excess material, placed during deployment, shall be used to prevent bridging due to temperature or installation procedures. Allowances for additional material due to temperature and installation procedures shall be included in the bid and at no additional cost to the OWNER.
- H. "Fishmouths" or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 inches beyond the cut in all directions.

3.7 SEAMING PROCEDURES

If the INSTALLER proposes to conduct seaming operations outside of the approved conditions as specified herein (i.e., outside the weather parameters or night operations), written information and supporting data verifying seam quality can be maintained shall be submitted to the ENGINEER for review and approval 48 hours in advance. Alternate seaming operations will not be allowed without prior approval from the ENGINEER. If during the course of the WORK, the ENGINEER, CQA CONSULTANT, or OWNER decides the WORK is inadequate, the CONTRACTOR shall adjust operations as required or WORK shall be ceased. The CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS for placing and seaming the geomembrane shall apply to all WORK conditions.

- A. Seams shall meet the following requirements:
 1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
 2. Minimize number of field seams in corners, odd-shaped geometric locations, and outside corners.
 3. Slope seams (panels) shall extend a minimum of 6 feet beyond the grade break into the flat area.
 4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CQA CONSULTANT and INSTALLER.
 5. Align seam overlaps consistent with the requirements of the welding equipment being used. The panels of geomembrane have a finished overlap of 4 inches for extrusion welding and 6 inches for fusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam.
 6. Seaming shall extend to the outside edge of panels placed within the anchor trench.

- B. During welding operations provide at least 1 Master Seamer who shall provide direct supervision over other welders as necessary.
- C. Extrusion Welding
 - 1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
 - 2. Clean geomembrane surfaces by disc grinder or equivalent.
 - 3. Purge welding apparatus of heat-degraded extrudate before welding.
- D. Hot Wedge Welding
 - 1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
 - 2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
 - 3. Protect against moisture build-up between sheets.
- E. Trial Welds
 - 1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
 - 2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subbase and similar ambient temperature.
 - 3. Minimum of 2 trial welds per day, per welding apparatus, 1 made prior to the start of WORK and 1 completed at mid-shift (typically after lunch break). Additionally, perform trial welds at any time the welding equipment is shut down and restarted.
 - 4. Cut 4, one-inch wide by 6 inch long test strips from the trial weld.
 - 5. Quantitatively test specimens for peel adhesion and then for shear strength.
 - 6. Trial weld specimens shall pass when the minimum results, as indicated in TABLE 02700-5 MINIMUM PEEL AND SHEAR SEAM STRENGTH VALUES, are achieved in both peel and shear tests.
 - a. The break, when peel testing, occurs in the liner material itself not through peel separation (FTB).
 - b. The break is ductile.
 - 7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed passing trial welds.
- F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. Immediately prior to seaming procedures, the seam area shall be completely free of moisture, dirt, or foreign material of any kind. The INSTALLER shall demonstrate acceptable seaming can be performed by completing acceptable trial welds.
- G. Defects and Repairs
 1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
 2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.
- H. Cold weather installations should follow the guidelines contained in GRI GM9.

3.8 FIELD QUALITY ASSURANCE

- A. The MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the OWNER'S CQA Plan. The CQA CONSULTANT and CONTRACTOR shall be responsible for assuring this participation.
- B. Welding equipment shall be calibrated prior to each day's welding in accordance with the Installation Plan. The INSTALLER shall record all calibration data for inclusion in the final report. Additional test welds shall be performed for each welding machine every 1 hours, if welder is turned off, prior to starting WORK, after lunch, or as directed by the CQA CONSULTANT.

3.9 NON-DESTRUCTIVE TESTING

- A. Non-destructive testing shall be carried out as the seaming progresses. All seams shall be non-destructively tested in the presence of the CQA CONSULTANT. Insufficient seams shall be labeled, recorded, repaired and re-tested.
 1. Vacuum Box Testing - Shall be performed in accordance with ASTM D5641/D5641M-16 Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
 - a. Shall be required for all extrusion welds, except for those welds inaccessible to the vacuum box, such as geomembrane boots. Air pressure gauges shall read 0 psi when testing apparatus is not turned on. Pressure gauges not reading 0 psi shall be replaced. Vacuum box apparatus shall be capable of sustaining a vacuum pressure 2 psi (gauge) for 5 seconds while placed on a seam. The following procedures shall be followed:

- 1) Energize the vacuum pump and reduce the tank pressure to approximately 6 inches of mercury, i.e., 4 psi (gauge). All gauges shall read 0 psi when the vacuum pump is not turned on. Gauges not reading 0 psi shall be replaced.
 - 2) Wet a strip of geomembrane approximately 6 inches by 24 inches with a soapy solution.
 - 3) Place the box over the wetted soapy area.
 - 4) Close the bleed valve and open the vacuum valve.
 - 5) Ensure that a leak tight seal is created.
 - 6) For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles, which would indicate defects in the geomembrane and/or welding.
 - 7) If no bubble appears after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 6 inches overlap, and repeat the process.
 - 8) All areas where soap bubbles appear shall be marked and repaired in accordance with this Section.
2. Air Pressure Testing - Shall be performed in accordance with ASTM D5820-95(2018) Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
- a. Testing apparatus shall be capable of generating a minimum pressure of 10 psi. Air pressure gauges shall read 0 psi when testing apparatus is not turned on. Pressure gauges not reading 0 psi shall be replaced. The air channel shall be pressurized from 20 to 25 psi and allowed to stabilize. Once stabilized, the channel pressure shall be sustained for a minimum of 2 minutes. If loss of pressure is more than 1 psi, or the pressure does not stabilize, the seam shall be rejected, the faulty area located and repaired and the seam re-tested. The following procedures shall be followed:
 - 1) Seal both ends of the seam to be tested.
 - 2) Insert needle or other approved pressure feed device into the tunnel created by the fusion weld.
 - 3) Insert a protective cushion between the air pump and the geomembrane.
 - 4) Energize the air pump to a pressure between 20 and 25 psi, close valve, allow channel pressure to stabilize, and sustain channel pressure for approximately 2 minutes.
 - 5) If loss of pressure is more than 1 psi or does not stabilize, locate faulty area and repair.

- 6) After a seam has passed a pressure test, release pressure at the end of seam that is opposite the air pump and pressure gauge assembly to ensure that the seam is continuous and has been completely tested. The seal shall be repaired in accordance with this Section.
- B. The CQA CONSULTANT shall include all results from the destructive and non-destructive seam tests into the final report.

3.10 DESTRUCTIVE TESTING

- A. Destructive seam tests shall be performed on seam samples cut from the geomembrane locations selected by the CQA CONSULTANT. The purpose of these tests are to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.
- B. Performed by the CQA CONSULTANT with assistance from the INSTALLER.
- C. Location and Frequency of Testing
 1. Installed geomembrane shall be tested at a rate of one test per 500 linear feet of fusion welded seam at locations selected by the CQA CONSULTANT.
 2. Test locations will be determined after seaming.
- D. Sampling procedures are performed as follows:
 1. INSTALLER shall cut samples at locations designated by the CQA CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 2. The CQA CONSULTANT will number each sample and the location will be noted on the installation as-built.
 3. The CONTRACTOR shall remove the sample with the seam centered lengthwise, approximately 12 inches wide across the seam by 16 inches long, and test a portion of the geomembrane seam in accordance with the CQA Plan. The location shall be recorded, repaired, and tested. The repair of the destructive seam samples shall be at no additional cost to the OWNER. The CQA CONSULTANT shall distribute the samples as follows:
 - a. A 12 inch by 16 inch portion to the CQA CONSULTANT for Third Party Laboratory Quality Assurance testing.
 - b. A 12 inch by 16 inch portion shall be retained by the INSTALLER for field testing.
 - c. A 12 inch by 16 inch portion to the OWNER for archive storage.
 4. Testing performed on each sample shall include geomembrane peel adhesion and seam strength. Seam peel strength and shear strength shall meet the requirements specified in TABLE 02700-5 MINIMUM PEEL AND SHEAR SEAM STRENGTH VALUES.

TABLE 02700-5 MINIMUM PEEL AND SHEAR SEAM STRENGTH VALUES

TEST METHOD/PROPERTY	VALUE (MINIMUM)
ASTM D6392-12(2018) Peel Strength	
Wedge Weld	50 (lb/in width)
Extrusion Weld	50 (lb/in width)
Peel Separation	<25 (%)
ASTM D6392-12(2018) Shear Strength	
Wedge Weld	50 (lb/in width)
Extrusion Weld	50 (lb/in width)
Peel Separation	<25 (%)

5. Field Testing - Ten 1-inch wide strips shall be cut from the CONTRACTOR portion of the sample and these shall be tested using a tensiometer in the field by the INSTALLER, 5 for peel and 5 for shear. If any field test sample fails to pass the TECHNICAL SPECIFICATIONS then the procedures outlined in this Section shall be followed.
6. Laboratory Testing - Testing by the CQA CONSULTANT will include seam strength and peel adhesion. A total of 5 specimens will be tested from each sample for each test method. All of the 5 specimens must pass the minimum values listed in TABLE 02700-5 MINIMUM PEEL AND SHEAR SEAM STRENGTH VALUES. Specimens will be selected from the samples and tested alternately, by test, (i.e., peel, shear, peel, shear). All specimens must separate by FTB failure for each test in order for the seam to pass destructive test sampling. If the failure is FTB but an AD-BRK with incursion of 25% or greater occurs the test will be considered a failure. The results will not be averaged. The CQA CONSULTANT will provide test results to the CONTRACTOR no more than 48 hours after the samples are received at the laboratory. The only exception shall be weekends or official holidays when the laboratories are closed. Arrangements to schedule testing of destructive samples on weekends and holidays shall be approved by the CQA CONSULTANT 48 hours in advance. Additional costs for lab work on holidays or weekends shall be at no additional expense to the OWNER and shall be paid by the CONTRACTOR.
7. Procedures for Destructive Test Failure - The following procedures shall apply whenever a sample fails a destructive test, whether the test is conducted by the CQA CONSULTANT'S laboratory or the CONTRACTOR by field tensiometer. The geomembrane INSTALLER shall have two options, the cost of which shall be at no additional expense to the OWNER:
 - a. The geomembrane INSTALLER can reconstruct the seam between any two passed test locations.
 - b. The geomembrane INSTALLER can trace the welding path to an intermediate location at 10 feet, minimum, from the location of the failed test in each

direction, and take a specimen for an additional field test at each location. If these additional specimens pass the test, then full laboratory destructive samples shall be taken. These additional tests shall be at the expense of the CONTRACTOR. If these laboratory samples pass, 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 exceeding 100 feet of reconstructed seam, a sample taken from within the reconstructed zone must pass destructive testing. Whenever a sample fails, additional testing may be required for seams that were welded by the same welder and/or welding apparatus or welded during the same time shift. Such additional testing shall be at the CONTRACTOR'S expense.

3.11 REPAIR PROCEDURES

- A. All seams and non-seam areas of the geomembrane shall be inspected by the INSTALLER and CQA CONSULTANT for 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 inspection. The geomembrane surface shall be brushed, blown, or washed by the CONTRACTOR if the amount of dust, mud, or debris inhibits inspection. The CQA CONSULTANT shall decide if cleaning of the geomembrane is needed to facilitate inspection. The INSTALLER shall be responsible for repair of defective areas at no additional expense to the OWNER.
- B. Agreement upon the appropriate repair method shall be decided between CQA CONSULTANT and INSTALLER by using one of the following repair methods:
 - 1. Patching - Patches shall be round or oval in shape made of the same geomembrane and extend a minimum of 6 inches beyond the edge of defects. All patches shall be of the same compound and thickness as the geomembrane specified. All patches shall have their top edge beveled with an angle grinder prior to placement on the geomembrane. Patches shall be applied using approved methods only.
 - 2. Abrading and Re-welding - Used to repair short section of a seam.
 - 3. Spot Welding - Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 - 4. Capping - Used to repair long lengths of failed seams.
 - 5. Remove the unacceptable seam and replace with new material.
- C. The following procedures shall be observed when a repair method is used:
 - 1. All geomembrane surfaces shall be clean and dry at the time of repair.
 - 2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

3. Extend patches or caps at least 4 inches for extrusion welds and 6 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

D. Repair Verification

1. Each repair shall be non-destructively tested. In addition the CQA CONSULTANT may require a destructive seam sample be obtained from a repaired seam. Repairs that pass the non-destructive and/or destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.
2. Number and log each patch repair (performed by CQA CONSULTANT).

