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State of New Mexico
ENVIRONMENT DEPARTMENT
Water and Waste Management Division
US DOE Kirtland Area Office - ESHCB
P.O. Box 5400
Albuquerque, NM 87185-5400

CAF3
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JUDITH M. ESPINOSA
SECRETARY

RON CURRY
DEPUTY SECRETARY

BRUCE KING
GOVERNOR

MEMORANDUM

TO: Stephanie Stoddard, Permitting, H&RMB, NMED
FROM: William P. Moats, Mixed Waste, H&RMB, NMED
DATE: August 14, 1992
RE: Cannon Air Force Base, Landfill #5, Cell #3

On August 4, 1992, I informally received a partial revision of "Specifications for Landfill #5 Cell #3 Soil Cap" from Mark Wittrock of the U. S. Army Corps of Engineers. I have attached a copy of these revised specifications to this memorandum.

I have not yet had time to review the revised specifications in any detail. However, I did not identify any design changes that would be unacceptable to the NMED in a quick, preliminary scan of the contents. I hope to do a detailed review of these revised specifications by next Wednesday afternoon, and will transmit any comments I have as soon as possible.

Attachments: Revised "Specifications for Landfill #5 Cell #3 Soil Cap"
xc: John Parker, Mixed Waste, H&RMB, NMED

file: \wp51\doc\stoddard

1.4 Quality Control Organization.

1.4.1 CQC System Manager. The Contractor shall identify an individual within his organization at the site of the work, who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This individual shall provide inspection of the work to ensure compliance with the contract plans and specifications. This person shall be on the job site at all times that work is in progress. This person shall have as a minimum: three (3) years verifiable experience at the construction skilled-craft foreman level or above; at least three (3) years verifiable experience as a construction Contractor Quality Control Representative.

1.5 Submittals. Submittals shall be as specified in the Section 01300 entitled "SUBMITTALS".

1.6 Control. Contractor Quality Control is how the Contractor assures himself that his construction complies with the requirements of the contract plans and specifications. The controls shall be adequate to cover all construction operations, including both onsite and offsite fabrication, and will be keyed to the proposed construction sequence. The controls shall include at least three phases of control for all definitive features of work as follows:

1.6.1 Preparatory Phase. This shall be performed prior to beginning any work on any definable feature of work. It shall include a review of contract requirements; a check to assure that all materials and/or equipment have been tested, submitted and approved; a check to assure that provisions have been made to provide required control testing; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment. The Contractor shall attach copies of codes appropriately referenced in the Technical Provisions. The Contracting Officer's Authorized Representative (ACO) shall be notified at least 48 hours in advance of beginning of any of the required actions of the preparatory phase. The results of the preparatory phase actions shall be made a matter of record in the Contractor's Quality Control documentation as required below. Subsequent to the preparatory phase and prior to commencement of work, the Contractor shall instruct applicable workers as to the acceptable level of workmanship required in his CQC plan in order to meet contract specifications.

1.6.2 Initial Phase. This phase starts as soon as a representative portion of the particular feature of work has been accomplished. This phase shall include examination of the quality of workmanship and a review of control testing for compliance with contract requirements. The work shall be inspected for use of defective or damaged materials, omissions, and dimensional requirements. The Contracting Officer's Representative shall be notified at least 24 hours in advance of the inspection of the initial phase. The inspection results shall be made a matter of record in the CQC documentation as required below. The initial phase should be repeated for each new crew to work on site, or if acceptable standards of workmanship are not being met.

1.6.3 Follow-Up-Phase. Daily inspections shall be performed to assure continuing compliance with contract requirements. The inspections shall be made

a matter of record in the CQC documentation as required below. Final follow-up inspections shall be conducted and all deficiencies corrected prior to the start of additional features of work.

2. DOCUMENTATION.

2.1 The Contractor shall maintain current records of quality control operations, activities, and tests performed including the work of the subcontractors. These records shall be on an acceptable form and indicate a description of trades working on the project, the numbers of personnel working, the weather conditions encountered, any delays encountered, and acknowledgement of deficiencies noted along with the corrective actions taken on current and previous deficiencies. In addition, these records shall include factual evidence that required activities or tests have been performed, including but not limited to the following:

- a. Type and number of control activities and tests involved.
- b. Results of control activities or tests.
- c. Nature of defects, causes for rejection, etc.
- d. Proposed remedial action.
- e. Corrective actions taken.

