CONSTRUCTION QUALITY ASSURANCE PLAN

PLANT SCHERER - ASH POND AP-1
MONROE COUNTY, GEORGIA

FOR

Georgia Power

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AECOM

AECOM, 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560, (919) 461-1230, (919) 461-1415

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ACRONYMS AND ABBEVIATIONS

AP-1	Plant Scherer Ash Pond 1
AR	Administrative Regulations
ASTM	American Society for Testing and Materials
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
CPT	Cone Penetrometer Testing
CMT	Construction Materials Testing
CQA	Construction Quality Assurance
CQC	Construction Quality Control
EPA	Environmental Protection Agency
E&SC	Erosion and Sediment Control
GA	Georgia
GAEPD	Georgia Environmental Protection Division
GDM	Geocomposite Drainage Media
GM	Geomembrane
GPC	Georgia Power Company
GSWCC	Georgia Soil and Water Conservation Commission
HDPE	High Density Polyethylene
LLDPE	Linear Low-Density Polyethylene
NPDES	National Pollutant Discharge Elimination System
QA	Quality Assurance
QC	Quality Control
SCS	Southern Company Services
USEPA	United States Environmental Protection Agency
WWTS	Waste Water Treatment System

Note : Acronyms and abbreviations not included in the table are defined in the text the first time used.

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1 GENERAL

1. The Georgia Environmental Protection Division (GAEPD) solid waste program shall be notified of each major construction or closure event prior to construction. Construction Quality Assurance (CQA) shall be provided by a third-party consulting engineering firm procured by the OWNER knowledgeable and experienced in Construction Materials Testing (CMT) of soils, geosynthetics. Construction Quality Control (CQC) shall be provided by a third-party consulting engineering firm procured by the CONTRACTOR experienced in the inspection and testing of soils, geosynthetics, erosion and scour control materials, and proposed structures. Resumes and qualifications including experience with projects of similar type, size, and complexity shall be provided to Georgia Power for their review and approval.

2. The services of the CQA and CQC firms shall be required during construction and installation of all surface impoundment cover components described in this document.

3. Definitions related to construction quality include:

    a. CONSTRUCTION QUALITY ASSURANCE (CQA): In the context of this Plan, Construction Quality Assurance is defined as a planned and systematic program employed by the OWNER to document conformity of the earthwork construction, geosynthetics installation, protective cover and other elements of the Final Cover with the approved Project Drawings and the Specifications and/or this CQA Plan. CQA is provided by the CQA ENGINEER as a representative of the OWNER and is independent from the CONTRACTOR and all manufacturers. The CQA program is designed to provide adequate confidence that items or services meet contractual and regulatory requirements.

    b. CONSTRUCTION QUALITY CONTROL (CQC): Refers to actions taken by manufacturers, fabricators, installers, and/or the CONTRACTOR to document that the materials and the workmanship meet the requirements of the Project Drawings and the Specifications and/or this CQA Plan. The manufacturer's and quality control (QC) requirements are included in this CQA Plan by reference only. A complete updated version of each geosynthetic component manufacturer's QC Plan shall be incorporated as part of the CONTRACTOR's CQC Plan.

4. This CQA Plan is not intended to substitute for or over-ride the Specifications, or the CONTRACTOR’s CQC Plan. The CONTRACTOR is instructed to bring discrepancies between the Specifications and/or CQC and this CQA Plan to the attention of the CQA ENGINEER who shall then notify the DESIGN ENGINEER for resolution. The DESIGN ENGINEER has the sole authority to determine resolution of discrepancies existing within the Contract Documents (this may also require the approval of the OWNER and GAEPD). Unless otherwise determined by the DESIGN ENGINEER, the more stringent requirement shall be the controlling resolution.

5. CQC testing requirements for conformance: It is recognized that standards and test methods specified for this CQA Plan or the CQA/CQC program may be modified, updated, withdrawn or

replaced by the standards writing organizations. In addition, advances to design, testing or regulatory programs could occur over the life of the Closure. The DESIGN ENGINEER will update the CQA Plan as required to reflect changes to test methods, or to include new test methods or standards that best address the needs of the Closure design and/or construction. This may result in changes to the ASTM and other standards or test methods outlined in this CQA Plan. The CQA Plan should be updated to reflect such changes in any applicable standards or methods. It is the intent of this CQA Plan that, when conflicts exist between the Specifications and/or this CQA Plan and this CQA Plan in test methods, test frequencies, values, or other requirements, the CQA Plan are to be followed as long as all regulatory performance requirements are met as confirmed by the CQA ENGINEER.

6. The project team shall consist of the following:

   - OWNER: The Owner is Georgia Power Co., who owns and is responsible for the facility.
   - DESIGN ENGINEER: Responsible for providing interpretations and clarifications, reviewing and approving shop drawings, authorizing minor variations in the work from the requirements and rejecting defective work (duties and responsibilities are described in General Conditions as "ENGINEER"). The DESIGN ENGINEER shall be a registered professional engineer licensed in Georgia.
   - CONTRACTOR: The CONTRACTOR is responsible for earthwork and the construction of the subgrade, compacted soil barrier, earthwork, and for placement of the geosynthetic materials, drainage and cover systems, and all other ancillary Closure construction activities. The CONTRACTOR is responsible for the overall CQC on the project and coordination of submittals to the DESIGN ENGINEER and the CQA ENGINEER. Additional responsibilities of the CONTRACTOR are defined by the Specifications and/or this CQA Plan.
   - CQC ENGINEER: Responsible for executing the quality control testing as stated in the Project Drawings, specifications, this CQA plan and the project objectives. The CQC ENGINEER shall be procured by the CONTRACTOR and report to CQA ENGINEER. This CQC ENGINEER shall be a registered professional engineer licensed in Georgia. Reference to the CQC ENGINEER, for the purpose of this document, shall include the CQC ENGINEER or his representative.
   - CQA ENGINEER: Responsible for implementing the quality assurance requirements as stated in the Project Drawings, Specifications, this CQA plan and the project objectives; verifying basic data as reasonable and complete; outlining procedures to process data, developing statistical procedures for the analysis of test data; and preparing quality assurance memoranda and quality assurance reports. The CQA ENGINEER shall report to Georgia Power. This CQA ENGINEER shall be a registered professional engineer licensed in Georgia. Reference to the CQA ENGINEER, for the purpose of this document, shall include the CQA ENGINEER or his representative.
   - ENGINEERING TECHNICIANS: Responsible for field observations, testing, and inspection. Technicians will be assigned to the project as deemed necessary by the CQC ENGINEER and will be responsible to the CQC ENGINEER. The CQC ENGINEER, technicians, or the

CQC ENGINEER'S representative shall be on-site during all construction activities except clearing and grubbing and initial grading activities. Initial evaluation of various soil types by CQC personnel during construction shall be largely visual; therefore, all CQC personnel must be experienced with Visual-Manual Procedures for soil description and identification (ASTM D2488). The CQA ENGINEER will have responsibility of confirming the CQC ENGINEERS' technicians and other supporting personnel are suitable in number, experience, and capability. The CQA ENGINEER has the authority to request personnel changes by the CQC ENGINEER if a deficiency in any of these requirements are seen.

- GEOSYNTHETICS CQC LABORATORY: The Geosynthetics CQC Laboratory is a party, independent from the OWNER and CONTRACTOR, which is responsible for conducting tests on conformance samples of geosynthetics used in the Final Cover system. The Geosynthetics CQC Laboratory service cannot be provided by any party involved with the manufacture, fabrication, or installation of any of the geosynthetic components. The services of the Geosynthetics CQC Laboratory are coordinated by the CQC ENGINEER and are paid for by the CONTRACTOR. The CQA ENGINEER will review all Geosynthetics CQC Laboratory testing results to confirm that the results and proposed materials meet the project requirements.

- THE SOILS CQC LABORATORY: The Soils CQC Laboratory is a party, independent from the OWNER and CONTRACTOR, which is responsible for conducting geotechnical tests on conformance samples of soils and aggregates used for structural fill, barrier, construction materials, and cover systems. The services of the Soils CQC Laboratory are coordinated by the CQC ENGINEER and are paid for by the CONTRACTOR. The CQA ENGINEER will review all soils CQC Laboratory testing results to confirm that the results and proposed materials meet the project requirements.

- AS-BUILT SURVEYOR: As-built certification surveys shall be performed by the CONTRACTOR using a registered professional land surveyor licensed in Georgia on the components of the closure construction and Final Cover system. Required As-Built Drawings are identified in the Specifications and/or this CQA Plan. At a minimum, As-Built Drawings shall be prepared for the following:

  a. Base grades or prepared subgrade beneath structural fill comprised of soil or CCR,

  b. Alignments and inverts of piping,

  c. Modified or abandoned spillways, stilling basins, or other drainage structures,

  d. Modification or removal of Registered Dams, including slopes, elevations, revetments, outlets/spillways, or any other critical features,

  e. Cap Geomembrane subgrade elevations,

  f. Top of Final Cover Protective Soil,

  g. Lines, grades and alignments for stormwater management swales or conveyance channels on or adjacent to the Final Cover.

  h. Additional construction of closure features critical to record drawing purposes and/or directed by the CQA ENGINEER.

As-Built drawings shall be approved by both the CQC ENGINEER and the CQA ENGINEER, and any engineered components of the As-Built drawings must be sealed by the engineer in-charge who shall be employed or procured by the CONTRACTOR for purposes of the work.

2 EARTHWORK AND GRADING

2.1 General

1. This section of the CQA Plan addresses earthwork (excavation, structural fill embankment, general filling) and outlines the soils CQA/CQC program to be implemented with regard to material acceptance, subgrade acceptance, field control and record tests, and resolution of problems. Note that CCR may be included as structural or general fill within the limits of the Closure.

2. The CQC ENGINEER or his representative will observe and document all grading activities and test the placement and compaction of in-situ materials and structural fill. The CQC ENGINEER is responsible for certifying that the materials and construction were in accordance with the Project Drawings, Specifications, and this CQA Plan.

