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| Backus | 06/06/2016 | 26173 | 9231-CDLF-2012 |

May 25, 2016

Ms. Pat Backus, P.E.
 Permitting Engineer
 NC DEQ, Division of Waste Management
 1646 Mail Service Center
 Raleigh, NC 27699-1646



**RE: Brownfield Road C&D Landfill – Phase 2B (SWS Permit No. 92-31)
 Response to Comments – Permit to Construct Application
 Raleigh, North Carolina**

Dear Ms. Backus:

Smith Gardner Inc. (S+G) is pleased to respond to your April 19, 2016 comments (**Attached**) on behalf of Wake Reclamation, LLC (a Waste Industries Company). Please find our responses (**bold**) corresponding to your comments presented in *italics*.

Attachment G – Technical Specifications

Comment 1: Rock Removal – Section 02229 is reference in Section 02223 Embankment but is not included in the Technical Specifications attachment.

Response: Section 02229 (Rock Removal) has been added to Attachment G – Technical Specifications and the Technical Specification Table of Contents has been updated to reflect its addition.

Comment 2: Landfill Gas Wells/Vents – Section 13252 is referenced in Section 02614 High Density Polyethylene (HDPE) Pipe but is not included in the Technical Specification attachment.

Response: Section 13252 (Landfill Gas Vents) was unintentionally included in the Section 02614 High Density Polyethylene (HDPE) pipe; it has been removed from this specification.

Attachment I – Operations Plan

Comment 3: Section 1.2.3 – Contact information – North Carolina Department of Environmental Quality

- *Liz Patterson is in the Raleigh Central Office*
- *Dennis Shackelford has retired and Drew Hammonds has been appointed as his replacement. His email is andrew.hammonds@ncdenr.gov*

Response: The contact information in Section 1.2.3 has been updated.

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Section 2.2 Acceptable Waste

Comment 4: The definition listed in the operation plan for "Land Clearing and Inert Debris Waste" is incorrect. The referenced statute, G.S. 130A-290(a)(15), states "Land-clearing debris" means solid waste which is generated solely from land-clearing activities. 15A NCAC 13B .0101 (23) states "Land clearing waste" means solid waste with is generated from land-clearing activities such as stumps, trees, limbs, brush, grass, and other naturally occurring vegetative material. Please note that "yard trash", which was listed in the definition provided, is specifically excluded from disposal in a C&DLF unit by 15A NCAC 13B .0542(e)(14).

Response: The Land Clearing and Inert Debris Waste bullet item in Section 2.2 has been updated to read

"Land Clearing and Inert Debris Waste: as defined in G.S. 130A-290 (a)(15) and 15A NCAC 13B .0101 (23) means solid waste that is generated solely from land-clearing activities, such as stumps, tree trunks and other naturally occurring vegetative material."

Comment 5: It is stated that "special wastes" described in Section 2.5.3 may also be accepted at the facility. Section 2.5.3 describes special handling procedures for asbestos. There is a statutory definition for "special wastes" in G.S. 130A-290(a)(40). It does not include asbestos waste. "Special wastes" are one of the waste excluded for disposal in a C&DLF unit by 15A NCAC 13B .0542(e)(12). Asbestos waste can be accepted and disposed based on 15A NCAC 13B .0542(c)(2). It might be better to use terminology that doesn't conflict with a regulatory definition.

Response: The term special waste has been removed from the operations plan and Section 2.5.3 has been renamed to Asbestos Waste Management to alleviate potential terminology conflicts.

Section 2.3 Prohibited Wastes

Comment 6: There are more wastes that can't be disposed of in a C&DLF unit than are listed in the operation plan. These are listed in 15A NCAC 13B .0542(e). This rule will be referenced in the permit and it might be beneficial to reference this rule in this section so that your screening will exclude these wastes.

Response: Section 2.3 has been updated to include a more extensive list of prohibited waste as well as referencing 15A NCAC 13B .0542(e). An updated Section 2.3 is provided below:

The following wastes are prohibited from being accepted at the C&D landfill facility:

- **Containers** such as tubes, drums, barrels, tanks, cans, and bottles unless they are empty and perforated to ensure that no liquid, hazardous or municipal solid waste is contained therein,
- **Garbage** as defined in G.S. 130A-290(a)(7),

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- Hazardous waste as defined in G.S. 130A-290(a)(8), to also include hazardous waste from conditionally exempt small quantity generators,
- Industrial solid waste unless a demonstration has been made and approved by the Division that the landfill meets the requirements of Rule .0503(2)(d)(ii)(A),
- Liquid wastes,
- Medical waste as defined in G.S. 130A-290(a)(18),
- Municipal solid waste as defined in G.S. 130A-290(a)(18a),
- Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761,
- Radioactive waste as defined in G.S. 104E-5(14),
- Septage as defined in G.S. 130A-290(a)(32),
- Sludge as defined in G.S. 130A-290(a)(34),
- Special wastes as defined in G.S. 130A-290(a)(40),
- White goods as defined in G.S. 130A-290(a)(44), and
- Yard trash as defined in G.S. 130A-290(a)(45),

Brownfield Road LF will implement a waste screening program described in Section 2.4, to prohibit these types of waste. Solid waste section specifications regarding prohibited waste are presented in 15A NCAC 13B .0542(e).

Asbestos waste may be accepted by the facility if handled according to Section 2.5.3.

Attachment F – Financial Assurance

Comment 7: The estimate you have provided includes Phase 2B and is reasonable and acceptable. However, because it may be a few years before Phase 2B is constructed and because you may be closing Phase 1 in the interim, I don't plan to issue a letter approving the financial assurance at this time. The facility already has financial assurance in place for the area in the permit to operate.

Response: We agree with your reasoning. Phase 2 Stage 2A is currently under construction and an updated financial assurance will be submitted with those documents.

Drainage

The following comments (as understood by S+G) stem from the meeting on November 30, 2015 where project specifics were discussed.

Comment 8: The drainage path of stormwater on Drawing S3 (Final Cover Grading and Drainage Plan) is unclear. The drawing shows the flow direction of stormwater (arrows) along the side slope swales but does not show it flowing downslope, off of the hill.

The Drawing S3 (Final Cover Grading and Drainage Plan) shows the final cover design, including directing drainage to the depicted downpipe locations. Arrows are directed to the down pipes and it is implied that stormwater enters the down pipes. Please see Detail 6/FC2 (Down Pipe) and, subsequently, Detail 7/FC2 (Side Slope Bench Drain).

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Comment 9: How is the Cap Diversion Berm designed along the limits of the alternate final cover system. Is the related Detail 1/FC2 correct?

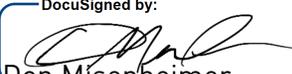
The new Detail 1/FC2 (Geomembrane Cap Diversion Berm) replaces the previous Cap Diversion Berm Detail. A revised Detail on Drawing S3 is provided.

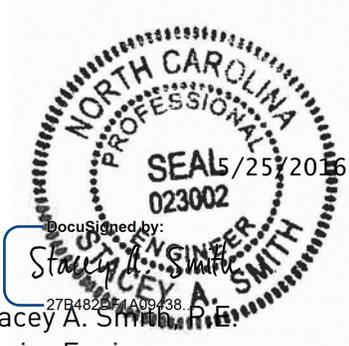
Comment 9: During the meeting, S+G determined that a revised detail for a Landfill Gas Vent (Detail 8/FC2) should be provided.

The new Detail 8/FC2 (Gas Vent) replaces the previous Landfill Gas Vent Detail. A revised Detail FC2 is provided in Drawing S3.

Please contact us with comments of questions at 919-828-0577 or by email below.

Sincerely,
SMITH GARDNER, INC.

DocuSigned by:

Don Misenheimer
Project Manager
don@smithgardnerinc.com

DocuSigned by:

Stacey A. Smith, P.E.
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Senior Engineer
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Attachments

cc: Don Plessinger, Waste Industries
David Pepper, Waste Industries
Elizabeth Werner, NCDEQ
File

Technical Specifications

Brownfield Road C&D Landfill
NC Solid Waste Permit No. 92-31
Raleigh, North Carolina

Prepared For:



Wake Reclamation, LLC
Raleigh, North Carolina

October 2015

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



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Brownfield Road C&D Landfill
NC Solid Waste Permit No. 92-31

Technical Specifications

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SECTION 02110

SITE PREPARATION

Site Preparation: Site Preparation includes clearing, grubbing, and stripping operations which precede the proposed construction.

A. Description

1. General:

- a. The Contractor shall furnish all labor, material, and equipment to complete Site Preparation in accordance with the Contract Drawings and these Specifications.
- b. Principal items of work include:
 - 1. Notifying all authorities owning utility lines running to or on the property. Protect and maintain all utility lines to remain and cap those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.
 - 2. Clearing the site within the clearing limits, including removal of grass, brush, shrubs, trees, loose debris, and other encumbrances except for trees to remain.
 - 3. Boxing and protecting all areas to be preserved.
 - 4. Removing all topsoil from designated areas and stockpiling on site where directed by the Engineer for future use.
 - 5. Disposing from the site all debris resulting from work under this Section.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-------------|----------------|
| Excavation | 02222 |
| Embankment | 02223 |

B. Materials Not Used.

C. Submittals

The Contractor shall submit the following to the Engineer prior to performance of the work:

- 1. Location for disposal of clearing debris and waste.

D. Construction

1. Clearing of the Site:

- a. Clearing limits, as shown on the Contract Drawings, shall be established by the Contractor's Surveyor. Once established, the clearing limits shall be inspected and approved by the Engineer prior to clearing the affected areas.
- b. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shown on the Contract Drawings shall be cleared and grubbed.
- c. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, fencing, and other perishable and objectionable material.

Should it become necessary to remove a tree, bush, brush, or other plants outside the clearing limits, the Contractor shall do so only after permission has been granted by the Engineer.

- d. Excavation resulting from the removal of trees, roots, and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 02223, Embankment, of these Specifications.
- e. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional cost to the Owner, if such, in his opinion, they are too close to the work to be maintained or have become damaged due to the Contractor's operations.

2. Stripping and Stockpiling Existing Topsoil:

- a. Existing topsoil and sod on the site within areas designated on the Contract Drawings shall be stripped to whatever depth it may occur, and stored in locations directed by the Engineer.
- b. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling.
- c. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

3. Grubbing:

- a. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks, and other perishable materials to a depth of at least 6 inches below ground surfaces.

b. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

4. Disposal of Cleared and Grubbed Material:

No open burning of clearing debris will be allowed on this project.

END OF SECTION

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SECTION 02140

DEWATERING

Dewatering: Dewatering refers to controlling and disposing of surface and shallow ground water as is necessary for proper excavation, compaction, and other operations requiring dry conditions.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Dewatering in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-------------|----------------|
| Excavation | 02222 |
| Embankment | 02223 |

B. Materials Not Used.

C. Submittals

Procedures for Dewatering proposed by the Contractor shall be submitted to the Engineer for review prior to any Dewatering operations.

D. Construction

1. The Contractor shall do all Dewatering as required for the completion of the work. All surface or ground water removed by Dewatering operations shall be disposed of in accordance with all applicable regulations.
2. The Dewatering system shall be of sufficient size and capacity as required to control ground water or seepage to permit proper excavation operations, embankment construction and reconstruction, subgrade preparation, and to allow concrete to be placed in a dry condition. The system shall include a sump system or other equipment, appurtenances, and other related earthwork necessary for the required control of surface water. The Contractor shall drawdown ground water to at least 3 feet below the bottom of excavations at all times in order to maintain a dry and undisturbed condition.
3. The Contractor shall take all the steps that he considers necessary to familiarize himself with the surface and subsurface site conditions, and shall obtain the data that is required to analyze the water and soil environment at the site and to assure that the materials

used for the Dewatering systems will not erode, deteriorate, or clog to the extent that the Dewatering systems will not perform properly during the period of Dewatering.

4. The Contractor shall control, by acceptable means, all water regardless of source. Water shall be controlled and its disposal provided for at each berm, structure, etc. when necessary. The entire periphery of the excavation area shall be ditched and diked to prevent surface water from entering the excavation where applicable. The Contractor shall be fully responsible for disposal of the water and shall provide all necessary means at no additional expense to the Owner. The Contractor shall be solely responsible for proper design, installation, proper operation, maintenance, and any failure of any component of the system.
5. The Contractor shall be responsible for and shall repair without cost to the Owner, any damage to work in place and the excavation, including damage to the bottom due to heave and including removal of material and pumping out of the excavated area. The Contractor shall be responsible for damages to any other area or structure caused by his failure to maintain and operate the Dewatering system proposed and installed by the Contractor.

END OF SECTION

SECTION 02222

EXCAVATION

Excavation: Excavation includes excavating, sealing, hauling, scraping, undercutting, removal of accumulated surface water or ground water, stockpiling, and all necessary and incidental items as required for bringing the landfill and related structures to the specified lines and grades.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment required to complete Excavation of the project area in accordance with the Contract Drawings and these Specifications, except as noted below:

- a. Clearing and grubbing and removal of topsoil is addressed in Section 02110, Site Preparation, of these Specifications.
- b. Removal of rock is addressed in Section 02229, Rock Removal, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Site Preparation | 02110 |
| Embankment | 02223 |
| Erosion and Sedimentation Control | 02270 |
| CQA Manual | Attached |

3. Quality Assurance:

Quality Assurance during Excavation will be provided by the Owner as described in the accompanying Project CQA Manual.

4. Definitions:

- a. Excavation: shall consist of the removal and satisfactory disposal and/or stockpiling of all materials (borrow and/or unsuitable materials included) located within the limits of construction including widening cuts and shaping of slopes necessary for the preparation of roadbeds, slope areas, cutting of any ditches, channels, waterways, entrances, and other work incidental thereto.
- b. Borrow: shall consist of approved on-site material required for the construction of embankments/fills or for other portions of the work.

- c. Select Borrow (Where Applicable): shall consist of approved off-site material required for the construction of embankments/fills, roadway subgrade, backfilling, or for other portions of the work as shown on Contract Drawings or in these Specifications. The Contractor shall make his own arrangements for obtaining select borrow and pay all costs involved.
- d. Unsuitable Material: is any in-place or excavated material which contains undesirable materials or is in a state which is not appropriate, in the opinion of the CQA Engineer, for the intended use or support of planned structures, embankment, or excavation. This may include but not be limited to organic material, waste/refuse, soft, or wet material not meeting required specifications, etc.
- e. Unsuitable Material Overexcavation: shall consist of the removal and satisfactory disposal of all unsuitable material located within the limits of construction and below subgrade elevations shown or indicated on the Contract Drawings. Where excavation to the subgrade elevations results in a subgrade or slopes of unsuitable material, the Contractor shall overexcavate such material to below the grades shown or indicated on the Contract Drawings or as otherwise directed by the Engineer and CQA Engineer.

B. Materials

Excavation shall include the removal of all soil, weathered rock, boulders, conduits, pipe, unsuitable material, and all other obstacles encountered and shown or indicated on the Contract Drawings and/or specified herein.

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

- 1. Information on Excavation equipment to be used.
- 2. List of disposal site(s) for waste and unsuitable materials.
- 3. For excavations not shown on the Contract Drawings and if requested by the Engineer, submit excavation plans clearly showing the limits and slopes of the proposed excavation.
- 4. Survey Results:

Survey results for the completed landfill subgrade shall be submitted for review prior to placement of overlying materials.

D. Construction

- 1. The Contractor shall conduct Excavation activities in such a manner that erosion of disturbed areas and off site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. The Contractor shall excavate to the lines and grades shown on the Contract Drawings and stockpile all suitable excavated materials. As the excavation is made, the materials will be examined and identified to the CQA Engineer.

The Contractor will perform all surveys necessary to establish and verify lines and grades for all Excavation, including pipe excavations, soil overexcavation, and anchor trenches.

3. Stockpiling:

The Contractor shall stockpile the materials in appropriate stockpiles as approved by the CQA Engineer. The Contractor shall use equipment and methods as necessary to maintain the moisture content of soils stockpiled (excluding topsoil) at or near their optimum moisture content.

Stockpiles shall be properly sloped and the surfaces sealed by the Contractor at the end of each working day, or during the day in the event of heavy rain, to the satisfaction of the Engineer.

4. The Contractor shall protect all existing facilities and structures including, but not limited to, existing utilities, monitoring wells, signs, grade stakes, etc. during the grading and stockpiling operations.
5. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such sheeting, timbering, pumping, and drainage as may be required.
6. Excavation slopes shall be flat enough to avoid sloughs and slides that will cause disturbance of the subgrade or damage of adjacent areas. Slides and overbreaks which occur due to negligence, carelessness, or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as directed by the Engineer at no additional cost to the Owner.
7. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded. All protruding roots and other vegetation shall be removed from slopes.
8. The bottom of all excavations for structures and pipes shall be examined by the CQA Engineer for bearing value and the presence of unsuitable material. If, in the opinion of the CQA Engineer, additional Excavation is required due to the low bearing value of the subgrade material, or if the in-place materials are soft, yielding, pumping and wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted structural fill, or material directed by the CQA Engineer. No payment will be made for subgrade disturbance caused by inadequate dewatering or improper construction methods.

9. Any areas excavated below design subgrade elevations by the Contractor, unless directed by the CQA Engineer, shall be brought back to design elevations at no cost to the Owner. The Contractor shall place and compact such material in accordance with Section 02223, Embankment, of these Specifications.
10. The Contractor shall dispose of excess or unsuitable excavation materials on-site at location(s) approved by the Owner.
11. The Contractor shall properly level-off bottoms of all excavations. Proof-rolling shall be conducted with appropriate equipment.
12. Upon reaching subgrade elevations shown in excavation areas, the Contractor shall scarify subgrade soils to a minimum depth of 6" and obtain the CQA Engineer's approval of quality. If unsuitable materials are encountered at the subgrade elevation, perform additional excavations as approved by the CQA Engineer to remove unsuitable materials.
13. Overexcavation and Backfill:
 - a. Where subgrade materials are determined to be unsuitable, such materials shall be removed by the Contractor to the lengths, widths, and depths approved by the Engineer and CQA Engineer in advance and backfilled with compacted Embankment in accordance with Section 02223, Embankment, of these Specifications.
 - b. No additional payment will be made for such overexcavation and backfill 1 foot or less than the finished subgrade as this is considered superficial.
 - c. Where overexcavation of unsuitable material is greater than 1 foot beneath the finished subgrade, payment shall be made on a unit price basis for overexcavation and backfill and the measured quantity shall include the entire excavation quantity below the finished subgrade elevations. The unit price for overexcavation and backfill shall include disposal of unsuitable materials.
14. All cuts shall be brought to the grade and cross section shown or indicated on the Contract Drawings, or established by the Engineer, prior to final inspection.
15. The Contractor shall protect finished lines and grades of completed excavation against excessive erosion, damage from trafficking, or other causes and shall repair any damage at no additional cost to the Owner.
16. Trench Excavation:
 - a. All pipe Excavation and trenching shall be done in strict accordance with these Specifications, all applicable parts of the OSHA Regulations, 29 CFR 1926, Subpart P, and other applicable regulations. In the event of any conflicts in this information, safe working conditions as established by the appropriate OSHA guidelines shall govern.
 - b. The minimum trench widths shall be as indicated on the Contract Drawings. Enlargements of the trench shall be made as needed to give ample space for

operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Contract Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing.

- c. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.
- d. Hand excavation shall be employed wherever, in the opinion of the Engineer, it is necessary for the protection of existing utilities, poles, trees, pavements, obstructions, or structures.
- e. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the Engineer and, in general, such length shall be limited to approximately one hundred (100) feet.
- f. Pipe Bedding: All pipe bedding shall be as shown on the Contract Drawings, unless otherwise specified herein, or shall be approved by the CQA Engineer.

17. Sheeting and Bracing:

- a. The Contractor shall furnish, place, and maintain such sheeting and bracing which may be required to support sides of Excavation or to protect pipes and structures from possible damage and to provide safe working conditions in accordance with current OSHA requirements. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports put in at the sole expense of the Contractor. The Contractor shall be responsible for the adequacy of all sheeting and bracing used and for all damage resulting from sheeting and bracing failure or from placing, maintaining, and removing it.
- b. The Contractor shall exercise caution in the installation and removal of sheeting to insure that excessive or unusual loadings are not transmitted to any new or existing structure. The Contractor shall promptly repair at his expense any and all damage that can be reasonably attributed to sheeting installation or removal.
- c. All sheeting and bracing shall be removed upon completion of the work.

18. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed at the Contractor's sole expense.

19. Excavations into Waste:

The Contractor shall use caution when making excavations into waste. Any exposed waste shall be tarped or covered in some fashion (as approved by the Engineer) at the end of each day to prevent exposure to vectors.

20. Surveying:

Upon completion of the landfill subgrade, the subgrade shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) to ensure the top of the subgrade meets the grades specified on the Contract Drawings.

END OF SECTION

SECTION 02223

EMBANKMENT

Embankment: Embankment is the on-site compacted fill that provides the foundation and the berms for the containment area, the subgrade for some access roadways and structures, and backfill around structures and piping.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Embankment including borrowing, hauling, screening, discing, drying, compaction, control of surface and subsurface water, final grading, sealing, and all necessary and incidental items as detailed or required to complete the Embankment, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Excavation | 02222 |
| Rock Removal | 02229 |
| Erosion and Sedimentation Control | 02270 |
| CQA Manual | Attached |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

| | |
|-------------|---|
| ASTM D 698 | Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³). |
| ASTM D 1556 | Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method. |
| ASTM D 2167 | Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method. |
| ASTM D 2216 | Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. |
| ASTM D 2487 | Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). |

| | |
|-------------|--|
| ASTM D 2488 | Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). |
| ASTM D 2937 | Standard Test Method for Density of Soil in Place by the Drive Cylinder Method. |
| ASTM D 4643 | Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method. |
| ASTM D 4959 | Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method. |
| ASTM D 6938 | Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth). |

4. Quality Assurance:

Quality Assurance during placement of Embankment will be provided by the Owner as described in the accompanying Project CQA Manual.