2.2 These records shall cover both conforming and defective or deficient features and shall include a statement that supplies and materials incorporated in the work comply with the contract. Legible copies of these records shall be furnished to the CO daily. Preparatory and initial inspections will be documented on an approved form and submitted in duplicate with the quality control report for the day of inspection.

2.3 Deficiency Log. The Contractor shall maintain at the site a deficiency log which includes entries of all deficiencies or departures from contract requirements in the work which the CQC and/or the Government Quality Assurance personnel have noted. The deficiency log shall include the following:

- a. Date deficiency noted.
- b. Name of person noting deficiency.
- c. CQC report number deficiency noted on.
- d. Brief description of deficiency.
- e. Date deficiency correction noted.
- f. The Contractor shall submit for review the deficiency log to the Government at each monthly progress payment request and shall surrender permanently the deficiency log to the Government at completion of the work but prior to final

inspection. The deficiency log shall be made available to the Government for review at all times during the life of the contract.

2.4 The Contractor shall establish and implement a serialized numbering system for letters sent to the Government. The numbering system shall identify the contract number and shall progress sequentially starting with the number one (1) and continuing thereafter without break in numbering. All letters sent to the Government shall include a subject heading, which identifies the Contract Clause Number, Special Clause Number, or Technical Provision Number, and the particular subject item addressed by the letter.

2.5 Notification of Noncompliance. The Contracting Officer will notify the Contractor of any noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his representative at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

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SECTION 02224 - GAS VENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

This section covers the source and placement of compacted sand filter and PVC pipe to construct a gas vent system for the landfill.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

- | | |
|----------------|--|
| ASTM D 75 | (1987) Sampling Aggregates. |
| ASTM C 136 | (1984; Rev. a) Sieve Analysis of Fine and Coarse Aggregates. |
| ASTM D 422-63 | Particle size Analysis of Soils |
| ASTM D 1556 | (1982) Density of Soil in Place by the Sand-Cone Method. |
| ASTM D 2216 | (1980) Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures |
| ASTM D 2487 | (1985) Classification of Soils for Engineering Purposes. |
| ASTM D 3034 | Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings |
| ASTM D 4253-83 | Maximum Index Density of Soils Using a Vibratory Table. |
| ASTM D 4318-87 | Liquid Limit, Plastic Limit, and Plasticity Index of Soils. |
| ASTM D 4643-87 | Determination of Water (Moisture) Content of Soil by the Microwave Oven Method. |
| ASTM F 758 | Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage |

1.3 DEFINITIONS

1.3.1 Sand Filter Material

1.3.1.1 Satisfactory Materials

Materials shall be classified in accordance with ASTM D 2487 and free from roots and other organic matter, trash, debris and frozen materials. Sand material shall be compromise of tough, durable particles, shall be reasonably free from thin, flat and elongated pieces, and shall contain no organic materials. Limestone and/or Caliche screenings are not acceptable. The sand materials shall consist of well graded sand between the limits specified below:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square-mesh Sieve</u>
3/8-inch	100
No. 4	95-100
No. 16	45-80
No. 50	10-30
No. 100.	2-10

1.3.2 Degree of Compaction

Degree of compaction is a percentage of the relative maximum density obtained by the test procedure presented in ASTM D 4253, abbreviated below as a percent of laboratory maximum density.

1.3.3 PVC Pipe Material

1.3.3.1 Satisfactory Materials

PVC pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight. Polyvinyl Chloride (PVC) Pipe and Fittings shall conform to ASTM D 3034 (SDR 35), F 949, or F 758, Type PS 46.

1.4 SUBMITTALS

The following shall be submitted in accordance with SECTION: 01300 - SUBMITTALS:

SD-39 Qualifications

The Contractor shall furnish the qualifications of the commercial testing laboratory who will be performing testing in accordance with PART 3 paragraph, SAMPLING AND TESTING.