3.12 ANCHOR TRENCH

- A. The anchor trench shall be excavated as shown on the CONTRACT DRAWINGS prior to geomembrane installation. No loose soil, roots, rocks, or materials capable of damaging the geomembrane shall be allowed beneath the geomembrane. The anchor trench shall be backfilled and compacted as indicated on the CONTRACT DRAWINGS, and in a manner that prevents any damage to the geomembrane. The geomembrane shall not have sharply folded corners when placed into the anchor trench. The geomembrane shall be welded the entire length of the panel, including through the entire dimension of the trench.
- B. The perimeter of the geomembrane shall be identified with edge of liner markers as shown in the CONTRACT DRAWINGS.

3.13 OVERLYING GEOCOMPOSITE

- A. During placement of the geocomposite upon the geomembrane, precautions shall be taken to prevent damage to the geomembrane by restricting heavy equipment traffic. Unrolling the geocomposite can be accomplished through the use of lightweight, rubber-tired equipment such as a 4-wheel all-terrain vehicle (ATV). This vehicle can be driven directly on the geomembrane, provided the ATV makes no sudden stops, starts, or turns.
- B. Geomembrane which is covered prior to approval by the CQA CONSULTANT shall be uncovered at no additional cost to the OWNER.
- C. The CONTRACTOR shall schedule his WORK so as to permit as much time as needed for testing and CQC/CQA documentation before placing the overlying soil layer(s).
- D. The CONTRACTOR shall place the overlying geocomposite layer immediately upon approval of the geomembrane by the CQA CONSULTANT to prevent damage, uplift, or degradation of the geomembrane.

3.14 SURVEY CONTROL STAKES

- A. Survey stakes in the vicinity of the geomembrane shall be placed with care as not to penetrate the geomembrane liner. Plastic traffic cones, cardboard tubes or other items as approved by the ENGINEER may be used as survey control devices.

3.15 FINAL ACCEPTANCE

- A. The CONTRACTOR shall retain ownership and responsibility for the installed geomembrane until final acceptance by the OWNER.
- B. Final acceptance of the geomembrane by the OWNER will occur when:
1. All installation activities are completed.
 2. All documentation of installation is completed and the INSTALLER'S final report is submitted to and accepted by the ENGINEER.
 3. All documents presented in this Section have been submitted to the ENGINEER and approved.

**TABLE 02700-6 GEOMEMBRANE MATERIAL PROPERTIES
40 MIL TEXTURED LLDPE GEOMEMBRANE LINER**

TEST METHOD/PROPERTY	VALUE	TEST FREQUENCY (MINIMUM)
ASTM D5994/D5994M-10(2015)e1 Thickness (min. avg.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	nom. (-5%) -10% -15%	Per roll
ASTM D7466/D7466M - 10(2015)e1 Asperity Height ^{1, 2}	4 mil (min. avg.)	Every 2nd roll
ASTM D1505-18 or ASTM D792-20 Density	0.939 g/cc (min. avg.)	1 per 100,000 SF
ASTM D6693/D6693M-20 Type IV Tensile Properties ³ • Yield Strength • Break Strength • Yield Elongation • Break Elongation	126 lbs/in (min. avg.) 90 lbs/in (min. avg.) 12% (each) 100% (min)	1 per 100,000 SF 1 per 100,000 SF 1 per 100,000 SF 1 per 100,000 SF
ASTM D1004-21 Tear Resistance	42 lb (min. avg.)	1 per 100,000 SF
ASTM D4833/D4833M-07(2020) Puncture Resistance	90 lb (min. avg.)	1 per 100,000 SF
ASTM D5397-20 Stress Crack Resistance ⁴	300 hour min.	Per GRI GM10
ASTM D4218-20 Carbon Black Content ⁵	2.0 - 3.0%	1 per 100,000 SF
ASTM D5596-03(2021) Carbon Black Dispersion ⁶		1 per 100,000 SF
Oxidative Induction Time (OIT) (min. avg.) ⁷ (a) ASTM D3895-19 Oxidation Induction Time - or - (b) ASTM D5885/D5885M - 20 High Pressure OIT	100 minutes min 400 minutes min	Per each formulation

UV Resistance (a) ASTM D3895-19 Oxidation Induction Time (min. avg.) - or - (b) ASTM D5885/D5885M-20 High Pressure OIT - % retained after 1,600 hrs	N.R. 35% (min. avg.)	Per each formulation
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Notes:

1. Report all 10 readings and an average reading for each side.
2. Perform 10 readings on both sides of each textured roll.
3. Machine Direction (MD) and Cross Machine Direction (XMD) average values should be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gauge length of 1.3 inches. Break elongation is calculated using a gauge length of 2.0 in.
4. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on the smooth edges of textured rolls or on smooth sheets made from the same formulation as that being used for the textured sheet.
5. Other methods such as ASTM D4218-20 Carbon Black Content (muffle furnace) or microwave methods are acceptable if an appropriate correlation to ASTM D1603-20 (tube furnace) can be established.
6. Carbon black dispersion (only near spherical agglomerates) for 10 different views. Minimum of 9 in Categories 1 or 2, and 1 in Category 3.
7. The MANUFACTURER has the option to select either one of the OIT (ASTM D5885/D5885M-20 High Pressure OIT) per GRI GM13 requirements. It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

END OF SECTION

SECTION 02900

SEEDING AND SODDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to complete the WORK specified in this Section.
- B. The WORK shall include, but not necessarily be limited to: soil preparation, liming, fertilizing, grass seeding and mulching, sodding and maintenance of all areas requiring vegetation as shown on the CONTRACT DRAWINGS and as specified herein.
- C. The CONTRACTOR shall construct grassing operations in strict conformity with the CONTRACT DRAWINGS and in accordance with the most recent edition of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.
- D. Grass seeding and mulching shall be required in the entire area of the CONTRACTOR'S construction staging/laydown area.
- E. Within the entire closure area footprint, top slopes are to be hydroseeded and sideslopes are to be sodded where the 40 mil Textured LLDPE Geomembrane Liner will be placed, regardless of the approximate limits that may be indicated on the CONTRACT DRAWINGS

1.2 SUBMITTALS

- A. Seed - Signed copies of VENDOR'S statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed. Statement shall certify that each container of seed delivered is fully labeled in accord with Federal Seed Act and equals or exceeds TECHNICAL SPECIFICATION requirements.
- B. Sod - Prior to placing sod, the CONTRACTOR shall notify the ENGINEER of the source and permit the ENGINEER to inspect.
- C. The CONTRACTOR shall submit documentation to the ENGINEER from the SUPPLIER regarding species and percentages of purity.
- D. Fertilizer - Furnish duplicate copies of invoices for all fertilizer used on PROJECT, along with certification of quality and warranty.
- E. Guarantee - The CONTRACTOR shall furnish copies of MANUFACTURER /SUPPLIER warranties or guarantees for all products provided under this Section.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. See Section 02220 Excavation, Backfill, Fill and Grading.

2.2 SEED

- A. Fresh, clean, new-crop seed labeled in accord with U.S. Department of Agriculture Rules and Regulations and the FDOT Standard Specifications under the Federal Seed Act in effect on date of bidding. The CONTRACTOR shall provide seed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified in TABLE 2900-1 GRASS SEED. Furnish seed in sealed standard containers labeled with PRODUCER'S name and seed mixture and percentages of purity, germination, and weed seed for each grass seed species required.

TABLE 2900-1 GRASS SEED

COMMON NAME	MINIMUM PERCENT GERMINATION	MINIMUM PERCENT PURITY	MAXIMUM PERCENT WEED-SEED
Bahia Grass	80	95	1.0
Bermuda Grass (Hulled)	85	95	1.0

2.3 SOD

- A. The CONTRACTOR shall provide dense, strongly rooted Bahia Grass sod or Bermuda sod less than 2 years old and free of weeds and undesirable native grasses. Sod shall be certified by the SUPPLIER to meet the Florida State Plant Board Specifications.

2.4 MULCH

- A. The CONTRACTOR shall provide clean, seed-free, threshed straw of oats, wheat, barley, rye, beans, peanuts or other locally available mulch material. Do not use mulch that contains an excessive quantity of matured seeds of noxious weeds, or other species that will grow or provide a menace to surrounding land. Do not use mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.

2.5 FERTILIZER

- A. The CONTRACTOR shall provide commercial fertilizer conforming to FDOT Standard Specifications, Section 982.

2.6 LIMESTONE

- A. Dolomitic limestone shall be an approved product designated for agricultural use.

2.7 SULFUR

- A. Sulfur chips shall be an approved product designated for agricultural use.

2.8 WATER

- A. The water used in the seeding and sodding operations may be obtained from any spring, pond, lake, stream or municipal water system. The water shall be free of excess and harmful chemicals, acids, alkalies, or any substance, which might be harmful to plant growth. Water containing greater than 800 parts per million (ppm) dissolved solids shall not be used.

PART 3 - EXECUTION

3.1 GENERAL

- A. Topsoil shall be placed to achieve a depth of 6 inches in all areas indicated to be sodded on the CONTRACT DRAWINGS and as specified herein.
- B. Mulch material shall be applied uniformly over all seeded areas indicated on the CONTRACT DRAWINGS and as specified herein.
- C. The period of sod establishment shall begin immediately after completion of sodding in an area and shall continue for a period of 1 years after the completion of sodding on the entire PROJECT unless the desired cover is established in a shorter period of time and shortening of the sod-establishment period is authorized by the ENGINEER.

3.2 SOIL PREPARATION

- A. The CONTRACTOR shall, by a qualified laboratory, conduct laboratory analysis on 3 representative samples to determine pH content and nutrient levels. The rate for adding sulphur or lime shall be based upon recommendation by the laboratory.
- B. All areas to receive topsoil, seed and/or sod shall be raked, and all rubbish, sticks, roots and stones larger than 1 inches shall be removed. Loosen Subgrade surface immediately prior to being covered with topsoil. Subgrade shall be inspected and approved by the Construction Quality Assurance Representative (CQAR) before topsoil is placed.
- C. Topsoil shall be placed over approved areas to a depth sufficiently greater than required so that after natural settlement and light rolling the complete WORK will conform to the lines, grades, and elevations as indicated on the CONTRACT DRAWINGS. No topsoil shall be spread in water or while excessively wet.
- D. Loosen topsoil surface to a minimum depth of 6 inches. Remove stones over 1 inches in any dimension and sticks, roots, rubbish, and other extraneous matter.

3.3 APPLICATION OF LIMESTONE, SULFUR AND FERTILIZER

- A. Sulfur and Limestone - If laboratory results indicate the addition of sulphur or lime is necessary, spread uniformly over designated areas to be seeded or sodded at the rate recommended. Thoroughly mix through upper 6 inches of topsoil.
- B. After application of sulfur or lime, and prior to applying fertilizer, loosen areas to be seeded or sodded with a suitable device if soil has become hard or compacted. Correct any surface irregularities in order to prevent pockets or low areas, which will allow water to stand.
- C. Fertilizing - Distribute fertilizer uniformly with a suitable distributor over areas to be seeded or sodded at a rate of 30 pounds per 1,000 square feet.
- D. Incorporate fertilizer into topsoil to depth of at least 3 inches by disk harrowing or other approved methods. Clean surface of stones or other substances, which will interfere with, turf development or subsequent mowing operations.
- E. Grade areas for seed or sod to a smooth, even surface with a loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas, which can be seeded or sodded soon after preparation.

3.4 SEEDING OPERATIONS

- A. All disturbed areas that will not be reworked or sodded within 14 calendar days maximum shall be temporarily seeded and mulched. Disturbed areas outside the "Limits of Construction" as shown on the CONTRACT DRAWINGS shall be sodded at no additional cost to the OWNER.
- B. Temporary seeding shall be in accordance with FDOT Standard Specifications, Section 570 and applied at a mixture and rate in conformance with FDOT Index No. 105, for Zone II, Inland conditions. Steep slope seeding shall be in accordance with FDOT Standard Specifications, Section 570.
- C. Mulching shall be in accordance with FDOT Standard Specifications, Section 570.
- D. Rolling shall be in accordance with FDOT Standard Specifications, Section 570.
- E. Watering shall be in accordance with FDOT Standard Specifications, Section 570.
- F. Protect seeded slopes against erosion with erosion netting or other methods approved by the ENGINEER.