5. Definitions:

- a. Embankment: Shall include construction of all site earthwork including roadways, subgrade, perimeter berm embankments, including preparation of the areas upon which materials are to be placed. Embankment may also be referred to as structural and/or controlled fill. All Embankment materials may be either (off-site) Select Borrow or (on-site) Borrow unless otherwise noted on Contract Drawings or specified by the Engineer.
- b. Prepared Subgrade: The ground surface after clearing, grubbing, stripping, excavation, scarification, and/or compaction, and/or proof rolling to the satisfaction of the CQA Engineer.
- c. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well-graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.
- d. Unclassified Fill: The nature of materials to be used is not identified or described herein but must be approved by the Engineer prior to use.

B. Materials

- 1. Embankment materials shall consist of clean well-graded natural soil classified as SP, SW, SM, SC, ML, or CL (ASTM D 2487) containing no topsoil or other deleterious material. Additionally, for the upper 3 feet beneath the final wearing surface of roadways including shoulders, Embankment materials shall have a liquid limit less than 50%, a plasticity

index less than 20% (ASTM D 2487) and have a maximum standard Proctor dry density of at least 100 pounds per cubic foot (ASTM D 698).

Other material classifications may be approved by the Engineer.

2. Stones or rock fragments shall not exceed one half the maximum lift thickness as compacted in any dimension. Isolated rocks shall be a maximum of 24-inches in any dimension.
3. Embankment materials shall have a 12% maximum loss on ignition (ASTM D 2974).

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

1. Information on equipment to be used for construction of Embankment.
2. Descriptive information on the location and source of any off-site borrow material to be used for Embankment, where applicable. Information shall include Standard Proctor curves (ASTM D698) for each borrow material.

D. Construction

1. The Contractor shall conduct Embankment activities in such a manner that erosion of disturbed areas and off-site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.
2. All placement and compaction of Embankment shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.
3. Embankment shall be placed and compacted to the lines and grades shown on the Contract Drawings. Placement of Embankment outside the construction limits shall occur only as directed and approved by the Engineer.

The Contractor will perform all surveys necessary to establish and verify lines and grades for all Embankment.

4. The Contractor shall protect all existing facilities including, but not limited to, utilities and monitoring wells.
5. Subgrade Preparation:
 - a. The CQA Engineer shall inspect the exposed subgrade prior to placement of Embankment to assure that all rocks, topsoil, vegetation, roots, debris, or other deleterious materials have been removed.
 - b. Prior to placement of Embankment, the exposed subgrade shall be proofrolled using a static smooth-drum roller, loaded tandem axle dump truck, or other suitable equipment in the presence of the CQA Engineer. Any soft or unsuitable

materials revealed before or during the in-place compaction shall be removed as directed by the CQA Engineer and replaced with suitable Embankment.

6. Surfaces on which Embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the Embankment with the existing surface.
7. The Contractor shall be responsible for preparing the materials for the Embankment, including but not limited to, in-place drying or wetting of the soil necessary to achieve the compaction criteria of these Specifications.
8. Embankment materials shall be placed in a manner permitting drainage and in continuous, approximately horizontal layers.
9. Compaction Requirements:
 - a. The Contractor shall compact Embankment in accordance with the requirements shown in Table 1 of this section. If Embankment does not meet the specified requirements, the Contractor shall rework the material, as may be necessary and continue compaction to achieve these requirements, or remove and replace the material to achieve the specified requirements, at Contractor's expense.
 - b. Each lift shall be compacted prior to placement of succeeding lifts. In confined areas, mechanical equipment, suitable for small areas and capable of achieving the density requirements, shall be required.
 - c. Lift compaction shall be performed with an appropriately heavy, properly ballasted, penetrating-foot or smooth-drum vibratory compactor depending on soil type. Compaction equipment shall be subject to approval by the CQA Engineer.
10. Embankment that becomes excessively eroded, soft, or otherwise unsuitable shall be removed or repaired by the Contractor as directed by the CQA Engineer, at no cost to the Owner.
11. The exposed surface of Embankment shall be rolled with a smooth-drum roller at the end of each work day to protect from adverse weather conditions.
12. Where Embankment is to be placed and compacted on slopes that are steeper than 3H:1V, the subgrade shall be benched to a minimum depth of 6 inches and the Embankment shall be placed in horizontal lifts.
13. Backfilling for Structures and Piping:
 - a. All structures, including manholes and pipes shall be backfilled with Embankment as shown in the Contract Drawings and as described in these Specifications.
 - b. Where sheeting is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when sheeting is removed. If significant volumes of soil cannot be prevented

from clinging to the extracted sheets, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that sheeting will be driven in similar soil conditions or employ other appropriate means to prevent loss of support.

- c. When backfilling around structures, do not backfill until concrete has sufficiently cured (as determined by the CQA Engineer) and is properly supported. Place backfill in a manner to avoid displacement or damage of structures.

Table 1: Required Embankment Properties

| Item | Required % Standard Proctor (ASTM D698) ² | Required Moisture Content ³ | Maximum Lift Thickness (Compacted) (inches) |
|--|--|--|---|
| Embankment Beneath Structures and Roads ¹ | 100 | +/- 2% of Optimum (std. Proctor) | 8 |
| Embankment | 95 | As Required for Compaction | 8 |
| Backfill Around Structures | 95 | | 8 |
| Backfill in Pipe Trenches | 95 | | 6 |
| Unclassified Fill | N/A | N/A | N/A |

Notes:

1. Embankment beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope. Embankment beneath roads shall be considered to include all embankment placed within 3 vertical feet of the final wearing surface and shall also include shoulders.
2. Determine field density using ASTM D 6938, ASTM D 1556, ASTM D 2167, or ASTM D 2937.
3. Determine field moisture content using ASTM D 6938, ASTM D 2216, ASTM D 4643, or ASTM D 4959.
4. The Engineer may allow exceptions to the above criteria for areas outside of the containment area which are not subject to significant long-term loads.

END OF SECTION

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SECTION 02229

ROCK REMOVAL

Rock Removal: Rock Removal refers to the removal of rock material of a size and nature which cannot be excavated by traditional means.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Rock Removal which may be necessary during construction, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-------------|----------------|
| Excavation | 02222 |
| Embankment | 02223 |

B. Materials

For the purposes of this Project, Rock shall refer to any material occupying an original volume of at least one cubic yard which cannot be excavated with a single-tooth ripper drawn by a large crawler tractor or an excavator equipped with a rock ripping bucket having a minimum draw bar pull or stick crowd force rated at not less than 56,000 pounds (Caterpillar D 8K, D9, or equivalent dozers; Caterpillar 375 or equivalent excavator).

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Submit Rock Removal procedures for review and approval in advance.
2. Pre-Blasting Requirements:
 - a. Submit the qualifications of the blasting subcontractor (or of the Contractor himself if applicable), including applicable licensing information and proof of insurance.
 - b. If the Contractor uses a separate firm to perform pre-blast or post-blast surveys and/or damage analysis, the Contractor shall submit the appropriate qualifications.
 - c. Submit the procedure for handling blasting damages and claims.

- d. Submit a blasting plan for review and approval at least 2 weeks prior to any blasting.
 - e. Where notification of nearby property owners is required, the Contractor shall provide the Engineer with a sample of each required notification letter for approval prior to sending the letter.
3. Post-Blasting Requirements:
- a. Submit a copy of any/all pre-blast surveys, blasting logs, seismograph records, video records, and post-blast surveys.

D. Construction

- 1. When rock is encountered, immediately notify the Engineer and do not proceed until instructions are received and measurements are made for the purpose of establishing the quantity of rock excavation. When payment is to be made on a unit price basis, test pits at suitable spacing (as approved by the Engineer) shall be used to determine the top of rock elevations for a large area (Rock Removal - Mass) and along the length of a pipeline or other excavation of limited width (Rock Removal - Trench).
- 2. Quantities shall be determined by the Contractor's surveyor and shall be approved by the Engineer prior to commencement of rock excavation and shall be the basis for payment. The surveyed top elevations of the rock and the dimensions given in the following paragraph shall be used to determine the quantity of rock for payment.
- 3. Where rock is encountered above design subgrade elevations outside of the footprint of the liner system, rock shall be removed to approximately 1 foot below the subgrade lines and grades indicated on the Contract Drawings as approved by the Engineer. Within the footprint of the liner system (current or future cell), rock shall be removed to at least 4 feet below the design subgrade elevations (or, alternatively, at least 4 feet below Engineer-adjusted subgrade elevations). In pipe trenches, rock shall be removed to at least 6 inches below the pipe invert elevations and 2 feet wider than the outside diameter of pipe, but not less than 3 feet minimum trench width.

The subgrade shall be brought back up to grade by placing suitable Embankment as described in Section 02223, Embankment, of these Specifications. The cost of the rock removal shall include the cost of this related earthwork.

- 4. Blasting:
 - a. Blasting cannot be performed on the project unless authorized in advance by State Solid Waste regulators, the Engineer, and the Owner.
 - b. Blasting shall only be performed when all other reasonable methods fail to remove the rock.
 - c. The Contractor shall secure a blasting permit from the local Fire Department and/or any appropriate Government Agency before using any explosives.
 - d. Blasting procedures shall conform to all applicable local and State laws and

ordinances. Approval of the Engineer and Owner is required before the performance of any blasting. The Contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden.

- e. Unless otherwise authorized, blasting shall be performed such that the measured peak particle velocity at the nearest on or off-site structure or monitoring well is no greater than 1 inch per second as verified by seismograph(s).
- f. The Contractor shall keep explosive materials that are on the project site in specially constructed boxes provided with locks. These boxes shall be painted red and plainly identified as to their contents. Failure to comply with this requirement shall be grounds for suspension of blasting operations until full compliance is made.
- g. Two weeks prior to performing any pre-blast surveys, the Contractor shall notify all property owners within 500 feet of the blasting zone of the intent to perform the pre-blast surveys within the area. The letter shall include the following; the name of the Contractor, the name of the project, whom he is working for (the Owner), what the pre-blast survey is, a number to call to set up an appointment, and any other pertinent information. Additional notifications may be required for structures close to the blast or special conditions.
- h. Two weeks prior to blasting, the Contractor shall notify all property owners within 500 feet of the blasting zone of the intent to perform blasting within the area. The letter shall include the following; the name of the Contractor, the name of the project, whom he is working for (the Owner), the approximate date of blasting, warnings used, and who to contact in case of damage. Damage claim forms are available from the Owner. Additional notifications maybe required for structures close to the blast or special conditions.
- i. Prior to blasting, the Contractor shall perform pre-blast surveys of structures within 500 feet of the blasting zone. Structures shall include houses, buildings, pools, roads, sidewalks, concrete structures, exposed utilities, etc. The pre-blast survey shall contain a detailed inspection of the exterior and interior of the building showing location of all existing damage to the house and surrounding structures. The pre-blast survey shall include photographic evidence as well as written evidence and will be done in the presence of the property owner. Should any property owner refuse to allow a pre-blast survey, the Contractor shall document the refusal by providing evidence of attempts to perform the survey.
- j. The Contractor shall notify the Engineer and Owner, at least 24 hours in advance, of the blasting. The Owner or their representative shall witness all blasting.
- k. When blasting in close proximity of utility lines, the Contractor shall contact the owner of the utility in advance of the blasting. It is strongly encouraged that the utility have a representative on site in case they are needed.
- l. Blasting shall be performed between the hours of 9:00 a.m. through 3:30 p.m. Monday through Friday. Blasting at other times and days may be allowed with prior permission from the Owner and Engineer.

- m. Signs stating "Danger Blasting Zone" shall be installed along roads, public ways, in the vicinity of occupied buildings immediately adjacent to the blast area and other locations deemed necessary to warn the public of the blasting area. Additional signs relating to use of electronic devices may be required depending on the ignition devices used in the blasting.
- n. No blasting shall be performed unless a galvanometer is employed to check cap circuits. The Contractor shall also keep a blasting log containing the following information for each and every blast:
 - (1) Date of blast;
 - (2) Time of blast;
 - (3) Foreman's name;
 - (4) Approximate depth of overburden;
 - (5) Amount and type of explosive used in each hole;
 - (6) Type of caps used (instant or delay);
 - (7) Number and depth of holes; and
 - (8) Weather.

This blasting log shall be made available to the Engineer upon request and shall be kept in an orderly manner.

- o. The Contractor shall monitor all blasting with up to four (4) seismographs placed near structures, monitoring wells, or other locations in proximity to the blast. The number and location of the seismographs shall be approved by the Engineer prior to blasting. In no case shall less than one be used. The seismograph shall measure ground vibration as well as air shock. After blasting, all seismograph records shall be provided to the Engineer.
- p. The Contractor shall notify emergency services immediately prior to blasting.
- q. Five minutes prior to blasting, the Contractor shall sound a series of long blasts on a horn and siren for 1 minute followed by an announcement over a loud speaker: "Attention, Attention, We will be blasting in five minutes." and repeated.
- r. One minute prior to blasting, the Contractor shall sound a series of short blasts on a horn and siren followed by an announcement over a loud speaker: "Attention, Attention, We will be blasting in one minute." and repeat.
- s. After the one-minute time and confirming the area is clear, the announcement of "Fire in the Hole" will be made over the loud speaker. After which time the blast shall be detonated.
- t. After the blast is complete and the area has been determined to be safe, the Contractor shall sound a prolonged blast on the horn and siren followed by the announcement over the loud speaker of "All Clear".
- u. After blasting, a post-blast survey maybe required if the blast exceeds vibration parameters, damage is reported, or as the Engineer or Owner may require. The

post-blast survey shall be similar in form as the pre-blast survey.

- v. A video recording of all blasting shall be performed from the 5-minute warning through the all-clear signal. The video camera shall be placed on a tripod at a safe distance from the blast. The camera shall be placed so the entire blast may be seen. The camera shall record date, time, sound, and video in a digital format on a mini-DVD tape, video CD, or video DVD. Each tape, CD, or DVD shall be in a case. Both the case and video media shall be labeled showing the job name, date of the video, and location. An index shall be provided showing the sequence and location of each blast on the video. Still pictures of before and after the blast may be submitted also but will not be an acceptable substitute for a video.
 - w. The Contractor shall immediately notify the Engineer and Owner of any damage observed in post-blast surveys or damage claims. A copy of any damage claim form shall be provided to both the Engineer and Owner.
 - x. The Contractor shall be responsible for any and all damage or injury to persons or property resulting from the use of explosives. Any damage done shall be promptly repaired by the Contractor at his expense.
5. Excavated rock shall be placed on-site in locations as directed by the Owner.

END OF SECTION

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SECTION 02240

GEOTEXTILES

Geotextiles: For the proposed construction, a Type GT-S (Separator/Filter) Geotextile, is specified. The Type GT-S Geotextile will be placed in between soil subgrade and aggregate in access roads and in some erosion control and drainage applications.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Geotextiles including all necessary and incidental items as detailed or required for the Contractor to complete the installation in accordance with the Contract Drawings and these Specifications, except as noted below:

- a. Geotextiles used as a Silt Fence is covered under Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Erosion and Sedimentation Control | 02270 |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO) are hereby made a part of these specifications.

| | |
|-------------|---|
| ASTM D 4355 | Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus. |
| ASTM D 4491 | Standard Test Methods for Water Permeability of Geotextiles by Permittivity. |
| ASTM D 4533 | Standard Test Method for Trapezoid Tearing Strength of Geotextiles. |
| ASTM D 4632 | Standard Test Method for Grab Breaking Load and Elongation of Geotextiles. |
| ASTM D 4751 | Standard Test Method for Determining Apparent Opening Size of a Geotextile. |

| | |
|--------------|---|
| ASTM D 5261 | Standard Test Method for Measuring Mass per Unit Area of Geotextiles. |
| ASTM D 6241 | Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50 mm Probe. |
| AASHTO M 288 | Standard Specification for Geotextiles. |

4. Quality Assurance:

Quality Assurance during installation of Geotextiles will be provided by the Owner.

B. Materials

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each roll of Geotextile shall identify the length, width, lot and roll numbers, and name of Manufacturer.

2. The Type GT-S Geotextile shall be a nonwoven spunbonded or nonwoven needlepunched synthetic fabric consisting of polyester or polypropylene manufactured in a manner approved by the Engineer. Woven fabrics may be used in certain applications if approved in advance by the Engineer.
3. All Geotextiles shall conform to the properties listed in Table 1 of this section.

C. Submittals

Prior to the installation of Geotextiles, the Contractor shall submit the following to the CQA Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each type of Geotextile attesting that the Geotextiles meet the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of each Geotextile to be used. The samples shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
2. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
3. Seaming Procedures: Submit proposed seaming procedures including proposed method and equipment.

4. Quality Control Certificates: For Geotextiles delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided which represent every roll of each type of Geotextile supplied. Each certificate shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 2 of this section.
5. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. Construction

1. Shipping, Handling, and Storage:

All Geotextiles shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Failing CQA Material Control Tests:

Geotextiles that are rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and CQA testing of Geotextiles supplied as replacement for rejected material shall be performed by the CQA Engineer at Contractor's cost.

3. Installation:

- a. The surface receiving the Geotextiles shall be prepared to a relatively smooth condition, free of obstructions, standing water, excessive depressions, debris, and very soft, excessively wet, and/or loose pockets of soil. This surface shall be approved by the CQA Engineer prior to Geotextile placement.
- b. Geotextiles shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, Geotextiles shall be rejected by the CQA Engineer if they have defects, rips, holes, flaws, evidence of deterioration, or other damage.
- c. The Geotextiles shall be placed smooth and free of excessive wrinkles.
- d. On slopes, Geotextiles shall be anchored at the top and unrolled down the slope. In the presence of wind, all Geotextiles shall be weighted with sandbags or other material as appropriate. Geotextiles uplifted by wind may be reused upon approval by the CQA Engineer.

4. Seams:

- a. all Geotextile seams shall be overlapped.

5. Repair Procedures:

- a. Any Geotextile that is torn, punctured, or otherwise damaged shall be repaired or replaced, as directed by the CQA Engineer, by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of Geotextile placed over the failed areas and shall overlap the existing Geotextile a minimum of 18 inches from any point of the rupture. Patches shall be spot sewn or heat bonded so as not to shift during cover placement.

6. Cover Placement:

- a. Except when designed to remain exposed, Geotextiles shall be covered in a timely manner to limit potential UV damage. Unless otherwise approved by the Engineer, covering shall occur within 30 days of installation. Extension of this time may be considered by the Engineer based on weather conditions (i.e. prolonged cloud cover during 30 day period) or technical information provided by the Manufacturer that would justify an extension.

- (1) The Engineer may conduct sampling and testing of any Geotextiles exposed for a period longer than allowed to verify the material properties. The cost associated with this testing and the subsequent repair(s) shall be borne solely by the Contractor regardless of the test results. In no case will the maximum length of exposure be greater than 60 days without verification of material properties.

- b. Placement of cover over Geotextiles shall be performed in a manner as to ensure that the Geotextiles or underlying materials are not damaged. Cover material shall be placed such that excess tensile stress is not mobilized in the Geotextile.

Table 1: Required Geotextile Properties

| Property | Test Method | Units | Value ¹ |
|---|--------------|--------------------|--|
| | | | Type GT-S |
| Geotextile Construction (NW = Nonwoven) (W = Woven) | ----- | ----- | NW or W ² |
| Mass per Unit Area (Unit Weight) | ASTM D 5261 | oz/yd ² | N/A |
| UV Resistance (500 hrs) | ASTM D 4355 | % | 70 |
| Strength Class ⁴ | AASHTO M 288 | Class | 2 |
| Tensile Properties: Grab Strength Grab Elongation | ASTM D 4632 | lbs % | 160 (NW) 250 (W) ≥ 50 (NW) < 50 (W) |
| Puncture Resistance | ASTM D 6241 | lbs | 410 (NW) 950 (W) |
| Trapezoidal Tear Strength | ASTM D 4533 | lbs | 55 (NW) 90 (W) |
| Apparent Opening Size (AOS) | ASTM D 4751 | U.S. Sieve | 70+ |
| Permittivity | ASTM D 4491 | sec ⁻¹ | 1.0 |

Notes:

1. Minimum Average Roll Value (MARV).
2. Woven geotextiles shall be approved in advance by the Engineer. Woven geotextiles formed exclusively with slit film fibers are not acceptable.
3. AASHTO M 288 criteria include the above listed requirements for: Tensile Properties, Puncture Resistance, Trapezoidal Tear Strength, and Burst Strength.

Table 2: Required Manufacturer Quality Control Tests

| Property | Test Method | Minimum Test Frequency |
|----------------------------------|--------------------|-------------------------------|
| Mass per Unit Area (Unit Weight) | ASTM D 5261 | 200,000 ft ² |
| Ultraviolet Resistance (500 hrs) | ASTM D 4355 | Periodic |
| Tensile Properties | ASTM D 4632 | 200,000 ft ² |
| Apparent Opening Size (AOS) | ASTM D 4751 | Periodic |
| Permittivity | ASTM D 4491 | Periodic |
| Puncture Resistance | ASTM D 6241 | 200,000 ft ² |
| Trapezoidal Tear Strength | ASTM D 4533 | 200,000 ft ² |

END OF SECTION

SECTION 02258

VEGETATIVE SOIL LAYER

Vegetative Soil Layer (VSL): The Vegetative Soil Layer (VSL) is placed in the final cover system in order to support permanent vegetative cover. This section includes the topsoil to be placed as the upper 6 inches of the VSL.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of the VSL (including topsoil) for the landfill cover, including borrowing, hauling, spreading, and final grading and all necessary and incidental items as detailed or required to complete the VSL, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------|----------------|
| HDPE Pipe | 02614 |
| Drainage Geocomposite | 02712 |
| LLDPE Geomembrane | 02778 |
| Revegetation | 02930 |
| CQA Manual | Attached |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

| | |
|-------------|--|
| ASTM D 422 | Standard Test Method for Particle Size Analysis of Soils. |
| ASTM D 2487 | Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). |

4. Quality Assurance:

Quality Assurance during placement of Vegetative Soil Layer will be provided by the Owner as described in the accompanying Project CQA Manual.