2.2 PVC VENT PIPES

Four, 4-inch diameter, perforated PVC pipes and fitting shall be used for the base of the venting system. Non-perforated PVC 4-inch diameter pipe shall be used for the vertical portion of the vent. Each vertical vent pipe shall be fitted with an inverted "U" or a "J" bent at the end, and the end opening shall be protected with a perforated cap. The contractor shall submit details of his method and procedure of providing a watertight joint of the vertical vent pipe with the geocomposite membrane for approval by the Contracting Officer before the venting system is installed.

2.3 PERFORATIONS IN PVC PIPE

2.3.1 Slotted Perforations in PVC Pipe

Circumferential slots shall be cleanly cut along the length of the horizontal pipe. Width of slots shall not exceed $1/8$ inch nor be less than $1/32$ inch. Length of the individual slots shall not exceed $1-1/2 \pm 1/4$ for the 4-inch diameter pipe. Slots shall be approximately 3 inches center-to-center along the pipe. Rows of slots shall be symmetrically spaced so that they are fully contained in 2 quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe.

2.3.2 Circular Perforations in PVC Pipe

Circular holes shall be cleanly cut along the length of the horizontal pipe. Diameters of holes shall not exceed $3/8$ inch nor be less than $3/16$ inch and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 3 inches center-to-center along the pipe. The rows shall be approximately $1-1/2$ inches apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows.

PART 3 - EXECUTION

3.1 GENERAL

3.2 PREPARATION OF GROUND SURFACE FOR FILL

All vegetation, trees and brush, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be removed before the fill is started. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.

3.3 SAND VENT MATERIAL

The vent material fill shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Satisfactory material shall be used in forming required fill. Compacted fill shall be satisfactory material and shall be reasonably free of debris, roots, organic material, frozen materials and trash, and shall not contain clods, rock or fractured stones. The material shall be placed in successive horizontal layers of 8 inches in loose thickness depth for the full width of the cross section. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be at a moisture content of optimum or greater. ~~Moisture content adjustments shall be assisted by using a disk that will penetrate the full loose layer thickness and will searify the upper two inches of the underlying lift. Disking shall continue until the specified moisture is obtained throughout the layer to be compacted.~~

3.3.1 Spreading

After dumping , the materials shall be spread by bulldozer or other approved means in approximately horizontal layers over the fill area. Unless otherwise directed, the thickness of these layers before compaction shall be as specified hereinafter in part 3. The entire surface of any section of the gas vent layer under construction shall be maintained in such condition that construction equipment can travel to any part of one section. Ruts in the surface of any layer shall be filled satisfactorily before compacting.

3.3.2 Compaction

Each layer of sand material shall be compacted. Water content shall be ~~as required to achieve the specified percent of compaction maintained at optimum.~~ Density of compacted mixture shall be at least 90 95 percent of laboratory maximum density in accordance with ASTM D 4253 . Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the ~~vibratory steel wheel~~ roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical vibratory plates, and shall be shaped and finished by hand methods.

3.3.3 Layer Thickness

Compacted thickness of the ~~bedding gas vent sand~~ material shall be as indicated. No layer shall be in excess of 8 inches in loose thickness nor less than 3 inches in compacted thickness.

3.3.4 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be smooth and of uniform texture. Light blading during compaction may be necessary for the finished surface to conform

to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompacted, or replaced as directed.

3.3.5 Smoothness

Surface of the layer shall show no deviations in excess of 3/8-inch when tested with the 12-foot straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.3.6 Thickness Control

Compacted thickness of the layer shall be within 1/2-inch of the thickness indicated. Where the measured thickness is more than 1/2-inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2-inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4-inch of the thickness indicated.

3.4 PVC VENTS

3.4.1 Installation of Filter Fabric or Filter Sock

One layer of filter fabric or a filter sock shall be wrapped or placed around the perforated or slotted collector pipes in such a manner that longitudinal overlaps of fabric are in unperforated or unslotted quadrants of the pipes. The overlap shall be at least 2 inches. The fabric or sock shall be secured to the pipe in such a manner that the backfill materials will not infiltrate through any fabric overlaps.