2.2 Earthwork Material Acceptance

All material to be used as subgrade and pre-subgrade fill shall be accepted in advance by the CQA ENGINEER. Acceptance is based upon successful completion of CQC testing outlined below. Such testing can be performed either during excavation and stockpiling or from existing stockpiles prior to use. Only materials approved by the CQA ENGINEER shall be used for closure construction.

2.3 Material Control Tests (On-site Sources)

1. Acceptance of materials excavated on-site to be used for compacted soil barrier, if applicable, shall be based on initial hydraulic conductivity testing (ASTM D 5084) conducted in advance of construction. Materials to be utilized as compacted soil barrier are to consist of on-site or off-site cohesive soils and meet hydraulic conductivity requirements outlined in the Specifications and/or this CQA Plan. Per the CCR rules, these materials shall have a hydraulic conductivity no greater than 10^{-5} cm/sec. Proposed compacted soil barrier soils shall be subjected to laboratory hydraulic conductivity tests on samples compacted in the laboratory to a variety of moisture/density values as outlined in the Specifications and/or this CQA Plan.

2. Final Cover soil layers that are not intended as compacted soil barrier do not have hydraulic conductivity test or performance requirements. Refer to the Project Drawings and Specifications for the intended function of the soil layers.

3. Candidate soils located in cut areas will be separated from unclassified soils and stockpiled separately, as outlined in the Project Drawings and/or Specifications. A band of moisture/density values shall be delineated by the CQA ENGINEER based upon the CQC laboratory testing data. This band will then be used as the acceptable range of moisture/density values for field compaction control.

4. The procedure for CQC testing during excavation and stockpiling (including existing stockpiles) is outlined below.

    a. Soil will be examined during excavation activities. Unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries shall be made in the daily log. The daily logs and supporting information (i.e. field sketches, photographs, load tickets, etc.) shall be provided to the CQA ENGINEER.

    b. During stockpiling operations, control tests, as shown on Table 2.1, will be performed by the CQC ENGINEER prior to placement of any compacted materials.

    c. Material Control Tests (Off-Site Source)

5. Acceptance of off-site borrow source materials to be used for the compacted soil barrier shall be based on initial hydraulic conductivity testing (ASTM D 5084) conducted in advance of construction. Materials to be utilized as compacted soil barrier are to consist of approved cohesive soils that meet hydraulic conductivity requirements outlined in the CQA Plan. Proposed compacted soil barrier soils shall be subjected to laboratory hydraulic conductivity tests on samples compacted in the laboratory to a variety of moisture/density values as outlined in the Specifications and/or this CQA Plan. A band of moisture/density values, which results in the required hydraulic conductivity, shall be delineated by the CQA ENGINEER based on the laboratory testing data. This band will then be used as the acceptable range of moisture/density values for field compaction control.

6. The procedure for CQC testing after delivery and during stockpiling is outlined below.

    a. Soil will be examined after delivery and placement at on-site stockpile(s). Unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries shall be made in the daily log. The daily logs and supporting information (i.e. field sketches, photographs, load tickets, etc.) shall be provided to the CQA ENGINEER.

    b. During stockpiling operations, control tests, as shown on Table 2.1, will be performed by the CQC ENGINEER prior to placement of any compacted materials.

2.4 Subgrades

1. During construction, conformance and performance testing of the subgrade soil or CCR materials shall be performed by the CQC ENGINEER. The CQC ENGINEER shall monitor and document proofrolling of areas that are cut to achieve grade. Material placed to achieve grades indicated on the Project Drawings shall be tested by the CQC ENGINEER in accordance with the test methods and frequencies listed herein to verify that the compacted fill materials used by the CONTRACTOR comply with the CQA Plan. Areas of proofrolling or compacted fill that do not conform to the Specifications and/or this CQA Plan will be delineated and reported to the CONTRACTOR. The CQC ENGINEER shall work with the CQA ENGINEER to document that these areas are reworked by the CONTRACTOR and retested until passing results are achieved.

2. The CQC ENGINEER shall monitor and document if the subgrade is damaged by excess moisture (causing softening), insufficient moisture (causing desiccation and shrinkage), or by freezing. When such conditions exist, the CQC ENGINEER shall evaluate the suitability of the subgrade by the following methods as applicable:

    a. moisture / density testing;

    b. continuous visual inspection during proofrolling;

    c. other test methods identified herein.

3. The CQC ENGINEER shall inform the CONTRACTOR and shall document when the CONTRACTOR repairs areas damaged as indicated above. The CQC ENGINEER shall retest the repaired areas until passing results are achieved.

4. If passing results cannot be reasonably achieved by reworking in-place subgrade materials, the subject area/materials may be undercut and replaced with approved materials at the approval of the CQA ENGINEER. Undercut areas must achieve passing test results by the CQC ENGINEER and documentation for location, dimension, and volume by both the CQC ENGINEER and CONTRACTOR.

5. Subgrades shall not be considered accepted until approved by the CQA ENGINEER.

2.5 Conformance Testing

1. It will be necessary for the CQA ENGINEER to observe and for the CQC ENGINEER to test the placement of any fill that will be utilized for subgrades beneath proposed structures and the Final Cover System. These soils are referred to herein as “structural fill” soils and the CQA ENGINEER will need to verify the materials are uniform and conform to the general requirements of the CQA Plan based on testing performed by the CQC ENGINEER. For soil materials obtained from on-site or off-site borrow areas, visual inspections and conformance tests shall be performed by the CQC ENGINEER and approved by the CQA ENGINEER prior to the materials being used.

2. CCR materials excavated from AP-1 may also be used for structural fill within the limits of the Final Cover to achieve design lines and grades. CCR materials may not be subject to conformance testing requirements, unless it is utilized for structural subgrade material. CCR materials utilized for cover subgrade construction may require specific gradation requirements as specified in the Specifications and/or this CQA Plan. Any conformance testing required on CCR shall be completed the CQC ENGINEER and results reviewed by the CQA ENGINEER.

2.6 In-Place Test Methods and Frequency

1. All testing shall be conducted in accordance with this CQA Plan. The field testing methods used to evaluate the suitability of soils during their installation shall be approved by the CQA

ENGINEER and performed by the CQC ENGINEER in accordance with current ASTM test procedures indicated in Table 2.2.

2. Documentation and reporting of the test results shall be the responsibility of the CQC ENGINEER. Approval of test results shall be the responsibility and authority of the CQA ENGINEER.

3. The Standard Proctor Test (ASTM D698) shall be used for the determination of moisture/density relationships unless otherwise indicated. In-place moisture/density testing shall be by nuclear test method ASTM D6938 (non CCR materials), the sand cone test method ASTM D1556, or drive cylinder test method ASTM D2937. The sand cone test method ASTM D1556 or drive cylinder test method ASTM D2937 shall be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration. Conflicts regarding acceptance of test results shall be resolved by the DESIGN ENGINEER.

4. Testing shall be conducted during the course of the work by the CQC ENGINEER. The minimum CMT frequencies are presented in the table below. The frequency may be increased at the discretion of the CQA ENGINEER or if variability of the materials is observed by the CQA ENGINEER. Sampling locations shall be selected by the CQC ENGINEER, but locations may be modified or increased by the CQA ENGINEER. If necessary, the location of routine in-place density tests shall be determined using a non-biased sampling approach.

5. During construction, the frequency of control and/or record testing may be increased at the discretion of the CQA ENGINEER when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

    a. The rollers slip during rolling operation;

    b. The lift thickness is greater than specified;

    c. The fill material is at an improper moisture content;

    d. Fewer than the specified number of roller passes are made;

    e. Soil-clogged rollers are used to compact the material;

    f. The rollers may not have used optimum ballast;

    g. The fill materials differ substantially from those specified;

    h. The degree of compaction is doubtful; or

    i. Directed by CQA ENGINEER.

2.7 Protection of Subgrades and Fill Surfaces

1. The CQC ENGINEER shall monitor newly graded areas to verify the CONTRACTOR is protecting these areas from traffic and erosion until construction is complete. Any issues protecting the subgrades shall be immediately brought to the attention of the CQA ENGINEER.

TABLE 2.1: CQC TESTING PROGRAM - SOIL FILL CONTROL TESTS

PROPERTY	TEST METHOD	TEST FREQUENCY
CONTROL TESTS:		
Visual Classification	ASTM D 2488	Each Soil
Moisture-Density Relationship	ASTM D 698	5,000 CY per Each Soil
Material Index	ASTM D 4318 ASTM D 422 (with hydrometer)	5,000 CY per Each Soil

TABLE 2.2: CQC TESTING PROGRAM - PROTECTIVE SOIL LAYER CONTROL TESTS

PROPERTY	TEST METHOD	TEST FREQUENCY
CONTROL TESTS:		
Visual Classification	ASTM D 2488	Each Soil
Moisture-Density Relationship	ASTM D 698	5,000 CY per Each Soil
Material Index	ASTM D 4318 ASTM D 422 (with hydrometer)	5,000 CY per Each Soil
Hydraulic Conductivity	ASTM D 5084	10,000 CY per Each Soil

TABLE 2.3: CQC TESTING PROGRAM - VEGETATIVE COVER LAYER CONTROL TESTS

PROPERTY	TEST METHOD	TEST FREQUENCY
CONTROL TESTS:		
Visual Classification	ASTM D 2488	Each Soil
Moisture-Density Relationship	ASTM D 698	5,000 CY per Each Soil
Material Index	ASTM D 4318 ASTM D 422 (with hydrometer)	5,000 CY per Each Soil
Organic Content	ASTM D 2974	5,000 CY per Each Soil

TABLE 2.4: CQC TESTING PROGRAM - FIELD TESTING

PROPERTY	TEST METHOD	TEST FREQUENCY
CONTROL TESTS:		
Atterberg Limits	ASTM D4318	1 per 60,000 sf per lift
Grain Size (sieves only)	ASTM D422	1 per 60,000 sf per lift
Hydraulic Conductivity (compacted soil barrier)	ASTM D5084	1 per 100,000 sf per lift
Lift Thickness	-----	Each Lift
In-Place Density and Moisture Content	ASTM D 6938[1]	Structural Fill 1 per 100 ft. x 100 ft. grid pattern per lift 1 per 500 LF/lift of Berms and Trenches (< 200 ft. base width) Compacted Soil Barrier 1 per 100 ft. x 100 ft. grid pattern per lift

Notes:

1. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937. For every 10 nuclear density tests perform at least 1 density test by ASTM D 1556, ASTM D 2167, or ASTM D 2937 as a verification of the accuracy of the nuclear testing device. Whichever provides the larger number of tests.
2. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959. For every 10 nuclear-moisture tests perform at least 1 moisture test by ASTM D 2216, ASTM D 4643, or ASTM D 4959 as a verification of the accuracy of the nuclear testing device.