3.5 SODDING OPERATIONS

- A. The setting of sod pieces shall be staggered in such a manner as to avoid continuous seams where possible.
- B. Sod shall be carefully placed by hand, edge to edge, in rows at right angles to the slope.

- C. Sodding shall be in accordance with FDOT Standard Specifications, Section 570.
- D. Watering shall be in accordance with FDOT Standard Specifications, Section 570.

3.6 MAINTENANCE

- A. The CONTRACTOR shall keep all seeded and sodded areas watered and in good condition until the CONTRACTOR has submitted a request for Final Payment including the CONTRACTOR'S Release and all Subcontractor Affidavits (Final Completion).
- B. The repair of any erosion or sod relocation necessary prior to the sod becoming firmly rooted to the existing soil will be the responsibility of the CONTRACTOR at no additional cost to the OWNER.
- C. Begin maintenance of seeded and sodded areas immediately after each portion is planted and continues until final acceptance.
- D. Maintenance shall be in accordance with FDOT Standard Specifications, Section 570 and FDOT Standard Specifications, Section 570; however, at a minimum, all temporary and final seeded and sodded areas shall be watered 3 times per week with a minimum of 1/4 inch water applied per watering event.

3.7 FINAL ACCEPTANCE

- A. Sodded and seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of specified grass is established, free of weeds, bare or dead spots, and surface irregularities.
- B. The CONTRACTOR shall maintain the sodded and seeded areas in a satisfactory condition until final acceptance of the PROJECT. Such maintenance shall include the filling, leveling, and repairing of any washed or eroded areas, as may be necessary. If the planted areas must be resodded, reshaped, or otherwise repaired, regardless of cause, the CONTRACTOR shall perform such WORK at the CONTRACTOR'S expense. The ENGINEER, at any time may require replanting of any areas in which the establishment of the grass stand does not appear to be developing satisfactory at no additional cost to OWNER.
- C. The period of sod establishment for areas that are resodded or reseeded shall extend to 1 year after the completion of re-sodding or reseeding unless otherwise authorized by the ENGINEER.
- D. Locations that were disturbed by the CONTRACTOR during construction activities shall be brought to their original condition prior to Final Acceptance.

END OF SECTION

SECTION 02931

GEOCOMPOSITE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes the manufacture, fabrication, testing, and installation of geocomposite. The CONTRACTOR shall furnish all materials, labor, supervision, administration, management, Construction Quality Control (CQC), and equipment necessary for unloading, on-site handling, storage, and installation of geocomposite, which is a three-layer material comprised of an inner core of high density polyethylene (HDPE) geonet between an upper and lower layer of non-woven geotextile (the geotextile is thermally fused to both sides of the geonet) as shown on the CONTRACT DRAWINGS and as specified herein.
- B. All materials shall conform to the requirements of this Section and shall be of new stock of the highest grade available, free from defects, and recently manufactured.
- C. All WORK shall be performed in strict accordance with the TECHNICAL SPECIFICATIONS, CONTRACT DRAWINGS, conformance with the MANUFACTURER'S recommendations, and with current industry standards.
- D. Quality Control (QC) testing specified in this Section is the CONTRACTOR'S responsibility and all costs shall be included in the Bid Price. The OWNER is responsible for the Quality Assurance (QA) testing.
- E. Throughout this Section, all references to CQA CONSULTANT and the requirement to submit a final report, signed and sealed by a professional engineer, shall mean a professional engineer licensed in the State of Florida.

1.2 CONSTRUCTION QUALITY CONTROL/QUALITY ASSURANCE

- A. CQC shall be performed by the geocomposite INSTALLER. The INSTALLER'S responsibilities shall include, but is not limited to the following:
 - 1. Supervise all geocomposite installation activities.
 - 2. Perform and document CQC testing as specified herein.
 - 3. Certify geocomposite materials and installation as meeting requirements of the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
- B. Construction Quality Assurance (CQA) will be performed by a designated CQA CONSULTANT and QA TESTING LABORATORY retained by the OWNER.
- C. The CQA CONSULTANT or OWNER'S REPRESENTATIVE shall obtain samples and perform conformance testing of the geocomposite as indicated in this Section. The material will

not be shipped to the PROJECT site until all results have been received and approved by the CQA CONSULTANT.

- D. The CQA CONSULTANT, or his Construction Quality Assurance Representative (CQAR), shall observe and monitor the geocomposite installation activities.
- E. Based upon review of the CQC and CQA final reports, the CQA CONSULTANT will provide certification to the regulatory agencies the geocomposite was installed in accordance with the TECHNICAL SPECIFICATIONS.
- F. The CONTRACTOR shall schedule WORK to provide sufficient time as required to complete CQC and CQA field testing and documentation prior to placing any overlying layers above the geocomposite and shall keep the CQA CONSULTANT'S QA TESTING LABORATORY informed of the construction progress to provide sufficient time for laboratory testing.
- G. The CQA CONSULTANT shall submit a final report, signed and sealed by a professional engineer licensed in the State of Florida, certifying the test results.

1.3 SUBMITTALS

- A. The CONTRACTOR shall submit in writing to the ENGINEER for approval 21 calendar days prior to delivery of the geocomposite to the PROJECT site, documentation on the following qualifications:
 - 1. Qualifications - MANUFACTURER'S qualifications for each product showing a minimum of 1,000,000 SF of manufacturing experience.
- B. The CONTRACTOR shall submit in writing to the ENGINEER for approval 21 calendar days prior to delivery of the geocomposite to the PROJECT site, documentation on the following products:
 - 1. Geonet Resin - The name of the HDPE resin supplier, the production plant, the brand name, and name of resin used to manufacture the product.
 - 2. Material Data - Complete MANUFACTURER'S specifications, descriptive drawings, and literature for each product, including the product identification and suppliers of the polymer resin and recommended method for handling and storage of all materials prior to installation. Describe the MANUFACTURER'S methodology to comply with the requirements specified for Manufacturer Quality Control (MQC).
 - 3. MQC - A complete description of the MANUFACTURER'S formal QC/QA Programs for manufacturing, fabricating, handling, installing, and testing. The description shall include, but not be limited to, polymer resin supplier and product identification, acceptance testing, production testing, installation inspection, installation techniques, repairs, and acceptance. The document shall include a complete description of methods for both roll end and roll side joining.
 - 4. Prequalification - Independent laboratory test results demonstrating compliance with the material properties listed in TABLE 02931-5 GEONET PROPERTIES, TABLE 02936-2 GEOTEXTILE PROPERTIES, and TABLE 02937-3 GEOCOMPOSITE

PROPERTIES. In addition, the MANUFACTURER must provide a certificate of compliance which states the material to be installed will use the same manufacturing techniques, resin type, and formulation as that for which test results were submitted.

5. Transmissivity - The MANUFACTURER'S test data that indicates transmissivity values shown in TABLE 02931-7 GEOCOMPOSITE PROPERTIES can be met at 100 hours of testing.
6. Roll Layout Drawings - Submit at a minimum, a geocomposite roll layout drawing and installation details. The roll layout drawing shall be drawn to scale and be coordinated with the geomembrane panel layout. Installation details shall include cross sections, temporary anchorage, anchor trenches, and other terminations.
 - a. Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
7. Protection from Wind and Weather - The methodology used to protect each product from wind, dirt, and direct sunlight. At a minimum, the methodology shall reflect materials shall be shipped and stored in rolls furnished at the manufacturing facility to prevent exposure of the geotextile to ultraviolet light, precipitation, moisture, mud, dirt, dust, puncture, or other damaging conditions.
8. Recommended storage, loading, unloading, and handling equipment (include model number or load capacity).
9. Installation Instructions - Submit samples of the product with a complete set of specifications, and MANUFACTURER'S complete written instructions for installation and joining.
10. Geocomposite Production - Submit statement of production dates for each product.
11. MQC Certificates - The MQC certificates, written on the MANUFACTURER'S company letterhead, for each roll of geocomposite, including roll identification numbers, and the results (listed individually) of QA/QC testing performed by the MANUFACTURER.
12. MQC Test Reports - See Part 2 of this Section for tests and test frequencies to be provided within 72 hours of completion of the test and prior to material shipment.

1.4 MATERIAL AND INSTALLATION WARRANTY

- A. Material shall be warranted, on a pro-rata basis against MANUFACTURER'S defects for a period of 5 years from the date of final acceptance.
- B. Installation shall be warranted by the CONTRACTOR against defects in workmanship for a period of 1 years from the date of final acceptance.
- C. Warranty conditions proposed by the MANUFACTURER / INSTALLER concerning limits of liability will be submitted by the CONTRACTOR and will be evaluated upon receipt and must be acceptable to the OWNER prior to installation of the geocomposite.

PART 2 - PRODUCTS

2.1 GEONET

- A. The geocomposite shall consist of a void maintaining geonet structure with a non-woven geotextile heat bonded to both sides to provide water flow meeting the requirements listed in TABLE 02931-5 GEONET PROPERTIES.
- B. The geonet shall consist of new, first-quality products designed and manufactured specifically for the intended purpose designated in this TECHNICAL SPECIFICATIONS, as satisfactorily demonstrated by prior use. The geonet shall contain stabilizers to prevent ultraviolet light degradation. The HDPE shall be unmodified HDPE containing no plasticizer, fillers, chemical additives, reclaimed polymers, or extenders. Approximately 2 percent carbon black shall be added to the resin for ultraviolet resistance. The only other allowable compound elements shall be anti-oxidants and heat stabilizers, of which up to 1.5 percent total, as required for manufacturing, may be added.
- C. The geonet shall meet the requirements listed in TABLE 02931-5 GEONET PROPERTIES.

2.2 GEOTEXTILE

- A. The geotextile shall meet the requirements listed in TABLE 02931-6 GEOTEXTILE PROPERTIES.

2.3 GEOCOMPOSITE

- A. All products or components of the geocomposite shall be obtained from a single MANUFACTURER. Fusion of the geonet and geotextile, for each product, shall be completed by a single MANUFACTURER.
- B. For general information purposes only, the geocomposite shall be:
 - 300 mil AGRU Geomposite manufactured by AGRU America, Inc.
 - ENGINEER approved equal
- C. The final material shall meet the requirements listed in TABLE 02931-7 GEOCOMPOSITE PROPERTIES for both the top slope and side slope.
- D. The geocomposite shall be fabricated by heat bonding the geotextile to both sides of the geonet. No burn-through of geotextiles shall be permitted. No glue or adhesive shall be permitted. The bond between the geotextile and the geonet shall meet the requirements listed in TABLE 02931-7 GEOCOMPOSITE PROPERTIES.
- E. The geocomposite shall be supplied as a continuous sheet with no factory seams. During installation, the roll length shall be maximized to provide the largest manageable roll for the fewest field seams.

2.4 MANUFACTURING QUALITY CONTROL TESTING

- A. Testing during manufacturing shall be accomplished by the MANUFACTURER'S laboratory.
- B. LLDPE resin testing during manufacturing shall be accomplished by the MANUFACTURER laboratory. The MANUFACTURER shall test the resin batches per the frequency, at a minimum, that conforms to TABLE 02931-1 RESIN MQC TESTING. The finished rolls shall be identified by a roll number corresponding to the resin batch used.

TABLE 02931-1 RESIN MQC TESTING

TEST METHOD/PROPERTY	SPECIFIED VALUE	FREQUENCY (MINIMUM)
ASTM D1505-18 Polymer Density	minimum 0.940 g/cm ³	1 per batch
ASTM D1238-20 Polymer Melt Flow Index	maximum 1.0 g/10min	1 per batch

- C. Geonet shall be tested during manufacturing for compliance with TABLE 02931-5 GEONET PROPERTIES. Minimum test frequencies shall be observed according to TABLE 02931-2 GEONET MQC TESTING.