B. Materials

Soil that meets all of the following requirements shall be classified as select soil fill for use in construction of the VSL.

1. Soil shall be classified according to the Unified Soil Classification System (USCS) as SM, SC, CL-ML, ML, or CL (ASTM D 2487). Alternatives to these requirements must be approved in advance by the Engineer. The Engineer shall verify that the upper geotextile of the underlying Drainage Geocomposite is anticipated to perform acceptably as a filter in contact with the selected soil(s) (if applicable).
2. Select soil fill materials shall be reasonably free of gypsum, ferrous, and/or calcareous concretions and nodules, refuse, roots, or other deleterious substances.
3. Continuous and repeated visual inspection of the materials being used will be performed by the Contractor to ensure proper soils are being used. In addition, the CQA Engineer shall make frequent inspections of the placement operations and materials, and will consult with the Engineer.
4. The VSL shall be uniform, smooth, and free of debris, rock, plant materials, and other foreign material larger than 3 inches in diameter. The material should contain no sharp edges. This material must be capable of supporting growth of vegetative cover.
5. Topsoil: The upper 6 inches of VSL shall be natural or blended soil material capable of supporting the growth of vegetative cover.

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

1. Before approval is given to proceed, the Contractor shall submit descriptive information on placement equipment to be used in construction of the VSL.

2. Survey Results:

After completion of a segment of VSL, survey results shall be submitted for review prior to VSL acceptance.

D. Construction

1. The VSL may be placed directly over geosynthetics and/or piping; thus, extreme caution shall be exercised by the Contractor to prevent damage to these materials.
2. All placement and compaction of VSL shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.
3. VSL shall be placed over geosynthetics only after areas have been released by the Geosynthetics Installer and the CQA Engineer. VSL shall be placed as specified below:
 - a. The VSL, including topsoil, shall be placed and spread using low ground pressure (6 psi or less) tracked equipment. The CQA Engineer shall approve the equipment used to place the VSL.
 - b. Tracked equipment used to place and spread VSL shall operate on at least 1 foot of material overlying geosynthetics and/or piping. Sharp turning of tracked

equipment on the VSL will not be permitted.

- c. On slopes of 6H:1V or steeper, VSL shall be placed and spread from the bottom up unless otherwise approved by the Engineer. No material shall be dumped down a slope.
 - d. VSL shall be placed and compacted to the lines and grades shown on the Contract Drawings with the exception that a 0.15 foot overbuild at Contractor's expense is allowed. The Contractor will perform all surveys necessary to establish and verify lines and grades for all VSL.
 - e. VSL shall be compacted by tracking the final lift with tracked equipment.
4. The VSL shall be spread in a manner that minimizes development of wrinkles or tension in the underlying geosynthetics. Any portion of the underlying geosynthetics that develops excessive wrinkles or crimp or is otherwise damaged shall be repaired by the Geosynthetics Installer at no expense to the Owner.
- a. VSL shall not be placed when conditions are warm enough to produce excessive wrinkles in the underlying geosynthetics. Likewise, VSL shall not be placed when conditions are cold enough to produce tension in the underlying geosynthetics.
 - b. If during spreading, excessive wrinkles develop, the Contractor shall adjust placement and spreading methods, or cease until the underlying geosynthetics cool and wrinkles decrease in size.
 - c. Wrinkles that exceed approximately 6 inches in height and cannot be eliminated by amended placement and spreading methods or underlying geosynthetics that become crimped shall be cut and repaired by the Geosynthetics Installer in a method approved by the Engineer.
5. Stockpiling of VSL on the final cover shall be subject to advance approval by the Engineer. Any hauling equipment (dump trucks, etc.) operating over geosynthetics shall have a minimum of 3 feet of separation between the vehicle wheels and the Geomembrane.
6. The CQA Engineer may require removal of VSL and/or other underlying layers at the Contractor's sole expense to allow examination of the underlying geosynthetics and/or piping. Any damage to underlying layers or excessive wrinkling or crimping during placement of the VSL shall be repaired in accordance with the applicable section of these Specifications at the Contractor's sole expense.
7. After the specified thickness has been achieved and verified, the Contractor shall proceed immediately with seeding.
8. Surveying:
- After completion of a segment of VSL, the VSL shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) to ensure:

- a. The specified thickness has been achieved. A hand auger or similar method may be used to check for thickness at each location.
- b. The top of the VSL slopes at grades specified on the Contract Drawings; and
- c. VSL placed more than 0.15 feet beyond the limits of the lines and grades as shown on the Contract Drawings will not be accepted and must be removed at the Contractor's sole expense if required by the Engineer.

This work shall be performed at the Contractor's cost by a registered surveyor.

END OF SECTION

SECTION 02270

EROSION AND SEDIMENTATION CONTROL

Erosion and Sedimentation Control: Erosion and Sedimentation Control is a system of construction and engineered measures (devices, structures, practices, etc.) which act to minimize surface water induced erosion of disturbed areas and the resulting off-site sedimentation.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of and maintain Erosion and Sedimentation Control measures and related work in accordance with the Contract Drawings and these Specifications.

All Erosion and Sedimentation Control work shall be in accordance with the latest edition of the North Carolina Erosion and Sediment Control Planning and Design Manual as well as applicable regulations.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|---------------------------------|----------------|
| Geotextiles | 02240 |
| Rip Rap | 02271 |
| Rolled Erosion Control Products | 02275 |
| HDPE Pipe | 02614 |
| Stormwater Systems | 02720 |
| Revegetation | 02930 |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

| | |
|-------------|--|
| ASTM D 3786 | Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method. |
| ASTM D 4355 | Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus). |
| ASTM D 4491 | Standard Test Methods for Water Permeability of Geotextiles by Permittivity. |

| | |
|-------------|--|
| ASTM D 4533 | Standard Test Method for Trapezoid Tearing Strength of Geotextiles. |
| ASTM D 4632 | Standard Test Method for Grab Breaking Load and Elongation of Geotextiles. |
| ASTM D 4751 | Standard Test Method for Determining Apparent Opening Size of a Geotextile. |
| ASTM D 4833 | Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products. |

B. Materials

1. Custom Basins:

Permanent sediment or detention basins shall be constructed as shown on the Contract Drawings.

2. Permanent Drainage Channels, Diversions, Swales, and Ditches:

Permanent drainage channels, diversions, swales, and ditches shall be constructed as shown on the Contract Drawings.

3. Silt Fence:

Silt fences shall be constructed as shown on the Contract Drawings and as needed, based on the Contractor's discretion and Engineer's approval. The silt fence is a permeable barrier erected within and downgradient of small disturbed areas to capture sediment from sheet flow. It is made of filter fabric buried at the bottom, stretched, and supported by posts and wire mesh backing. Silt fence shall conform to the following properties:

- a. Posts: Posts shall be 1.33 lb/linear foot steel (preferred) or wood with a minimum length of 5 feet. Steel posts shall be "U" or "T"-type. Wood posts shall have a minimum diameter of 4-inches.
- b. Filter Fabric: Filter fabric shall be a woven geotextile made specifically for sediment control. Filter fabric shall conform to the properties listed in Table 1 of this section.

4. Geotextiles:

Geotextiles shall conform to the requirements of Section 02240, Geotextiles, of these Specifications.

5. Stone Check Dams:

Stone check dams shall be constructed as shown on the Contract Drawings.

6. Rip Rap:

Rip Rap shall conform to the requirements of Section 02271, Rip Rap, of these Specifications.

7. Down Chutes and Pipes:

Down chutes and pipes shall be constructed as shown on the Contract Drawings.

8. Rolled Erosion Control Products (RECPs):

Rolled Erosion Control Products (RECPs) shall conform to the requirements of Section 02275, Rolled Erosion Control Products, of these Specifications.

9. Other Work:

In addition to the Erosion and Sedimentation Control measures shown on the Contract Drawings, the Contractor shall provide adequate means to prevent any sediment from entering any storm drains, drop inlets, ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation of off-site areas. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed. All paved areas shall be scraped and swept as necessary to prevent the accumulation of dirt and debris. Work associated with this provision shall be considered incidental to the project and no separate payment will be made.

10. Temporary and Permanent Ground Cover:

The Contractor shall provide temporary or permanent ground cover (or other acceptable measure(s)) adequate to restrain erosion on erodible slopes or other areas within 21 calendar days following completion of any phase of grading. The Contractor shall provide permanent ground cover for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following the completion of construction.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all Erosion and Sedimentation Control materials manufactured for the project have been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. Construction

1. Establishment of Erosion and Sedimentation Control Measures:
 - a. All Erosion and Sedimentation Control measures will be constructed according to the Contract Drawings and these Specifications.
 - b. Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the Erosion and Sedimentation Control measures may need to be adjusted on several occasions to reflect the current phase of construction.
 - c. Erosion and Sedimentation Control measures shall be established prior to the work in a given area. Where such practice is not feasible, the Erosion and Sedimentation Control measure(s) shall be established immediately following completion of the clearing operation.
 - d. The construction schedule adopted by the Contractor will impact the placement and need for specific measures required for the control of erosion. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and prevent or correct the discharge of sediment outside the limits of construction (unless controlled by other on-site measure(s)).
 - e. The location and extent of Erosion and Sedimentation Control measures shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from construction areas. All deviations from the control provisions shown on the Contract Drawings shall have the prior approval of the Engineer.

2. Inspection and Maintenance of Erosion and Sedimentation Control Measures:
 - a. The Contractor shall furnish the labor, material, and equipment required for the inspection and maintenance of all Erosion and Sedimentation Control measures. Maintenance shall be scheduled as required for a particular measure to maintain the removal efficiency and intent of the measure.
 - b. All Erosion and Sedimentation Control measures shall be inspected at least once every seven calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period and appropriate maintenance conducted. A rain gauge shall be maintained on the site and a record of the rainfall amounts and dates shall be kept properly.
 - c. Maintenance shall include, but not be limited to:
 - (1) The removal and satisfactory disposal of trapped or deposited sediments from basins, traps, barriers, filters, and/or drainage features/devices;

- (2) Replacement of filter fabrics used for silt fences upon loss of efficiency; and
 - (3) Replacement of any other components which are damaged or cannot serve the intended use.
 - d. The Contractor shall accept and maintain any existing sediments that are included in existing sediment traps or basins that accept or will accept stormwater flow and or sediment accumulation from all areas within the Contractor's limits of construction.
 - e. Sediments removed from Erosion and Sedimentation Control measures shall be disposed of in locations that will not result in off-site sedimentation as approved by the Engineer.
 - f. All Erosion and Sedimentation Control measures shall be maintained to the satisfaction of the Engineer until the site has been stabilized.
3. Graded Slopes and Fills:
- The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetated cover or other adequate measures.
4. Finish Grading:
- All disturbed areas shall be uniformly graded to the lines, grades, and elevations shown on the Contract Drawings. Except for certain erosion and sedimentation control measures and other areas designated to impound water, all areas shall be graded to drain. Finished surfaces shall be reasonably smooth, compacted, and free from irregular surface changes. Unless otherwise specified, the degree of finish shall be that ordinarily obtainable from either blade or scraper operations. Areas shall be finished to a smoothness suitable for application of topsoil.
5. Revegetation:
- Revegetation shall conform to the requirements of Section 02930, Revegetation, of these Specifications.
6. Cleanup:
- a. The Contractor shall remove from the site all subsoil excavated from his work and all other debris including, but not limited to, branches, paper, and rubbish in all landscape areas, and remove temporary barricades as the work proceeds.
 - b. All areas shall be kept in a neat, orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer.

Table 1: Required Silt Fence Filter Fabric Properties

| Property | Test Method | Units | Value ¹ |
|------------------------------------|-------------|-------------------|--------------------|
| Grab Tensile Strength ² | ASTM D 4632 | lbs | 90 x 90 |
| Grab Elongation | ASTM D 4632 | % | 20 (Max.) |
| Ultraviolet Resistance (500 hrs) | ASTM D 4355 | % | 80 |
| Apparent Opening Size (AOS) | ASTM D 4751 | U.S. Sieve | 30+ |
| Permittivity | ASTM D 4491 | sec ⁻¹ | 0.05 |

Notes:

1. Minimum Average Roll Value (MARV).
2. Values for machine and cross machine direction (MD x XD), respectively.

END OF SECTION

SECTION 02271

RIP RAP

Rip Rap: This section includes all rip rap aprons and channel protection.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Rip Rap for protection of earthen slopes against erosion as indicated, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Geotextiles | 02240 |
| Erosion and Sedimentation Control | 02270 |

3. Reference Standards:

The latest revision of the following standards of the North Carolina Department of Transportation (NCDOT) are hereby made a part of these Specifications.

NCDOT Standard Specifications for Roads and Structures (2006).

B. Materials

1. Rip Rap: Rip Rap shall be of the size indicated on the Contract Drawings and shall conform to NCDOT Section 1042, Rip Rap Materials.

2. Geotextiles: Geotextiles shall conform to the requirements outlined in Section 02240, Geotextiles, of these Specifications.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results prior to installation, that all Rip Rap has been produced in accordance with these Specifications.

2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. Construction

1. Surface Preparation:

- a. Trim and dress all areas to conform to the Contract Drawings as indicated with tolerance of 2 inches from theoretical slope lines and grades.
- b. Bring areas that are below allowable minimum tolerance limit to grade by filling with compacted Embankment material similar to adjacent material.
- c. Geotextiles shall be placed as shown on the Contract Drawings and in accordance with Section 02240, Geotextiles, of these Specifications.
- d. Do not place any stone material on the prepared surface prior to inspection and approval to proceed from the Engineer.

2. Placing Rip Rap:

Rip Rap shall be placed in accordance with NCDOT Section 876, Rip Rap.

END OF SECTION

SECTION 02275

ROLLED EROSION CONTROL PRODUCTS

Rolled Erosion Control Products: Rolled Erosion Control Products (RECPs) include erosion control blankets (ECB) and turf reinforcement mats (TRM) placed in channels and on slopes.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of all RECPs in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Erosion and Sedimentation Control | 02270 |
| Revegetation | 02930 |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

| | |
|-------------|--|
| ASTM D 4355 | Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus). |
| ASTM D 6475 | Standard Test Method for Measuring Mass per Unit Area of Erosion Control Blankets. |
| ASTM D 6524 | Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats. |
| ASTM D 6525 | Standard Test Method for Measuring Nominal Thickness of Permanent Erosion Control Products. |
| ASTM D 6566 | Standard Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats. |
| ASTM D 6818 | Standard Test Method for Ultimate Tensile Properties of Turf Reinforcement Mats. |

B. Materials

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each RECP shall identify the length, width, product name, and name of Manufacturer.

2. Erosion Control Blanket (ECB) (Single Net):

ECB (single net) shall consist of a machine-produced mat of straw or wood excelsior fiber covered on the top side with a photodegradable extruded plastic or woven biodegradable netting and sewn together with degradable thread. ECB (single net) shall also conform to the properties listed in Table 1 of this section. ECB (single net) shall be S75, as manufactured by North American Green, CURLEX I, as manufactured by American Excelsior Company, LANDLOK S1, as manufactured by Propex Fabrics, or approved equal.

Flexterra Flexible Growth Media (FGM), as manufactured by Profile Products, applied at a minimum rate of 3,500 lbs/acre is an acceptable substitute for ECB to be placed on 2H:1V slopes (a minimum rate of 3,000 lbs/acre shall be used on 3H:1V slopes).

3. Turf Reinforcement Mat (TRM) (Type 1):

TRM (Type 1) shall consist of a dense web of crimped and interlocking polypropylene fibers positioned between two biaxially oriented nets and mechanically bound together by parallel stitching with polypropylene thread. TRM (Type 1) shall be designed to accelerate seedling emergence, exhibit high resiliency, and possess strength and elongation properties to limit stretching in a saturated condition. TRM (Type 1) shall be stabilized against chemical and UV degradation which are normally found in a natural soil environment and shall have no biodegradable components. TRM (Type 1) shall also conform to the properties listed in Table 1 of this section. TRM (Type 1) shall be LANDLOK TRM 435, as manufactured by Propex Fabrics, or approved equal.

4. anchors: Anchors for RECPs shall consist of machine made staples of No. 8 gauge new steel wire formed into a "U" shape. The size when formed shall be not less than 8 inches in length with a throat of not less than 1 inch in width. Longer anchors may be required for loose soils. Other anchors, such as metal pins or plastic pegs, may also be used if approved in advance by the Engineer.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each RECP attesting that each RECP meets the physical and manufacturing requirements

stated in these Specifications. The Contractor shall also submit a sample of each RECP to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

2. Installation Guidelines/Instructions: The Manufacturer's guidelines/instructions for installation shall be submitted for review.
3. Furnish copies of delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. Construction

1. Shipping, Handling, and Storage:

All RECPs shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Installation - General:

- a. Placing of RECPs shall be done immediately following seeding. Seeding shall be performed in accordance with Section 02930, Revegetation, of these Specifications.
- b. RECPs shall be placed to the lines and grades shown on the Contract Drawings. The earth surface shall be smooth and free from stones, clods, or debris which will prevent the contact of the RECP with the soil. Care shall be taken to preserve the required line, grade, and cross section of the area.
- c. RECPs shall be unrolled in the direction of the flow of water and shall be applied without stretching so that it will lie smoothly but loosely on the soil surface.
- d. At the time of installation, RECPs shall be rejected, if they have defects, rips, holes, flaws, evidence of deterioration, or other damage.
- e. The Engineer may require adjustments in the installation requirements to fit individual conditions.

3. Installation - Channels:

RECPs installed in channels shall be unrolled parallel to the direction of water flow. The first roll shall be centered longitudinally in the channel and anchored with staples. Subsequent rolls shall be installed outward to the edges of the channel and be lapped to allow installation of a common row of anchors. RECP ends shall be overlapped with the upstream ends on top ("shingled"). Refer to the Contract Drawings and/or the Manufacturer's installation guidelines/instructions for installation details.

4. Installation - Slopes:

RECPs installed on slopes shall be oriented in vertical strips and anchored. Subsequent rolls shall be installed outward to the edge(s) of the original roll and be lapped to allow installation of a common row of anchors. RECP ends shall be shingled. Refer to the Contract Drawings and/or the Manufacturer's installation guidelines/instructions for installation details.

5. Maintenance:

Maintenance of RECPs shall be in accordance with Section 02270, Erosion and Sedimentation Control, of these Specifications.

Table 1: Required Rolled Erosion Control Product Properties

| Property | Test Method | Units | Value ¹ |
|--|-------------|---------------------|--|
| Erosion Control Blanket (ECB) (Single Net) | | | |
| Mass per Unit Area | ASTM D 6475 | lbs/yd ² | 0.5 ± 10% (Straw) 0.7 ± 10% (Excelsior) |
| Tensile Strength ² | ASTM D 6818 | lbs/ft | 50 x 65 |
| Tensile Elongation | ASTM D 6818 | % | 20 |
| Maximum Permissible Shear Stress (Un-Vegetated) | ----- | lbs/ft ² | 1.55 |
| Functional Longevity | ----- | months | 12 |
| Turf Reinforcement Mat (TRM) (Type 1) | | | |
| Mass per Unit Area | ASTM D 6566 | oz/yd ² | 8 |
| Thickness | ASTM D 6525 | inches | 0.35 |
| Tensile Strength ² | ASTM D 6818 | lbs/ft | 225 x 175 |
| Tensile Elongation | ASTM D 6818 | % | 50 (max.) |
| Resiliency | ASTM D 6524 | % | 80 |
| UV Resistance (1,000 Hours) | ASTM D 4355 | % | 80 |
| Maximum Permissible Shear Stress (Long-Term Vegetated) | Large Scale | lbs/ft ² | 5 |

Notes:

1. Typical for ECB; Minimum Average Roll Value (MARV) for TRM.
2. Values for machine and cross machine direction (MD x XD), respectively.

END OF SECTION

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SECTION 02520

WELL ABANDONMENT

Well Abandonment: Well Abandonment may include the complete over-reaming, removal, and grouting of wells and piezometers as noted herein and on the Contract Drawings.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Well Abandonment in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|------------------|----------------|
| Site Preparation | 02110 |

3. Drilling Contractor Qualifications:

Well Abandonment shall be performed by a licensed drilling contractor that has previous experience abandoning wells.

B. Materials Not Used.

C. Submittals

The Contractor shall submit the following to the Engineer prior to performance of the work:

1. Drilling Contractor Qualifications:

Submit proof of previous project experience with Well Abandonment.

2. Submit information on proposed drilling equipment and grout.

3. Documentation (abandonment forms, boring logs, etc.).

D. Construction

1. The Contractor shall notify the Engineer at least three business days prior to performance of Well Abandonment. No Well Abandonment shall take place unless the Engineer is on-site to observe the work.

2. Well Abandonment:

- a. The Contractor shall abandon the wells/piezometers as listed in Table 1 of this section.
- b. The Contractor shall abandon each well/piezometer as follows and in accordance with State well abandonment regulations (15A NCAC 2C.0113).
 - 1) Remove locking steel cover and concrete pad where applicable.
 - 2) For wells/piezometers completed in soil, over-ream each boring to the bottom of the borehole using hollow stem augers with an inside diameter larger than the original boring. Using a tremie pipe, place grout from the bottom of the borehole to the ground surface (Note that for wells/piezometers located in cut areas, grout shall be placed only to design subgrade elevations.).
 - 3) For wells/piezometers completed in rock use a tremie pipe to place grout from the bottom of the PVC casing to the ground surface (Note that for wells/piezometers located in cut areas, grout shall be placed only to design subgrade elevations.).