2. Unless otherwise specified by the CQA ENGINEER, all equipment operating on cap cover soil material overlying the geocomposite shall comply with the following:

TABLE 2.5: MAXIMUM ALLOWABLE EQUIPMENT PRESSURE PER COVER THICKNESS

MAXIMUM EQUIPMENT GROUND PRESSURE	THICKNESS OF OVERLYING FILL
<5 psi	1.0 ft
>5 psi and <10 psi	1.5 ft
>10 psi	2.0 ft

2.8 CCR Removal

"CCR removal" refers to the process of verifying and documenting that CCR has been removed from AP-1. AP-1 is known to contain a mixture of fly ash and bottom ash collectively referred to as CCR. Within the closure-by-removal area, the CCR will be excavated until native soils are encountered indicating that the CCR has been removed. In addition, a 6-inch layer of soil will be removed below the verified CCR/soil interface. The CCR excavation and removal criteria are described below.

Visual Verification of CCR Removal Procedure:

Under the direction of the CQA ENGINEER, the CQC ENGINEER will monitor and document CCR removal according to the following procedure:

1. The CQC ENGINEER will prepare an AP-1 map using a 100-foot grid spacing. Grid points will be assigned a unique alphanumeric label for reference and documentation of CCR removal. The AP-1 map shall be reviewed and approved by the CQA ENGINEER prior to implementation and daily throughout CCR removal operations.

2. CCR will be excavated until there is no visible CCR present. This surface will be referred to as the CCR/soil interface.

3. CQC ENGINEER personnel will observe the CCR/soil interface at the working face to confirm that visible CCR has been removed. Observations shall be made with reference to the approved AP-1 grid map. Observations will include, but not be limited to, taking photographs, and describing soil color. CQC personnel will document observations in field logs or reports. The proposed logging and reporting methods shall be reviewed and approved by the CQA ENGINEER prior to implementation and the field logs or reports shall be reviewed and approved daily throughout CCR removal operations by the CQA ENGINEER.

4. The CCR/soil interface surface shall be surveyed daily, by the CONTRACTOR, or as needed to document and the completed excavation surface for As-Built and record purposes. The daily or routine survey data shall be reviewed by both the CQC ENGINEER and the CQA ENGINEER. The survey and/or the record data shall not be considered complete until approved by the CQA ENGINEER.

5. The excavation will continue to a minimum 6-inches below the CCR/soil interface. This surface will be referred to as the bottom of excavation. Excavated soil will be disposed of at an off-site permitted landfill.

6. The bottom of excavation surface will be surveyed and confirmed to be a minimum of 6-inches below the CCR/soil interface as the final stage of CCR removal. The bottom of excavation surface survey shall not be considered complete until approved by the CQA ENGINEER.

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3 FINAL COVER GEOMEMBRANE

3.1 General

This section of the CQA Plan addresses the geomembrane component of the Final Cover and outlines the CQA/CQC program to be implemented with regard to manufacturer and installer acceptance, material acceptance, subgrade acceptance, field and laboratory control and record tests, repairs, and resolution of problems.

3.2 Geomembrane Manufacturer and Installer Acceptance

1. The CONTRACTOR shall submit the qualifications of the Geomembrane Manufacturer and the Geomembrane Installer, as described in the Specifications and/or this CQA Plan, to the OWNER and CQA ENGINEER for acceptance.

2. The CQA ENGINEER will review the CONTRACTOR's submittals for conformance with the Specifications and/or this CQA Plan.

3. Cap Geomembrane will only be shipped to the site once submittals and CQA Conformance Testing is completed and the material approved by the OWNER and CQA ENGINEER.

3.3 Cap Geomembrane Material Acceptance and Conformance Testing

1. Samples for CQA conformance tests, as shown on Table 3.1, will be obtained by the CQC ENGINEER at the indicated frequencies upon delivery of the geomembrane. Alternatively, samples may be randomly obtained at the manufacturing site by the CQC ENGINEER or representatives of the GEOSYNTHETICS CQC LABORATORY.

    a. Unless otherwise specified, samples will be 3 feet long by the roll or sheet width. The CQC ENGINEER will mark the machine direction on the samples with an arrow.

    b. All material control tests will be performed by the GEOSYNTHETICS CQC LABORATORY.

    c. All material control tests results shall be provided to the CQA ENGINEER for review and approval.

2. The following procedure will apply whenever a sample fails a material control test:

    a. The Geomembrane Installer will replace each roll or sheet of Cap Geomembrane that is in non-conformance with the Specifications and/or this CQA Plan with a roll or sheet that meets Specifications and/or this CQA Plan.

    b. The Geomembrane Installer will remove conformance samples for testing by the GEOSYNTHETICS CQC LABORATORY from the closest numerical roll or sheet on both sides of the failed roll or sheet. These two samples must both conform to Specifications and/or this CQA Plan. If either of these samples fail, then the next numerical roll or sheet

will be tested until a passing roll or sheet is found. This additional conformance testing will be at the expense of the Geomembrane Installer.

c. If either of the two closest rolls or sheets fail, the CQA ENGINEER will dictate the frequency of additional testing.

3. The CQC ENGINEER will document actions taken in conjunction with material control test failures.

4. During shipment and storage, all geomembrane will be protected as required by the Specifications and/or this CQA Plan. The CQC ENGINEER will observe rolls upon delivery at the site.

5. Upon delivery, the CQC ENGINEER will document that the Manufacturer's quality control certificates have been provided at the specified frequency and that each certificate identified the rolls or sheets related to it; and review the Manufacturer's quality control certificates and document that the certified properties meet the Specifications and/or this CQA Plan.

6. All control test results must be available at the site prior to the deployment of all geomembrane. The CQA ENGINEER will examine all results from laboratory conformance testing. Approval of these test results and the materials acceptance and conformance testing by the CQA ENGINEER is required before geomembrane installation can begin.

3.4 Geomembrane Installation

1. A Geosynthetics Pre-Construction Meeting will be held at the site prior to placement of the geosynthetics as outlined in the Specifications and/or this CQA Plan. At a minimum, the meeting will be attended by the OWNER, DESIGN ENGINEER, CQA ENGINEER, CQC ENGINEER, CONTRACTOR, and Geosynthetic Installation Superintendent(s).

2. The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and, above all, review the CQA Plan with all of the parties involved. It is very important that the requirements regarding submittals, testing, repair, recordkeeping, etc. be known and accepted by all.

3. This meeting should include all of the activities referenced in this CQA Plan and the Specifications. The meeting will be documented by the CQA ENGINEER and minutes will be transmitted to all parties.

4. The Geomembrane Installer will provide the CQC ENGINEER with a list of proposed seaming personnel and their experience records. This document will be reviewed by the CQA ENGINEER for compliance with the Specifications and/or this CQA Plan. The Geomembrane-Installer Supervisor will provide the CQC ENGINEER a list of personnel present on-site each day the geomembrane installation crew is on-site. The personnel list shall be provided to the CQA ENGINEER daily prior to beginning work for his approval.

5. Subgrade Preparation - The Geomembrane Installer will document in writing with the CQC ENGINEER that the surface on which that day's geomembrane will be installed meets the surface preparation requirements of the Specifications and/or this CQA Plan. The certificate of acceptance will be given to the CQA ENGINEER prior to commencement of geomembrane installation in the area under consideration. To facilitate a timely covering of the underlying surface, the CQA ENGINEER may allow subgrade acceptance in areas as small as one acre. After the supporting soil has been accepted by the Geomembrane Installer, it will be the Geomembrane Installer's responsibility to indicate to the CQC ENGINEER and CQA ENGINEER any change in the supporting soil condition that may require repair work. If the CQA ENGINEER concurs with the Geomembrane Installer, then the CQA ENGINEER will notify the CQC ENGINEER and CONTRACTOR that the supporting soil is required to be repaired.

    a. The CQC ENGINEER must visually inspect and approve the subgrade before the day's placement and before placement of each Cap Geomembrane panel and provide the inspection results to the CQA ENGINEER. The subgrade surface must meet grades, consistency and particle size limitations outlined in the Specifications. The CQC ENGINEER will report any non-conforming areas to the CONTRACTOR for repair. Subgrade repairs must be approved and made under the direction of the CQA ENGINEER.

6. The CQC ENGINEER will confirm that anchor trenches have been constructed and backfilled according to the Contract Drawings and Specifications and/or this CQA Plan. The CQA ENGINEER will document construction of anchor trenches based on data and information provided by the CQC ENGINEER.

7. Field Panel Identification - The CQC ENGINEER will confirm that the Geomembrane Installer labels each field panel with an "identification code" (number or letter-number consistent with the layout plan) agreed upon by the Geomembrane Installer, CQC ENGINEER, and CQA ENGINEER at the Geosynthetics Pre-Construction Meeting and consistent with the approved Geomembrane Panel Layout Drawing. Any discrepancies in the panel layout must be reported to the CQA ENGINEER.

    a. The CQC ENGINEER and Geomembrane Installer will establish a table or chart showing correspondence between roll or sheet numbers and field panel identification codes. This documentation shall be submitted to the CQA ENGINEER weekly for review and verification. The field panel identification code will be used for all quality control and quality assurance records.