3.4.2 Jointing

PVC joints shall be in accordance with the requirements of ASTM D 3034, D 3212, of F 949.

3.4.3 Installation of PVC Vents

Each vent shall be carefully inspected before it is to be installed. Any defects in the pipe shall cause the pipe to be rejected. No vents shall be laid when the weather is unsuitable for such work. The pipe shall be laid to the grades and alignment as indicated. All vents in place shall be inspected prior to backfilling.

3.5 SAMPLING AND TESTING

Sampling and testing shall be performed by an government approved commercial testing laboratory or may be tested by the Contractor subject to approval. No work requiring testing shall be permitted until the facilities have been inspected and approved. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspections required because of failure of the first inspection will be charged to the Contractor. Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Field in-place density shall be determined in accordance with ASTM D 1556 . When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements, at no additional expense to the Government. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.5.1 Test Results

A coordinate system (x,y,z) shall be established to report sample locations. All tests including failures shall be reported and submitted to the Contracting Officer within 24 hours of the time of sampling. Only passing tests are acceptable. In the event of a failing moisture or density test a minimum of two passing tests of the suspect area of the fill shall be run. Results shall verify that materials comply with this specification. When a material source is changed, the new material will be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

3.5.2 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with ASTM D 75.

3.5.3 Sieve Analysis

Before starting work, at least one sample of material to be placed shall be tested in accordance with ASTM C 136 and ASTM D 422 on sieves conforming to ASTM E 11. After the initial test, a minimum of one analysis shall be performed for each 1000 CY of material placed, with a minimum of three analyses for each day's run until the layer is completed.

~~3.5.4 Liquid Limit and Plasticity Index~~

~~One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with ASTM D 4318.~~

3.5.5 Classification of Soils for Engineering Purposes

Soils classification shall be performed for each sieve analysis. Soils classification shall be in accordance with ASTM D 2487.

3.5.6 Density Control

The Contractor shall adequately control his compaction operations by tests made in accordance with ASTM D 1556 . One in-place density and one in-place moisture test shall be performed per 10,000 square feet, or fraction thereof, of each lift. One in-place density and one in-place moisture test shall be performed per 100 cubic feet, or fraction thereof, for hand compacted areas. Moisture content shall be in accordance with ASTM D 2216 or ASTM D 4643 for determining density. ~~When ASTM D 4643 is utilized, the moisture content should be checked a minimum of once per each ten (10) microwave oven method using ASTM D 2216.~~ The density test hole shall be backfilled and compacted to the required moisture and density of the adjacent fill. Additional tests shall be made as necessary. All test results shall be made available to the Contracting Officer. Acceptance tests may be made by the Government for verification of compliance; however, the Contractor shall not depend on such test for his control of operations. Deficiencies in construction shall be corrected by the contractor at no additional cost to the Government.

3.5.7 Density-Moisture Determinations for Vent Materials

Test for determination of maximum density and optimum moisture content shall be performed by the contractor in accordance with the requirements of ASTM D 4253 . ~~A minimum of one laboratory density and gradation test shall be performed each placement day or fraction thereof. Additional tests shall be run for each material change. Density Moisture Tests shall be run on the same sample on which the in place density test is run. The percent compaction of the fill sample is then calculated from the results of the field and laboratory density tests. The above testing shall include Atterberg limits and grain size determinations and shall be made on the same material as the in place density and moisture test.~~

3.6 PROTECTION

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements or the contract.

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SECTION 02245

GEOCOMPOSITE MEMBRANE LINER (GML) ✓

PART 1 - GENERAL

1.1 SCOPE

This section covers the furnishing and installation of a geocomposite membrane liner(s). All work shall be performed in strict accordance with the liner manufacturer's recommendations, as shown on the drawings, and as described in the specifications. The term "geocomposite membrane liner" shall be defined as a 40 mil, High Density Polyethylene (HDPE), liner with either a sodium bentonite glued to the HDPE liner or combination of the 40 mil HDPE Liner and a separate sodium bentonite liner, glued or sewn to a fabric, and placed under the HDPE liner. The term "geocomposite membrane liner" will be abbreviated "GML" in the remainder of this section.