TABLE 02931-2 GEONET MQC TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D5199-12(2019) Thickness	1 per 50,000 SF
ASTM D7179-18 Tensile Strength	1 per 100,000 SF
ASTM D4218-20 Carbon Black	1 per 100,000 SF
ASTM D1505-18 Polymer Density	1 per 100,000 SF
ASTM D1238-20 Polymer Melt Index	1 per 100,000 SF

- D. Geotextile shall be tested during manufacturing for compliance with TABLE 02931-6 GEOTEXTILE PROPERTIES. Minimum test frequencies shall be observed according to TABLE 02931-3 GEOTEXTILE MQC TESTING.

TABLE 02931-3 GEOTEXTILE MQC TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D4491/D4491M-21 Permittivity	1 per 100,000 SF
ASTM D5261-10(2018) Mass per Unit Area	1 per 100,000 SF
ASTM D4751-20b AOS	1 per 100,000 SF
ASTM D4632/D4632M-15a Grab Tensile	1 per 100,000 SF
ASTM D4632/D4632M-15a Grab Elongation	1 per 100,000 SF

ASTM D4533/D4533M-15 Trapezoidal Tear Strength	1 per 100,000 SF
ASTM D6241-14 CBR Puncture	1 per 100,000 SF

- E. Upon fusion of the geotextile and geonet, the product shall be tested during manufacturing for compliance with TABLE 02931-7 GEOCOMPOSITE PROPERTIES. Minimum test frequencies shall be observed according to TABLE 02931-4 GEOCOMPOSITE MQC TESTING.

TABLE 02931-4 GEOCOMPOSITE MQC TESTING

TEST METHOD/PROPERTY	FREQUENCY (MINIMUM)
ASTM D4716/D4716M-20 Transmissivity	1 per 100,000 SF
ASTM D7005/D7005M-16 Ply Adhesion	1 per 100,000 SF

- F. The CQA CONSULTANT shall inspect every roll for bonding integrity between the geonet and the geotextile. All poorly bonded and/or delaminated material shall be rejected. Visible lack of bonding of any areas exceeding one square foot or multiple locations on the same roll that are considered excessive by the ENGINEER will be cause for rejection of the roll.

2.5 CQA CONFORMANCE TESTING

- A. In-Plant Conformance Sample Testing Services - The OWNER'S REPRESENTATIVE and CQA CONSULTANT have qualified personnel to collect conformance samples directly at the following facilities:
- Solmax GSE - Houston, Texas
 - AGRU America - Kingwood, Texas
 - Poly-Flex, Inc. - Grand Prairie, Texas
 - SKAPS Industries - Athens, Georgia
1. Conformance sample(s) of the geocomposite will be collected by the OWNER'S REPRESENTATIVE or CQA CONSULTANT prior to shipment to the PROJECT site.
 2. Conformance sample(s) of the geocomposite will be tested by the CQA CONSULTANT prior to shipment to the PROJECT site.
 3. The CONTRACTOR shall coordinate with the MANUFACTURER, CQA CONSULTANT, and OWNER to schedule the delivery date of the geocomposite to the PROJECT site.
 4. The CONTRACTOR shall inform, in writing, the CQA CONSULTANT and ENGINEER 15 days prior to the actual date of shipment from the MANUFACTURER. Geocomposite shall not be shipped prior to testing without the ENGINEER'S and CQA CONSULTANT'S approval.

5. Geocomposite products shipped to the PROJECT site without approved conformance test results shall be sampled and tested upon delivery to the PROJECT site by the CQA CONSULTANT. All costs associated with collecting and shipping samples from the PROJECT site will be the CONTRACTOR'S responsibility. The CONTRACTOR shall allow a minimum of 15 days for sampling and testing of geocomposite upon delivery to the PROJECT site prior to installation.
 6. Once sampled at the MANUFACTURER'S plant geocomposite products shall not be added or removed from the shipment. Upon addition or removal of products the following conditions shall prevail:
 - a. Geocomposite products added shall be sampled for conformance testing at the CONTRACTOR'S expense.
 - b. Individual geocomposite products removed from the shipment, which have been previously sampled or tested - Additional samples that have identical lot or batch numbers shall be sampled for conformance testing at the CONTRACTOR'S expense.
- B. Conformance Sample Test Frequency - The geocomposite shall be randomly sampled and tested by the OWNER'S REPRESENTATIVE or CQA CONSULTANT. The initial conformance testing shall be at the OWNER'S expense.
1. The initial conformance tests shall include one sample per lot but at a rate of not less than that indicated in TABLE 02931-5 GEONET PROPERTIES, TABLE 02931-6 GEOTEXTILE PROPERTIES, and TABLE 02931-7 GEOCOMPOSITE PROPERTIES of material from consecutively numbered rolls, whichever is smaller. A lot is defined as a group of consecutively numbered rolls manufactured from the same resin batch or production line.
 2. Samples shall be taken across the entire width of the rolls and shall not include the first 4 feet if stored outside or damaged. The averaged test results of the geocomposite samples shall meet or exceed the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS.
 3. Samples that do not satisfy the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS shall be cause to reject applicable rolls. If a geocomposite sample fails to meet CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS, subsequent tests shall be performed at random on additional geocomposite samples produced from the same resin batch to determine whether all rolls produced from the same batch shall be considered as unsatisfactory and therefore rejected. The additional testing, borne by the CONTRACTOR, may be performed to more closely identify the rolls which do not comply with the TECHNICAL SPECIFICATIONS. Rejected rolls will not be installed and shall be removed from the PROJECT site as directed by the ENGINEER or CQA CONSULTANT at no additional cost to the OWNER.

TABLE 02931-5 GEONET PROPERTIES

TEST METHOD/PROPERTY	SPECIFIED VALUE	FREQUENCY (MINIMUM)
ASTM D5199-12(2019) Thickness (Top Slope)	330 mil (min. avg.)	1 per 100,000 SF
ASTM D5199-12(2019) Thickness (Side Slope)	300 mil (min. avg.)	1 per 100,000 SF
ASTM D7179-18 Tensile Strength ¹	60 lbs/in (min. avg.)	1 per 100,000 SF
ASTM D4218-20 Carbon Black	2.0 - 3.0%	1 per 100,000 SF
ASTM D1505-18 Polymer Density	0.940 g/cc (min. avg.)	1 per 100,000 SF
ASTM D1238-20 Polymer Melt Index	1.0 g/10min (max)	1 per 100,000 SF

Note:

1. Machine direction.

TABLE 02931-6 GEOTEXTILE PROPERTIES

TEST METHOD/PROPERTY	SPECIFIED VALUE	FREQUENCY (MINIMUM)
ASTM D5261-10(2018) Mass per Unit Area	6 oz/yd ² (MARV)	1 per 100,000 SF
ASTM D4751-20b AOS	#70 sieve (0.212 mm) (MaxARV)	1 per 100,000 SF
ASTM D6241-14 CBR Puncture	435 lbs (MARV)	1 per 100,000 SF
ASTM D4491/D4491M-21 Permittivity	1.5 sec-1 (Min.)	1 per 100,000 SF
ASTM D4632/D4632M-15a Grab Tensile	170 lbs (MARV)	1 per 100,000 SF
ASTM D4632/D4632M-15a Grab Elongation	50 lbs (MARV)	1 per 100,000 SF
ASTM D4533/D4533M-15 Trapezoidal Tear Strength	65 lbs (Min.)	1 per 100,000 SF

TABLE 02931-7 GEOCOMPOSITE PROPERTIES

TEST METHOD/PROPERTY	SPECIFIED VALUE	FREQUENCY (MINIMUM)
ASTM D7005/D7005M-16 Ply Adhesion	1 lbs/inch (Avg.)	1 per 100,000 SF
ASTM D4716/D4716M-20 Transmissivity (Top slope) ¹	3.3 x 10 ⁻³ m ² /sec (Min.)	1 per 100,000 SF
ASTM D4716/D4716M-20 Transmissivity (Side slope) ¹	1.72 x 10 ⁻³ m ² /sec (Min.)	1 per 100,000 SF
ASTM D5321/D5321M-20 Interface Friction Angle ²	20.5 degrees (Min.)	1 per 100,000 SF

ASTM D5321/D5321M-20 Interface Friction Angle ³	20.5 degrees	1 per 100,000 SF
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Notes:

1. ASTM D4716/D4716M-20 Transmissivity - The CQA CONSULTANT will perform testing at the rate indicated in TABLE 02931-7 GEOCOMPOSITE PROPERTIES. The following testing parameters will be followed with the results submitted to the ENGINEER or CQA CONSULTANT:
 - a. Normal Stress = 500 psf
 - b. Water = 20° C (68° F)
 - c. Gradient = 0.25
 - d. Test Configuration = Ottawa Sand/Geocomposite/Geomembrane
 - e. Test Time Period = 100 hours.
 - f. Apply normal stress under saturated conditions for 1 hour minimum prior to start of test. Test data from the MANUFACTURER using the identical testing configuration and parameters shall indicate that transmissivity values when tested in excess of 100 hours do not fall below the minimum value listed in TABLE 02931-7 GEOCOMPOSITE PROPERTIES. Thickness of the core geonet must be monitored during application of the normal compressive load and flow testing. Report to provide hydraulic conductivity and transmissivity.
2. ASTM D5321/D5321M-20 Interface Friction Angle protective cover material and geocomposite - The CQA CONSULTANT will perform testing at the rate indicated in TABLE 02931-7 GEOCOMPOSITE PROPERTIES on samples of the protective cover material and geocomposite. The following testing parameters will be followed with the results submitted to the ENGINEER or CQA CONSULTANT:
 - a. The protective cover material shall be prepared and molded to a minimum of 90% of ASTM D698-12e2 Standard Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort. The direct shear box shall be a minimum of 12 inches by 12 inches. Each normal load shall be preload at the specified normal load for a minimum of 24 hours prior to testing to dissipate pore pressures. Fully saturate soil prior to testing for each normal load.
 - b. Three Normal Loads = 200 psf, 500 psf, and 1,000 psf.
 - c. Strain Rate = 1 mm/min (0.04 in/min).
 - d. A minimum PEAK value of 0 psf adhesion and 20.5 degrees for the interface friction angle is required for this PROJECT. The interface friction angle shall be the result of a linear regression line drawn continuously through the three shear strength results obtained for the normal loads specified. Provide the results of peak and residual values.
 - e. Adhesion may be considered by the ENGINEER to determine equivalent stability for this PROJECT.

3. ASTM D5321/D5321M-20 Interface Friction Angle geocomposite and geomembrane - The CQA CONSULTANT will perform testing at the rate indicated in TABLE 02931-7 GEOCOMPOSITE PROPERTIES on samples of the geocomposite and geomembrane. The following testing parameters will be followed with the results submitted to the ENGINEER or CQA CONSULTANT:
 - a. The direct shear box shall be a minimum of 12 inches by 12 inches. Each normal load shall be preload at the specified normal load for a minimum of 1 hour prior to testing to dissipate pore pressures. Fully saturate soil prior to testing for each normal load.
 - b. Three Normal Loads = 200 psf, 500 psf, and 1,000 psf.
 - c. Strain Rate = 1 mm/min (0.04 in/min).
 - d. A minimum PEAK value of 0 psf adhesion and 20.5 degrees for the interface friction angle is required for this PROJECT. The interface friction angle shall be the result of a linear regression line drawn continuously through the three shear strength results obtained for the normal loads specified. Provide the results of peak and residual values.
 - e. Adhesion may be considered by the ENGINEER to determine equivalent stability for this PROJECT.

PART 3 - EXECUTION

3.1 MATERIAL PROTECTION

- A. It is the CONTRACTOR'S responsibility to provide all labor and materials for protection of the product during the period of time prior to installation of overlying soils. The CONTRACTOR'S protection method is subject to the approval of the ENGINEER.

3.2 MATERIAL LABELING, DELIVERY, STORAGE, AND HANDLING

- A. Labeling
 1. Each roll of material shall have a MANUFACTURER'S identification label. Each roll shall be labeled to provide product identification adequate for inventory and quality control purposes. At a minimum each roll label shall identify the following characteristics per ASTM D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples:
 - a. Product identification information (MANUFACTURER name and address, brand name, product code).
 - b. Product lot number and individual roll number.
 - c. Date of fabrication.
 - d. Roll length and width.
 - e. All geocomposite rolls shall be shipped and stored in packaging furnished at the manufacturing facility that is resistant to degradation by ultraviolet (UV) light, is moisture resistant, and prevents exposure to precipitation, mud, dirt, dust, puncture, or other damaging conditions.