8. Field Panel Placement - The CQC ENGINEER will confirm that field panels are installed at the location indicated in the approved Geomembrane Panel Layout Drawing. The CQC ENGINEER will record the identification code, location, and date of installation of each field panel. The field panel placement data and information must be provided to the CQA ENGINEER daily for review and verification.

    a. The CQC ENGINEER will confirm that CQA Plan-related restrictions on placement of Cap Geomembrane are fulfilled. Additionally, the CQC ENGINEER will confirm that the

supporting soil has not been damaged by weather conditions or the Geomembrane-Installer during placement activities.

b. The CQC ENGINEER will visually observe each panel, after placement and prior to seaming, for damage. The CQC ENGINEER will advise the Geomembrane Installer which panels, or portions of panels, should be rejected, repaired, or accepted and seek approval from the CQA ENGINEER. Damaged panels or portions of damaged panels which have been rejected by the CQC ENGINEER will be marked and their removal from the work area recorded by the CQC ENGINEER for review by the CQA ENGINEER. Repairs shall be made based on the recommendations and direction of the CQA ENGINEER according to procedures described in this section, and record of any panel replacements and/or repairs shall be recorded by the CQC ENGINEER and reviewed with the CQA ENGINEER for verification.

c. The CQC ENGINEER will visually monitor each panel after placement, during and after seaming to observe and document that temporary anchorage, control of wrinkles in the panel, and backfilling of anchor trenches are completed by the Geomembrane Installer in accordance with the Specifications and/or this CQA Plan. Monitoring results shall be provided to the CQA ENGINEER for review and record keeping.

d. Field panel placement shall be recorded daily by the CQC ENGINEER and the panel placement data and information provided to the CQA ENGINEER daily for review and verification. As a minimum, the CQC ENGINEER will document as a part of the panel placement record keeping that:

- The panel is placed in such a manner that it is unlikely to be damaged; and
- Any tears, punctures, holes, thin spots, etc. are either marked by the Geomembrane Installer for repair or the panel is rejected
- Slack or wrinkles in the panel have been managed in accordance with the Specifications and/or this CQA Plan,
- Anchor trenches and other anchorage methods are in place.

e. The final field panel placement must be accepted by the CQA ENGINEER before any materials are placed above the geomembrane.

9. Field Seaming - The Geomembrane Installer will provide the CQC ENGINEER and CQA ENGINEER with a Geomembrane Panel Layout Drawing, i.e., a drawing of the area to be lined showing all expected seams. The CQA ENGINEER will review the seam layout drawing and document that it is consistent with the accepted state of practice and this CQA Plan. In addition, no panels not specifically shown on the seam layout drawing may be used without the CQA ENGINEER'S prior acceptance.

a. A seam numbering system compatible with the panel numbering system will be agreed upon at the Geosynthetics Pre-Construction Meeting. An on-going written record of the seams and repair areas shall be maintained by the CQC ENGINEER and Geomembrane Installer with weekly review by the CQA ENGINEER.

b. Field seaming processes must comply with Specifications and/or this CQA Plan. Proposed alternate processes will be documented and submitted to the DESIGN ENGINEER and CQA ENGINEER for their acceptance. Only seaming apparatuses which have been specifically accepted by make and model shall be used. The CQC ENGINEER will submit all documentation to the CQA ENGINEER and the DESIGN ENGINEER for their concurrence.

10. Field Seam Control Testing – Each field seam – regardless of the size and type of seam, is to be tested using an approved non-destructive and destructive test method. Non-destructive seam testing is intended to cover the entire length of the seam and destructive seam testing is intended to examine representative portions of the selected seam for conformance.

    a. Prior to the start of each shift during production seaming, the Geomembrane Installer will complete trial seams on appropriate sized pieces of identical or equivalent geomembrane material to verify seams meet the minimum seam strength requirements as according to the Specifications. Trial seams are made in the field adjacent to or in the work area.

    b. Trial seams are performed for each welder to be used and by each operator of extrusion welders, and by the primary operator of each fusion welder. Each trial seam is assigned a number and the test results recorded in the appropriate log by the CQC ENGINEER and Geomembrane Installer. The CQC ENGINEER observes trial seams and compiles trial seam logs to be provided to the CQA ENGINEER daily for review and approval.

    c. The CQC ENGINEER and Geomembrane Installer will test and document all seam welds continuously over their full length using one of the following nondestructive seam tests, or as outlined in the Specifications and/or this CQA Plan. This testing is performed simultaneously with Cap Geomembrane deployment as the work progresses and not at the completion of all field seaming. All seam welds CQC testing data shall be provided to the CQA ENGINEER daily for review and approval.

    d. The CQC ENGINEER observes the nondestructive testing on a full time basis to document conformance with this CQA Plan and the Specifications and/or this CQA Plan. Observe the completed seams to identify areas where over-grinding or overheating of the Cap Geomembrane have occurred. Such areas are to be repaired in accordance with the CQA Plan, and the Geomembrane Installer will modify equipment or methods to eliminate these conditions. All nondestructive CQC testing data shall be provided to the CQA ENGINEER daily for review and approval.

    e. The Geomembrane Installer will obtain 12-inch x 36-inch (or longer as needed) samples of field seams with the seam centered lengthwise, suitable for testing, at an average frequency of one sample per 1,000 linear feet of weld, to verify the seams meet the minimum seam strength requirements as shown in the Specifications and/or this CQA Plan. The sample is to be cut into three equal-length pieces, one to be given to the Geomembrane Installer for field destructive testing, one given to the CQC ENGINEER for laboratory destructive testing, and one given to the CQA ENGINEER as an archive sample. The date, time, equipment, seam number, and seaming parameters will be marked on each sample and recorded by the CQC ENGINEER. All field destructive seam strength CQC testing data shall be provided to the CQA ENGINEER daily for review and

approval. All laboratory destructive seam strength CQC testing data shall be provided to the CQA ENGINEER for review and approval upon completion of the testing and release of the data from the GEOSYNTHETICS CQC LABORATORY.

f. All holes in the Cap Geomembrane resulting from destructive seam sampling will be immediately repaired in accordance with repair procedures described in the Specifications and/or this CQA Plan.

g. The laboratory destructive test samples will be packaged and shipped to the GEOSYNTHETICS CQC LABORATORY by the CQC ENGINEER in a manner that will not damage the test sample.

h. The CQA ENGINEER will review laboratory test results as soon as they become available and transmit to the affected parties.

i. The CQA ENGINEER may require additional random samples to be taken for testing in areas which visually appear defective and not in accordance with the project requirements.

11. Field Seam Record Test Failure - For noncomplying tests, the CQA ENGINEER will:

    a. Observe continuity testing of the repaired areas performed by the CQC ENGINEER and Geomembrane Installer;

    b. Confirm the record location, date, test unit number, name of tester, and compile the record of testing provided by the CQC ENGINEER and Geomembrane Installer;

    c. Conduct a walk-through inspection with the CQC ENGINEER and Geomembrane Installer of all impacted seam areas and document that the areas have been tested in accordance with the CQA Plan and Specifications and/or this CQA Plan; and

    d. Document that the CQC ENGINEER and Geomembrane Installer have marked repair areas.

    e. All defective seam test failures must be bounded by acceptable destructive tests as directed by the CQA ENGINEER. The CQA ENGINEER will document repair actions taken in conjunction with any seam test failures.

12. Repairs and Verification - All repair procedures must be completed in accordance with the Specifications and/or this CQA Plan. The CQA ENGINEER will observe and document repair procedures.

    a. Each repair is to be numbered and logged by the CQC ENGINEER and Geomembrane Installer and recorded by the CQA ENGINEER.

    b. Each repair will be non-destructively tested by the CQC ENGINEER and Geomembrane Installer using the methods required by the Specifications and/or this CQA Plan. Repairs which pass non-destructive testing are considered to be an indication of an adequate repair.

c. A failed test indicates that the repair must be redone and retested until passing test results are achieved.

13. Liner System Acceptance - The Geomembrane Installer and the Geosynthetic Manufacturers will retain all ownership and responsibility for the Cap Geomembrane until acceptance by the OWNER. The Cap Geomembrane will be accepted for placement of overlying geosynthetic, soil or aggregate materials once the following conditions are met:

    a. Installation is completed;

    b. Folds, wrinkles or other surface conditions outside the criteria outlined in the Specifications and/or this CQA Plan are not observed;

    c. Verification of the adequacy of all seams and repairs, including associated testing, is complete;

    d. CQA ENGINEER provides the DESIGN ENGINEER with a final copy of the nondestructive test documentation, repair information, and as-built drawings, as submitted by the CQC ENGINEER and Geomembrane Installer;

    e. CQA ENGINEER furnishes the DESIGN ENGINEER with documentation, submitted by the CQC ENGINEER and Geomembrane Installer that the geomembrane was installed in accordance with the Geomembrane Manufacturer's recommendations as well as the Contract Drawings and Specifications and/or this CQA Plan;

    f. The CQA ENGINEER will document that the installation has proceeded in accordance with this CQA Plan and the Specifications and/or this CQA Plan for the project except as noted to the DESIGN ENGINEER. This documentation will be based on data and information provided by the CQA ENGINEER.

14. Materials In Contact With Geomembranes - The quality assurance procedures indicated in this paragraph are only intended to monitor that the installation of these materials does not damage the Cap Geomembrane, that reasonable measures are taken to protect the Cap Geomembrane, and to provide additional quality assurance procedures as necessary to monitor that systems built with these materials will be constructed to achieve proper performance.

    a. Soils - Prior to placement of overlying soils, the CQC ENGINEER will visually confirm that soil materials to be placed against the Cap Geomembrane comply with Specifications and/or this CQA Plan. The Geomembrane Installer will provide the CQC ENGINEER a written surface acceptance certificate in accordance with the Specifications and/or this CQA Plan. The surface acceptance certificate shall be provided to the CQA ENGINEER before covering the subgrade. All soil materials are to be placed and compacted in accordance with the Specifications and/or this CQA Plan.

    b. Sumps and Connections to Appurtenances - The CQC ENGINEER will confirm that Installation of the Cap Geomembrane in appurtenance areas, and connection of the Cap Geomembrane to appurtenances have been made according to the Specifications and/or this CQA Plan, and the Cap Geomembrane or appurtenances have not been visibly

damaged while making connections. Record of the CQC ENGINEER's acceptance of appurtenances shall be provided to the CQA ENGINEER prior to covering appurtenance connections of the Cap Geomembrane.