Alternative procedures must be approved in advance by the Engineer.

Table 1: Well Abandonment Schedule

| Well/ Piezometer | Completed in Soil or Rock | Outside Diameter of Soil Boring (Inches) | Total Depth (Feet) ¹ |
|---------------------|------------------------------|---|------------------------------------|
| G-14 | Soil/PWR | NA | 52.5 |
| G-15 | Soil/PWR | NA | 64.5 |
| G-17 | Soil | NA | 74.2 |

Notes:

1. Minor ($\leq 5\%$) differences may be expected in boring depths.

END OF SECTION

SECTION 02614

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

High Density Polyethylene (HDPE) Pipe: HDPE Pipe is used in the stormwater and landfill gas vent systems.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of HDPE Pipe in accordance with the Contract Drawings and these Specifications. The Contractor shall also clean and test pipelines where required.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------|----------------|
| Excavation | 02222 |
| Embankment | 02223 |
| Drainage Geocomposite | 02712 |
| LLDPE Geomembrane | 02778 |
| CQA Manual | Attached |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

| | |
|-------------|--|
| ASTM D 638 | Standard Test Method for Tensile Properties of Plastics. |
| ASTM D 790 | Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials. |
| ASTM D 1238 | Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer. |
| ASTM D 1505 | Standard Test Method for Density of Plastics by the Density-Gradient Technique. |
| ASTM D 1603 | Standard Test Method for Carbon Black in Olefin Plastics. |
| ASTM D 2837 | Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials. |

| | |
|-------------|---|
| ASTM D 3035 | Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter. |
| ASTM D 3261 | Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing. |
| ASTM D 3350 | Standard Specification for Polyethylene Plastics Pipe and Fitting Materials. |
| ASTM F 412 | Standard Terminology Relating to Plastic Piping Systems. |
| ASTM F 714 | Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter. |
| ASTM F 1417 | Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air. |
| ASTM F 1473 | Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins. |
| ASTM F 2164 | Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure. |

4. Quality Control:

The Contractor shall perform pressure testing of HDPE Pipe as described in this section.

5. Quality Assurance:

Quality Assurance during placement of HDPE Pipe will be provided by the Owner as described in the accompanying Project CQA Manual.

B. Materials

1. All HDPE Pipe shall be manufactured from new materials meeting the physical requirements shown in Table 1 of this section.
2. All HDPE Pipe shall have smooth interior walls and the DR (dimension ratio) and diameter of the pipe shall be as shown on the Contract Drawings.
3. All HDPE Pipe having an outside diameter 3.5 inches and larger shall meet the requirements of ASTM F 714. All HDPE Pipe having an outside diameter less than 3.5 inches shall meet the requirements of ASTM D 3035.
4. Visible defects, such as cracks, creases, crazing, non-uniformly pigmented areas, or undispersed raw materials shall not be acceptable and will result in rejection of the pipe by the CQA Engineer.

5. Pipe Perforations: The perforations of the perforated HDPE Pipe shall be as shown on the Contract Drawings.
6. All HDPE Pipe fittings shall be in accordance with ASTM D 3261 and shall be pressure rated to match the system piping. The fittings shall be manufactured from the same materials as the pipe itself. The butt fusion outlets of fittings shall be machined to the same DR as the system piping to which they are to be fused.

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all HDPE Pipe manufactured for the project has been produced in accordance with these Specifications.
2. Submit a copy of the HDPE Pipe Manufacturer's recommendations for shipping, handling, and storage of pipe.
3. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

4. Survey Results:

After placement of HDPE Pipe, survey results shall be submitted for review prior to acceptance.

D. CONSTRUCTION

1. Shipping , Handling, and Storage:

All HDPE Pipe shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. HDPE Pipe Installation:

- a. The Contractor shall install HDPE Pipe to the lines and grades shown on the Contract Drawings. Line and grade of piping shall be maintained with laser or approved equivalent. The Contractor shall give the CQA Engineer sufficient notice so that the he may observe field location and installation activities.
- b. Excavation for buried lines shall be backfilled as directed by the Engineer as shown on the Contract Drawings. Sand backfill or approved soil backfill compacted to at least 95 percent of the Standard Proctor dry density (ASTM D 698) shall be used.

Sharp stones or other potentially damaging material shall be removed from the base of the trench prior to placement of the piping. A leveling course, as required, shall consist of sand or other approved material.

- c. Pipe Connections: Joining of HDPE Pipe shall be as follows:
 - (1) General pipe sections shall be butt-fusion welded according to the Manufacturer's recommendations and shall be performed by an appropriately trained fusion technician.
 - (2) Pipe ends to be butt-fusion welded shall be clean and dry at the time of welding. No welding shall occur during precipitation or excessive moisture.
 - (3) The Contractor shall grind burrs or other potentially damaging areas in the welds prior to placement of the pipe.
 - (4) Specified bolted pipe connections shall be made as specified on the Contract Drawings using stainless steel hardware and neoprene gaskets.
 - (5) Polyethylene stub ends and flanges must be at the ambient temperature of the surrounding soil at the time they are bolted tight to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction of the polyethylene.
 - (6) Properly executed electrofusion fittings may be used.
 - (7) Where piping is designed to be inspected and cleaned via cleanout ports, appropriate fittings shall be used to facilitate movement of inspection and cleaning tools along the length of the pipe.
- d. Perforated HDPE Pipe shall be placed during construction as shown on the Contract Drawings.

3. Cleaning:

- a. All HDPE Pipe shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind and shall be kept clear of such accumulation until final acceptance of the work.

4. Pressure Testing:

- a. All solid piping where factory or field joints have been performed requires pressure testing prior to approval by the CQA Engineer, except as noted below:
 - (1) Any unjointed section of pipe showing visual signs of damage or that is of questionable quality may be required to be pressure tested as directed by the CQA Engineer.
 - (2) Cleanout risers within the containment areas do not require pressure testing.

- b. Pressure testing shall be conducted by the Contractor in a manner approved by the Engineer. Such testing shall be observed by the CQA Engineer.
- c. Down Pipes: Down pipes shall be tested using low-pressure air in accordance with ASTM F 1417.
- d. The pressures used in testing must not exceed the working pressure of the lowest rated component in the system (i.e. valves, meters, flanges, unions, etc.). The Manufacturer's recommendation for pressure testing may also be acceptable as an alternative if approved in advance by the Engineer.
- e. Pressure testing of short sections of piping to be placed in confined or inaccessible areas may be pressure tested by the Contractor prior to installation when approved by the Engineer. Temporary fittings, etc. required to plug section ends shall be provided by the Contractor at no expense to the Owner.
- f. Any piping that does not meet the pressure test criteria shall be repaired and retested at the Contractor's expense. No piping shall be approved until successful pressure testing is completed.

5. Surveying:

The Contractor shall survey all HDPE Pipe on 100 foot centers and at bends to ensure the proper location and grade of the piping.

- 6. All waste materials removed during installation of HDPE Pipe shall be disposed of on site in the active lined landfill as directed by the Owner and Engineer. The Contractor shall weigh waste materials at the facility scales prior to disposal. No tipping fee will be charged to the Contractor for disposal of these wastes.

Table 1: Required HDPE Pipe Properties

| Property | Test Method | Units | Value ¹ |
|-----------------------------------|-------------|-------------------|--------------------|
| Material Designation | ASTM D 412 | ----- | PE 3408 |
| Cell Classification | ASTM D 3350 | ----- | 345464 C |
| Density | ASTM D 1505 | g/cm ³ | 0.955 |
| Melt Flow Index | ASTM D 1238 | g/10 min | 0.1 |
| Flexural Modulus | ASTM D 790 | psi | 130,000 |
| Tensile Strength @ Yield | ASTM D 638 | psi | 3,200 |
| SCG (PENT) | ASTM F 1473 | hours | > 100 |
| Hydrostatic Design Basis at 73° F | ASTM D 2837 | psi | 1,600 |
| UV Stabilizer | ASTM D 1603 | % Carbon Black | 2 - 3% |

Notes:

1. Nominal Values.

END OF SECTION

SECTION 02712

DRAINAGE GEOCOMPOSITE

Drainage Geocomposite (DGC): The Drainage Geocomposite (DGC) consists of a geonet drainage core and heat-bonded nonwoven geotextile. The purpose of the DGC is to rapidly transmit flow to collection piping.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of DGC, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------|----------------|
| Vegetative Soil Layer | 02258 |
| HDPE Pipe | 02614 |
| LLDPE Geomembrane | 02778 |
| CQA Manual | Attached |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

| | |
|-------------|---|
| ASTM D 1505 | Standard Test Method for Density of Plastics by the Density-Gradient Technique. |
| ASTM D 1603 | Standard Test Method for Carbon Black in Olefin Plastics. |
| ASTM D 4218 | Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique. |
| ASTM D 4355 | Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus. |
| ASTM D 4491 | Standard Test Methods for Water Permeability of Geotextiles by Permittivity. |

| | |
|-------------|---|
| ASTM D 4632 | Standard Test Method for Grab Breaking Load and Elongation of Geotextiles. |
| ASTM D 4716 | Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products. |
| ASTM D 4751 | Standard Test Method for Determining Apparent Opening Size of a Geotextile. |
| ASTM D 5199 | Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes. |
| ASTM D 5261 | Standard Test Method for Measuring Mass per Unit Area of Geotextiles. |
| ASTM D 5321 | Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method. |
| ASTM D 6241 | Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50 mm Probe. |
| ASTM D 6243 | Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method. |
| ASTM D 7005 | Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites. |
| ASTM D 7466 | Standard Test Method for Measuring the Asperity Height of Textured Geomembrane. |

4. Quality Control:

The Contractor shall perform Quality Control tests in accordance with Table 3 of this section.

5. Quality Assurance:

Quality Assurance during installation of DGC will be provided by the Owner as described in the accompanying Project CQA Manual.

B. Materials

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall

have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each roll of DGC shall identify the length, width, lot and roll numbers, and name of Manufacturer.

2. The geonet drainage core shall be manufactured by extruding polyethylene strands to form a three dimensional structure to provide planer water flow.
3. A nonwoven needlepunched geotextile, consisting of polyester or polypropylene and manufactured in a manner approved by the Engineer, shall be heat-bonded to the geonet drainage core. Roll edges shall have a maximum unbonded length of 6 inches, unless otherwise approved by the Engineer. Heat bonding shall be performed by the Manufacturer prior to shipping to the site.
4. Final Cover Drainage Geocomposite:

Final Cover DGC shall have a nonwoven geotextile heat-bonded to both sides of the geonet drainage core. Physical properties of the DGC shall be as shown in Table 1 of this section.

Alternatively, the Final Cover DGC may consist of a series of small diameter pipes bonded on both sides within two non-woven geotextiles. This material shall be DRAINTUBE or approved equal meeting the geotextile and geocomposite properties as shown in Table 1 of this section.

C. Submittals

Prior to DGC installation, the Contractor shall submit the following to the CQA Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for the DGC attesting that the DGC meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of the DGC to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
2. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
3. Seaming Procedures:

Submit proposed seaming procedures including proposed method and equipment.
4. Quality Control Certificates: For DGC delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided which represent every roll of DGC. Each certification shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 2 of this section.

5. Contractor Quality Control Test Results: The Contractor shall provide the results of required testing.
6. Furnish copies of delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. Construction

1. Shipping, Handling, and Storage:

All DGC shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Failing CQA Material Control Tests:

DGC that is rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and quality assurance testing of DGC supplied as replacement for rejected material shall be performed by the CQA Engineer at Contractor's cost.

3. Installation:

- a. The DGC shall be placed only on Geomembrane that has been approved by the Geomembrane Installer and accepted by the CQA Engineer. The Contractor shall remove debris, including sediment to the degree possible, from the Geomembrane prior to placement of the DGC.
- b. DGC shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, the DGC shall be rejected, if it has defects, rips, holes, flaws, evidence of deterioration, or other damage. Isolated areas of up to 1 square yard where the geotextile has become delaminated from the geonet drainage core may be allowed by the CQA Engineer as long as there appears to be a good bond between the geotextile and the geonet in surrounding areas. Rolls where the geotextile appears to be easily delaminated from the geonet such as by foot or ATV traffic shall be rejected.
- c. Orientation: If the DGC transmits flow in a predominant direction (typically along the roll length), then the DGC shall be installed with the predominant flow direction laid approximately perpendicular to contour lines (i.e. in the direction of the slope) or as specified by the Engineer. Otherwise, DGC shall be installed with the machine direction (along the roll length) generally in the direction of flow or as specified by the Engineer.
- d. The DGC shall be placed smooth and free of excessive wrinkles.
- e. The Contractor shall provide temporary anchorage of the DGC at the top of perimeter and interior berms during installation as necessary to prevent movement during construction. Such anchorage may include sandbags and the like, as approved by the CQA Engineer. Permanent bonding to the Geomembrane shall be prohibited.

4. Seams:

- a. All seams constructed on slopes of 6H:1V or steeper or within 10 feet of the toe of a slope of 6H:1V or steeper shall be vertical seams, except where slope lengths exceed standard roll lengths and elsewhere as approved in advance by the Engineer. Where allowed by the Engineer, end seams on slopes of 6H:1V or steeper shall be staggered a minimum of 5 feet between adjacent rolls.
- b. Geonet Drainage Core: The geonet drainage core shall be laid with a 3 inch minimum overlap seam along roll edges and a 6 inch minimum overlap seam along roll ends and shall be secured using plastic ties. Ties shall be placed every 5 feet along roll edges; every 12 inches along roll ends; and every 6 inches in the anchor trench.
- c. Geotextile Component(s): Where applicable, the bottom geotextile of the DGC shall be overlapped with the same of the adjacent rolls. The top geotextile of the DGC shall be continuously sewn or heat bonded to the same of the adjacent rolls with methods approved by the Engineer.
 - (1) Seams to be sewn shall be sewn using a Type 401 stitch. One or two rows of stitching may be used. Each row of stitching shall consist of 4 to 7 stitches per inch. The minimum distance from the geotextile edge to the stitch line nearest to that edge (seam allowance) shall be 1.5 inches if a Type SSa (prayer or flat) seam is used. The minimum seam allowance for all other seam types shall be 1.0 inches.
 - (2) Seams to be heat bonded shall be bonded using hot plate, hot knife, ultrasonic, or other approved devices.

5. Repairs:

Any DGC that is torn, crushed, punctured, or otherwise damaged shall be repaired or replaced, as directed by the CQA Engineer, by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of material, placed over the damaged area and shall overlap the existing material a minimum of 12 inches from any point of the damage. The patch shall be connected to the geonet drainage core of the damaged material using plastic cable ties at a 6 inch spacing and the upper geotextile of the patch shall be spot sewn or heat bonded to the upper geotextile of the damaged material. A geotextile patch, spot sewn or heat bonded to the damaged material, may be used where damage is to only that portion of the DGC.

6. Cover Placement:

- a. DGC shall be covered in a timely manner to limit potential UV damage. Unless otherwise approved by the Engineer, covering shall occur within 30 days of installation. Extension of this time may be considered by the Engineer based on weather conditions (i.e. prolonged cloud cover during 30 day period) or technical information provided by the Manufacturer that would justify an extension.

- (1) The Engineer may conduct sampling and testing of any DGC exposed for a period longer than allowed to verify the material properties. The cost associated with this testing and the subsequent repair(s) shall be borne solely by the Contractor regardless of the test results. In no case will the maximum length of exposure be greater than 60 days without verification of material properties.
- b. Placement of materials over DGC shall be performed in a manner as to ensure that DGC and the underlying geosynthetics are not damaged; minimal slippage of DGC on the underlying geosynthetics occurs; no excess tensile stresses occur in the DGC; and that no portion of the DGC develops excessive wrinkles or crimp. Wrinkles that exceed approximately 6 inches in height and cannot be eliminated by amended placement and covering methods or DGC that becomes crimped shall be cut and repaired by the Geosynthetics Installer in a method approved by the Engineer.

Table 1: Required Drainage Geocomposite Properties

| Property | Test Method | Units | Value |
|--|--------------------|-----------------------|-------------------------------------|
| Geonet: | | | |
| Thickness | ASTM D 5199 | inches | 0.25 (See Note 1) |
| Density | ASTM D 1505 | g/cm ³ | 0.94 |
| Carbon Black Content | ASTM D 1603/D 4218 | % | 2-3 |
| Geotextile: | | | |
| Mass per Unit Area (Unit Wt.) | ASTM D 5261 | oz/yd ² | 6 |
| Tensile Properties: | ASTM D 4632 | | |
| Grab Strength | | lbs | 160 |
| Grab Elongation | | % | ≥ 50 |
| Puncture Resistance | ASTM D 6241 | lbs | 410 |
| Apparent Opening Size (AOS) | ASTM D 4751 | U.S. Sieve | 70+ |
| Permittivity | ASTM D 4491 | sec ⁻¹ | 1.0 |
| Ultraviolet Resistance (500 hrs) | ASTM D 4355 | % | 70 |
| Geocomposite: | | | |
| Ply Adhesion | ASTM D 7005 | lb/inch | 2.0 Typ. 1.0 Min. Avg. |
| Transmissivity: | ASTM D 4716 | m ³ /m/sec | 1.0 x 10 ⁻³ (See Note 2) |
| Interface Shear Strength (Peak) ³ | ASTM D 5321 | psf | 125 psf (Load = 200 psf) |

Notes:

1. A thicker geonet may be required depending on transmissivity requirements.
2. Final Cover:
Conduct test for transmissivity at a normal compressive load of 1,000 psf and at a hydraulic gradient of 0.33 after a seating period of at least 24 hours. Boundary conditions are soil (sand) interface on the upper geotextile and textured LLDPE geomembrane against the lower geotextile.
3. DGC shall have adequate adhesion against adjacent materials under low normal loads to achieve the successful installation of overlying components without slippage.

Table 2: Required Manufacturer Quality Control Tests

| Property | Test Method | Minimum Test Frequency |
|-----------------------------|--------------------|--------------------------------------|
| Geonet: | | |
| Thickness | ASTM D 5199 | 50,000 ft ² |
| Density | ASTM D 1505 | 50,000 ft ² |
| Carbon Black Content | ASTM D 1603/D 4218 | 50,000 ft ² |
| Geotextile: | | |
| Mass Per Unit Area | ASTM D 5261 | 200,000 ft ² |
| Tensile Properties | ASTM D 4632 | 200,000 ft ² |
| Puncture Resistance | ASTM D 6241 | 200,000 ft ² |
| Apparent Opening Size (AOS) | ASTM D 4751 | 600,000 ft ² |
| Permittivity | ASTM D 4491 | 600,000 ft ² |
| UV Resistance | ASTM D 4355 | 600,000 ft ² |
| Geocomposite: | | |
| Ply Adhesion | ASTM D 7005 | 100,000 ft ² |
| Transmissivity ¹ | ASTM D 4716 | 100,000 ft ² (See Note 2) |

Notes:

1. Conduct transmissivity tests in accordance with the criteria given in Table 1.
2. The required Manufacturer's quality control testing for transmissivity may be reduced to one test per resin lot or one test per 500,000 ft² (whichever provides the larger number of tests) if the minimum measured transmissivity is at least 50% greater than specified.

Table 3: Required Contractor Quality Control Tests

| Property | Test Method | Minimum Test Frequency |
|--------------------------|----------------------------------|------------------------|
| Interface Shear Strength | ASTM D 5321 ASTM D 6243 (GCL) | (See Note 1) |

Notes:

1. Test each interface to be used on this project using representative samples of materials to be supplied under normal loads indicated and using test parameters as specified by the Engineer. For this project, interfaces to be tested are:
 - A. Textured LLDPE (40 mil) against existing cover soils (intermediate cover);
 - B. Drainage Geocomposite against textured LLDPE-GM (30 mil); and
 - C. Vegetative Soil Layer against Drainage Geocomposite.

If there are material differences in the surface of any of the geosynthetic materials from one side to the other, then all possible combinations of interfaces shall be tested. This testing shall be performed at Contractor cost by an independent GAI accredited laboratory and submitted to the Engineer for review prior to shipping. Upon review of test results, the Engineer may allow exceptions to the above criteria.

For tests involving textured geomembranes, the laboratory shall also report the asperity height (ASTM D 7466) for the material samples used in the actual direct shear tests.

END OF SECTION

SECTION 02720

STORMWATER SYSTEMS

Stormwater Systems: Stormwater Systems shall include all piping, pipe fittings, flared end sections, and other appurtenances designated to convey stormwater.

A. Description

1. General:

The contractor shall furnish all labor, material, and equipment to complete installation of Stormwater Systems in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Excavation | 02222 |
| Embankment | 02223 |
| Erosion and Sedimentation Control | 02270 |
| Rip Rap | 02271 |
| HDPE Pipe | 02614 |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM), the American Association of State Highway and Transportation Officials (AASHTO), and the North Carolina Department of Transportation (NCDOT) are hereby made a part of these specifications.

| | |
|-------------|--|
| ASTM C 76 | Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe. |
| ASTM C 150 | Standard Specification for Portland Cement. |
| ASTM D 1248 | Standard Specification for Polyethylene Plastics Molding and Extrusion Materials For Wire and Cable. |
| ASTM D 2321 | Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications. |
| ASTM D 3350 | Standard Specification for Polyethylene Plastics Pipe and Fittings Materials. |
| AASHTO M 36 | Specification for Corrugated Steel Pipe. |

| | |
|--------------|---|
| AASHTO M 252 | Specification for Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter. |
| AASHTO M 294 | Specification for Corrugated Polyethylene Pipe, 12 to 36 Inch Diameter. |
| NCDOT | Standard Specifications for Roads and Structures and Roadway Standard Drawings. |

B. Materials

1. Flared End Sections:

Flared end sections shall be reinforced and shall be fabricated from the same materials meeting the same requirements as the pipe to which they are connected. All reinforced concrete and corrugated metal flared end sections shall meet the requirements of the NCDOT. Corrugated polyethylene flared end sections shall be as recommended by the pipe manufacturer.