B. Delivery

1. Geocomposite rolls delivered to the PROJECT site shall be only those indicated on MQA/MQC Certificates.
2. The MANUFACTURER typically assumes responsibility for initial loading and shipping of the geocomposite. Unloading, on-site handling, and storage shall be the responsibility of the CONTRACTOR.
3. Rolls of geocomposite will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading according to the MANUFACTURER'S recommendations.
4. A visual inspection of each roll should be made by the CONTRACTOR and CQAR as it is unloaded to identify to determine if any packaging or material has been damaged during transit. Minor rips or tears in the plastic packaging shall be repaired with moisture resistant tape prior to being placed in storage to prevent moisture damage.
5. Rolls of geocomposite exhibiting damage shall be marked and set aside for closer examination during deployment. Damaged materials will be identified and repaired or rejected at the discretion of the ENGINEER. Materials to be repaired as specified herein.
6. The CONTRACTOR shall contact the MANUFACTURER prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment to be utilized.
7. The CONTRACTOR assumes all liability with regards to shipping, transport, and unloading of the geocomposite required to complete the WORK. The OWNER shall not be responsible for damaged, lost or miss-stocked shipments, or mishandled or damaged materials.

C. Storage

1. The MANUFACTURER shall identify, in writing, the proper equipment and methods for unloading materials and storage procedures for the products delivered to the PROJECT site.
2. Storage of the geocomposite rolls shall be the responsibility of the CONTRACTOR. The materials shall be unloaded by the CONTRACTOR in areas designated by the OWNER. The CONTRACTOR shall provide the proper equipment and labor necessary to unload the material upon delivery to the PROJECT. The materials shall not be stored or unloaded in areas that will impair the operations of the landfill facility or be deleterious to the materials.
3. Do not remove the plastic wrapping until deployment.
4. All geocomposite rolls shall be stored and maintained dry in a flat location area away from high-traffic areas but sufficiently close to the WORK area to minimize handling.
5. Geocomposite shall be stored no higher than three to four rolls high or limited to the height at which the lifting apparatus may be safely handled by installation personnel.

6. Rolls of geocomposite should not be stacked upon one another to the extent that deformation of the core occurs.
7. Outdoor storage shall not exceed 6 months.
8. Geocomposites shall not be exposed to sunlight for more than 10 days unless otherwise specified and guaranteed by the geocomposite MANUFACTURER.
9. Protected from theft and vandalism.
10. Rolls shall not be stacked on uneven or discontinuous surfaces in order to prevent bending, deformation, damage to the geocomposite or cause difficulty inserting the core pipe.
11. Rolls should be stored in a manner that prevents sliding or rolling from the stacks. This may be accomplished by the use of chock blocks or by use of the dunnage shipped between rolls.
12. All stored geocomposite rolls must be covered with a plastic sheet or tarpaulin until their installation. Covering shall protect the geotextile from ultraviolet light exposure, precipitation, mud, dirt, puncture, cutting or any other damaging or deleterious conditions.

D. Handling

1. Each roll of geocomposite delivered to the site shall inspected by the CONTRACTOR, at a minimum, as follows:
 - a. The CONTRACTOR shall provide transportation, labor, and handling for delivery of the geocomposite to the PROJECT site. Special transportation or handling requirements for the geocomposite shall be provided by the CONTRACTOR.
 - b. The equipment for transportation, handling, loading, and unloading the geocomposite shall be of sufficient size and capacity to safely and efficiently handle geocomposite materials without damage or personnel injury occurring. The type, size and capacity shall be according to the MANUFACTURER and INSTALLER requirements.
 - c. The CONTRACTOR shall provide all equipment, labor, unloading, on-site handling, and installation of the geocomposite.
 - d. Upon delivery to the PROJECT site, the geocomposite material shall be inspected by the CONTRACTOR to confirm that proper labeling, transportation, handling, and storage procedures are followed. Damage to geocomposite rolls caused by the CONTRACTOR during unloading, on-site handling, and installation will be repaired at no additional cost to the OWNER. Rejected materials will be identified and removed from the PROJECT site as directed by the OWNER and CQA CONSULTANT at no additional cost to the OWNER.

3.3 DEPLOYMENT

- A. The product shall be installed in accordance with the MANUFACTURER'S recommendations and the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS. In case of a conflict between these documents, the more stringent requirements shall apply. Any deviations from these procedures must be reviewed and accepted by the ENGINEER prior to construction.
- B. Orientation
 - 1. Geocomposite shall be rolled down the slope in such a manner as to continually keep the material in tension. If necessary, the material shall be positioned by hand after unrolling to minimize wrinkles. The material shall not be unrolled laterally (i.e., across the slope).
- C. The CONTRACTOR shall provide sufficient ballast and temporary anchorage to protect the product. The CONTRACTOR is responsible for protecting the product from damage due to weather at all times.
- D. Physical Damage
 - 1. Personnel walking on the product shall not engage in activities or wear footwear that could damage the material. Smoking shall not be permitted on or near the geosynthetics.
 - 2. Equipment shall not damage the material by handling, trafficking, or leakage of hydrocarbons. The surface shall not be used as a work area for preparing patches, storing tools and supplies, or other uses.
- E. Bridging - The product shall be installed to avoid bridging.
- F. Corners - In corners, where overlaps between rolls are staggered, an extra roll shall be installed from the top to the bottom of the slope.
- G. Weather Protection - Each product shall be protected from direct sunlight or precipitation prior to installation. After installation this product shall not be exposed to direct sunlight and shall be covered within 30 days of installation. Product which is exposed to direct sunlight for 30 days or more shall be replaced at the CONTRACTOR'S expense.
- H. The geocomposite shall be properly anchored within the anchor trench to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geocomposite.
- I. If there are any obstructions (such as outlet pipes) while deploying the geocomposite, the geocomposite shall be cut to fit around the obstruction. Care should be taken as to make sure there is no gap between the obstruction and the geocomposite. The geocomposite should be cut in a way that the lower geotextile has an excess overhang. There must be enough of the upper geotextile to be able to tuck the upper geotextile back under the geocomposite to protect the exposed geonet core. This will prevent any soil particles from migrating into the geonet core flow channels.

3.4 FIELD QUALITY CONTROL

- A. Field Joining - The CONTRACTOR shall inspect all roll end joints and roll side joints. The results of these inspections shall be documented in the daily reports. Field joints shall comply with the requirements of TABLE 02931-8 GEOCOMPOSITE JOINING.
- B. QC Reporting Procedures - All information regarding the installation of the geocomposite will be recorded in the CONTRACTOR'S daily report. This information shall include the following at a minimum:
 - 1. Reference to product submittals, certifications, substitutions, and approvals.
 - 2. Dates of installation.
 - 3. Location and quantity of materials installed.
 - 4. Statement of whether materials were installed in accordance with the TECHNICAL SPECIFICATIONS.
 - 5. Additional information as required.
 - 6. All product certifications, filed appropriately for future reference.

3.5 CLEANLINESS

- A. The interface between the geocomposite and the geomembrane shall be clean, dry, and free of dirt and dust during installation. If dirt, dust, or water is present, the CONTRACTOR shall clean the WORK area. Products which are clogged with silts or other materials shall be discarded and shall not be installed.

3.6 ROLL JOINING METHODS

- A. TABLE 02931-8 GEOCOMPOSITE JOINING summarizes acceptable roll joining methods.
- B. Lap Seams - The bottom layer of geotextile shall be lap seamed. Lap seaming is accomplished by overlapping adjacent geotextile a minimum of 4 inches.
- C. Nylon Ties - The geonet shall be overlapped and fastened with nylon ties. Nylon ties shall be yellow or white in color to facilitate inspection.
- D. Machine Sewn Seams - The top layer of geotextile shall be sewn. Sewing shall be accomplished with a lock-stitching sewing machine, stitch Type 401. The thread shall be polymeric thread which complies with MANUFACTURER'S recommendations. The seam shall be placed at a minimum of 4 inches from the geotextile edges. The finished seam shall be folded to one side.

3.7 ROLL JOINING REQUIREMENTS

- A. The minimum requirements for joining rolls are specified in TABLE 02931-8 GEOCOMPOSITE JOINING.
- B. Roll Ends - The end of each roll of geocomposite shall be overlapped a minimum of 4 inches. The geonet portion shall be shingled, with the uphill end overlapping the downhill end. The geonet portion shall be tied 2 feet on center at a minimum. The bottom layer of geotextile shall be overlapped a minimum of 4 inches. The upper layer of geotextile shall be machine sewn. Where the geocomposite is to terminate, the upper geotextile shall be folded over the ends with a minimum of 6 inches of geotextile placed under the geocomposite. Butt seams should be staggered, heat seal top layer of geotextile.
- C. Adjacent Roll Sides - At roll sides, the material shall be overlapped a minimum of 4 inches. The bottom geotextile shall be overlapped. The geonet shall be overlapped and tied a minimum of 5 feet on center with nylon ties as described above. The upper layer of geotextile shall be machine sewn as described above.

3.8 REPAIRS

- A. Limitations - In general, damaged, soiled, or delaminated products shall be discarded. Products which have major damage, which require extensive repairs or replacement, shall be discarded as directed by the OWNER at the CONTRACTOR'S expense.
- B. Minor Damage - Minor damage is defined as a hole 2 inches or smaller in diameter in the product. Minor damage shall be repaired by snipping out protruding geonet and machine sewing or thermal bonding a geotextile patch over the hole. The patch shall be a minimum of 6 inches larger than the damaged area in all directions. If thermal bonding is conducted, care shall be taken to prevent excessive heat damage to the surrounding geosynthetics.
- C. Major Damage - Major damage is defined as a hole larger than 2 inches diameter through the product. Major damage shall be repaired by replacing the entire panel width. If a major damage to geocomposite rolls is caused by the CONTRACTOR during unloading, on-site handling, and installation, the geocomposite will be repaired at no additional cost to the OWNER.

TABLE 02931-8 GEOCOMPOSITE JOINING

LOCATION	LAYER	JOINING METHOD	OVERLAP (MINIMUM)	TYING FREQUENCY (MINIMUM)
Roll End	Upper Geotextile	Machine Sewing	6 inches	N/A
	Geonet	Nylon Ties	4 inches	2 feet on center
	Lower Geotextile	Overlap	4 inches	N/A
Roll Side	Upper Geotextile	Machine Sewing	4 inches	N/A
	Geonet	Nylon Ties	4 inches	5 feet on center
	Lower Geotextile	Overlap	4 inches	N/A
Repair of Minor Damage	Upper Geotextile	Machine Sewing/ Thermal Bonding	6 inches	N/A

	Geonet	N/A	N/A	N/A
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3.9 PLACEMENT OF OVERLYING MATERIALS

- A. The geocomposite should not be covered before observation and acceptance by the CQAR.
- B. Placement of drainage sand over the geocomposite by the CONTRACTOR shall be conducted in accordance with the requirements included in Section 02220 Excavation, Backfill, Fill, and Grading.

END OF SECTION

SECTION 02940

GEOTEXTILE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes the manufacture, testing, and installation of geotextile. The CONTRACTOR shall furnish all labor, supervision, administration, management, quality control, and installation equipment necessary for the unloading, on-site handling, storage, installation and Construction Quality Control (CQC) testing of non-woven geotextile for the Stormwater toe drain system as shown on the CONTRACT DRAWINGS and as specified herein.
- B. All materials shall conform to the following requirements and shall be of new stock of the highest grade available, free from defects, and recently manufactured.
- C. All WORK shall be performed in strict accordance with the TECHNICAL SPECIFICATIONS, CONTRACT DRAWINGS, conformance with the MANUFACTURER'S recommendations, and with current industry standards.

1.2 SUBMITTALS

- A. The CONTRACTOR shall submit in writing to the ENGINEER, for approval, prior to delivery of the geotextile to the PROJECT site and prior to installation documentation on the following:
 1. Submit MANUFACTURER'S prequalification, test reports and data, specifications, installation instructions and roll dimensions.
 2. Submit copies of evaluation reports provided by the MANUFACTURER demonstrating that properties for the materials comply with TECHNICAL SPECIFICATIONS requirements.
 3. The ENGINEER'S approval shall be obtained prior to the use of any materials in the PROJECT.