TABLE 3.1: CQC TESTING FOR LLDPE CAP GEOMEMBRANE (SMOOTH) MATERIAL ACCEPTANCE

PROPERTY	TEST METHOD	TEST FREQUENCY
CONTROL TESTS:		
Thickness	ASTM D 5199	100,000 ft^2 or 1 per Lot
Density	ASTM D 1505/D 792	100,000 ft^2 or 1 per Lot
Carbon Black Content	ASTM D 4218	100,000 ft^2 or 1 per Lot
Carbon Black Dispersion	ASTM D 5596	100,000 ft^2 or 1 per Lot
Tensile Properties:	ASTM D 6693 Type IV	
Tensile Strength at Yield		100,000 ft^2 or 1 per Lot
Tensile Strength at Break		100,000 ft^2 or 1 per Lot
Elongation at Yield		100,000 ft^2 or 1 per Lot
Elongation at Break		100,000 ft^2 or 1 per Lot
Tear Resistance	ASTM D 1004	100,000 ft^2 or 1 per Lot

Notes:

1. Conformance criteria in general accordance with the latest edition of GRI GM17 "Standard Specification for Test Methods, Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes."

4 GEOCOMPOSITE DRAINAGE MEDIA (GDM)

4.1 General

This section of the CQA Plan addresses Geocomposite Drainage Media (GDM) and outlines the CQA program to be implemented with regard to material acceptance, material control tests, repairs, and resolution of problems. GDM is generally comprised of a Geotextile and Geonet. The Geotextile may be connected to the HDPE bi-planar Geonet by heat bonding in the factory. A Geotextile may be bonded to one or both sides of the Geonet. Material thickness is assumed to be a minimum of 250 mils. The minimum transmissivity on the 5:1 slopes is $7.4x10^{-4}$ meters squared per second. This section is intended to cover all types of GDM described above.

4.2 GDM Manufacturer and Installer Acceptance

1. The CONTRACTOR shall submit the qualifications of the GDM Manufacturer and the Geomembrane Installer, as described in the Specifications and/or this CQA Plan, to the OWNER and CQA ENGINEER for acceptance.

2. The CQA ENGINEER will review the CONTRACTOR's submittals for conformance with the Specifications and/or this CQA Plan.

3. GDM will only be shipped to the site once submittals and CQA Conformance Testing is completed and the material approved by the OWNER and CQA ENGINEER.

4.3 GDM Material Acceptance and Conformance Testing

1. Samples for CQC conformance tests will be obtained by the CQC ENGINEER at the indicated frequencies upon delivery of the GDM. Alternatively, samples may be randomly obtained at the manufacturing site by the CQC ENGINEER or representatives of the GEOSYNTHETICS CQC LABORATORY.

    a. Conformance tests and frequencies for the GDM and the Geonet component of the GDM are shown on Table 4.1. Conformance tests and frequencies for the Geotextile component of the GDM are shown on Table 4.2.

2. Unless otherwise specified, samples will be 3 feet long by the roll or sheet width. The CQC ENGINEER will mark the machine direction on the samples with an arrow.

3. All material control tests will be performed by the GEOSYNTHETICS CQC LABORATORY.

4. The following procedure will apply whenever a sample fails a material control test:

    a. The Geosynthetic Installer will replace the roll of GDM that is in non-conformance with the Specifications and/or this CQA Plan with a roll that meets Specifications and/or this CQA Plan.

b. The Geosynthetic Installer will remove samples for testing by the GEOSYNTHETICS CQC LABORATORY from the closest numerical roll on both sides of the failed roll. These two samples must both conform to Specifications and/or this CQA Plan. If either of these samples fail, then the next numerical roll will be tested until a passing roll is found. This additional testing will be at the expense of the Geosynthetic Installer. If either of the two closest rolls fail, the CQA ENGINEER will dictate the frequency of additional testing.

c. The CQA ENGINEER will document actions taken in conjunction with material control test failures.

5. Document that the Manufacturer's quality control certificates have been provided at the specified frequency and that each certificate identified the rolls related to it.

6. Review the Manufacturer's quality control certificates and document that the certified properties meet the Specifications and/or this CQA Plan.

7. During shipment and storage, all GDM will be protected as required by the Specifications and/or this CQA Plan. The CQC ENGINEER will observe rolls upon delivery at the site.

8. Upon delivery, the CQC ENGINEER will document that the Manufacturer's quality control certificates have been provided at the specified frequency and that each certificate identified the rolls or sheets related to it, and review the Manufacturer's quality control certificates and document that the certified properties meet the Specifications and/or this CQA Plan.

9. All control test results must be available at the site prior to the deployment of all GDM. The CQA ENGINEER will examine all results from laboratory conformance testing. The control test results for each roll must be approved by the CQA Engineer prior to being installed or used in the Closure construction.

4.4 GDM Installation

1. Handling and Placement - The Geosynthetic Installer will handle and place all GDM in such a manner as required by the Specifications and/or this CQA Plan and Manufacturer. Installation must not result in damage to the underlying Cap Geomembrane.

2. When several layers of GDM are overlapped, care should be taken to ensure that overlapped GDM are placed in the same flow direction. The CQC ENGINEER will observe the overlapping of GDM. Overlapping GDM should not be laid in perpendicular directions to the underlying GDM unless otherwise specified by the DESIGN ENGINEER. This may be a challenge for relatively flat Final Cover slopes and the installation sequence should be evaluated in the field by the CQC ENGINEER and the Geosynthetic Installer. Any GDM overlapping issues or discrepancies shall be brought to the attention of the CQA ENGINEER.

3. Adjacent rolls of GDM will be joined according to Project Drawings and Specifications and/or this CQA Plan.

4. Any holes or tears in the GDM shall be repaired in accordance with the Specifications and/or this CQA Plan. The CQC ENGINEER will observe and document repairs. The repair documentation shall be provided to the CQA ENGI NEER for review and approval.

5. All soil, crushed stone aggregate or revetment materials installed over the GDM shall be placed in accordance with the Specifications and/or this CQA Plan.

6. Deficiencies - The CQC ENGINEER shall immediately determine the extent and nature of all defects and deficiencies and report them to the CQA ENGINEER. All defects and deficiencies will be documented by the CQA ENGINEER and reported to the DESIGN ENGINEER. The CONTRACTOR shall correct defects and deficiencies to the satisfaction of the CQA ENGINEER. The CQC ENGINEER will observe all retests on repaired defects. Retesting data on defects and deficiencies shall be provided to the CQA ENGINEER for review and approval.

TABLE 4.1: CQC TESTING FOR GDM MATERIAL ACCEPTANCE

PROPERTY	TEST METHOD	TEST FREQUENCY
CONTROL TESTS:		
Thickness (geonet only)	ASTM D 5199	100,000 ft^2 or 1 per Lot
Density (geonet only)	ASTM D 1505	100,000 ft^2 or 1 per Lot
Ply Adhesion	ASTM D 7005	250,000 ft^2 or 1 per Lot
Hydraulic Transmissivity	ASTM D 4716[1]	250,000 ft^2

Notes:

1. Conduct tests for transmissivity in accordance with the conditions given in Table 4.3 and for the Specifications and/or this CQA Plan.
2. Additional testing requirements for Geonet component of GDM to be established in the Specifications and/or this CQA Plan.

TABLE 4.2: CQC TESTING PROGRAM FOR GEOTEXTILE MATERIAL ACCEPTANCE

PROPERTY	TEST METHOD	TEST FREQUENCY
CONTROL TESTS:		
Grab Tensile Strength	ASTM D 4632	100,000 ft^2 or 1 per Lot[1]
Puncture Resistance	ASTM D 4833	100,000 ft^2 or 1 per Lot[1]
Trapezoidal Tear Strength	ASTM D 4533	100,000 ft2 or 1 per Lot1

Notes:

1. Whichever provides the larger number of tests.
2. Additional testing requirements for Geotextile component of GDM to be established in the Specifications and/or this CQA Plan.

5 ENGINEERED TURF BARRIER LAYER

5.1 General

This section of the CQA Plan addresses the Alternative Final Cover geosynthetic barrier that consists of an engineered composite of a 40-mil linear low-density polyethylene (LLDPE) geomembrane liner with a synthetic turf cover. An infill using sand may be used to ballast the Engineered Turf. Other systems may be used to secure the Engineered Turf in-place, including mechanical anchors and crushed stone aggregate ballast, as outlined in the Specifications and/or this CQA Plan. This Engineered Turf replaces the Cap Geomembrane, GDM and Protective Cover soil. The CQA program to be implemented with regard to manufacturer and installer acceptance, material acceptance, subgrade acceptance, field and laboratory control and record tests, repairs, and resolution of problems are addressed in this section.

5.2 Engineered Turf Manufacturer and Installer Acceptance

1. The CONTRACTOR shall submit the qualifications of the Engineered Turf Manufacturer and the Engineered Turf Installer, as described in the Specifications and/or this CQA Plan, to the OWNER and CQA ENGINEER for acceptance.

2. The CQA ENGINEER will review the CONTRACTOR's submittals for conformance with the Specifications and/or this CQA Plan.

3. Engineered Turf will only be shipped to the site once submittals and CQC Conformance Testing is completed and the material approved by the OWNER and CQA ENGINEER.

5.3 Engineered Turf Material Acceptance and Conformance Testing

1. Samples for CQC conformance tests, as shown on Tables 5.1 and 5.2, will be obtained by the CQC ENGINEER at the indicated frequencies upon delivery of the Engineered Turf. The geomembrane component of the Engineered Turf will be tested separately from the composite material. Alternatively, samples may be randomly obtained at the manufacturing site by the CQC ENGINEER or representatives of the GEOSYNTHETICS CQC LABORATORY.

    a. Unless otherwise specified, samples will be 3 feet long by the roll or sheet width and exclude the outer lap of the roll. The CQC ENGINEER will mark the machine direction on the samples with an arrow.

    b. All material control tests will be performed by the GEOSYNTHETICS CQC LABORATORY.

    c. All material control test results shall be provided to the CQA ENGINEER for review and approval.

2. The following procedure will apply whenever a sample fails a material control test:

a. The Engineered Turf Manufacturer will replace each roll or sheet of Engineered Turf that is in non-conformance with the Specifications and/or this CQA Plan with a roll or sheet that meets Specifications and/or this CQA Plan.

b. The Engineered Turf Installer will remove conformance samples for testing by the GEOSYNTHETICS CQC LABORATORY from the closest numerical roll or sheet on both sides of the failed roll or sheet. These two samples must both conform to Specifications and/or this CQA Plan. If either of these samples fail, then the next numerical roll or sheet will be tested until a passing roll or sheet is found. This additional conformance testing will be at the expense of the Engineered Turf Installer. If either of the two closest rolls or sheets fail, the CQA ENGINEER will dictate the frequency of additional testing.