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all Stormwater Systems have been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. Construction

1. All piping shall be installed by skilled workmen and in accordance with the best standards for piping installation. Proper tools and appliances for the safe and convenient handling and installation of the pipe and fittings shall be used.
2. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced at the Contractor's expense.
3. Excavation and backfilling of pipe trenches shall be as described in Section 02222, Excavation and Section 02223, Embankment, respectively, of these Specifications.
4. Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe and fittings. Proper facilities shall be provided for lowering sections of pipe into trenches. No materials shall be dropped or dumped into the trench.
5. Water shall be kept out of the trench until jointing and backfilling are completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so

that no water, earth, or other substance will enter the pipes, fittings, or valves. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored as required.

6. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade.
7. The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints, and fittings. Before joints are made, each pipe shall be well bedded on a solid foundation. No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid by the Contractor at his own expense.

END OF SECTION

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SECTION 02725

GABIONS

Gabions: This section includes all stone filled Gabion (basket) linings, including both box Gabions and Gabion (Reno) mattresses.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Gabions for protection of earthen slopes against erosion as indicated including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Erosion and Sedimentation Control | 02270 |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the U.S. Federal Specifications are hereby made a part of these Specifications.

ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

U.S. Federal Specification QQ-W-461H.

B. Materials

1. Stone for Gabions: Stone for Gabions shall be sound, durable, and free from seams, cracks, and other structural defects. Stone shall be of the size indicated in Table 1 of this section.

2. Gabions:

a. Gabions shall be as manufactured by Maccaferri Gabions, Inc., or approved equal. Sizes shall be as shown on the Contract Drawings.

b. Gabions shall be manufactured in such a manner that their sides, ends, lid, and diaphragm(s) can be assembled to form rectangular units of the specified dimensions. Gabions shall be of a single unit construction. The front, base, back, and lid shall be woven into a single unit. The ends and diaphragm(s) shall be

factory connected to the base. All perimeter edges of the mesh forming the Gabion shall be securely selvedged so that the joints obtained have at least the same strength as the wire mesh itself.

c. Dimensions:

(1) Box Gabions (Thickness \geq 1 Foot): The Gabion length shall be 2, 3, or 4 times its horizontal width. The horizontal width shall not be less than 36 inches. Where the Gabion length exceeds 1.5 times its horizontal width, the Gabion shall be divided into cells of equal length by diaphragm(s) of the same mesh and gauge as the Gabion body.

d. Materials and Fabrication:

- (1) All wire used in the fabrication of Gabions and in the wiring operations shall be galvanized and shall conform to U.S. Federal Specifications QQ-W-461H and possess soft tensile strength with a Class 3, Finish 5 zinc coating in accordance with ASTM A 641.
- (2) All mesh joints shall be flexible and double twisted to prevent unraveling.
- (3) All wire and coating for Gabions shall be as indicated in Table 1 of this section.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results prior to installation, that all Gabions have been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. Construction

1. Surface Preparation:

- a. Trim and dress all areas to conform to the Contract Drawings as indicated with tolerance of 2 inches from theoretical slope lines and grades.
- b. Bring areas that are below allowable minimum tolerance limit to grade by filling with compacted Embankment material similar to adjacent material.
- c. Geotextiles shall be placed as shown on the Contract Drawings and in accordance with Section 02240, Geotextiles, of these Specifications.
- d. Do not place any Gabions on the prepared surface prior to inspection and approval to proceed from the Engineer.

2. Installing Gabions:

- a. Assemble and erect Gabions according to the manufacturer's instructions. Remove components from the bundles, unfold flat on the ground, and flatten all kinks and bends.

Assemble units individually, by erecting the sides, ends, and diaphragm(s), ensuring that all creases are in the correct position and the tops of all sides levels, all in accordance with manufacturer's instructions.

The four corners of the unit shall be laced first, after overlapping the mesh, followed by lacing the edges of the internal diaphragm(s) to the sides.

The recommended lacing procedure consists of cutting a length of lacing wire (approximately 1½ times the distance to be laced -- not to exceed 5 feet). Secure the wire terminal at the corner by looping and twisting, then proceed to lace with alternating single and double loops at approximately four (4) to five (5) inch intervals.

- b. Carry the assembled units to the job site and place in their proper location. For structural integrity, all adjoining empty units must be laced along the perimeter of their contact surfaces to obtain a monolithic structure.
- c. Fill units with stone specified.

Care shall be taken when placing fill material to assure that the steel wire mesh will not be broken or damaged.

Along all exposed Gabion edges, the outer layer of stone shall be carefully placed and packed by hand, in order to ensure proper alignment and a neat, compact, square appearance.

The last layer of stone shall be level with or slightly higher than the top of the unit to allow proper closing of the lid.

Well packed filling without undue bulging, and secure lacing, is essential in all structures.

- d. The lids shall be stretched tight over the fill, using crowbars or lid closing tools, until the lid meets the perimeter edges of the front and end panels.

The lid shall then be tightly laced along all edges, ends, and diaphragm(s) in the same manner as described above for assembling. Adjacent lids may be wired down simultaneously. All ends of wire shall be turned into the mesh on completion of each Gabion.

- e. Where shown on the drawings or otherwise directed by the Engineer, the mesh shall be cut, folded, and wired together to suit existing site conditions. The mesh must be cleanly cut and the surplus mesh cut out completely, or folded back and

neatly wired to an adjacent unit. The cut edges of the mesh shall be securely laced together with lacing wire in the manner described above for assembling.

Table 1: Required Gabion Properties

| Property | Value ¹ | |
|---------------|--------------------------|--------------------------|
| | Box Gabions | Gabion (Reno) Mattresses |
| Stone Size | 4" to 8" | 3" to 6" |
| Mesh Opening | Hexagonal, 3.25" x 4.25" | Hexagonal, 2.5" x 3.25" |
| Zinc Coating | 0.80 oz/ft ² | 0.70 oz/ft ² |
| Mesh Wire | 0.120" (US Gauge 11) | 0.087" (US Gauge 13.5) |
| Lacing Wire | 0.087" (US Gauge 13.5) | 0.087" (US Gauge 13.5) |
| Selvedge Wire | 0.154" (US Gauge 9) | 0.106" (US Gauge 11) |

Notes:

1. Nominal Values.

END OF SECTION

SECTION 02778

LLDPE GEOMEMBRANE

LLDPE Geomembrane (LLDPE-GM): The LLDPE Geomembrane serves as the primary hydraulic barrier in the landfill final cover. It is of great importance that the LLDPE-GM be free from defects and installed free from damage.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of LLDPE-GM including all necessary and incidental items as detailed or required to complete the installation in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------|----------------|
| Excavation | 02222 |
| Embankment | 02223 |
| Vegetative Soil Layer | 02258 |
| Drainage Geocomposite | 02712 |
| CQA Manual | Attached |

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the Geosynthetic Research Institute (GRI) are hereby made a part of these Specifications.

| | |
|-------------|---|
| ASTM D 792 | Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement. |
| ASTM D 1004 | Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting. |
| ASTM D 1505 | Standard Test Method for Density of Plastics by the Density-Gradient Technique. |
| ASTM D 1603 | Standard Test Method for Carbon Black in Olefin Plastics. |
| ASTM D 5199 | Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes. |

| | |
|-------------|--|
| ASTM D 5321 | Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method. |
| ASTM D 5596 | Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics. |
| ASTM D 5820 | Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes. |
| ASTM D 5994 | Standard Test Method for Measuring Core Thickness of Textured Geomembrane. |
| ASTM D 6392 | Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods. |
| ASTM D 6693 | Standard Test Method for Determining Tensile Properties of Nonreinforced Flexible Polyethylene and Nonreinforced Polypropylene Geomembranes. |
| ASTM D 7466 | Standard Test Method for Measuring the Asperity Height of Textured Geomembrane. |
| GRI GM9 | Cold Weather Seaming of Geomembranes. |
| GRI GM17 | Standard Specification for Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes. |
| GRI GM19 | Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes. |

4. Quality Control:

- a. The Contractor shall perform Quality Control tests in accordance with Table 2 of this section.
- b. The Geomembrane Installer shall follow the procedures and requirements described in the accompanying Project CQA Manual during installation of LLDPE-GM including performing and documenting trial seams, nondestructive and destructive Quality Control tests, and repairs.

5. Quality Assurance:

Quality Assurance during installation of LLDPE-GM will be provided by the Owner as described in the accompanying Project CQA Manual.

6. Manufacturers Qualifications:

The Manufacturer shall have previously demonstrated his ability to produce the required LLDPE-GM by having successfully manufactured a minimum of 5,000,000 ft² of LLDPE-GM for hydraulic containment purposes.

7. Installer Qualifications:

- a. Installation of the LLDPE-GM shall be performed by an Installer that has installed a minimum of 5,000,000 ft² of LLDPE-GM (or similar material) within the past five (5) years in similar landfill installations.
- b. All Installation Supervisors assigned to the Project shall have previously managed the installation of at least 2,000,000 ft² of LLDPE-GM (or similar material) using the same techniques to be used on site.
- c. All seaming equipment operators shall have demonstrated performance on previous geomembrane installations and/or documented training.

8. Warranties:

- a. General: Should a defect occur, which is covered under warranty, the Warrantor shall bear all costs for repair and/or relocation and replacement of the LLDPE-GM.
- b. Workmanship: The Contractor shall furnish the Owner a warranty from the Installer of the LLDPE-GM which warrants their workmanship to be free of defects on a prorata basis for five (5) years after the final acceptance of the Work. This warranty shall include but not be limited to all field seams, anchor trenches, attachments to appurtenances, and penetration seals, as applicable.
- c. Manufacturer's Warranty: The Contractor shall furnish the Owner a warranty from the LLDPE-GM Manufacturer for the materials used. The material warranty shall be for defects or failures related to manufacture on a prorata basis for five (5) years after the date of shipment.

B. Materials

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes. The LLDPE-GM and LLDPE-GM Manufacturer shall be approved by the Engineer.

The LLDPE-GM shall be supplied in rolls which shall have a minimum width of 22 feet. The roll length shall be maximized to provide the largest manageable sheet for the fewest seams. Labels on the roll shall identify the thickness, length, width, lot and roll numbers, and name of Manufacturer.

2. LLDPE-GM Materials:

- a. Textured LLDPE-GM shall be 40 mils thick. Resin and sheet properties of LLDPE-GM shall meet or exceed the requirements of GRI GM17 and Table 1 of this section.
- b. Materials classified as Very Flexible Polyethylene (VFPE) which otherwise meet the requirements of this section are also acceptable.

3. Extrusion Resin/Typical Extrudate:

Extrusion resin/typical extrudate used for extrusion seaming of LLDPE-GM shall be linear low density polyethylene (LLDPE). Physical properties shall be the same as the LLDPE-GM sheet. The extrudate's additives shall be thoroughly dispersed throughout the rod or bead. The extrudate shall be free of contamination by moisture or foreign matter and shall be recommended for use with the associated sheet material.

4. Texturing:

Textured LLDPE-GM, where required, shall be fabricated using coextrusion or impingement methods. Texturing shall not be created by lamination, impingement, or embossing. All texturing shall be uniform in appearance and coverage on the finished sheet. Textured LLDPE-GM shall be textured on both sides of the sheet.

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

1. Pre-Installation Requirements:

Prior to LLDPE-GM installation, the Contractor shall submit the following:

- a. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for the LLDPE-GM attesting that the LLDPE-GM meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of the LLDPE-GM to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
- b. Qualifications:
 - (1) Submit list of equipment and personnel proposed for the Project. Include equipment type and quantities. Include personnel experience on similar projects.
 - (2) Submit resume and references of Installation Supervisor to be assigned to the Project, including data and duration of employment and pertinent experience information.

- (3) Submit resumes and references of installation personnel who will perform seaming operations, including dates and durations of employment and pertinent experience information.

- c. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.

- d. Delivery Date: Submit notification of the scheduled delivery dates for the materials.

- e. Installation Procedures and Drawings:

Submit installation procedures and (shop) drawings for carrying out the work.
 - (1) Installation procedures to be addressed shall include but not be limited to material installation, repair, and protection to be provided in the event of rain or strong winds.

 - (2) Shop drawings shall have LLDPE-GM sheet layout with proposed size, number, position, and sequence of placing all panels, and indicating the location of all field seams. Shop drawings shall also show complete details and/or methods for anchoring the LLDPE-GM, making field seams, and making seals around pipes and structures penetrating the LLDPE-GM (if applicable).
Following review, these procedures and drawings shall be used for installation of the LLDPE-GM. Any deviations from these procedures and drawings must be approved by the Engineer and CQA Engineer.

- f. Quality Control Certificates: For LLDPE-GM delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided which represent every roll of LLDPE-GM. Each certificate shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall meet or exceed the requirements of GRI GM17.

- g. Contractor Quality Control Test Results: The Contractor shall provide the results of required testing.

- h. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

2. Post-Installation Requirements:

Upon completion of the LLDPE-GM installation, the Contractor shall submit the following:

- a. Certificate stating that the LLDPE-GM has been installed in accordance with the Drawings, Specifications, and the Manufacturer's recommendations.
- b. Completed Manufacturer's and workmanship warranties.
- c. Record Information: Record information shall include but not be limited to:
 - (1) CQC Documentation: Includes trial seam logs, panel placement logs, panel seaming logs, non-destructive seam testing report forms, field destructive seam testing report forms, and repair logs.
 - (2) As-Built Drawing: Includes the requirements listed in Paragraph D.8 (Surveying) of this Specification.

Finalization of payment for LLDPE-GM installation shall not be made until the above submittals have been reviewed by the CQA Engineer.

D. CONSTRUCTION

1. Shipping, Handling, and Storage:

The LLDPE-GM shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Failing CQA Material Control Tests:

LLDPE-GM that is rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and CQA testing of LLDPE-GM supplied as replacement for rejected material shall be performed by the CQA Engineer at Contractor's cost.

3. Subgrade Preparation:

- a. The surface of the subgrade shall be smooth, uniform, free from sudden changes in grade (such as vehicular ruts), rocks or stones greater than 1/2 inch in size, debris, and deleterious materials. During actual placing and seaming of the LLDPE-GM, the subgrade shall be kept free of all standing water. If the subgrade below the LLDPE-GM becomes excessively wet and unstable as determined by the CQA Engineer, it shall be dried and recompacted, and replaced if needed.
- b. Before an individual panel of LLDPE-GM is installed; the Contractor and Installer shall verify in writing and submit to the CQA Engineer:
 - (1) Lines and grades are in conformance with the Drawings and Specifications.

- (2) The surface area to be lined has been rolled and compacted, free of irregularities and abrupt changes in grade.

4. LLDPE-GM Placement:

a. Weather Conditions:

LLDPE-GM placement shall not proceed at an ambient temperature below 32° F or above 100° F unless otherwise authorized, in writing, by the Engineer. Installation of LLDPE-GM at temperatures below 32° F, if authorized by the Engineer, shall follow GRI GM9. LLDPE-GM placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or in excessive winds. Any portion of LLDPE-GM or subgrade damaged due to weather conditions shall be repaired at the Contractor's cost.

b. Method of Placement:

- (1) Each panel of the LLDPE-GM shall be installed in accordance with the approved shop drawings prepared by the Contractor. The layout shall be designed to keep field seaming of the LLDPE-GM to a minimum and consistent with proper methods of LLDPE-GM installation.
- (2) Panels shall be oriented perpendicular to the line of the slope crest (i.e., down and not across slope).
- (3) The LLDPE-GM shall be placed smooth and free of excessive wrinkles.
- (4) LLDPE-GM rolls shall be placed using proper spreader and rolling bars with cloth slings. If a sheet must be displaced a distance greater than its width, a slip sheet shall be used.
- (5) The CQA Engineer shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the CQA Engineer and as described in this section.
- (6) The Installer shall avoid dragging the LLDPE-GM on rough soil subgrades.
- (7) All LLDPE-GM shall be anchored as shown on the Contract Drawings and consistent with Manufacturer's recommendations.
- (8) Personnel working on the LLDPE-GM shall not smoke, wear damaging shoes, or involve themselves in any activity that may damage the LLDPE-GM, in the opinion of the CQA Engineer.
- (9) The LLDPE-GM shall be properly weighted to avoid uplift due to wind.
- (10) Vehicular traffic across the LLDPE-GM shall not be allowed, except that four-wheel (or greater) all-terrain vehicles (ATVs) with low ground

pressure may be allowed if approved in advance by the Engineer. The Contractor shall submit proposed equipment and procedures for use of ATVs to the CQA Engineer as part of his submittals. If ATVs are allowed by the Engineer, each ATV shall be operated such that no sudden stops, starts, or turns are made.

- (11) All damage shall be recorded and located on the record drawings.
- (12) When tying into existing LLDPE-GM, excavation of previously installed geosynthetics shall be performed in a manner that minimizes damage to the existing geosynthetics and as approved by the Engineer. All damage to the existing geosynthetics shall be repaired by the Geosynthetics Installer at the Contractor's sole expense.
- (13) The LLDPE-GM shall be kept free of debris, unnecessary tools, and materials. In general, the LLDPE-GM area shall remain neat in appearance.

c. Pipe Penetrations:

All pipe penetrations through the LLDPE-GM shall be as shown in the Contract Drawings. Alternative penetration details may be approved by the Engineer and CQA Engineer.

5. Field Seams:

- a. Individual panels of LLDPE-GM shall be laid out and overlapped by a minimum of 4 inches prior to seaming. The area to be seamed shall be cleaned and prepared in accordance with the Manufacturer's recommendations.
- b. Dual or single track hot wedge methods shall be used for straight seams.
- c. Extrusion fillet methods shall be used to seam cross seam tees, patches, repairs, and penetration boots. All extrudate shall be free of dirt, dry, and protected from damage. To limit overgrinding, the amount of grinding exposed after an extrusion seam is completed shall be less than 1/4 inch.
- d. The seaming equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the LLDPE-GM so as to ensure that changes in environmental conditions will not affect the integrity of the seam.
- e. All seams shall have a seam number that corresponds with the panel layout numbers. The numbering system shall be used in the development of the record drawings. Seam numbers shall be derived from the combination of the two panel numbers that are to be seamed together.
- f. Where horizontal seams are required on sloped surfaces, the panels shall be placed such that the "upstream" panel forms the upper panel and overlaps the "downstream" panel in order to minimize infiltration potential. All seams

constructed on slopes of 6H:1V or steeper shall be vertical seams, except where slope lengths exceed standard roll lengths and elsewhere as approved in advance by the Engineer. Where approved, end seams on slopes of 6H:1V or steeper shall be staggered a minimum of 5 feet and shall be made at an angle of approximately 45 degrees.

- g. All panels placed on slopes of 6H:1V or steeper shall extend a minimum of 5 feet beyond the grade break with a slope flatter than 6H:1V.
- h. All seams shall extend to the full extent of the anchor trench (where applicable).
- i. Unless otherwise approved by the Engineer, all "T" seams (i.e., the result of three panels placed together) shall be staggered a minimum of 3 feet along either seam and shall be covered with a patch.
- j. No junctions of four or more panels shall be allowed unless approved by the Engineer.
- k. If extrusion seaming equipment is stopped for longer than one minute, it shall be purged to remove heat-degraded extrudate. All purged extrudate shall be placed on a sacrificial sheet and disposed of.
- l. To prevent moisture buildup during seaming, it may be necessary to place a movable protective layer of plastic directly below each overlap of LLDPE-GM that is to be seamed.
- m. If required, a firm substrate shall be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support.
- n. Excessive wrinkles along geomembrane seams shall be minimized. Fish-mouths or large wrinkles shall be cut along the ridge of the wrinkle to allow a flat overlap, which shall be re-seamed. All cuts shall be repaired with a patch.
- o. All seams (including repairs) shall meet or exceed the requirements of GRI GM19 and Table 3 of this section.
- p. No overlying material shall be placed over the LLDPE-GM until approved by the CQA Engineer.

6. Anchor Trench:

- a. The anchor trench shall be constructed as shown on the Contract Drawings and as specified herein. The anchor trench shall be maintained by the Contractor.
- b. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the LLDPE-GM.
- c. The anchor trench shall be adequately drained to prevent water ponding and softening to adjacent soils. The anchor trench shall be backfilled with controlled fill material and compacted to 90% standard Proctor dry density (ASTM D 698).

- d. If the anchor trench is located in a clay susceptible to desiccation, the amount of trench open at any time shall be limited to one day of LLDPE-GM installation capacity.

7. Repair Procedures:

- a. Any portion of the LLDPE-GM exhibiting signs of defect or failing a nondestructive or a destructive test, shall be repaired by the Geomembrane Installer. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be made by the CQA Engineer. The procedures available include:
 - (1) Patching - Apply a new piece of LLDPE-GM sheet over, and at least 6-inches beyond the limits of a defect. The patch shall be extrusion seamed to the underlying LLDPE-GM. This method should be used to repair holes, tears, destructive test locations, undispersed raw materials, contamination by foreign matter, dents, pinholes, and pressure test holes.
 - (2) Capping - Apply a new strip of LLDPE-GM along the length of a delineated faulty seam. The cap strip shall extend at least 6-inches beyond the limit of the seam and the edges shall be extrusion seamed to the underlying LLDPE-GM. This method should be used to repair lengths of extrusion or hot wedge seams.
 - (3) Replacement - The faulty seam is removed and replaced.
- b. In addition, the following provisions shall be satisfied:
 - (1) Surfaces of the LLDPE-GM which are to be repaired shall be abraded no more than one hour prior to the repair;
 - (2) All surfaces must be clean and dry at the time of the repair;
 - (3) All seaming equipment used in repairing procedures must be approved;
 - (4) The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the CQA Engineer;
 - (5) Extrusion seaming of flaps of dual track hot wedge seams is not acceptable. A patch or cap strip shall be used; and
 - (6) Patches or caps shall extend at least 6-inches beyond the edge of the defect, and all patch corners shall be rounded.