1.2 APPLICABLE PUBLICATIONS

The publications listed below form a part of the specification to the extent referenced. The publications are referenced to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 638	(1989) Tensile Properties of Plastics.
ASTM D 696	(1991) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 Degrees C and 30 Degrees C
ASTM D 1004	(1990) Initial Tear Resistance of Plastic Film and Sheeting.
ASTM D 1204	(1984) Linear Dimensional changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
ASTM D 1238; REV B	(1988) Flow Rates of Thermoplastics by Extrusion Plastometer.
ASTM D 1505	(1985; R 1990) Density of Plastics by the Density-Gradient Technique.
ASTM D 1593	(1981; R 1988) Nonrigid Vinyl Chloride Plastic Sheeting.
ASTM D 1693	(1979; R 1988) Environmental Stress - Cracking of Ethylene Plastics.

ASTM D 2216	(1980) Laboratory determination of Water (Moisture) Content of Soil by the Microwave Oven Method. (1980) Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
ASTM D 2434	(R 1974) Test Method for Permeability of Granular Soils (Constant Head)
ASTM D 3083	(1976; R 1983) Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining.
ASTM D 3895	(1980; R 1986) Copper - Induced Oxidative Induction Time of Polyolefins by Thermal Analysis.
FEDERAL TEST METHOD STANDARDS (FTMS)	
101 C 2065.1	Puncture Resistance and Elongation Test.

1.3 SUBMITTALS

Submit shop drawings for GML installation, including anchorage details, penetration details, and layout plan.

Submit copies of laboratory and field test reports presenting data on GML materials and seams.

The following shall be submitted in accordance with Section 01300 SUBMITTALS:

SD-70, Test Reports

Certified copies of laboratory test reports, including all test data, shall be submitted for the sodium bentonite. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials.

SD-76, Certificates of Compliance

The HDPE liner and Sodium Bentonite will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished. No GML shall be used until notice of acceptance has been given by the Contracting Officer. The GML materials may be subjected to check testing by the Government. Samples may be obtained at the mill, at transfer points, or at the project site.

1.4 GENERAL REQUIREMENTS

1.4.1 HDPE Liner Material

The material shall be unsupported high-density polyethylene (HDPE) 40 mil in thickness and shall be extruded to produce a uniform sheet free of defects such as holes, tears, nodules, blisters, or other manufacturing defects that may effect the serviceability. The HDPE liner shall conform to the following criteria listed below:

<u>ITEM</u>	<u>40 MIL</u>	<u>SPECIFICATION</u>
Thickness, mils (nominal)	40	ASTM D 1593 Par 8.1.3
Density g/cc (Min)	0.94	ASTM D 1505
Melt Flow Index g/10 (Max)	0.3	ASTM D 1238 Condition E (190°C, 2.16 kg)
Tensile Properties (Typical)		ASTM D 638 Type IV
1. Tensile Strength at Break (lbs/inch width)	160	Dumb-bell at 2 ipm
2. Tensile Strength at Yield (lbs/inch width)	95	
3. Elongation at Break (Percent)	700	
4. Elongation at Yield (Percent)	13	
Tear Resistance Initiation lbs (Typical)	30	ASTM D 1004 Die C Condition E (190°C, 2.16 kg)
<u>ITEM</u>	<u>40 MIL</u>	<u>SPECIFICATION</u>
Dimensional Stability % Change each direction (Max)	±2	ASTM D 1204 Condition E (190°C, 2.16 kg)
Resistance to Soil Burial Percent Change in Original Value (Typ)		ASTM D 3083 using ASTM D 638 Type IV Dumb-bell at 2 ipm
1. Tensile Strength at Break	±10	
2. Tensile Strength at Yield	±10	
3. Elongation at Break	±10	
4. Elongation at Yield	±10	
Environmental Stress Crack Hours (Min)	1500	ASTM D 1693 (10% Igepal, 50°C)
Puncture Resistance Pounds (Typ)	52	FTMS Method 2065
Coefficient of Liner Thermal Expansion $\times 10^{-4}$ cm\ (cm °C) (Typical)	1.2	ASTM D 696