PART 2 - PRODUCTS

2.1 GEOTEXTILE

- A. Material shall be a non-woven monofilament geotextile equivalent to:
 - Filterweave 402 as manufactured by TenCate Mirafi
 - Filterweave 402 as manufactured by TenCate Mirafi

2.2 MANUFACTURING QUALITY CONTROL TESTING

- A. The CONTRACTOR shall coordinate with the MANUFACTURER, CQA CONSULTANT, and OWNER to schedule the delivery date of the geotextile to the PROJECT site.
- B. The CONTRACTOR shall inform, in writing, the CQA CONSULTANT and ENGINEER 15 days prior to the actual date of shipment from the MANUFACTURER.
- C. Geotextile shall be tested by the MANUFACTURER for the compliance with TABLE 02940-1 GEOTEXTILE PROPERTIES following minimum properties and test frequencies.

TABLE 02940-1 GEOTEXTILE PROPERTIES

TEST METHOD/PROPERTY	SPECIFIED VALUE	FREQUENCY (MINIMUM)
ASTM D5261-10(2018) Mass per Unit Area	6 oz/yd ²	1 per 100,000 SF
ASTM D4751-20b AOS	#70 sieve (0.212 mm)	1 per 100,000 SF
ASTM D4491/D4491M-21 Permittivity	110 gal/min/ft ²	1 per 100,000 SF
ASTM D6241-14 CBR Puncture	435 lbs/in	1 per 100,000 SF
ASTM D4632/D4632M-15a Grab Tensile	365 x 170 lbs	1 per 100,000 SF
ASTM D4533/D4533M-15 Trapezoidal Tear Strength	115 x 65 lbs/in	1 per 100,000 SF

2.3 CQA CONFORMANCE TESTING

- A. In-Plant Conformance Sample Testing Services - The OWNER'S REPRESENTATIVE and CQA CONSULTANT have qualified personnel to collect conformance samples directly at the following facilities:
 - Solmax GSE - Houston, Texas
 - AGRU America - Kingwood, Texas
 - Poly-Flex, Inc. - Grand Prairie, Texas
 - SKAPS Industries - Athens, Georgia
1. Conformance sample(s) of the geotextile will be collected by the OWNER'S REPRESENTATIVE or CQA CONSULTANT prior to shipment to the PROJECT site.
2. Conformance sample(s) of the geotextile will be tested by the CQA CONSULTANT prior to shipment to the PROJECT site
3. The CONTRACTOR shall coordinate with the MANUFACTURER, CQA CONSULTANT, and OWNER to schedule the delivery date of the geotextile to the PROJECT site.

4. The CONTRACTOR shall inform, in writing, the CQA CONSULTANT and ENGINEER Choose an item. prior to the actual date of shipment from the MANUFACTURER. Geotextile shall not be shipped prior to testing without the ENGINEER'S and CQA CONSULTANT'S approval.
5. Geotextile products shipped to the PROJECT site without approved conformance test results shall be sampled and tested upon delivery to the PROJECT site by the CQA CONSULTANT. All costs associated with collecting and shipping samples from the PROJECT site will be the CONTRACTOR'S responsibility. The CONTRACTOR shall allow a minimum of Choose an item. for sampling and testing of geotextile upon delivery to the PROJECT site prior to installation.
6. Geotextile shall be tested by the MANUFACTURER for the compliance with TABLE 02940-2 GEOTEXTILE CONFORMANCE PROPERTIES following minimum properties and test frequencies.

TABLE 02940-2 GEOTEXTILE CONFORMANCE PROPERTIES

TEST METHOD/PROPERTY	SPECIFIED VALUE	FREQUENCY (MINIMUM)
ASTM D5261-10(2018) Mass per Unit Area	6 oz/yd2 (MARV)	1 per 100,000 SF
ASTM D4751-20b AOS	#70 sieve (0.212 mm) (MaxARV)	1 per 100,000 SF
ASTM D6241-14 CBR Puncture	435 lbs (MARV)	1 per 100,000 SF
ASTM D4491/D4491M-21 Permittivity	1.5 sec-1 (Min.)	1 per 100,000 SF
ASTM D4632/D4632M-15a Grab Tensile	160 lbs (MARV)	1 per 100,000 SF
ASTM D4632/D4632M-15a Grab Elongation	50 lbs (MARV)	1 per 100,000 SF
ASTM D4533/D4533M-15 Trapezoidal Tear Strength	65 lbs (Min.)	1 per 100,000 SF

PART 3 - EXECUTION

3.1 MATERIAL PROTECTION

- A. It is the CONTRACTOR'S responsibility to provide all labor and materials for protection of the product during the period of time prior to installation of overlying materials. The CONTRACTOR'S protection method is subject to the approval of the ENGINEER.

3.2 MATERIAL LABELING, DELIVERY, STORAGE, AND HANDLING

- A. Labeling
 1. Each roll of material shall have a MANUFACTURER'S identification label. Each roll shall be labeled to provide product identification adequate for inventory and quality control purposes. At a minimum each roll label shall identify the following characteristics per ASTM D4873/D4873M-17(2021) Standard Guide for

Identification, Storage, and Handling of Geosynthetic Rolls and Samples:

- a. Product identification information (MANUFACTURER name and address, brand name, product code).
- b. Product lot number and individual roll number.
- c. Date of fabrication.
- d. Roll length and width.
- e. All geotextile rolls shall be shipped and stored in packaging furnished at the manufacturing facility that is resistant to degradation by ultraviolet (UV) light, is moisture resistant, and prevents exposure to precipitation, mud, dirt, dust, puncture, or other damaging conditions.

B. Delivery

1. Geotextile rolls delivered to the PROJECT site shall be only those indicated on MQA/MQC Certificates.
2. The MANUFACTURER typically assumes responsibility for initial loading and shipping of the geotextile. Unloading, on-site handling, and storage shall be the responsibility of the CONTRACTOR.
3. Rolls of geotextile will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading according to the MANUFACTURER'S recommendations.
4. A visual inspection of each roll should be made by the CONTRACTOR as it is unloaded to identify to determine if any packaging or material has been damaged during transit. Minor rips or tears in the plastic packaging shall be repaired with moisture resistant tape prior to being placed in storage to prevent moisture damage.
5. Rolls of geotextile exhibiting damage shall be marked and set aside for closer examination during deployment. Damaged materials will be identified and repaired or rejected at the discretion of the ENGINEER. Materials to be repaired as specified herein.
6. The CONTRACTOR shall contact the MANUFACTURER prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment to be utilized.
7. The CONTRACTOR assumes all liability with regards to shipping, transport, and unloading of the geotextile required to complete the WORK. The OWNER shall not be responsible for damaged, lost or miss-stocked shipments, or mishandled or damaged materials.

C. Storage

1. The MANUFACTURER shall identify, in writing, the proper equipment and methods for

unloading materials and storage procedures for the products delivered to the PROJECT site.

2. Storage of the geotextile rolls shall be the responsibility of the CONTRACTOR. The materials shall be unloaded by the CONTRACTOR in areas designated by the OWNER. The CONTRACTOR shall provide the proper equipment and labor necessary to unload the material upon delivery to the PROJECT. The materials shall not be stored or unloaded in areas that will impair the operations of the landfill facility or be deleterious to the materials.
3. Do not remove the plastic wrapping until deployment.
4. All geotextile rolls shall be stored and maintained dry in a flat location area away from high-traffic areas but sufficiently close to the WORK area to minimize handling.
5. Geotextile shall be stored no higher than three to four rolls high or limited to the height at which the lifting apparatus may be safely handled by installation personnel.
6. Rolls of geotextile should not be stacked upon one another to the extent that deformation of the core occurs.
7. Outdoor storage shall not exceed 6 months.
8. Geotextile shall not be exposed to sunlight for more than 15 days unless otherwise specified and guaranteed by the geotextile MANUFACTURER.
9. Protected from theft and vandalism.
10. Rolls shall not be stacked on uneven or discontinuous surfaces in order to prevent bending, deformation, damage to the geotextile or cause difficulty inserting the core pipe.
11. Rolls should be stored in a manner that prevents sliding or rolling from the stacks. This may be accomplished by the use of chock blocks or by use of the dunnage shipped between rolls.
12. All stored geotextile rolls must be covered with a plastic sheet or tarpaulin until their installation. Covering shall protect the geotextile from ultraviolet light exposure, precipitation, mud, dirt, puncture, cutting or any other damaging or deleterious conditions.

D. Handling

1. Each roll of geotextile delivered to the site shall inspected by the CONTRACTOR, at a minimum, as follows:
 - a. The CONTRACTOR shall provide transportation, labor, and handling for delivery of the geotextile to the PROJECT site. Special transportation or handling requirements for the geotextile shall be provided by the CONTRACTOR.

- b. The equipment for transportation, handling, loading, and unloading the geotextile shall be of sufficient size and capacity to safely and efficiently handle geotextile materials without damage or personnel injury occurring. The type, size and capacity shall be according to the MANUFACTURER and INSTALLER requirements.
- c. The CONTRACTOR shall provide all equipment, labor, unloading, on-site handling, and installation of the geotextile.
- d. Upon delivery to the PROJECT site, the geotextile material shall be inspected by the CONTRACTOR to confirm that proper labeling, transportation, handling, and storage procedures are followed. Damage to geotextile rolls caused by the CONTRACTOR during unloading, on-site handling, and installation will be repaired at no additional cost to the OWNER. Rejected materials will be identified and removed from the PROJECT site as directed by the OWNER and CQA CONSULTANT at no additional cost to the OWNER.

3.3 INSTALLATION

- A. The product shall be installed in accordance with the MANUFACTURER'S recommendations and the CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS. In case of a conflict between these documents, the more stringent requirements shall apply. Any deviations from these procedures must be reviewed and accepted by the ENGINEER prior to construction.
- B. No equipment shall be allowed to operate on the geotextile, and any tears or damage to the geotextile shall be repaired prior to placement. The surface of the geotextile shall be kept relatively clean and free of debris during installation.
- C. Geotextile shall not be placed in a trench that is excessively wet or has standing water.
- D. Geotextile shall be overlapped as shown in the CONTRACT DRAWINGS. Overlapped material can be sewn to maintain overlap during backfilling operations.
- E. Geotextile sheets shall be joined in accordance with the MANUFACTURER'S recommendations and the CQA Plan.
- F. The CONTRACTOR shall place all cover materials in such a manner to prevent damage to the materials, slippage of the underlying layers, and excessive tensile stresses in the materials.

3.4 REPAIRS

- A. Geotextile damaged during placement shall be replaced or repaired at the CONTRACTOR'S expense with a patch of the same geotextile double-sewn or heat-tacked into place. Repairs occurring on slopes steeper than 10H:1V shall be double-sewn in place. The CONTRACTOR shall be responsible for the documentation of repairs describing location and type of repair. Repair documentation shall be submitted to the ENGINEER.

3.5 GEOTEXTILE EXPOSURE FOLLOWING PLACEMENT

- A. Exposure of geotextiles to the elements between the time the geotextile is placed in the trench to the time backfilling operations are complete shall be limited to a maximum of 15 days to minimize ultraviolet damage. Any geotextile exposed to sunlight for more than 15 days shall be removed and replaced with new material at the CONTRACTOR'S expense.

3.6 PLACEMENT OF OVERLYING MATERIALS

- A. The geotextiles should not be covered before observation and acceptance by the CQAR.

END OF SECTION

SECTION 15090

LFG PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section includes all labor, materials, equipment and incidentals necessary to install complete and make ready for use all Landfill Gas (LFG) pipe, pipe fittings, and valves as specified herein and as indicated in the CONTRACT DRAWINGS.