8. Edge of Cover Markers:

The Contractor shall place edge of cover markers where shown on the Contract Drawings along the limits of the geomembrane. These markers shall be considered incidental to the LLDPE-GM installation.

9. Surveying:

- a. After completion of a segment of LLDPE-GM, the Contractor shall survey LLDPE-GM to obtain the following information:
 - (1) Location and numbering of all panels/seams.
 - (2) Location of all repairs/patches;
 - (3) Location of all destructive test locations; and
 - (4) Location of all pipe penetrations and other appurtenances (if applicable).
- b. No overlying materials shall be placed before survey information is obtained.
- c. The Contractor shall provide the CQA Engineer with updated survey information when requested by the CQA Engineer to verify that the required information is being obtained.

10. Cover Placement:

Placement of materials over LLDPE-GM shall be performed in a manner as to ensure that LLDPE-GM and the underlying geosynthetics are not damaged; minimal slippage of LLDPE-GM on the underlying geosynthetics occurs; no excess tensile stresses occur in the LLDPE-GM; and that no portion of the LLDPE-GM develops excessive wrinkles or crimp. Wrinkles that exceed approximately 6 inches in height and cannot be eliminated by amended placement and covering methods or LLDPE-GM that becomes crimped shall be cut and repaired by the Geosynthetics Installer in a method approved by the Engineer.

Table 1: Required LLDPE-GM Properties

| Property | Test Method | Units | Value |
|---|-------------|-------|-------------------|
| | | | 40 mil Textured |
| Interface Shear Strength (Peak) ^{1, 2} | ASTM D 5321 | psf | 125 psf (200 psf) |

Notes:

1. Textured LLDPE-GM shall have adequate adhesion against adjacent materials under low normal loads to achieve the successful installation of overlying components without slippage.
2. Note that the required values for textured LLDPE-GM may require an aggressively textured sheet.

Table 2: Required Contractor Quality Control Tests

| Property | Test Method | Minimum Test Frequency |
|--------------------------|-------------|------------------------|
| Interface Shear Strength | ASTM D 5321 | (See Note 1) |

Notes:

1. Test each interface to be used on this project using representative samples of materials to be supplied under normal loads indicated and using test parameters as specified by the Engineer. For this project, interfaces to be tested are:
 - A. Textured LLDPE-GM (40 mil) against existing cover soils (intermediate cover);
 - B. Drainage Geocomposite against textured LLDPE-GM (40 mil); and
 - C. Vegetative Soil Layer against Drainage Geocomposite.

If there are material differences in the surface of any of the geosynthetic materials from one side to the other, then all possible combinations of interfaces shall be tested. This testing shall be performed at Contractor cost by an independent GAI accredited laboratory and submitted to the Engineer for review prior to shipping. Upon review of test results, the Engineer may allow exceptions to the above criteria.

For tests involving textured geomembranes, the laboratory shall also report the asperity height (ASTM D 7466) for the material samples used in the actual direct shear tests.

Table 3: Required Seam Strength Properties

| Property | Test Method | Value | |
|--|-------------|-----------------|------------------------|
| | | Hot Wedge Seams | Extrusion Fillet Seams |
| 40 mil: | | | |
| Shear Strength ¹ | ASTM D 6392 | 60 lbs/inch | |
| Shear Elongation at Break ² | | 50% | |
| Peel Strength ¹ | | 50 lbs/inch | 44 lbs/inch |
| Peel Separation (Incursion) | | ≤ 25% | |
| Locus-of-Break | | See Note 3 | |

Notes:

1. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values.
2. Omit elongation measurements when performing field tests.
3. Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D 6392 (in this regard, SIP is an acceptable break code):

Hot Wedge: AD and AD-BRK with > 25% Separation

Extrusion Fillet: AD1, AD2, and AD-WLD (unless strength is achieved).

END OF SECTION

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SECTION 02930

REVEGETATION

Revegetation: Revegetation includes permanent Revegetation of all site areas disturbed by the Contractor whether inside the Contract Limits or not.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Revegetation in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

| <u>Work</u> | <u>Section</u> |
|-----------------------------------|----------------|
| Excavation | 02222 |
| Embankment | 02223 |
| Vegetative Soil Layer | 02258 |
| Erosion and Sedimentation Control | 02270 |
| Rolled Erosion Control Products | 02275 |

3. Warranty:

The Contractor shall be responsible for the satisfactory establishment and growth of a permanent stand of vegetation for a period of one year following the final seeding as judged by the Engineer. During this period, the Contractor shall be responsible for the maintenance items described in Paragraph D.4 (Maintenance) of this Specification.

B. Materials

1. Limestone: Unless otherwise defined by specific soil tests, supply agricultural grade ground limestone conforming to the current "Rules, Regulations, and Standards of the Fertilizer Board of Control."

2. Fertilizer: Unless otherwise defined by specific soil tests, supply commercial fertilizer meeting applicable requirements of State and Federal law. Do not use cyanamic compounds of hydrated lime. Deliver fertilizer in original containers labeled with content analysis.

3. Grass Seed: Supply fresh, clean, new-crop seed. Do not use seed which is wet, moldy, or otherwise damaged. Deliver seed in standard sealed containers labeled with producer's name and seed analysis, and in accord with US Department of Agriculture Rules and Regulations under Federal Seed Act.

4. Mulch: Supply clean, seed-free, threshed straw of oats, wheat, barley, rye, beans, or other locally available mulch material.
 - a. Do not use mulch containing a quantity of matured, noxious weed seeds or other species that will be detrimental to seeding, or provide a menace to surrounding land.
 - b. Do not use mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.
5. Binder: Supply emulsified asphalt or synthetic binder.
6. Water: Supply potable, free of substances harmful to growth.
7. Application rates, seed types, and other requirements shall be in accordance with Table 1 of this section.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Results of soil tests performed and proposed modifications, if any, to the specified requirements.
2. Certificates for each grass seed mixture, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed. Certify that each container of seed delivered is fully labeled in accordance with Federal Seed Act and equals or exceeds specification requirements.
3. Copies of invoices for fertilizer, showing grade furnished and total quantity applied.

D. Construction

1. The Contractor shall establish a smooth, healthy, uniform, close stand of grass from the specified seed. Prior to Revegetation, the Contractor shall adequately test the soils to be revegetated to ensure the adequacy of the specified requirements. Any modifications to these requirements deemed necessary after the review of soil test results, shall be at the Contractor's sole expense. The Engineer will perform the observations to determine when successful Revegetation is achieved.
2. Soil Preparation:
 - a. Limit preparation to areas which will be planted soon after preparation.
 - b. Loosen surface to minimum depth of four (4) inches.
 - c. Remove stones, sticks, roots, rubbish and other extraneous matter over three (3) inches in any dimension.

- d. Spread lime uniformly over designated areas at the rate specified in Table 1 of this section.
- e. After application of lime, prior to applying fertilizer, loosen areas to be seeded with double disc or other suitable device if soil has become hard or compacted. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
- f. Distribute fertilizer uniformly over areas to be seeded at the rate specified in Table 1 of this section.
 - (1) Use suitable distributor.
 - (2) Incorporate fertilizer into soil to depth of at least two (2) inches.
 - (3) Remove stones or other substances which will interfere with turf development or subsequent mowing.
- g. Grade seeded areas to smooth, even surface with loose, uniformly fine texture.
 - (1) Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
 - (2) Fine grade just prior to planting.

3. Seeding:

- a. Use approved mechanical power driven drills or seeders, mechanical hand seeders, or other approved equipment.
- b. Distribute seed evenly over entire area at the rate specified in Table 1 of this section.
- c. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds, excessive moisture, or other factors.
- d. Resume work only when favorable condition develops, or as directed by the Engineer.
- e. Lightly rake seed into soil followed by light rolling or cultipacking.
- f. Immediately protect seeded areas against erosion by mulching or placing Rolled Erosion Control Products in accordance with Section 02275 of these Specifications, where applicable.
 - (1) Spread mulch in a continuous blanket at the rate specified in Table 1 of this section.

- (2) Immediately following spreading mulch, secure with evenly distributed binder at the rate specified in Table 1 of this section.
- (3) For slopes not steeper than 3H:1V and as an option to using binder to secure mulch, use a mulch anchoring tool operated along the contour of the slope.

4. Maintenance:

The Contractor shall be responsible for maintaining all seeded areas through the end of his warranty period. The Contractor shall provide, at his expense, protection of all seeded areas against damage at all times until acceptance of the work. Maintenance shall include, but not be limited to, the following items:

- a. Regrade and revegetate all eroded areas until adequately stabilized by grass.
- b. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
- c. Replant bare areas using same materials specified.

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OPERATIONS MANUAL

Brownfield Road C&D Landfill
Raleigh, North Carolina
NC Solid Waste Permit No. 92-31

Prepared for:



Wake Reclamation, LLC
(a Waste Industries Company)
Raleigh, North Carolina

October 2015

Prepared by:

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OPERATIONS MANUAL

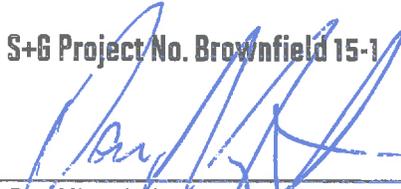
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Prepared For:

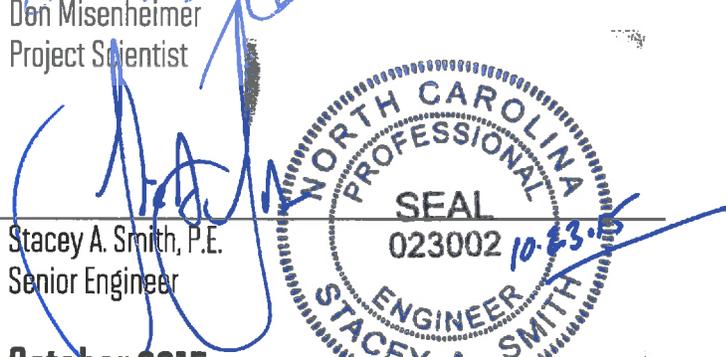


Wake Reclamation, LLC
Raleigh, North Carolina

S+G Project No. Brownfield 15-1



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Project Scientist



Stacey A. Smith, P.E.
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October 2015



NC LIC. NO. C-0628 (ENGINEERING)

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Brownfield Road C&D Landfill

NC Solid Waste Permit No. 92-31

Operations Manual

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1.0 GENERAL FACILITY OPERATION

1.1 Overview

This Operations Manual was prepared for the Brownfield Road Landfill facility (Brownfield Road LF), which operates as a construction and demolition debris (C&D) landfill (Permit No. 92-31) and is owned by Wake Reclamation, LLC (a subsidiary of Waste Industries USA, Inc.). The Brownfield Road LF is located at 2600 Brown Field Road in Raleigh, NC as shown on the Site Vicinity Map, included as **Figure 1**. The C&D landfill is located on approximately 37.5 acres within the northern portion of the property. This document discusses the operations of the landfill unit and other solid waste management activities:

- Scales and scale house facilities;
- Construction and Demolition Debris (C&D) landfill;
- Inert (concrete) debris storage area; and
- Asbestos-Containing Material (ACM) handling.

Refer to the **attached Figure 2** for the location of existing and proposed landfill units and other solid waste management activities.

The information contained herein was prepared to provide facility with a clear understanding of how the Design Engineer assumed that the completed facility would be operated. While deviations from the operations outlined here may be acceptable, they should be reviewed and approved by the Design Engineer. Please refer to the appropriate permit application for a detailed discussion and calculations for the individual components of each landfill unit, including phasing plans.

1.2 Contact Information

All correspondence and questions concerning the operation of the Brownfield Road LF facility should be directed to the appropriate Operator and State personnel listed below. Waste Reclamation, LLC is a wholly owned subsidiary of Waste Industries USA, Inc. For fire or police emergencies, dial 911.

1.2.1 Wake Reclamation, LLC

| | |
|--------------------|--|
| Address: | 2600 Brown Field Road Raleigh, North Carolina 27610 |
| Scale House Phone: | (919) 779-3339 |
| Fax: | (919) 779-3970 |
| General Manager: | Donald Plessinger |
| Email: | donald.plessinger@wasteindustries.com |

Phone: (919) 557-9583

1.2.2 Waste Industries USA, Inc.

Address: 3301 Benson Drive, Suite 600
Raleigh, North Carolina 27609

Region Manager: David Pepper
Email: david.pepper@wasteindustries.com
Phone: (919) 877-2235
Fax: (919) 557-9523

1.2.3 North Carolina Department of Environmental Quality

North Carolina DEQ - Raleigh Central Office (RCO)

217 West Jones Street
1646 Mail Service Center
Raleigh, North Carolina 27699-1646
Phone: (919) 707-8200
Fax: (919) 707-8200

North Carolina DEQ - Raleigh Regional Office

800 Barrett Drive
Raleigh, North Carolina 27609
Phone: (919) 791-4200
Fax: (919) 571-4718

Division of Waste Management (DWM) - Solid Waste Section:

Field Operations Branch Head: Jason Watkins (WSRO)
Email: jason.watkins@ncdenr.gov
Eastern District Supervisor: Andrew Hammond (FRO)
Email: andrew.hammond@ncdenr.gov
Environmental Senior Specialist: Liz Patterson (RCO)
Email: elizabeth.patterson@ncdenr.gov

Division of Energy, Mineral and Land Resources- Land Quality Section

Address: 800 Barrett Drive
Raleigh, North Carolina 27609
Phone: (919) 791-4200
Fax: (919) 571-4718

Regional Engineer: John Holley, P.E. (RR0)
Email: john.holley@ncdenr.gov

1.2.4 Wake County

Wake County Department of Water Quality
Post Office Box 550
Raleigh, North Carolina 27602
Phone: (919) 868-6414

Watershed Manager: Shawn Springer, EI
Email: shawn.springer@wakegov.com

1.3 Facility Operations

1.3.1 Facility Operating Hours

Normal hours of operation will be 7:00 A.M. to 4:00 P.M. Monday through Friday and occasionally on Saturdays as needed. The facility will be closed on holidays as designated by the Owner. The Owner may elect to modify these hours from time to time.

1.3.2 Operating Capacity

The Brownfield Road LF is approved to accept 1,100 tons per day, six (6) days a week, or 344,300 tons per year, per the franchise amendment granted by the Wake County Commissioners on January 20, 2004.¹ At the date of this plan, a reasonably expected disposal rate of 115,000 tons per year has been determined evaluating historical, current, and predicted future rates.

1.3.3 Service Area

The Brownfield Road LF facility is permitted to receive solid waste generated within the following Counties of the State of North Carolina (see **Figure 3**) consistent with the franchise amendment granted by the Wake County Board of Commissioners September 7, 2010²: Wake, Durham, Orange, Johnston, Franklin, Chatham, Alamance, Caswell, Person, Granville, Vance, Warren, Nash, Wilson, Wayne, Harnett, and Lee.

1 January 20, 2004 - Regular Meeting of the Wake County Board of Commissioners Meeting; Amendment of the original franchise to expand the service area, increase tonnage to was discussed and voted on. - Action: Passed. Ordinance granting the amended franchise was approved unanimously.

2 September 20, 2010 - Regular Meeting of the Wake County Board of Commissioners Meeting; amendment of the existing franchise to expand the service area was discussed and voted on. - Action: Passed. Ordinance granting the amended franchise was approved unanimously.

1.4 Access Control

Limiting access to the Brownfield Road LF facility is important for the following reasons:

- Unauthorized and illegal dumping of waste materials is prevented.
- Trespassing, and injury resulting therefrom, is discouraged.
- The risk of vandalism is greatly reduced.

Access to active areas of the landfill will be controlled by a combination of fences and natural barriers, and strictly enforced operating hours through the landfill entrance off of Brown Field Road. A scalehouse attendant will be on duty at all times when the landfill facility is open for public use to enforce access restrictions.

1.4.1 Physical Restraints

The site is accessed by an entrance road that intersects Brown Field Road on the eastern edge of the property. Scales and a scale house are provided along the entrance road where all refuse trucks entering the facility are weighed upon entering and exiting. The entrance has a gate that is securely locked during non-operating hours.

1.4.2 Security

Frequent inspections of gates and fences will be performed by landfill personnel. Evidence of trespassing, vandalism, or illegal operation will be reported to the Owner.

1.5 Signage

A prominent sign(s) containing the information required by the DWM is located immediately inside the main entrance to the facility. This sign(s) will provide information on operating hours, operating procedures, acceptable wastes and/or information as required under the facility permit. Additional signage will be provided as necessary within the waste disposal complex to distinguish the roadways to the active waste disposal areas, manage and direct traffic, regulate speed limits, identify groundwater monitoring wells, and define waste boundaries. Service and maintenance roads for use by operations personnel will be clearly marked and barriers (e.g., traffic cones, barrels, etc.) will be provided as required. Landfill personnel will routinely inspect the conditions of the posted signage to ensure that they are clearly visible and intact. Damaged or missing signage will be replaced.

1.5.1 Waste Limit Markers

During construction of new phases, expansion of the facility, or following closure of areas, waste limit markers will be used to identify the permitted limits of waste. The waste markers will be constructed of non-degradable material and will clearly state “waste limit” or “edge of liner” in bold lettering. Offsets are acceptable such that all wording is clear to DWM and operational staff. The waste markers will be maintained and replaced when damaged.

1.6 Communications

Two way radio communications is maintained between the landfill units, the landfill manager, and the scale house/office. The scale house/office has telephones in case of emergency and for the conduct of day-to-day business. Emergency telephone numbers are displayed in these locations. Cellular phones are available for key operating staff (i.e. managers, operators).

1.7 Fire Control

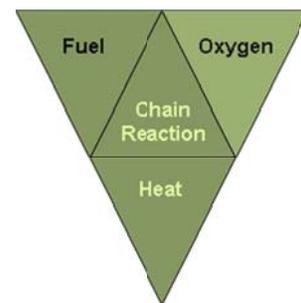
Although no open burning of waste is allowed at the facility, the possibility of fire within the processing and storage areas, the landfill, or a piece of equipment must be anticipated in the daily operation of the facility. Potential fire hazards include both surface conditions and subsurface conditions. Surface conditions include equipment operations and newly placed waste. Subsurface conditions include existing waste previously landfilled.

1.7.1 Open Burning

With the exception of the controlled burning of land clearing debris generated on-site or from emergency clean-up operations, no open burning is allowed at the facility. Controlled burning will occur only if permitted or approval by the DWM, the Division of Air Quality (DAQ), and the local fire department.

1.7.2 Fire Tetrahedron³

To better understand the properties of fire we can examine the fundamental methods to extinguish it. The fire “tetrahedron” illustrates the rule that in order to ignite and burn, each component represents a property of flaming fire; fuel, oxygen, heat, and chemical chain reaction. A fire is



³ National Fire Protection Association (www.nfpa.org)

prevented or extinguished by removing any one of them. A fire naturally occurs when the elements are combined in the right mixture (e.g., more heat needed for igniting some fuels, unless there is concentrated oxygen). The fire tetrahedron is a more modern adaptation of the traditional fire “triangle” recognizing the chemical reactions that may occur as a component – “the uninhibited chain reaction”. This chain reaction is the feedback of heat to the fuel to produce the gaseous fuel used in the flame. In other words, the chain reaction provides the heat necessary to maintain the fire. These principles are integral in the prevention and management of potential fire situations. *Please note this information is considered as a basis of understanding and may be superseded by the direction and skill of the local Fire Marshall.*

1.7.3 Equipment

A combination of factory installed fire suppression systems and/or portable fire extinguishers will be operational on all pieces of heavy equipment at all times. Potential fire hazards are created from the build-up of fine, dry dust particles on and around operational motors and control panels. The presence of these build-ups can cause overheating and potential fire if periodic equipment cleaning and maintenance are not practiced. Portable fire extinguishers should be maintained in a state of readiness on each piece of moving equipment and equipment should be cleaned periodically.

1.7.4 General Fire Management Strategies

Each fire situation is site specific; however, general strategies for active fire management include the following (in no particular order):

- Accelerated high temperature combustion (displacing fuel);
- Covering of the landfill burn area with soil (reduce oxygen);
- Covering of the burn area with foams (reduce oxygen);
- Flooding the burn area with water (reduce heat);
- Injecting an inert gas such as CO₂ (reduce oxygen);
- Excavating the burning material (displacing fuel) and then extinguishing it in small controlled areas; and
- Applying extinguishing agents that will interfere with and inhibit the combustion process at the molecular level (break the chemical reaction).

1.7.5 Fires Within Disposal Areas

Fires within the landfill disposal areas will be limited by the use of periodic cover as a fire break and control of “hot” loads entering the landfill. Trained personnel at the scale house will turn away all trucks containing waste that is suspected to be hot. If a hot load is placed on the working face, then the load will be spread as

thin as possible and cover soil will be immediately placed on the waste to extinguish the fire.

In general, fires that break out close to the surface of the disposal area should be excavated and smothered with cover material. Deep fires should be smothered out by placing moist soil on the surface and by constructing soil barriers around the fire. Where the smothering technique fails, the burning material must be excavated and smothered or quenched with water once the burning material is brought to the surface. Water is usually not effective unless it can be directly applied to the burning material.

1.7.6 Notification

The Operator will verbally notify the DWM (see **Section 1.2.3**) within 24 hours of discovery of a fire within any landfill disposal area. In addition, written documentation describing the fire, the actions carried out to extinguish the fire, and a strategy for preventing future occurrences will be provided to the DWM within 15 days following any such occurrence on the **Fire Occurrence Notification Form** included in **Appendix A**.