3. The CQC ENGINEER will document actions taken in conjunction with material control test failures.

4. During shipment and storage, all Engineered Turf will be protected as required by the Specifications and/or this CQA Plan. The CQC ENGINEER will observe rolls upon delivery at the site.

5. Upon delivery, the CQC ENGINEER will document that the Manufacturer's quality control certificates have been provided at the specified frequency and that each certificate identified the rolls or sheets related to it; and review the Manufacturer's quality control certificates and document that the certified properties meet the Specifications and/or this CQA Plan.

6. All control test results must be available at the site prior to the deployment of all Engineered Turf. The CQA ENGINEER will examine all results from laboratory conformance testing. Approval of these test results and the materials acceptance and conformance testing by the CQA ENGINEER is required before Engineered Turf installation can begin.

5.4 Geomembrane Component of Engineered Turf Installation

1. A Geosynthetics Pre-Construction Meeting will be held at the site prior to placement of the geosynthetics as outlined in the Specifications and/or this CQA Plan. At a minimum, the meeting will be attended by the OWNER, DESIGN ENGINEER, CQA ENGINEER, CQC ENGINEER, CONTRACTOR, and Geosynthetic Installation Superintendent(s).

2. The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and, above all, review the CQA Plan with all of the parties involved. It is very important that the requirements regarding submittals, testing, repair, recordkeeping, etc. be known and accepted by all.

3. This meeting should include all of the activities referenced in this CQA Plan and the Specifications. The meeting will be documented by the CQA ENGINEER and minutes will be transmitted to all parties.

4. The Engineered Turf Installer will provide the CQC ENGINEER with a list of proposed seaming personnel and their experience records. This document will be reviewed by the CQA

ENGINEER for compliance with Specifications and/or this CQA Plan. The Engineered Turf Installer Supervisor will provide a list of personnel present on-site each day the geomembrane installation crew is on-site. The personnel list shall be provided to the CQA ENGINEER daily prior to beginning work for his approval.

5. Subgrade Preparation - The Engineered Turf Installer will document in writing with the CQC ENGINEER that the surface on which that day's Engineered Turf will be installed meets the surface preparation requirements of the Specifications and/or this CQA Plan. The certificate of acceptance will be given to the CQA ENGINEER prior to commencement of Engineered Turf installation in the area under consideration. To facilitate a timely covering of the underlying surface, the CQA ENGINEER may allow subgrade acceptance in areas as small as one acre. After the supporting soil has been accepted by the Engineered Turf Installer, it will be the Engineered Turf Installer's responsibility to indicate to the CQC ENGINEER and CQA ENGINEER any change in the supporting soil condition that may require repair work. If the CQA ENGINEER concurs with the Engineered Turf Installer, then the CQA ENGINEER will notify the CQC ENGINEER and CONTRACTOR that the supporting soil is required to be repaired.

    a. The CQC ENGINEER must visually inspect and approve the subgrade before the day's placement and before placement of each Engineered Turf panel and provide the inspection results to the CQA ENGINEER. The subgrade surface must meet grades, consistency and particle size limitations outlined in the Specifications. The CQC ENGINEER will report any non-conforming areas to the CONTRACTOR for repair. Subgrade repairs must be approved and made under the direction of the CQA ENGINEER.

    b. Equipment proposed by the Engineered Turf Installer for installation of the Engineered Turf or anchoring systems must not rut or otherwise damage the subgrade. A test section using the actual materials and equipment proposed should be completed prior to production installation of the Engineered Turf.

6. The CQC ENGINEER will confirm that anchor trenches and other anchoring methods have been constructed and backfilled according to the Contract Drawings and Specifications and/or this CQA Plan. The CQA ENGINEER will document construction of anchor trenches based on data and information provided by the CQC ENGINEER.

7. Field Panel Identification - The CQC ENGINEER will confirm that the Engineered Turf Installer labels each field panel with an "identification code" (number or letter-number consistent with the layout plan) agreed upon by the Engineered Turf Installer, CQC ENGINEER, and CQA ENGINEER at the Geosynthetics Pre-Construction Meeting and consistent with the approved Engineered Turf Panel Layout Drawing. Any discrepancies in the panel layout must be reported to the CQA ENGINEER.

    a. The CQC ENGINEER and Engineered Turf Installer will establish a table or chart showing correspondence between roll or sheet numbers and field panel identification codes. This documentation shall be submitted to the CQA ENGINEER weekly for review and verification. The field panel identification code will be used for all quality control and quality assurance records.

8. Field Panel Placement - The CQC ENGINEER will confirm that field panels are installed at the location indicated in the approved Engineered Turf Panel Layout Drawing. Where filaments of the Engineered Turf are directional, the filaments should be oriented in the direction specified. The CQC ENGINEER will record the identification code, location, and date of installation of each field panel. The field panel placement data and information must be provided to the CQA ENGINEER daily for review and verification.

    a. The CQC ENGINEER will confirm that Project Specification-related restrictions on placement of Engineered Turf are fulfilled. Additionally, the CQC ENGINEER will confirm that the supporting soil has not been damaged by weather conditions or the Engineered Turf Installer during placement activities.

    b. The CQC ENGINEER will visually observe each panel, after placement and prior to seaming, for damage. The CQC ENGINEER will advise the Engineered Turf Installer which panels, or portions of panels, should be rejected, repaired, or accepted and seek approval from the CQA ENGINEER. Damaged panels or portions of damaged panels which have been rejected by the CQC ENGINEER will be marked and their removal from the work area recorded by the CQC ENGINEER for review by the CQA ENGINEER. Repairs shall be made based on the recommendations and direction of the CQA ENGINEER according to procedures described in this section, and record of any panel replacements and/or repairs shall be recorded by the CQC ENGINEER and reviewed with the CQA ENGINEER for verification.

    c. The CQC ENGINEER will visually monitor each panel after placement, during and after seaming to observe and document that temporary anchorage, control of wrinkles in the panel, and backfilling of anchor trenches are completed by the Engineered Turf Installer in accordance with the Specifications and/or this CQA Plan. Monitoring results shall be provided to the CQA ENGINEER for review and record keeping.

    d. Field panel placement shall be recorded daily by the CQC ENGINEER and the panel placement data and information provided to the CQA ENGINEER daily for review and verification. As a minimum, the CQC ENGINEER will document as a part of the panel placement record keeping that:

        - The panel is placed in such a manner that it is unlikely to be damaged,
        - Any tears, punctures, holes, thin spots, etc. are either marked by the Engineered Turf Installer for repair or the panel is rejected,
        - Slack or wrinkles in the panel have been managed in accordance with the Specifications and/or this CQA Plan,
        - Anchor trenches and other anchorage methods are in place.

    e. The final field panel placement must be accepted by the CQA ENGINEER before any materials are placed above the geomembrane.

9. Field Seaming - The Engineered Turf Installer will provide the CQC ENGINEER and the CQA ENGINEER with an Engineered Turf Panel Layout Drawing, i.e., a drawing of the area to be lined showing all expected seams. The CQA ENGINEER will review the seam layout drawing and

document that it is consistent with the accepted state of practice and this CQA Plan. In addition, no panels not specifically shown on the seam layout drawing may be used without the CQA ENGINEER'S prior acceptance.

a. A seam numbering system compatible with the panel numbering system will be agreed upon at the Geosynthetics Pre-Construction Meeting. An on-going written record of the seams and repair areas shall be maintained by the CQC ENGINEER and Engineered Turf Installer with weekly review by the CQA ENGINEER.

b. Field seaming processes must comply with Specifications and/or this CQA Plan. Proposed alternate processes will be documented and submitted to the DESIGN ENGINEER and CQA ENGINEER for their acceptance. Only seaming apparatuses which have been specifically accepted by make and model shall be used. The CQC ENGINEER will submit all documentation to the CQA ENGINEER and the DESIGN ENGINEER for their concurrence.

10. Field Seam Control Testing – Each field seam – regardless of the size and type of seam, is to be tested using an approved non-destructive and destructive test method. Non-destructive seam testing is intended to cover the entire length of the seam and destructive seam testing is intended to examine representative portions of the selected seam for conformance.

a. Prior to the start of each shift during production seaming, the Engineered Turf Installer will complete trial seams on appropriate sized pieces of identical or equivalent geomembrane material to verify seams meet the minimum seam strength requirements as shown in the Specifications and/or this CQA Plan and that seaming conditions and procedures are adequate. Trial seams are made in the field adjacent to or in the work area.

b. Trial seams are performed for each welder to be used and by each operator of extrusion welders, and by the primary operator of each fusion welder. Each trial seam is assigned a number and the test results recorded in the appropriate log by the CQC ENGINEER and Engineered Turf Installer. The CQC ENGINEER observes trial seams and compiles trial seam logs to be provided to the CQA ENGINEER daily for review and approval.

c. The CQC ENGINEER and Engineered Turf Installer will test and document all seam welds continuously over their full length using one of the following nondestructive seam tests, or as outlined in the Specifications and/or this CQA Plan. This testing is performed simultaneously with Engineered Turf deployment as the work progresses and not at the completion of all field seaming. All seam welds CQC testing data shall be provided to the CQA ENGINEER daily for review and approval.

d. The CQA ENGINEER observes the nondestructive testing on a full time basis to document conformance with this CQA Plan and the Specifications and/or this CQA Plan. Observe the completed seams to identify areas where over-grinding or overheating of the Engineered Turf geomembrane component have occurred. Such areas are to be repaired in accordance with the Specifications and/or this CQA Plan, and the Engineered Turf Installer will modify equipment or methods to eliminate these conditions. All nondestructive CQC testing data shall be provided to the CQA ENGINEER daily for review and approval.

e. The Engineered Turf Installer will obtain 12-inch x 36-inch (or longer as needed) samples of field seams with the seam centered lengthwise, suitable for testing, at an average frequency of one sample per 1,000 linear feet of weld, to verify the seams meet the minimum seam strength requirements as shown in the Specifications and/or this CQA Plan. The sample is to be cut into three equal-length pieces, one to be given to the Engineered Turf Installer for field destructive testing, one given to the CQC ENGINEER for laboratory destructive testing, and one given to the CQA ENGINEER as an archive sample. The date, time, equipment, seam number, and seaming parameters will be marked on each sample and recorded by the CQA ENGINEER. All field destructive seam strength CQC testing data shall be provided to the CQA ENGINEER daily for review and approval. All laboratory destructive seam strength CQC testing data shall be provided to the CQA ENGINEER for review and approval upon completion of the testing and release of the data from the GEOSYNTHETICS CQC LABORATORY.

f. All holes in the Engineered Turf resulting from destructive seam sampling will be immediately repaired in accordance with repair procedures described in the Specifications and/or this CQA Plan.

g. The laboratory destructive test samples will be packaged and shipped to the GEOSYNTHETICS CQC LABORATORY by the CQC ENGINEER in a manner that will not damage the test sample.

h. The CQA ENGINEER will review laboratory test results as soon as they become available and transmit to the affected parties.

i. The CQA ENGINEER may require additional random samples to be taken for testing in areas which visually appear defective and not in accordance with the project requirements.