1.2 REFERENCED DOCUMENTS

- A. The following American Society of Testing and Materials (ASTM) test methods shall be incorporated into this TECHNICAL SPECIFICATIONS in their entirety, subject to the indicated test modifications.
1. ASTM D1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
 2. ASTM D1748 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
 3. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 4. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other gravity-flow applications
 5. ASTM D2467 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
 6. ASTM D2513 Standard Specification for Thermoplastic Gas Pressure Pipe Tubing and Fittings
 7. ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
 8. ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
 9. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
- B. ASTM D3261 Butt Head Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing

C. Related Work Described Elsewhere:

1. Section 02220 Excavating, Backfill, Fill, and Grading
2. Section 02315 Trenching and Backfilling
3. Section 02500 LFG Extraction Wells and Wellheads
4. Section 16000 LFG Collection System Appurtenances

1.3 SUBMITTALS

- A. The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval prior to commencement of construction, certificates of compliance on materials furnished and MANUFACTURER'S brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance, and repair of each type of pipe, pipe fitting, and valve furnished.
- B. The CONTRACTOR shall prepare and submit Shop Drawings to the ENGINEER for review and approval. The Shop Drawings shall show the following:
 1. All dimensions, slopes, and invert elevations at connections to existing pipes.
 2. All tie-ins to the existing leachate collection system shall be field-verified and shown on the Shop Drawings. This shall include pipe size and burial depth at a minimum.
 3. Pipe Dimensions for each pipe size used:
 - a. Average outside diameter
 - b. Average inside diameter
 - c. Minimum average wall thickness.
 4. Each pipe and fitting size to be used

PART 2 - PRODUCTS

2.1 FLEXIBLE PVC PIPE ON WELLHEADS

- A. Flexible PVC pipe shall be UV-Resistant Solarguard™ Flexible Hose supplied by QED Environmental.
- B. Fasteners for flexible PVC pipe shall be high strength stainless steel banding kits supplied by QED Environmental, model number 40979.

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. All PVC pipe and fittings as indicated on the Drawings shall be Schedule 80 Polyvinyl Chloride conforming to ASTM D 1784, ASTM D 1785 (for pipe), and ASTM D 2467 (for fittings). All pipe and fittings shall be provided by one manufacturer. Acceptable manufacturers include Plastinetics, Inc. Chemtrol, ASAHI/America, or approved equal.
- B. PVC pipe and pipe fittings shall be manufactured from a compound which meets the requirements of Type 1, Grade 1, Polyvinyl Chloride PVC 1120, Class 12454-B, as outlined in ASTM D 1784. A Type 1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.
 - 1. Compound from which pipe is produced shall have a design stress rating of 13,800kPa at 23 degrees C, listed by the Plastic Piping Institute.
 - 2. Materials from which pipe and pipe fittings are manufactured shall have been tested and approved by NSF International.
 - 3. Pipe shall conform to the requirements of ASTM D-2241. Pipe shall be homogenous throughout and shall be free from cracks, holes, foreign inclusions, and other defects.
- C. PVC Pipe Storage: PVC pipe shall be stored or stacked so as to prevent damage by marring, crushing, or piercing. Maximum stacking height shall be limited to 6 feet. At the end of each day, all open ends of joined pipe shall be capped or otherwise covered to prevent entry by animals or debris. For storage over 5 days, a location shall be chosen out of direct sunlight or the piping and fittings will be covered.
- D. All pipe and fittings must be supplied by the same manufacturer.

2.3 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- A. All HDPE pipe and fittings 6-inch diameter and greater as indicated on the CONTRACT DRAWINGS shall be Standard Dimension Ratio (SDR) 11 and 17 high density polyethylene pipe (HDPE) using a 4710 type resin or equal.
- B. Dewatering discharge pipes and fittings shall be 2-inch diameter SDR 9 as indicated on the CONTRACT DRAWINGS.
- C. Air supply pipes and fittings shall be 2-inch diameter SDR 9 with yellow striping.
- D. Pipe shall be extruded from a Type III, Class C, Category 5, Grade P36 compound as described in ASTM D 1248. It shall be classified as cell 445574C according to ASTM D 3350 and have the material designation of PE 4710. The pipe shall be manufactured to meet the requirements of ASTM D 2513. Manufacturer's literature shall be adhered to when "MANUFACTURER'S recommendations" are specified. All pipe and fittings shall be provided by one MANUFACTURER.

E. HDPE Fittings

1. Fittings shall be manufactured from polyethylene compound having cell classification equal to or exceeding the compound used in the pipe.
2. All fittings 12 inches and smaller shall be molded, unless approved by the ENGINEER.

2.4 FLANGES FOR HDPE PIPE

- A. Flanges for HDPE pipe shall be convoluted ductile iron back-up rings with a minimum thickness of 1-inch, as manufactured by Improved Piping Product's, Inc. (800) 969-0962, of Orinda, California or equal. Hardware and fittings shall be stainless steel, finished with blue primer, and epoxy coated.
- B. The studs, nuts, and washers for the flanges shall be stainless steel. All below grade studs, nuts, and washers shall be thoroughly coated with Polyken Technologies 1027 Primer, or rubberized emulsion undercoating spray, or equal substitute, with no gaps in coverage. Below grade flanges shall be wrapped in 5-mil polyethylene sheeting just after installation and prior to backfilling to help prevent corrosion.
- C. Flange gaskets shall be full-face Neoprene.

2.5 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. All PVC pipe and fittings as indicated on the CONTRACT DRAWINGS shall be Schedule 80 Polyvinyl Chloride conforming to ASTM D 1784, ASTM D 1785 (for pipe), and ASTM D 2467 (for fittings). All pipe and fittings shall be provided by one MANUFACTURER. Acceptable manufacturers include Plastinetics, Inc. Chemtrol, ASAHI/America, or approved equal.
- B. PVC pipe and pipe fittings shall be manufactured from a compound which meets the requirements of Type 1, Grade 1, Polyvinyl Chloride PVC 1120, Class 12454-B, as outlined in ASTM D 1784. A Type 1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.
- C. Compound from which pipe is produced shall have a design stress rating of 13,800kPa at 23 degrees C, listed by the Plastic Piping Institute.
- D. Materials from which pipe and pipe fittings are manufactured shall have been tested and approved by NSF International.
- E. Pipe shall conform to the requirements of ASTM D-2241. Pipe shall be homogenous throughout and shall be free from cracks, holes, foreign inclusions, and other defects.
- F. PVC Pipe Storage: PVC pipe shall be stored or stacked so as to prevent damage by marring, crushing, or piercing. Maximum stacking height shall be limited to 6 feet. At the end of each day, all open ends of joined pipe shall be capped or otherwise covered to

prevent entry by animals or debris. For storage over 5 days, a location shall be chosen out of direct sunlight or the piping and fittings will be covered.

- G. All pipe and fittings must be supplied by the same MANUFACTURER.

2.6 PIPE MARKINGS

- A. All PVC and HDPE pipe shall be stamped by the MANUFACTURER with the following information at five foot intervals:

1. Manufacturer name or trademark
2. Nominal pipe size
3. Type of plastic (e.g., PE 4710)
4. Standard dimension ration (SDR) or Schedule (SCH) value
5. ASTM designations (i.e., ASTM D 2513)

2.6 VALVES

- A. All valves shall be complete with all necessary operators and other accessories or appurtenances which are required for the proper completion of the work. Operators and other accessories shall be sized and furnished by the valve supplier and factory mounted.
- B. Valves and operators shall be suitable for the exposure they are subject to, e.g., buried and landfill gas. Valves shall have all safety features required by OSHA.
- C. Unless otherwise shown, valves shall be the same size as the adjoining pipe.
- D. Valve position indicators shall be installed correctly to properly identify the valve position.
- E. Valve spacers shall be used for all valves 6 inches and larger.

2.7 PIPE LOCATOR / WARNING TAPE

- A. For LFG header and laterals as shown on the CONTRACT DRAWINGS, tape shall be a standard locator/warning tape imprinted with the words "Caution Gas Line Buried Below," as supplied by Reef Industries, Inc. (800-231-6074), or equal.

PART 3 – EXECUTION

3.1 GENERAL

- A. Pipe shall be stored or stacked so as to prevent damage by marring, crushing, or piercing. Maximum stacking height shall be limited to 6 feet.
- B. Pipe and pipe fittings shall be handled carefully in loading and unloading. They shall be lifted by hoists and lowered on skidways in such a manner as to avoid shock. Derricks,

ropes, or other suitable equipment shall be used for lowering the pipe into the extraction well borings. Pipe and pipe fittings shall not be dropped or dumped.

3.2 FIELD QUALITY CONTROL

- A. Pipe may be rejected for failure to conform to the Specifications or for the following reasons:
 - 1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of the pipe which could be cut off and discarded. Pipes within one shipment shall be rejected if defects exist in more than 5 percent of shipment or delivery.
 - 2. Cracks sufficient to impair strength, durability or serviceability of pipe.
 - 3. Defects indicating improper proportioning, mixing, or molding.
 - 4. Damaged ends, where such damage prevents making a satisfactory joint.
 - 5. Scratches or gouges of depth greater than 10 percent of pipe wall thickness.
- B. Acceptance of fittings, stubs, or other specially fabricated pipe sections shall be based on visual inspection at job site and documentation of conformance to these Specifications.
- C. The ENGINEER shall be notified by CONTRACTOR prior to burial of pipe.
- D. The CONTRACTOR and ENGINEER reserve the right to require destructive testing of any fusion weld on HDPE pipe.

3.3 PVC PIPE INSTALLATION

- A. PVC pipe installation shall conform to these Specifications, the manufacturer's recommendations, and as outlined in ASTM D 2774.
- B. Field perforations are not authorized.
- C. Pipe shavings from perforations shall be removed from the inside of all pipes using a method approved by and to the satisfaction of the Engineer.

3.4 JOINING OF PVC PIPE

- A. Joining of pipe shall be in accordance with ASTM D 2855.
- B. Preparation:
 - 1. All pipe shall be inspected for cuts, scratches, or other damage prior to installation. Pipe with imperfections shall not be used. All burrs, chips, etc. shall be removed from pipe interior and exterior.

2. The interior of the pipe shall be cleared of foreign matter; e.g., loose dirt, tape, pipe shavings, and paper. All loose dirt and moisture shall be wiped from the interior and exterior of the pipe end and the interior of the fitting.
 3. All pipe cuts shall be square, perpendicular to the center line of pipe. Pipe ends shall be beveled prior to applying primer and solvent cement so that the cement is not wiped off during insertion into the fitting socket.
- C. Solvent Welding:
1. A coating of primer as recommended by pipe supplier shall be applied to the entire interior surface of the fitting socket and to an equivalent area on the exterior of the pipe prior to applying solvent cement. The solvent cement shall comply with the requirements of ASTM D 2564 and shall be applied in strict accordance with manufacturer's specifications. Pipe shall not be primed or solvent welded during precipitation or when atmospheric temperature is below 40 degrees F or above 90 degrees F.
- D. Curing:
1. After solvent welding, the pipe shall remain undisturbed until cement has thoroughly set. As a guideline for joint setting time, use 1 hour for ambient temperatures 60-90 degrees F, or 2 hours when ambient temperature is 40-60 degrees F.
- E. Alignment
1. Pipe and pipe fittings shall be selected so as to minimize the linear deviation at the joints, and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting will be rejected.

3.5 FLEXIBLE PVC PIPE CONNECTIONS

- A. Connections to pipe shall be made with clamps in accordance with manufacturer's step-by-step procedures and recommendations, and as approved by the Engineer.

3.6 HDPE PIPE HANDLING

- A. HDPE pipe shall not be bent more than the minimum radius recommended by the MANUFACTURER for type, grade, and SDR. Care shall be taken to avoid imposing strains that will overstress or buckle the HDPE piping or impose excessive stress on the joints.
- B. Joining HDPE Pipe:
1. Only two methods shall be utilized to join HDPE pipe: heat fusion and mechanical joining.
 - a. Mechanical Joining shall be accomplished with HDPE flange adapters, neoprene gaskets, and ductile iron back-up flanges, and shall be used only where shown on the CONTRACT DRAWINGS.

- b. Heat Fusion joints shall be made in accordance with MANUFACTURER'S step-by-step procedures and recommendations.
 - 1) Fusion equipment and a trained operator shall be provided by the CONTRACTOR. Pipe fusion equipment shall be of the size and nature to adequately weld all pipe sizes and fittings necessary to complete the project.
 - 2) Branch saddle fusions shall be made in accordance with manufacturer's recommendations and step-by-step procedures. Branch saddle fusion equipment shall be of the size to facilitate saddle fusion within the pipe trench.
 - 3) Heat fusion shall be performed outside of the trench whenever practical.
 - 4) Before heat fusing pipe, each length shall be inspected for the presence of dirt, sand, mud, shavings, and other debris, and any foreign material shall be completely removed.
 - 5) At the end of each day, all open ends of fused pipe shall be capped or otherwise covered to prevent entry by animals or debris.
- c. As per the manufacturer's instructions, no fusion shall be performed in precipitation unless a shelter is provided.