Thermal Stability	2000	ASTM D 3895
Oxidation Induction Time		130°C, 800 psi O ₂
Minutes (Min)		

1.4.2 Sodium Bentonite

The Sodium Bentonite material and/or liner shall be a uniform sheet free of defects such as holes, tears, nodules, blisters, or other manufacturing defects that may effect the serviceability. The Sodium Bentonite shall conform to the following criteria listed below:

<u>ITEM</u>	<u>BENTONITE</u>	<u>SPECIFICATION</u>
Bentonite Loading lbs\ft ² (Min)	1.0	
Hydraulic Conductivity cm/sec (Max)	1x10 ⁻⁹	
Percent Montmorillonite	80-90%	
Silicon Dioxide (SiO ₂)	55-64%	
Aluminum Oxide (Al ₂ O ₃)	16-22%	
Ferric Oxide (Fe ₂ O ₃)	3-6%	
Sodium Oxide (Na ₂ O)	0-3%	
Magnesia (MgO)	2-4%	
Lime (CaO)	0-3%	

<u>ITEM</u>	<u>BENTONITE</u>	<u>SPECIFICATION</u>
Water Content	5-20%	ASTM D 2216
Bulk Density lbs\ft ³ (Typ)	77	

1.5 STORAGE OF GML

Until installed, factory-fabricated panels shall be stored in their original unopened crates; if outdoors, they shall be stored on pallets and shall be protected from the direct rays of the sun under a light-colored, heat-reflective, opaque cover in a manner that provides a free-flowing air space between the crate and cover. The Contractor shall be responsible for providing all required care and see that the GML is kept in good condition prior to its installation. Any GML materials found to be damaged shall be replaced with new at the Contractor's expense.

'PART 2 - PRODUCTS

2.1 GENERAL

The manufacturer(s) shall have produced, and have in service in similar applications for a period of not less than one (1) year and at least five (5) million square feet of GML meeting these specifications. The GML

manufacturer(s) shall furnish to the Government, evidence of this prior to the start of work. This evidence shall include names of contacts and phone numbers.

The Contractor shall provide GML products, or there equal, meeting the following specifications:

40 mil HDPE with glued Sodium Bentonite to liner; Gundseal from

Gundle Lining Systems, Inc.
19103 Gundle Road
Houston, Texas 77073;
1-800-435-2008.

40 mil HDPE Liner with a separate sodium bentonite liner, glued or sewn to a fabric, and placed under the HDPE liner:

BENTOMAT from
CETCO
1500 West Shure Dr.
Arlington Heights, IL 60004-1434
(708) 392-5800

CLAYMAX from
James Clem Corporation
444 N. Michigan Ave
Suite 1610
Chicago, Illinois 60611
(312) 321-6255
or
(505) 989-7029 - Southwest Office

If the Contractor proposed to provide other type materials, complete laboratory and descriptive information shall be submitted for evaluation by the Contracting Officer.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE FOR GML

The subgrade for the GML shall be prepared as specified in SECTION 02215 - PLASTIC FILTER FABRIC. An authorized representative of the GML manufacturer(s) shall certify in writing that the surface on which the GML is to be placed is acceptable, prior to start of GML placement.

3.2 PLACEMENT OF GML

3.2.1 General

The Contractor shall require the GML manufacturer(s) to furnish the services of a competent, factory trained, field technical representative to supervise

installation of the GML. The GML shall be placed over the prepared surfaces to be lined in such a manner as to assure minimum handling. Any portion of GML damaged during installation shall be removed or repaired by using an additional piece of GML, as specified hereinafter.

All equipment, tools, and machines used in performance of the work shall be subject to approval prior to commencement of work by the Contracting Officer. This equipment shall be maintained in satisfactory working conditions at all times.

3.2.2 Weather Limitations

GML shall be placed only when the temperature is above 45 degrees F. GML shall not be placed during rain, snow, or bad weather.