11. Field Seam Record Test Failure - For noncomplying tests, the CQA ENGINEER will:

a. Observe continuity testing of the repaired areas performed by the CQC ENGINEER and Engineered Turf Installer;

b. Confirm the record location, date, test unit number, name of tester, and compile the record of testing provided by the CQC ENGINEER and Engineered Turf Installer;

c. Conduct a walk-through inspection with the CQC ENGINEER and Engineered Turf Installer of all impacted seam areas and document that the areas have been tested in accordance with the CQA Plan and Specifications and/or this CQA Plan; and

d. Document that the CQC ENGINEER and Engineered Turf Installer have marked repair areas.

e. All defective seam test failures must be bounded by acceptable destructive tests as directed by the CQA ENGINEER. The CQA ENGINEER will document repair actions taken in conjunction with any seam test failures.

12. Repairs and Verification - All repair procedures must be completed in accordance with the Specifications and/or this CQA Plan. The CQA ENGINEER will observe and document repair procedures.

    a. Each repair is be numbered and logged by the CQC ENGINEER and Engineered Turf Installer and recorded by the CQA ENGINEER.

    b. Each repair will be non-destructively tested by the CQC ENGINEER and Engineered Turf Installer using the methods required by the Specifications and/or this CQA Plan. Repairs which pass non-destructive testing are considered to be an indication of an adequate repair.

    c. A failed test indicates that the repair must be redone and retested until passing test results are achieved.

13. Engineered Turf Acceptance - The Engineered Turf Installer and the Engineered Turf Manufacturers will retain all ownership and responsibility for the Engineered Turf until acceptance by the OWNER. The Engineered Turf will be accepted for placement of overlying aggregate materials (where applicable) once the following conditions are met:

    a. Installation is completed;

    b. Folds, wrinkles or other surface conditions outside the criteria outlined in the Specifications and/or this CQA Plan are not observed;

    c. Verification of the adequacy of all seams and repairs, including associated testing, is complete;

    d. CQA ENGINEER provides the DESIGN ENGINEER with a final copy of the nondestructive test documentation, repair information, and as-built drawings, as submitted by the CQC ENGINEER and Engineered Turf Installer;

    e. CQA ENGINEER furnishes the DESIGN ENGINEER with documentation, submitted by the CQC ENGINEER and Engineered Turf Installer that the Engineered Turf was installed in accordance with the Engineered Turf Manufacturer's recommendations as well as the Contract Drawings and Specifications and/or this CQA Plan;

    f. The CQA ENGINEER will document that the installation has proceeded in accordance with this CQA Plan and the Specifications and/or this CQA Plan for the project except as noted to the DESIGN ENGINEER. This documentation will be based on data and information provided by the CQC ENGINEER.

14. Materials In Contact With Engineered Turf - The quality assurance procedures indicated in this paragraph are only intended to monitor that the installation of these materials does not damage the Engineered Turf, that reasonable measures are taken to protect the Engineered Turf, and to provide additional quality assurance procedures as necessary to monitor that systems built with these materials will be constructed to achieve proper performance.

a. Soils – Placement of soil over the Engineered Turf may be required for access roadways, etc. Prior to placement of overlying soils, the CQC ENGINEER will visually confirm that soil materials to be placed against the Engineered Turf comply with Specifications and/or this CQA Plan. The Engineered Turf Installer will provide the CQC ENGINEER a written surface acceptance certificate in accordance with the Specifications and/or this CQA Plan. The surface acceptance certificate shall be provided to the CQA ENGINEER before covering the subgrade. All soil materials are to be placed and compacted in accordance with Specifications and/or this CQA Plan.

b. Sumps and Connections to Appurtenances - The CQC ENGINEER will confirm that Installation of the Engineered Turf in appurtenance areas, and connection of the Engineered Turf to appurtenances have been made according to the Specifications and/or this CQA Plan, and the Engineered Turf or appurtenances have not been visibly damaged while making connections. Record of the CQC ENGINEER's acceptance of appurtenances shall be provided to the CQA ENGINEER prior to covering appurtenance connections of the Cap Geomembrane.

5.5 Engineered Turf Installation

1. The Turf component that overlies the geomembrane component of the Engineered Turf is only to be installed after the geomembrane component installation is complete and approved by the CQA ENGINEER. The CQA ENGINEER must have all pertinent data on the installation, including survey data where required, before approval of the installation can be provided.

2. Along with the Engineered Turf Installer, visually inspect the surface of the Engineered Turf to identify debris or other materials that may damage or prohibit proper installation of the turf component.

3. If a test section using the proposed materials and equipment for turf installation is required, the test section must be completed by the Engineered Turf Installer and approved by the CQA ENGINEER prior to the start of production installation. Identify limits on equipment access.

4. The CQC ENGINEER will observe the turf panel placement and anchorage to verify conformance with the Specifications and/or this CQA Plan. Written acceptance of the turf installation must be provided by the Engineered Turf Installer to the CQA ENGINEER before installation of the turf can be considered complete.

5. If required in the Specifications and/or this CQA Plan, complete test seams on representative samples of the turf prior to the start of production seaming. Document the seaming of the turf panels for any thermal or mechanical sewing methods for conformance with the Specifications and/or this CQA Plan. Any test seam completions must be observed by the CQC ENGINEER and observation records provided to the CQA ENGINEER for review and verification.

5.6 Ballast Sand Installation over Engineered Turf

1. Sand may be required as part of the Engineered Turf system to ballast the geosynthetic components. Review the Specifications and/or this CQA Plan for ballast requirements.

2. Review the sand and installation data provided by the Engineered Turf Installer for conformance with the Specifications and/or this CQA Plan. Minimum layer thickness, gradation, application equipment, repair methods, construction equipment restrictions, etc. will be provided.

3. If a test section using the proposed materials and equipment for ballast installation is required, the test section must be completed by the Engineered Turf Installer. The test section installation must be observed by the CQC ENGINEER and approved by the CQA ENGINEER prior to the start of production installation. Identify limits on equipment access.

TABLE 5.1: CQC TESTING FOR LLDPE COMPONENT OF ENGINEERED TURF MATERIAL ACCEPTANCE

PROPERTY	TEST METHOD	TEST FREQUENCY
Thickness	ASTM D 5199	100,000 ft^2 or 1 per Lot
Density	ASTM D 1505/D 792	100,000 ft^2 or 1 per Lot
Carbon Black Content	ASTM D 4218	100,000 ft^2 or 1 per Lot
Carbon Black Dispersion	ASTM D 5596	100,000 ft^2 or 1 per Lot
Tensile Properties:	ASTM D 6693 Type IV	
Tensile Strength at Yield		100,000 ft^2 or 1 per Lot
Tensile Strength at Break		100,000 ft^2 or 1 per Lot
Elongation at Yield		100,000 ft^2 or 1 per Lot
Elongation at Break		100,000 ft^2 or 1 per Lot
Tear Resistance	ASTM D 1004	100,000 ft^2 or 1 per Lot

Notes:

1. Conformance criteria in general accordance with the latest edition of GRI GM17 "Standard Specification for Test Methods, Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes."

TABLE 5.2: CQC TESTING FOR ENGINEERED TURF MATERIAL ACCEPTANCE

COMPONENT	PROPERTY	TEST METHOD	TEST FREQUENCY
Engineered Turf	Yarn (Total Weight)	ASTM D5261	1 for every 100,000 sf
	Tensile Strength (Composite)	ASTM D4595	1 for every 400,000 sf
	Tensile Strength (Yarn)	ASTM D2256	1 for every 400,000 sf of material
	CBR Puncture Strength	ASTM D6241	1 for every 100,000 sf

6 PROTECTIVE COVER SOIL

6.1 General

1. This section of the CQA Plan addresses placement, spreading and (nominal) compaction of the Protective Cover soil and outlines the soils CQA program to be implemented with regard to material acceptance, subgrade acceptance, field control and record tests, and resolution of problems.

2. The CQC ENGINEER or his representative shall observe and document all grading activities and test the placement of in-situ or off-site borrow materials used for Protective Cover soil. The CQC ENGINEER is responsible for confirming that the materials and construction are in accordance with the Project Drawings, specifications, and this CQA Plan. The CQA ENGINEER will verify that the Protective Cover is placed in accordance with the approved Project Drawings, Specifications, and this CQA Plan.

3. Protective Cover should only be placed over geosynthetic barrier or drainage layers after these layers have been approved by the CQA ENGINEER.

6.2 Material Acceptance

1. All material to be used as Protective Cover will be accepted in advance by the CQA ENGINEER. Acceptance is based upon successful completion of CQC control testing outlined below. Such testing can be performed either during excavation and stockpiling or from on-site or off-site stockpiles prior to use.