1.7.7 Coordination With Local Fire Department

A copy of this Operations Manual will be filed with the local fire department including all contact information for the facility.

1.8 Severe Weather Conditions

Unusual weather conditions can directly affect the operation of the facility. Some of these weather conditions and recommended operational responses are as follows.

1.8.1 Ice Storms

An ice storm can make access to the facility dangerous, prevent movement or placement of cover soil, and, thus, may require closure of the landfill until the ice is removed or has melted. The determination to discontinue activities due to inclement weather conditions will be made by the Landfill Manager.

1.8.2 Heavy Rains

Exposed soil surfaces can create a muddy situation in some portions of the facility during rainy periods. The control of drainage and use of crushed stone on unpaved roads should provide all-weather access for the site and promote

drainage away from critical areas. In areas where the aggregate surface is washed away or otherwise damaged, new aggregate should be used for repair.

Intense rains can affect newly constructed drainage structures such as swales, diversions, cover soils, and vegetation. After such a rain event, inspection by facility personnel will be initiated and corrective measures taken to repair any damage found before the next rainfall.

1.8.3 Electrical Storms

The open area of a landfill is susceptible to the hazards of an electrical storm. If necessary, facility activities will be temporarily suspended during such an event. Refuge will be taken as necessary in the on-site buildings or in rubber-tired vehicles.

1.8.4 Windy Conditions

Facility operations during a particularly windy period may require that the working face be temporarily shifted to a more sheltered area. When this is done, the previously exposed face will be immediately covered with cover materials.

1.8.5 Violent Storms

In the event of hurricane, tornado, or severe winter storm warning issued by the National Weather Service, facility operations may be temporarily suspended until the warning is lifted. Equipment will be properly secured. A radio capable of tuning to NOAA Weather Radio-Providence shall be periodically monitored by landfill personnel.

1.9 Equipment Requirements

The Operator will make available as needed the equipment required to perform the necessary facility activities. Periodic maintenance of all equipment and minor and major repair work will be performed at designated maintenance zones.

The anticipated equipment requirements for operation and maintenance of the site are listed in the following table. These may vary based upon volume coming into the facility for disposal.

Table 1: Equipment Requirements

| Description | Primary Function (Allocation) |
|----------------------------|---|
| 1) Compactors (1) | Waste placement and compaction |
| 2) Dozers (1) | Stripping and grading of borrow areas, fine grading, slope work, and site cleanup |
| 3) Water Truck (1) | Dust control |
| 4) Large Excavator (1) | Loading and placement of cover soils |
| 5) Off Road Dump Truck (1) | Loading and hauling of cover soils |
| 6) Service Truck | Equipment maintenance and site management |
| 7) Other Equipment | As needed. |

1.10 Personnel Requirements

At least one responsible individual trained and certified in facility operations will be present at all times during all operating hours of the facility. An attendant will be present to oversee the unloading of waste. Annually, a supervisor, certified as a Manager of Landfill Operations (MOLO) by the Solid Waste Association of North America (SWANA) will train each facility employee. As part of this training, personnel learn to recognize loads which may contain prohibited wastes.

The anticipated personnel requirements for operation and maintenance of the site are listed in the following table. The numbers of site personnel can be adjusted based upon volume of waste received for disposal.

Table 2: Personnel Requirements

| Description | Primary Function (Allocation) |
|-----------------------------|--|
| 1) Site Manager (1) | Overall management of the facility |
| 2) Operations Manager (1) | Manage facility operations |
| 3) Scalehouse Attendant (1) | Receiving and weight for incoming loads |
| 4) Operators (2) | Management of workplace, leachate systems, cover placement |
| 5) Temp Labor (4) | General labor and operational staff around the site |
| 1) Site Manager (1) | Overall management of the facility |

1.11 Health and Safety

All aspects of the facility operations were developed with the health and safety of the operating staff, customers, and neighbors in mind. Prior to commencement of operations of the facility, a member of the operating staff will be designated site safety

officer. This individual, together with the facility's management will modify the site safety and emergency response program to remain consistent with SWANA and Occupational Safety and Health Administration (OSHA) guidance.

Safety equipment provided includes equipment rollover protective cabs, seat belts, audible reverse warning devices, hard hats, safety shoes, and first aid kits. Facility personnel will be encouraged to complete the American Red Cross Basic First Aid Course. Other safety requirements as designated by the Owner and Operator will also be implemented.

Facility employees will be routinely trained in health and safety by supervisory staff. All training will be documented. The following are some general recommendations for the health and safety of workers:

1.11.1 Personal Hygiene

The following items are recommended as a minimum of practice:

- Wash hands before eating, drinking, or smoking.
- Wear personal protective equipment as described in **Section 1.11.2**.
- Wash, disinfect, and bandage ANY cut, no matter how small it is. Any break in the skin can become a source of infection.
- Keep fingernails closely trimmed and clean (dirty nails can harbor pathogens).

1.11.2 Personal Protective Equipment

Personal Protective Equipment (PPE) must be evaluated as to the level of protection necessary for particular operating conditions and then made available to facility employees. The list below includes the PPE typically used and/or required in a solid waste management facility workplace.

- Safety shoes with steel toes.
- Noise reduction protection should be used in areas where extended exposure to continuous high decibel levels is expected.
- Disposable rubber latex or chemical resistant gloves for handling and/or sampling of waste materials.
- Dust filter masks.
- Hard hats (in designated areas)
- Portable eyewash.
- Safety goggles.
- Safety vests.

Following use, PPE's should be disposed of or adequately cleaned, dried, or readied for reuse.

1.11.3 Mechanical Equipment Hazard Prevention

All equipment should be operated with care and caution. All safety equipment such as horns, backup alarms, and lights should be functional. A Lockout-Tagout program will be used to identify equipment in need or under repair and insure that operation is "off-limits" prior to maintenance or repair. All operators will be trained in the proper operation of equipment.

1.11.4 Employee Health and Safety

Some general safety rules are:

- Consider safety first when planning and conducting activities.
- Review the equipment O&M manual(s) prior to attempting repairs/changes.
- Remember the buddy system for repair of mechanical equipment.
- Post emergency contact phone numbers.
- Provide easy and visible access to the Right to Know materials.
- Provide easy and visible access to first aid kits and fire extinguishers.

1.11.5 Physical Exposure

Facility personnel may come in contact with the fluids, solids, and airborne constituents found at the facility. Routine training should be conducted regarding the individual and collective materials used at the facility and their associated hazards. Training concerning safe work practices around these potential exposures should cover the use of equipment and proper disposal procedures.

1.11.6 Safety Data Sheets

Safety Data Sheets (SDS) will be collected on every waste (if available and appropriate) that enters the facility. Information will also be made available for all chemicals stored on site for use at the facility. SDS sheets will be stored in a location with all other Right to Know information for the site.

1.12 Utilities

Electrical power, water, telephone, and restrooms will be provided at the scale house/site office.

1.13 Recordkeeping Program

The Operator will maintain the following records in an operating record at the landfill:

- A. Current permit(s) (Permit to Construct, Permit to Operate, etc.);
- B. Current operations manual/plan and engineering plan;
- C. Inspection reports;
- D. Audit and compliance records;
- E. Annual landfill reports (including survey and other documentation related to airspace usage);
- F. Waste inspection records (see **Section 2.4.1**);
- G. Daily tonnage records and disposal records maintained at the scale house - including source of generation;
- H. Waste determination records;
- I. List of generators and haulers that have attempted to dispose of restricted wastes;
- J. Employee training procedures and records of training completed;
- K. All ground water monitoring and surface water quality information (See the current **Water Quality Monitoring Plan**) including:
 - 1. Monitoring well construction records;
 - 2. Sampling dates and results;
 - 3. Statistical analyses; and
 - 4. Results of inspections, repairs, etc.
- M. LFG monitoring results and remedial measures as required (see the current **LFG Monitoring Plan**);
- N. All closure and post-closure information, where applicable, including:
 - 1. Notification of intent to close;
 - 2. Testing;
 - 3. Certification; and
 - 4. Recording.
- O. Cost estimates or financial assurance documentation;
- P. A notation of the date and time of final cover placement;
- Q. OSHA 300 logs;
- R. Asbestos disposal records;
- S. Concrete Grinding Logs
- T. Laboratory Testing identifying soil or mulch properties such as density and gradation (if performed); and

The operating record will be kept up to date by the Operator or his designee. It will be presented upon request to the DWM for inspection. A copy of this Operations Manual will be kept at the facility and will be available for use at all times.

2.0 WASTE HANDLING OPERATIONS

2.1 Overview

This section describes the required waste handling operations for the Brownfield Road LF.

2.2 Acceptable Waste

The Brownfield Road LF will only accept waste that is generated from the approved service areas is consistent with the North Carolina solid waste regulations and the general conditions established in the operating permit. The acceptance of waste materials must satisfy the following definitions:

- Construction and Demolition Debris Waste: as defined in G.S. 130A-290 (a)(4) means solid waste resulting solely from construction, remodeling, repair or demolition operations on pavement, buildings, or other structures, but does not include inert debris, land-clearing debris or yard waste.
- Inert Debris Waste: as defined in G.S. 130A-290 (a)(14) means solid waste which consists solely of material that is virtually inert and that is likely to retain its physical and chemical structure under expected conditions of disposal, materials such as unpainted rock, brick, concrete, concrete block, uncontaminated soil, rock, and gravel.
- Land Clearing and Inert Debris Waste: as defined in G.S. 130A-290 (a)(15) and *15A NCAC 13B .0101 (23)* means solid waste that is generated solely from land-clearing activities, such as stumps, tree trunks and other naturally occurring vegetative material.
- Asphalt: in accordance with G.S. 130-294 (m).
- Other Waste: other solid waste as approved by the Solid Waste Section of the Division of Waste Management.

In addition, asbestos waste, as described in **Section 2.5.3**, may also be accepted at this facility.

2.3 Prohibited Wastes

The following wastes are prohibited from being accepted at the C&D landfill facility:

- Containers such as tubes, drums, barrels, tanks, cans, and bottles unless they are empty and perforated to ensure that no liquid, hazardous or municipal solid waste is contained therein,
- Garbage as defined in G.S. 130A-290(a)(7),
- Hazardous waste as defined in G.S. 130A-290(a)(8), to also include hazardous waste from conditionally exempt small quantity generators,

- Industrial solid waste unless a demonstration has been made and approved by the Division that the landfill meets the requirements of Rule .0503(2)(d)(ii)(A),
- Liquid wastes,
- Medical waste as defined in G.S. 130A-290(a)(18),
- Municipal solid waste as defined in G.S. 130A-290(a)(18a),
- Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761,
- Radioactive waste as defined in G.S. 104E-5(14),
- Septage as defined in G.S. 130A-290(a)(32),
- Sludge as defined in G.S. 130A-290(a)(34),
- Special wastes as defined in G.S. 130A-290(a)(40),
- White goods as defined in G.S. 130A-290(a)(44), and
- Yard trash as defined in G.S. 130A-290(a)(45),

Brownfield Road LF will implement a waste screening program described in **Section 2.4**, to prohibit these types of waste. Solid waste section specifications regarding prohibited waste are presented in 15A NCAC 13B .0542(e).

Asbestos waste may be accepted by the facility if handled according to **Section 2.5.3**.

2.4 Waste Screening Programs

To assure prohibited wastes are not entering the landfill facility, screening programs have been implemented. Waste received at the scale house entrance and directed to the working face is inspected by trained personnel. These individuals have been trained to spot indications of unacceptable and suspicious wastes, including: hazardous placarding or markings, liquids, powders or dusts, sludges, bright or unusual colors, drums or commercial size containers, and "chemical" odors. Screening programs for visual and olfactory characteristics of prohibited wastes are an ongoing part of the facility operation.

2.4.1 Waste Receiving and Inspection

All vehicles must stop at the scale house located near the entrance of the facility and visitors are required to sign-in. All waste transportation vehicles are weighed and the content of the load assessed. The scale attendant(s) requests from the driver of the vehicle a description of the waste it is carrying to ensure that unacceptable waste is not allowed into the landfill. The attendant(s) then visually checks the vehicle as it crosses the scale. Signs informing users of the acceptable and unacceptable types of waste are posted at the scale house or in the vicinity of the entrance to the site. Once passing the scales, the vehicles containing C&D wastes are routed to the landfill.

Vehicles are randomly selected for screening on a regular basis, depending on personnel availability. At least one vehicle per week, but not less than 1% by weight of the waste stream entering the facility (based on the previous week's

total), will be randomly selected by inspection personnel. A random truck number and time will be selected (e.g., the tenth load after 10:00 a.m.) on the day of inspections. However, if something looks suspicious is spotted in any waste load, that load is inspected further. Selected vehicles are directed to an area of intermediate cover adjacent to the working face where the vehicle will be unloaded. Waste is carefully spread using suitable equipment. An attendant trained to identify wastes that are unacceptable at the landfill inspects the waste discharged at the screening site. If unacceptable waste is found, the load will be isolated and secured by berming off the area. Unacceptable wastes that are nonhazardous will be removed from the C&D area and removed from the facility. All random waste inspections will be documented by landfill staff using the waste screening form provided in **Appendix B**.

For unacceptable wastes that are hazardous, the Hazardous Waste Contingency Plan outlined in **Section 2.4.2** will be followed. To determine the liquid content of the waste, a liquid determination will be performed by the paint filter test (see **Appendix C** for apparatus and procedures). The hauler is responsible for removing unacceptable waste from the landfill property. If no unacceptable waste is found, the load will be pushed to the working face and incorporated into the daily waste cell.

2.4.2 Hazardous Waste Contingency Plan

In the event that identifiable hazardous waste or waste of questionable character is detected at the landfill, appropriate equipment, protective equipment, personnel, and materials as necessary will be employed to isolate the wastes. DWM will be notified immediately (see **Section 1.2.3**) that an attempt was made to dispose of hazardous waste at the landfill. If the vehicle attempting disposal of such waste is known, all attempts will be made to prevent that vehicle from leaving the site or, if the vehicle has left the site, immediate notice will be served on the owner of the vehicle that hazardous waste, for which they have responsibility, has been disposed of at the landfill.

The landfill will assist the DWM as necessary and appropriate in the removal and disposition of the hazardous waste and in the prosecution of responsible parties. If needed, the hazardous waste will be covered with either on-site soils or other tarping material until such time when an appropriate method can be implemented to properly handle the waste. The cost of the removal and disposing of the hazardous waste will be charged to the owner of the vehicle involved. Any vehicle owner or operator who knowingly dumps hazardous waste in the landfill may be barred using the landfill.

Should an incident where hazardous waste is found at the landfill occur, the event will be documented by landfill staff using the waste screening form provided in **Appendix B**.

Records of information gathered as part of the waste screening programs will be maintained at the landfill site during its active life and as long as required by Brownfield Road LF and DWM.

2.5 Waste Disposal

2.5.1 Access

The location of access roads during waste placement will be determined by operations personnel in order to reflect waste placement strategy.

2.5.2 General Procedures

Waste transportation vehicles will arrive at the working face at random intervals. There may be a number of vehicles unloading waste at the same time, while other vehicles are waiting. In order to maintain control over the unloading of waste, a certain number of vehicles will be allowed on the working face at a time. The actual number will be determined by the truck spotter. This procedure will be used in order to minimize the potential of unloading unacceptable waste and to control disposal activity. Operations at the working face will be conducted in a manner which will encourage the efficient movement of transportation vehicles to and from the working face, and to expedite the unloading of waste.

The approach to the working face will be maintained such that two or more vehicles may safely unload side by side. A vehicle turn-around area large enough to enable vehicles to arrive and turn around safely with reasonable speed will be provided adjacent to the unloading area. The vehicles will back to a vacant area near the working face to unload. Upon completion of the unloading operation, the transportation vehicles will immediately leave the working face area. Personnel will direct traffic necessary to expedite safe movement of vehicles.

Waste unloading at the landfill will be controlled to prevent disposal in locations other than those specified by site management. Such control will also be used to confine the working face to a minimum width, yet allow safe and efficient operations. The width and length of the working face will be maintained as small as practical in order to maintain the appearance of the site, control windblown waste, and minimize the amount of cover required each day. Normally, only one working face will be active on any given day, with all deposited waste in other areas covered by either periodic or final cover, as appropriate.

The procedures for placement and compaction of solid waste include: unloading of vehicles, spreading of waste into adequately sized lifts, and compaction on

relatively flat slopes (i.e. 5H:1V max.), in two-foot intervals, using a minimum number of three full passes.

The use of portable signs with directional arrows and portable traffic barricades will facilitate the unloading of wastes to the designated disposal locations. These signs and barricades will be placed along the access route to the working face of the landfill or other designated disposal areas which may be established.

2.5.3 Asbestos Waste Management

Brownfield Road LF may dispose of regulated asbestos within the C&D landfill. Regulated asbestos-containing material (RACM) means:

- (a) Friable asbestos material;
- (b) Category I nonfriable asbestos-containing material (ACM) that has become friable;
- (c) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or
- (d) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations regulated by this subpart.

Asbestos containing materials are further defined as:

- Category I nonfriable asbestos-containing material (ACM) means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy.
- Category II ACM means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos as determined using the methods specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- Asbestos-containing material means any material containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure. *This material is non-regulated.*

Asbestos will only be accepted if it has been processed and packaged in accordance with State and Federal (40 CFR 61) regulations. Asbestos will arrive

at the site in vehicles that contain only the asbestos waste and only after advance notification by the generator.

Once the hauler brings the asbestos to the landfill, the hauler will be directed to the designated asbestos disposal area by operations personnel. The designated disposal area will be prepared by operations personnel by leveling a small area using a dozer or loader. Prior to disposal, the landfill operators will stockpile cover soil near the designated asbestos disposal area. The volume of soil stockpiled will be sufficient to cover the waste and to provide any berms, etc. to maintain temporary separation from other landfill traffic.

Once placed in the prepared area, the asbestos waste will be covered with a minimum of 18 inches of daily cover soil placed in a single lift. The surface of the cover soil will be compacted and graded using a tracked dozer or loader. The landfill compactor will be prohibited from operating over asbestos disposal areas until at least 18 inches of cover are in-place.

The landfill staff will record the approximate location and elevation of the asbestos waste once cover is in-place. The Landfill Manager or other supervisory staff will review pertinent disposal and location information to assure compliance with regulatory requirements and enter the information into the Operating Record.

Once disposal and recording for asbestos waste is completed, the disposal area may be covered with waste. No excavation into designated asbestos disposal areas will be permitted.

2.5.4 Periodic Cover

At the completion of waste placement each week or sooner, a 6 inch layer of earthen material will be placed over the exposed waste. This periodic cover is intended to control vectors, fire, odors, and blowing debris.

2.6 **Severe Weather Conditions**

Unusual weather conditions can directly affect the operation of the facility. Some of these weather conditions and recommended operational responses are as follows.

2.6.1 Ice Storms

An ice storm can make access to the landfill dangerous, prevent movement or placement of periodic cover, and, thus, may require closure of the facility until the ice is removed or has melted.

2.6.2 Heavy Rains

Exposed soil surfaces can create a muddy situation in some portions of the landfill during rainy periods. The control of drainage and use of crushed stone on unpaved roads should provide all-weather access for the site and promote drainage away from critical areas. In areas where the aggregate surface is washed away or otherwise damaged, new aggregate should be used for repair.

Intense rains can affect newly constructed drainage structures such as swales, diversions, cover soils, and vegetation. After such a rain event, inspection by landfill personnel will be initiated and corrective measures taken to repair any damage found before the next rainfall.

2.6.3 Electrical Storms

The open area of a landfill is susceptible to the hazards of an electrical storm. If necessary, landfilling activities will be temporarily suspended during such an event. To guarantee the safety of all field personnel, refuge will be taken in the on-site buildings or in rubber-tired vehicles.

2.6.4 Windy Conditions

The proposed operational sequence minimizes the occurrence of unsheltered operations relative to prevailing winds. If this is not adequate during a particularly windy period, work will be temporarily shifted to a more sheltered area. When this is done, the previously exposed face will be immediately covered with cover materials. In addition, laborers will pick up wind-blown debris as needed after episodes of strong wind.

2.6.5 Violent Storm

In the event of hurricane, tornado, or severe winter storm warning issued by the National Weather Service, landfill operations may be temporarily suspended until the warning is lifted. Cover material will be placed on exposed waste and buildings and equipment will be properly secured.

2.7 Height Monitoring

On a weekly basis, the landfill staff will monitor landfill top and side slope elevations. When such elevations approach the grades shown in the **facility Permit Drawings- S3 (Phase 2B - Final Grading and Drainage Plan)**, the final top of waste grades will be staked to limit over placement of waste.

3.0 RECYCLING AREA OPERATIONS

The facility's recycling and material recovery operation is intended to segregate co-mingled recyclable and/or reusable materials from the site's waste stream and temporarily store these materials within the permitted landfill footprint. Currently only clean concrete is recovered and reused on-site. The material recovery operation will take place within a portion of the site's active area and will therefore relocate from time to time along with the active area. Material recovery operations will only take place within the permitted waste limits and temporary material storage takes place in areas as shown on **Figure 2**.

As shown on **Drawing S1**, there will be a 25-foot minimum buffer between the temporary fence or physical barrier around the recycling (sorting) area and the limit of disposal in the active area. Sorting will occur only on previously landfilled surfaces (i.e. within the constructed, active cells) that are contained within the facility's groundwater monitoring network.