3.7 HDPE PIPE INSTALLATION

- A. Pipe installation shall comply with the requirements of ASTM D 2321, PPI TR-31/9-79, and the manufacturer's recommendations.
- B. Lengths of fused pipe to be handled as one segment shall not exceed 500 feet.
- C. Inside of pipe shall be free of debris such as shavings and dirt.
- D. The ENGINEER shall be notified prior to any pipe being installed in the trench in order to have an opportunity to inspect the following items:
 - 1. All butt and saddle fusions.
 - 2. Pipe integrity.
 - 3. Trench excavation and bedding material for rocks and foreign material.
 - 4. Proper trench slope.
 - 5. Trench contour to ensure the pipe will have uniform and continuous support.
 - 6. Proposed backfill sand and soil.

- E. Any irregularities found by the ENGINEER during this inspection must be corrected before lowering the pipe into the trench. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.
- F. Tie-ins shall be made out of the trench whenever possible. When tie-ins are to be made in a trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.
- G. Below grade piping shall be marked with warning tape to be buried in the trench above the pipe as indicated on the CONTRACT DRAWINGS.
- H. CONTRACTOR shall collect all pipe shavings and discard in a trash receptacle. Shavings shall not be left on the ground.
- I. All installed HDPE pipe shall be marked in 25-foot intervals corresponding to the stationing required for slope confirmation and conformance surveying. For main pipeline, station numbering shall be continuous and sequential. Station numbering shall be referenced in daily logs to document pipe installation progress.

3.8 FLANGED CONNECTIONS

- A. For flanged connections in virgin soil, the CONTRACTOR shall wrap and tape the flanges and bolts in 5-mil polyethylene sheeting prior to backfilling to help protect the assembly from corrosion.
- B. Flanges shall be joined with stainless steel studs and nuts. Stud lengths shall accommodate the required distance between flanges including valve spacers, if necessary.
- C. For flanged connections within the limits of refuse, all below grade back-up rings, studs, nuts and washers shall be thoroughly coated with Polyken Technologies 1027 Primer, or rubberized emulsion undercoating spray, or equal substitute.
- D. The CONTRACTOR shall wrap and tape the flanges and bolts in 5-mil polyethylene sheeting prior to backfilling.

3.9 PIPE SUPPORTS

- A. All piping and valves shall be supported in such a manner as to prevent any stress being transmitted between sections and connected equipment and appurtenances.

3.10 SEGMENT TESTING (AIR PRESSURE)

- A. The HDPE laterals and connections to LFG header, air supply lines, and condensate discharge line pipelines shall be subjected to pressure tests as described herein to detect any leaks in the piping. Testing shall be performed below grade (inside the trench). The CONTRACTOR shall accept the responsibility for locating, uncovering (if previously backfilled), and repairing any leaks detected during testing.

- B. Polyethylene piping shall be butt welded together into testing segments. Segments shall be connected to a testing apparatus on one end and fitted with fusion-welded caps on all openings.
- C. The segment to be tested shall be allowed time to reach constant and/or ambient temperature before initiating the test.
- D. The test must be performed during a period when the pipe segment will be out of direct sunlight; i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations. No testing will be allowed during the middle of the day or when pipe segments are exposed to sunlight.
- E. The test pressure for LFG laterals and header shall be 10 psig. The test pressure for air supply and condensate/dewatering pipes shall be 100 psig.
- F. Pressure drop during the test shall not exceed one percent of the testing gauge pressure over a period of one hour. This pressure drop shall be corrected for temperature changes before determining pass or failure. (See Section 3.11 for test failures). The Engineer shall sign off on a test form to indicate test compliance.
- G. The ENGINEER and CQA Consultant shall be notified prior to commencement of the testing procedure and shall be present during the test.
- H. All equipment for this testing procedure, including an adequately sized air compressor, fittings, caps/pipe plugs, etc., shall be furnished by the CONTRACTOR. Other necessary equipment includes a flange adaptor with a steel or brass blind flange. Tapped and threaded into the blind flange will be a temperature gauge with a scale of 0 to 100 degrees C with 1-deg. intervals, a pressure gauge with a scale that spans the test pressure range with increments equal to 0.1 percent of the test pressure, an appropriate valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Pipe reducers shall be utilized to adapt test flange to size of pipe being tested.

3.11 TEST FAILURE

- A. The following steps shall be performed when a pipe segment fails the one percent/onehour test described in Part 3.10 F, above.
 - 1. The pipe and all fusions shall be inspected for cracks, pinholes, or perforations.
 - 2. All blocked risers and capped ends shall be inspected for leaks.
 - 3. Leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.
- B. All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.
- C. After all leaks are repaired, a retest shall be performed in accordance with Part 3.10.

3.12 TEST REPORTING

- A. Each test (pass or failure) shall be reported in writing on the attached pipe testing form or another form approved by the ENGINEER.
- B. If failure occurs, CONTRACTOR shall provide the CQAR the following:
 - 1. Location of failure segment.
 - 2. Nature of leaks.
 - 3. Repairs performed.
 - 4. Results of test.

ATTACHMENT 15090a HDPE Pipe Pressure Protocol

END OF SECTION

HDPE PIPE PRESSURE TEST PROCEDURE

This protocol describes the method for testing the installation of HDPE pipelines and components using a low-pressure air test.

PROCEDURE

1. Isolate the section of HDPE pipe to be tested using fusion welded caps. Cap the ends of all branches, laterals, tees, wyes, and stubs included in the test to prevent air leakage. All caps shall be securely braced to prevent blowout.
2. Contractor shall install a temperature gauge, pressure gauge and fittings for connection of an air compressor hose and a ball valve to release the pressure at the completion of the test.
 - Temperature gauge shall have a range of 0 to 100 °C.
 - Pressure gauge shall have increments equal to 1% of the test pressure.

Contractor shall not install new holes in pipeline for the exclusive purpose of performing the air test. However, tapped holes shown on the Plans for items such as header isolation valve monitoring ports may be utilized.

3. Connect the hose to the inlet tap and portable air supply source. Add air slowly to the test section until the pressure inside the pipe reaches the required level as shown below:
 - LFG header, laterals and condensate dewatering discharge lines: 10 psig
 - Air supply line and leachate forcemain: 100 psig
4. Once pressurized and the pressure has stabilized, record the initial temperature (°C) and pressure of the air inside the pipe on the test report form.
5. Begin timing the test. At ten-minute intervals, record the temperature (°C) and pressure of the air inside the pipe on the test report form. Record this data for 6 intervals, until the total time equals 60 minutes.
6. For pipe segments that include an isolation valve, the pressure test must be performed to demonstrate the integrity of the valve. Contractor shall close the valve and perform pressure tests on the header segments on both sides of the valve. This will serve to identify if the valve is airtight.

CALCULATIONS

In order to determine if the section of pipe tested is acceptable, the following calculations must be made.

1. Calculate the final theoretical pressure.

$$P_{\text{final, theoretical}} (\text{psi}) = \frac{[P_{\text{initial}} (\text{psi}) + 14.7] * [T_{\text{final}} (^{\circ}\text{C}) + 273]}{T_{\text{initial}} (^{\circ}\text{C}) + 273}$$

where,

$P_{\text{final, theoretical}} (\text{psi})$ = the theoretical acceptable gauge air pressure in the pipe at the end of the 10 min. interval

$P_{\text{initial}} (\text{psi})$ = the gauge air pressure in the pipe at the start of the 10 min. interval

$T_{\text{initial}} (^{\circ}\text{C})$ = the air temperature in the pipe at the beginning of the 10 min. interval

$T_{\text{final}} (^{\circ}\text{C})$ = the air temperature in the pipe at the end of the 10 min. interval

2. Calculate the gauge pressure (P_c) corrected for the temperature at the end of the 10-minute interval using the following equation and the value for $P_{\text{final, theoretical}}$ calculated above:

$$P_c = P_{\text{final, theol}} (\text{psi}) - 14.7 \text{ psi}$$

3. Calculate the actual Percent Pressure Drop using the following equation:

$$\text{Percent Pressure Drop} = \frac{P_c - P_{\text{f, actual}}}{P_c} * 100\%$$

where,

$P_{\text{f, actual}}$ = the final gauge pressure in the pipe at the end of the interval

4. If the percent pressure drop is less than or equal to 1%, the pipe segment passes for that particular interval. If the percent pressure drop is greater than 1%, then the following steps shall be performed.

- a) All blocked risers and capped ends shall be inspected for leaks.

- b) The pipe and all fusions in the section tested shall be inspected for cracks, pinholes, or perforations.
 - c) Air pressure leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.
 - d) All confirmed pipe and joint leaks shall be repaired by cutting out the leaking area and rewelding the pipe.
 - e) After all leaks are repaired, a retest shall be performed. This process shall be repeated until a successful test is achieved.
5. Each test (passed or failed) shall be reported in writing.
6. For each test failure, Inspector shall note the following:
- a) Location of failure segment
 - b) nature of leaks
 - c) Repairs performed
 - d) Results of test

Upon completion of the test, open the ball valve and allow air to escape. Caps must not be removed until air pressure in all of the test sections has been reduced to atmospheric pressure.

DATA LOG**PROJECT NAME/NO:** _____**CONTRACTOR:** _____**PERSON PERFORMING TEST:** _____**OWNER REPRESENTATIVE:** _____**DATE:** _____**TIME:** _____**DESCRIPTION/LOCATION OF TEST SEGMENT:** _____

Interval #	Time (min)	T _{initial} (°C)	T _{final} (°C)	P _{g, initial} (in-H ₂ O)	P _{i, absolute} (in-H ₂ O)	P _{theoretical} * (in-H ₂ O)	P _c * (in-H ₂ O)	P _{f, actual} (in-H ₂ O)	% Pressure Drop*	Retest?
1	10									
2	20									
3	30									
4	40									
5	50									
6	60									

* See equations in procedure

PIPE SIZE: _____

SDR: _____

LENGTH: _____

DESCRIPTION/NATURE OF LEAKS & REPAIRS OF RETEST SEGMENT:_____

SECTION 16000

LFG COLLECTION SYSTEM APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK specified in this Section states that the Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all work and services for complete installation of the landfill gas (LFG) collection system appurtenances as shown on the CONTRACT DRAWINGS and as specified, in accordance with provisions of the Contract Documents.
- B. The work shall include, but not necessarily be limited to valves, access risers, blind flanges, installation of pipe, fittings, and connections, abandonment of gas extraction wells and piping, as specified and as shown on the CONTRACT DRAWINGS.
- C. All materials shall conform to the requirements of this Section and shall be of new stock of the highest grade available, free from defects, and recently manufactured.
- D. All WORK shall be performed in strict accordance with the TECHNICAL SPECIFICATIONS, CONTRACT DRAWINGS, conformance with the MANUFACTURER'S recommendations, and with current industry standards.

1.2 SUBMITTALS

- A. Materials shall not be incorporated in construction until approved by the ENGINEER.
- B. The CONTRACTOR shall notify the OWNER of the source of all materials and shall furnish a representative sample for approval, at least ten calendar days prior to the date of anticipated use of such material.
- C. Warranty package will be submitted to OWNER and ENGINEER for review and approval. All equipment specified in this Section shall be warranted by CONTRACTOR for a period of not less than one year from the date of acceptance.

PART 2 - PRODUCTS

2.1 WELL CAPS

- A. The well caps shall be QED 8-inch well diameter wellheads and caps as specified in the CONTRACT DRAWINGS. All well caps to be provided with EZ level indicator.

2.2 HIGH LEVEL INDICATOR

- A. All wellheads and caps to be provided with QED supplied Easy Level™ Liquid Level Indicator and QED supplied bubbler tubing.

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Provide services of equipment with a MANUFACTURER field service representative(s) to:
 - 1. Inspect equipment covered by these TECHNICAL SPECIFICATIONS.
 - 2. Supervise pre-start adjustment and installation checks.
 - 3. Provide a written statement from MANUFACTURER stating that MANUFACTURER'S equipment has been installed properly, started up and is ready for Operation by OWNER personnel.

END OF SECTION