2. Material Control Tests - Acceptance of materials used for Protective Cover is outlined in the Specifications and/or this CQA Plan. In general Protective Cover does not have a specified hydraulic conductivity. Maximum particle size and other criteria will be listed in the Specifications and/or this CQA Plan.

    a. Nominal compaction is generally all that is required for Protective Cover. For this reason, Moisture-Density Relationship and in-place density testing is usually not included in the CQC control testing or required as a part of this CQA Plan.

3. Topsoil may be specified and be considered as a separate layer of the Protective Cover. Do not mix topsoil and Protective Cover soil in stockpiles or during placement.

4. For Protective Cover soil originating from on-site borrow areas, these soils will be examined during excavation activities prior to placement into stockpiles. Unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries shall be made in the daily log by the CQC ENGINEER. The daily logs and supporting information (i.e. field sketches, photographs, load tickets, etc.) shall be provided to the CQA ENGINEER.

5. For Protective Cover soil originating from off-site borrow areas, soil will be examined after delivery and placement at on-site stockpile(s). Unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries shall be made in the daily log. The daily logs and supporting information (i.e. field sketches, photographs, load tickets, etc.) shall be provided to the CQA ENGINEER.

6. During excavation and stockpiling operations, control tests, as listed below and specified in the Specifications and/or this CQA Plan, will be performed by the CQC ENGINEER prior to placement.

    a. Visual Classification, ASTM D2488

    b. Grain Size (sieves only), ASTM D422

    c. Atterberg Limits, ASTM D4318

7. Results of all control tests shall be provided to the CQA ENGINEER for review and approval. No soil materials shall be used or placed for Protective Cover without approval from the CQA ENGINEER.

6.3 Protective Cover Subgrade

1. During construction, close, continuous visual monitoring of the geosynthetic subgrade shall be performed by the CQC ENGINEER and daily observations with records (measurements, sketches, photographs and notes) provided daily to the CQA ENGINEER for review and verification. Protective Cover soil cannot be placed on areas where the GDM or Cap Geomembrane is damaged, or if excessive wrinkles develop in the geosynthetics during placement.

2. The CQA ENGINEER will review the equipment proposed by the CONTRACTOR to place and spread the Protective Cover. Low ground pressure (LGP) equipment is generally specified, but the Specifications and/or this CQA Plan should be consulted. A test section for the CONTRACTOR to demonstrate placement equipment and methods should be considered.

3. The CQA ENGINEER will review the equipment and haul road locations and geometry proposed by the CONTRACTOR to haul the Protective Cover on the Final Cover area.

4. During placement of the Protective Cover, the CQC ENGINEER will monitor the Protective Cover soils for the presence of oversized particles, debris, and unsuitable material. If observed, the CQC ENGINEER will contact the CONTRACTOR and have unsuitable materials removed. If any damage to underlying geosynthetics is suspected or observed, these materials must be inspected immediately and any repairs completed in accordance with the Specifications and/or this CQA Plan and documented. The CQA ENGINEER must be notified of the removal of unsuitable materials and any suspected or observed damage of the underlying geosynthetics. Repairs shall not be made to the underlying geosynthetics without first consulting and acquiring approval of the CQA ENGINEER.

5. The CQC ENGINEER will monitor the thickness of the Protective Cover (and overlying Topsoil where applicable) and provide daily monitoring records to the CQA ENGINEER (random thickness measurements, notes, sketches, photographs, etc.). Visually monitor the thickness using hand excavation, telltales, or survey methods on a regular basis. The top of the Protective Cover is verified by the CQC ENGINEER and CONTRACTOR using the specified survey methods. The CQA ENGINEER will review survey data to verify the specified minimum thickness is achieved. The Protective Cover installation shall only be considered complete once approved by the CQA ENGINEER.

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7 RECORD DOCUMENTATION

7.1 Documentation

1. An effective CQA Plan depends largely on recognition of construction activities that should be monitored and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The CQC ENGINEER will confirm that quality monitoring requirements have been addressed and satisfied and that the daily and weekly CQC reporting satisfies the requirements of this CQA Plan.

2. The CQC ENGINEER will provide the CQA ENGINEER with their daily field and weekly progress reports including signed descriptive remarks/sketches, data sheets, and logs to document that required CQC activities have been completed. These reports will also identify potential quality control and assurance problems. The CQA ENGINEER will maintain at the job site a complete file of Contract Drawings including Addendums, reports, Specifications and/or this CQA Plan, accepted shop drawings, a CQC Plan, checklists, test procedures, daily logs, and other pertinent documents.

7.2 Daily Reports

1. The CQC ENGINEER 's reporting procedures will include preparation of a daily report which, at a minimum, will include the following information, where applicable:

    a. A unique identifying sheet number for cross referencing and document control;

    b. Date, project name, location, and other identification;

    c. Data on weather conditions;

    d. A reduced-scale Site Plan showing work areas and test locations;

    e. Descriptions and locations of on-going construction;

    f. Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;

    g. Locations where tests and samples were taken;

    h. A summary of test results;

    i. Calibrations or recalibrations of test equipment, and actions taken as a result of recalibration;

    j. Off-site materials received, including quality verification documentation;

k. Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality;

l. Summaries of pertinent discussions with the CONTRACTOR and/or other parties involved; and

m. The CQC ENGINEER's signature.

2. The daily report must be completed at the end of each CQC ENGINEER's shift, prior to leaving the site. This information will be submitted weekly to and reviewed by the CQA ENGINEER, and then provided to the OWNER and DESIGN ENGINEER. The CQA ENGINEER will work directly with the CQA ENGINEER to correct any inconsistencies, deficiencies, defects, or other issues noted in the daily report prior to issuing to the OWNER and DESIGN ENGINEER.

3. The CQA ENGINEER will utilize the data and information included in the daily CQC reporting to generate his reports and to include in the project record documents.

7.3 Progress Reports

1. The CQC ENGINEER will prepare a summary progress report each week, or at time intervals established at the pre-construction meeting. At a minimum, this report will include the following information, where applicable:

   a. A unique identifying sheet number for cross-referencing and document control;

   b. The date, project name, location, and other information;

   c. A summary of work activities during the progress reporting period;

   d. A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period and resolutions to minor deficiencies;

   e. Summary of test results, failures and retests, and

   f. Signature of the CQC ENGINEER.

2. The CQC ENGINEER's progress reports must summarize the major events that occurred during that week. Critical problems that occur shall be communicated verbally to the CQA ENGINEER immediately, as well as being included in the weekly reports. The CQC ENGINEER's weekly report must be submitted to the CQA ENGINEER no later than the Monday following the week reported, unless some other time schedule is established by the CQC ENGNEER and CQA ENGINEER. The CQA ENGINEER then reviews the weekly reports and provides them to the OWNER and DESIGN ENGINEER.

3. The CQA ENGINEER will utilize the weekly CQC ENGINEER's progress reports to generate his weekly report and to include in the project record documents.

4. Any major deficiencies denoted or occurring during construction will require a separate resolution report that must be approved by the CQA ENGINEER, OWNER, and DESIGN ENGINEER. Deficiency resolution reports shall be referenced in the weekly reporting.

7.4 Photographic Reporting

1. Photographs shall be taken by the CQC ENGINEER at regular intervals during the construction process and in areas deemed critical by the CQA ENGINEER or at the request of the OWNER and DESIGN ENGINEER.

2. These photographs will serve as a visual record of work progress, problems, and mitigation activities. These records will be presented to the DESIGN ENGINEER upon request, and upon completion of the project.

3. As an alternative to still-photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities. The DESIGN ENGINEER may require that a portion of the documentation be recorded by photographic means in conjunction with videotaping.

7.5 Deficiencies

The OWNER and DESIGN ENGINEER will be made aware of non-conformance with the requirements of this CQA Plan. The DESIGN ENGINEER will then determine the cause of the non-conformance and recommend appropriate changes in procedures or specifications to the CQA ENGINEER. When this type of evaluation is made, the results will be documented, and any revision to procedures or CQA Plan will be accepted by the OWNER and DESIGN ENGINEER.

7.6 Design and/or Project Technical Specification Changes

Design and/or Specifications or CQA Plan changes may be required during construction. In such cases, the CQA ENGINEER will notify the DESIGN ENGINEER. The DESIGN ENGINEER will then determine need for Addenda or field clarification and notify the OWNER, who then can notify the appropriate agency, if necessary.

7.7 Final Record Documentation Report

1. Throughout the Closure construction, the CQC ENGINEER will provide documentation on required forms, observation logs, field and laboratory testing data sheets including sample location plans necessary for the CQA ENGINEER to assemble a final Record Documentation Report (sealed by a Professional Engineer registered in the State of Georgia) at the completion of the project,, which will document that the work has been performed in compliance with the approved Contract Drawings and Specifications, and that the supporting documents provide the necessary record document information.

2. The CQC ENGINEER will also provide summaries of the data listed above for preparation of the report. The Record Contract Drawings will include scale Contract Drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, etc.).

3. All surveying and base maps required for development of the Record Contract Drawings will be completed by the CONTRACTOR's AS-BUILT SURVEYOR. These documents will be certified by the CONTRACTOR and delivered to the CQA ENGINEER and included as part of the final Record Documentation Report.

4. At a minimum, the items shown in Table 2.1 shall be included in the final Record Documentation Report.

7.8 Record Documentation

The CQA ENGINEER will provide certification that the final closure (cap) systems, access roads, ditches, detention basin, and other associated ancillary facilities for the Closure are constructed according to the Project Drawings, Specifications, and this CQA Plan. Said certification shall have the CQA ENGINEER's seal as a professional engineer registered in the State of Georgia.

7.9 Storage of Records

Handwritten data sheet originals, especially those containing signatures, will be stored by the CQA ENGINEER in a safe repository on site. Other reports may be stored by any standard method which will allow for easy access. All written documents will become property of the OWNER at the completion of construction.

TABLE 7.1: RECORD DOCUMENTATION REPORT GENERAL OUTLINE

1.0 Introduction

2.0 Project Description

3.0 CQA Program

3.1 Scope of Services

3.2 Personnel and Roles and Responsibilities

3.3 Summary of Deficiencies/Variances from Project Drawings and Specifications

4.0 Earthwork/Compacted Soil Barrier

5.0 Geosynthetic Barrier/Cap Geomembrane

7.0 Geocomposite Drainage Layer

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