The recyclable/reusable materials will generally be with the assistance of small equipment, as needed, stockpiles located in close proximity to the operation, processed, and re-used on-site. Recovered materials will not be stored speculatively. Remaining C&D wastes in the diverted loads will then be disposed in accordance with the site's C&D permit. The anticipated wastes to be recovered and their anticipated end uses include the following:

Table 3: Recyclable Materials

| RECYCLED WASTE | GENERAL OPERATION | ANTICIPATED END USES |
|----------------|---|--|
| Clean Concrete | Segregated with loader and/or excavator; rebar separated (magnets); stockpiled on-site; crushed | Used for on-site road aggregate etc. Removed metal taken off-site |

3.1 Safety

The recycling area will generally be located contiguous to the active, operating C&D disposal face. The recycling area will be partitioned from the active C&D area with physical barriers (i.e. fencing, earthen materials, etc.) for safety and protection of site personnel who are segregating materials within the recycling area. All equipment operating in the recycling area will be equipped with back-up alarms. All appropriate Personal Protective Equipment will be worn by workers in the recycling area, including two-way radios between the workers and equipment operators.

Asbestos Containing Waste (ACW) or suspected ACW will not be hauled to, or dumped into, the sorting area. ACW will be buried in accordance with applicable North Carolina and NESHAP requirements.

3.2 Operations

Only those C&D waste loads delivered to the site that contain predominantly recoverable materials will be diverted to the recycling area for segregation handling. Materials that are not recoverable, but which were dumped within the sorting area, will be pushed and/or loaded and hauled to the adjacent active area for proper disposal on a daily basis.

The landfill (intermediate) cover will be maintained at 12 inches in thickness in the recycling/sorting area. Additional material will be added as needed to maintain this buffer.

3.3 Equipment

Anticipated equipment to be used in and around the recycling area will include:

- one small rubber-tired loader, skid-steer, or bobcat; and
- one small excavator.

Other equipment may be added as needed.

3.4 Personnel

Based the amount received, up to four (4) site personnel, including equipment operators, are anticipated for operations within the recycling area of the site.

3.5 Recovered Material Management

Only waste loads which are predominantly recyclable materials will be diverted to the sorting area. Materials will be weighed on the site scales prior to being used on site.

3.6 Recordkeeping

As a result of the recovered material management practices, there will be accurate records and reporting of the weight of waste and the weight of recycled/reused materials. The net weight of waste equals the total weight of material entering the site minus the weight of recovered materials removed from the waste stream.

4.0 ENVIRONMENTAL MANAGEMENT

4.1 Overview

This section reviews the overall environmental management tasks required for the successful operation of the Brownfield Road LF.

4.2 Erosion and Sedimentation Control

A separate erosion and sedimentation control plan is provided in the Erosion and Sedimentation Control Plan of the Permit Application. This plan describes the engineered features and practices for preventing erosion and controlling sedimentation at this site. The erosion and sediment control system consists of the following major components:

1. Drainage Channels,
2. Diversion Berms (Side Slope Swales and Cap Diversion Berm),
3. Down Pipes, and
4. Sediment Basins/Traps.

The landfill side slopes are designed with 3H:1V slopes and diversion berms placed along the slope. The berms are designed to keep water volumes and velocities low enough to minimize erosion of the landfill cover. Maintenance of the cover system will involve periodic mowing and repair of any erosion problems and bare spots. These items will be inspected at least once a month and after any significant rainfall events.

The down pipes are designed to carry concentrated flows of surface water off of the landfill. The down pipes will be inspected at least once a month and after any significant rainfall event.

Additional erosion control measures have been taken within the drainage channels and at points of stormwater discharge. All final cover should be inspected regularly for erosion damage and promptly repaired.

Stormwater run-off from the LCID landfill is conveyed to sediment basins and traps. These structures should be inspected regularly for sediment build-up or erosion damage and should be cleaned out when sediments fill the lower half of each structure.

4.3 Landfill Gas Control

A landfill gas control and monitoring plan has been prepared for the site and is presented in Landfill Gas Management Plan.

4.4 Litter Control

The vegetative trees/brushes act as a barrier to keep litter contained within the site and a litter control crew will pick up litter around the site and on access roads routinely as required.

4.5 Vector Control

Due to the nature of the waste disposed in this landfill, vector control is not expected to be of concern.

4.6 Odor Control

Due to the nature of the waste disposed in this landfill, odor is not expected to be of concern.

4.7 Dust Control

Dust related to waste hauler traffic on the access roads will be minimized by using a water truck to limit dust on the gravel portion of the road. Dust generated by excavation of cover soil will be limited by watering the cut soil areas if accessible to the water truck.

4.8 Interim Cover

In addition to the occasional placement of the 6 inches of earthen material over the exposed waste, an additional 12 inches of earthen cover should be placed on all waste surfaces that have not received waste in three (3) months or more but are below final elevation. This intermediate cover should be graded and seeded such that precipitation run-off is channeled to the stormwater collection system.

4.9 Interim Cover Monitoring

Routine inspections of the entire site will include monitoring the interim covers to ensure the adequacy of the vegetative protective cover and to identify potential erosion concerns. Corrective actions will be taken to address any identified areas of concern.

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Figures

**Operations Manual
Brownfield Road C&D Landfill
NC Solid Waste Permit No. 92-31**

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SITE VICINITY MAP

NC LIC. NO. C-0828 (ENGINEERING)

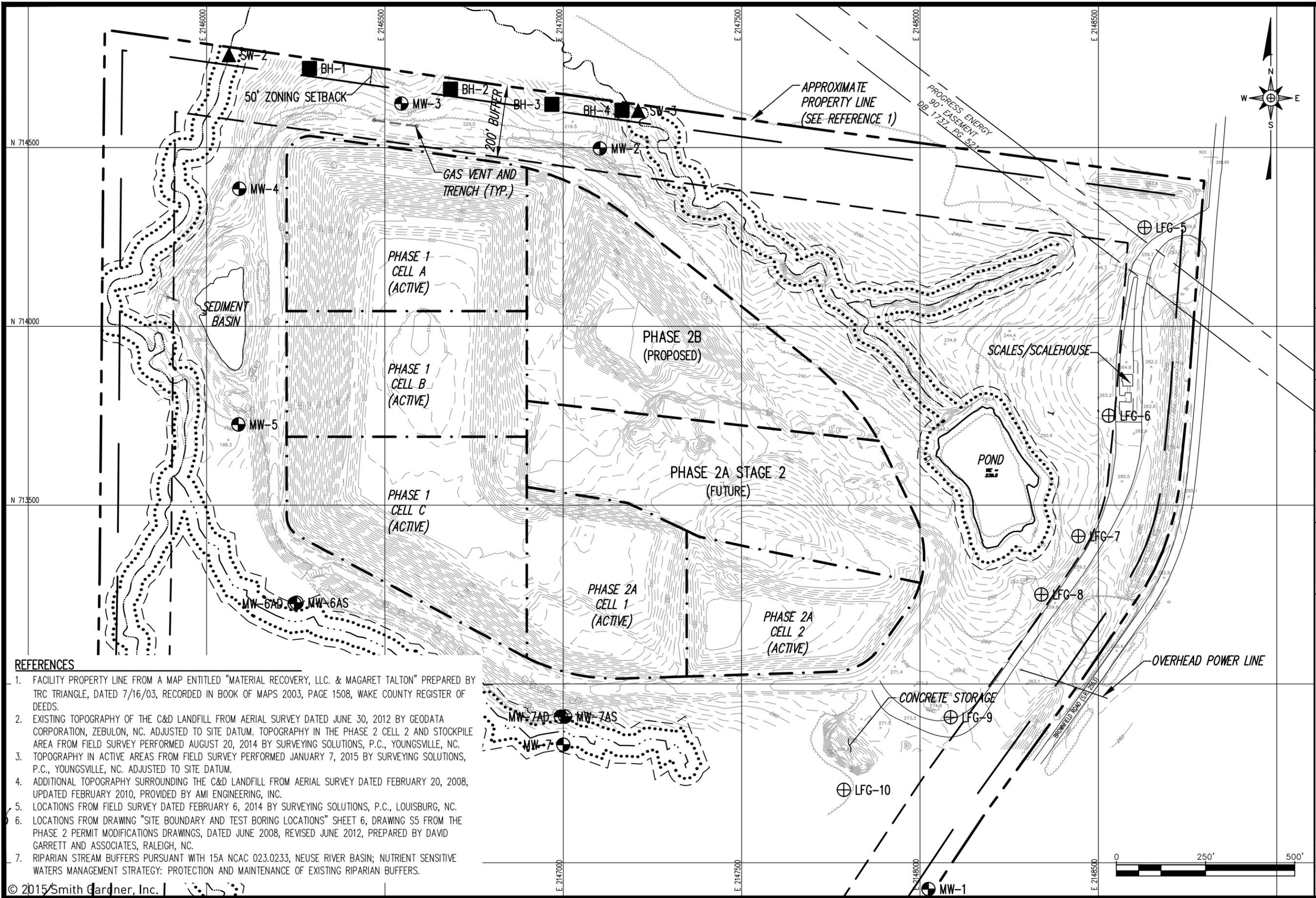
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| | | | | | |
|------------------|---------------------|--------------------|--------------------|---------------------------------|------------------|
| DRAWN: C.T.J. | APPROVED: D.M.M. | SCALE: AS SHOWN | DATE: Oct. 2015 | PROJECT NO.: BROWNFIELD 15-1 | FIGURE NO.: 1 |
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REFERENCES

1. FACILITY PROPERTY LINE FROM A MAP ENTITLED "MATERIAL RECOVERY, LLC. & MAGARET TALTON" PREPARED BY TRC TRIANGLE, DATED 7/16/03, RECORDED IN BOOK OF MAPS 2003, PAGE 1508, WAKE COUNTY REGISTER OF DEEDS.
2. EXISTING TOPOGRAPHY OF THE C&D LANDFILL FROM AERIAL SURVEY DATED JUNE 30, 2012 BY GEODATA CORPORATION, ZEBULON, NC. ADJUSTED TO SITE DATUM. TOPOGRAPHY IN THE PHASE 2 CELL 2 AND STOCKPILE AREA FROM FIELD SURVEY PERFORMED AUGUST 20, 2014 BY SURVEYING SOLUTIONS, P.C., YOUNGSVILLE, NC.
3. TOPOGRAPHY IN ACTIVE AREAS FROM FIELD SURVEY PERFORMED JANUARY 7, 2015 BY SURVEYING SOLUTIONS, P.C., YOUNGSVILLE, NC. ADJUSTED TO SITE DATUM.
4. ADDITIONAL TOPOGRAPHY SURROUNDING THE C&D LANDFILL FROM AERIAL SURVEY DATED FEBRUARY 20, 2008, UPDATED FEBRUARY 2010, PROVIDED BY AMI ENGINEERING, INC.
5. LOCATIONS FROM FIELD SURVEY DATED FEBRUARY 6, 2014 BY SURVEYING SOLUTIONS, P.C., LOUISBURG, NC.
6. LOCATIONS FROM DRAWING "SITE BOUNDARY AND TEST BORING LOCATIONS" SHEET 6, DRAWING S5 FROM THE PHASE 2 PERMIT MODIFICATIONS DRAWINGS, DATED JUNE 2008, REVISED JUNE 2012, PREPARED BY DAVID GARRETT AND ASSOCIATES, RALEIGH, NC.
7. RIPARIAN STREAM BUFFERS PURSUANT WITH 15A NCAC 023.0233, NEUSE RIVER BASIN; NUTRIENT SENSITIVE WATERS MANAGEMENT STRATEGY: PROTECTION AND MAINTENANCE OF EXISTING RIPARIAN BUFFERS.

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PREPARED BY: NC LIC. NO. C-0828 (ENGINEERING)

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FIGURE NO. 2

SCALE: AS SHOWN

APPROVED: D.M.M.

PROJECT NO: BROWNFIELD 15-1

DATE: Oct 2015

FILENAME: WI-B1085

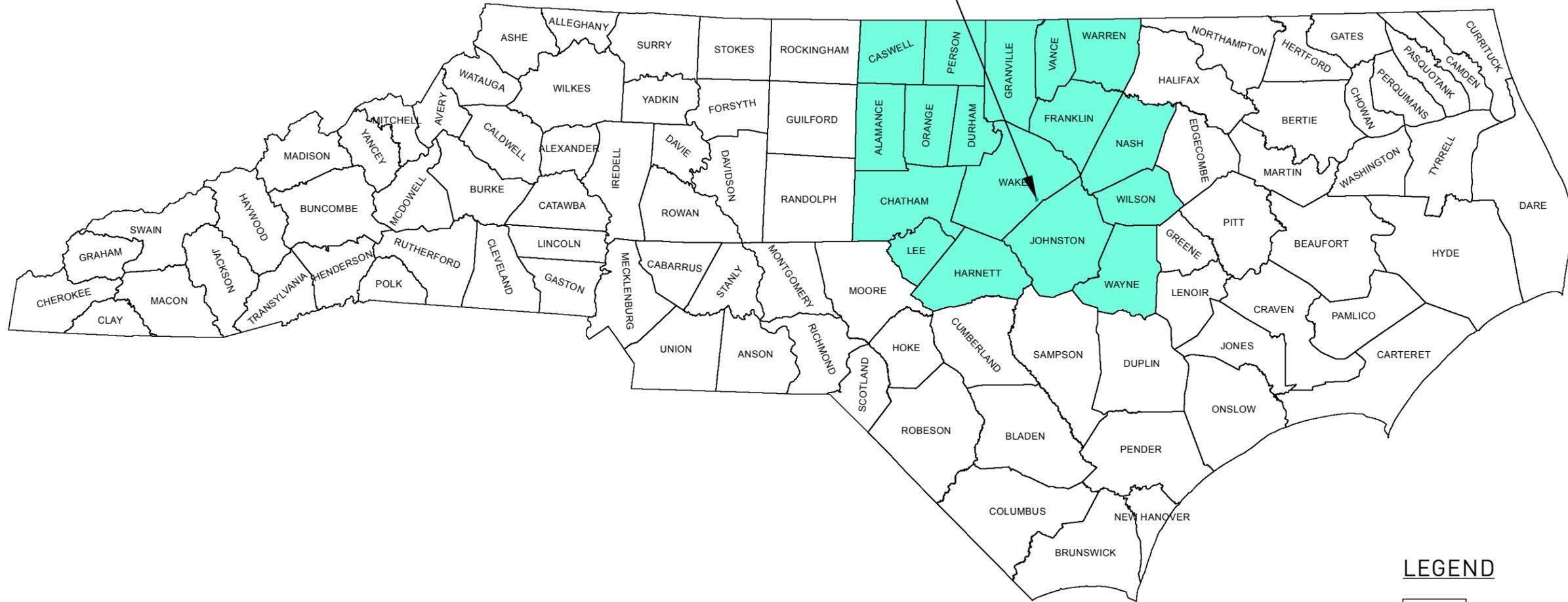
WAKE RECLAMATION, LLC
BROWNFIELD ROAD C&D LANDFILL
FACILITY PLAN

PREPARED FOR:

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BROWNFIELD ROAD C&D LANDFILL



LEGEND

-  COUNTY BOUNDARY
-  SERVICE AREA

| | | | | |
|-----------------|--|------------------------------|---------------|--------------------|
| DRAWN: C.T.J. | | APPROVED: D.M.M. | SCALE: N.T.S. | FIGURE NO.: 3 |
| DATE: Oct. 2015 | | PROJECT NO.: BROWNFIELD 15-1 | | FILENAME: WI-B1084 |

WAKE RECLAMATION, LLC
BROWNFIELD ROAD C&D LANDFILL
PLAN OF SERVICE AREA

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Appendix A

Fire Occurrence Notification Form

**Operations Manual
Brownfield Road C&D Landfill
NC Solid Waste Permit No. 92-31**

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SOLID WASTE MANAGEMENT FACILITY FIRE OCCURRENCE NOTIFICATION NC DENR Division of Waste Management Solid Waste Section



Notify the Section verbally within 24 hours and submit written notification within 15 days of the occurrence.
(If additional space is needed, use back of this form.)

NAME OF FACILITY: _____ PERMIT # _____

DATE AND TIME OF FIRE: _____ @ _____

HOW WAS THE FIRE REPORTED AND BY WHOM:

LIST ACTIONS TAKEN:

WHAT WAS THE CAUSE OF THE FIRE:

DESCRIBE AREA, TYPE, AND AMOUNT OF WASTE INVOLVED:

WHAT COULD HAVE BEEN DONE TO PREVENT THIS FIRE:

DESCRIBE PLAN OF ACTIONS TO PREVENT FUTURE INCIDENTS:

NAME: _____ TITLE: _____ DATE: _____

THIS SECTION TO BE COMPLETED BY SOLID WASTE SECTION REGIONAL STAFF
DATE RECEIVED _____

List any factors not listed that might have contributed to the fire or that might prevent occurrence of future fires:

FOLLOW-UP REQUIRED:
 NO PHONE CALL SUBMITTAL MEETING RETURN VISIT BY: _____ (DATE)

ACTIONS TAKEN OR REQUIRED:

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Appendix B

Waste Screening Form

**Operations Manual
Brownfield Road C&D Landfill
NC Solid Waste Permit No. 92-31**

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Wake Reclamation, LLC
Permit No. 92-31

WASTE SCREENING FORM

Day / Date: _____ Time Weighed in: _____
Truck Owner: _____ Driver Name: _____
Truck Type: _____ Vehicle ID / Tag No: _____
Weight: _____ Tare: _____
Waste Generator / Source: _____

Reason Load Inspected: Random Inspection _____ Staff Initials _____
Detained at Scales _____ Staff Initials _____
Detained by Operating Staff _____ Staff Initials _____

Inspection Location: _____

Approved Waste Determination Form Present? Yes _____ No _____ N/A _____

Description of Load: _____

Load Accepted (signature) _____ Date _____
Load Not Accepted (signature) _____ Date _____

Reason Load Not Accepted (complete only if load not accepted)

Description of Suspicious Contents:
Color: _____ Hazardous Waste Markings: _____
Texture: _____
Drums Present: _____ Smell: _____
Est. Cubic Yards in Load: _____
Est. Tons in Load: _____

Wake County Emergency Management Contacted? Yes _____ No _____

Company or Authority Contacted? _____
Hazardous Materials Present: _____

Hauler Notified (if waste not accepted) _____ Phone: _____ Time Contacted: _____
Other Observations: _____

Final Disposition
Signed: _____ Date _____
Waste Screening Inspector or Landfill Manager

Attach related correspondence to this form.
File completed form in Operating Record.

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Appendix C

Paint Filter Liquids Test EPA Method 9095

**Operations Manual
Brownfield Road C&D Landfill
NC Solid Waste Permit No. 92-31**

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METHOD 9095 PAINT FILTER LIQUIDS TEST From EPA SW-846

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

1. SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5 minute test period, the material is deemed to contain free liquids.

2. INTERFERENCES

INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

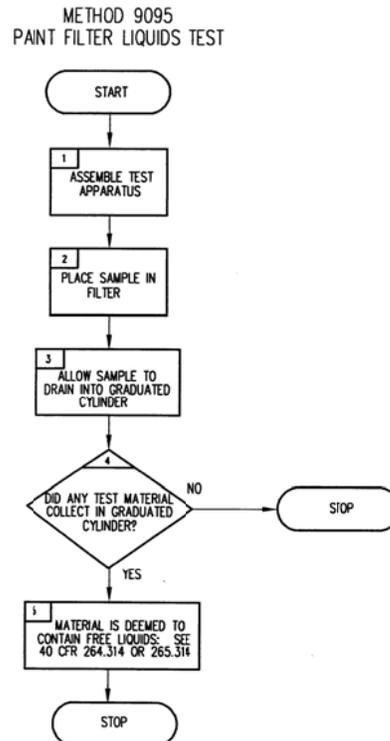
3. APPARATUS AND MATERIALS

APPARATUS AND MATERIALS

APPARATUS AND MATERIALS

APPARATUS AND MATERIALS

4.1 Conical paint filter:
Mesh number 60 (fine meshed)



size). Available at local paint stores such as Sherwin-Williams and Glidden for an approximate cost of \$0.07 each.

4.2 Glass funnel: If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 inch of the filter mesh to protrude should be used to support the filter. The funnel is to be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring or tripod.

4.4 Graduated cylinder or beaker: 100-mL.

4. REAGENTS

5.1 None.

5. SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 All samples must be collected according to the directions in Chapter Nine of EPA SW-846.

6.2 A 100 mL or 100 g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids.

6. PROCEDURE

7.1 Assemble test apparatus as shown in **Figure 1**.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter.

7.3 Allow sample to drain for 5 minutes into the graduated cylinder.

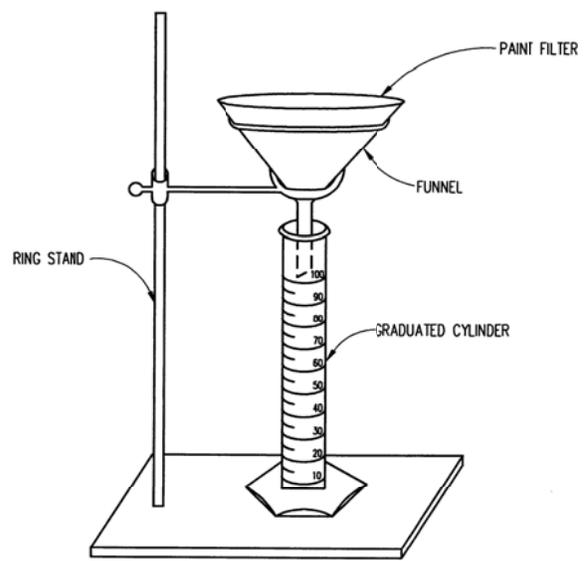


FIGURE 1. PAINT FILTER TEST APPARATUS.

7.4 If any portion of the test material collects in the graduated cylinder in the 5-min. period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

7. QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

8. METHOD PERFORMANCE

9.1 No data provided.

9. REFERENCES

10.1 None required.

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