3.2.3 Field Procedures

Field procedures shall be specifically suitable for the type of GML selected by the Contractor. The GML shall be installed with the bentonite face or layer down. The GML joints shall be overlapped a minimum of 1-foot, or as specified in the plans, with a layer of bentonite between the overlapping HDPE liners. The overlap edges shall be tapped to prevent the intrusion of soil between the overlap during placement of the overlaying soil. The GML shall be free of wrinkles, bulges and folds. Procedures for alternative material shall be submitted for evaluation by the Contracting Officer.

3.2.4 Quality of Workmanship

All joints, on completion of the work, shall be properly overlaid. Any lining surface showing improper installation, injury due to scuffing, penetration by foreign objects, or distress from rough subgrade shall, as directed by the Contracting Officer, be replaced or repaired at no additional cost to the Government.

3.3 SAMPLING AND TESTING

3.3.1 Sampling and Testing at Jobsite

3.3.1.1 Inspection of Sheet Installation

The Contractor shall conduct a visual inspection of each panel or sheet as it is unrolled. The Contracting Officer shall be notified of any damage. All faulty areas shall be repaired as specified in paragraph, PLACEMENT OF GML.

3.3.2 Approval of Materials

Source of all materials shall be selected well in advance of the time that materials will be required in the work. Manufactures certification and test results for the HDPE liner and sodium bentonite shall be submitted for approval not less than 30 days before the material is required for the work.

~~3.3.3 Friction Testing~~

~~Where CML is to be placed on slopes greater than 4:Horizontal on 1:Vertical, the Contractor shall perform laboratory friction tests using a direct shear test method as approved by the Contracting Officer to assure a minimum friction angle of 17° can be obtained between all cover system components. Friction testing shall be performed with a direct shear box with minimum dimensions of 12 inches by 12 inches and applied normal stresses of 1.0, 2.0, and 4.0 psi for each cover system interface. A displacement rate of 0.005 inches per minute shall be used. All cover system soil components shall be compacted to the density and moisture content required for full scale placement and then tested in a saturated condition. All geotextile shall be oriented such that the shear force is parallel to the downslope orientation of the geotextiles in the field. These tests shall be performed and the results approved by the Contracting Officer prior to delivery of the cover system components.~~

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Revised Specifications

SECTION 02210 - GRADING

PART 1 - GENERAL

1.1 SUMMARY (Not Applicable)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 75	(1987) Sampling Aggregates.
ASTM C 136	(1984; Rev. a) Sieve Analysis of Fine and Coarse Aggregates.
ASTM D 422-63	Particle size Analysis of Soils
ASTM D 1556	(1982) Density of Soil In-Place by the Sand-Cone Method.
ASTM D 1557	(1978) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 2216	(1987) Determination of Water (moisture) Content of Soil, Rock, & Soil-Aggregate Mixtures.
ASTM D 2487	(1985) Classification of Soils for Engineering Purposes.
ASTM D 4253-83	Maximum Index Density of Soils Using a Vibratory Table.
ASTM D 4318-87	Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4643	(1980) Laboratory determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

1.3 DEFINITIONS

1.3.1 Satisfactory Bedding Materials

Materials classified in ASTM D 2487 as GW, GP, GM, GC, SW, SP, SC, SM, and CL and free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 3 inches in any dimension are satisfactory.

1.3.2 Unsatisfactory bedding Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as CH, Pt, OH, OL, ML, and MH are unsatisfactory. Unsatisfactory materials also include refuse.

1.3.3 Satisfactory Cover Materials

Materials classified in ASTM D 2487 as SC and CL and free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 1 inch in any dimension are satisfactory. Satisfactory Cover Materials shall have the following properties:

1. Fines content \geq 30% passing the #200 sieve
2. Plasticity $PI \geq 15\%$
3. Course Aggregates retained on the #4 sieve $<$ 10%
4. No particles \geq 1-inch

1.3.4 Unsatisfactory Cover Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, MH, ML, CH, Pt, OH, and OL, are unsatisfactory. Materials classified in ASTM D 2487 as CH Pt, OH, OL, ML, and MH are unsatisfactory. Unsatisfactory materials also include refuse.

1.3.5 Cohesionless and Cohesive Materials

Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.3.6 Degree of Compaction

Degree of compaction is a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D 1557, Method D or ASTM D 4253. ASTM D 1557 shall be used for soils containing 15 percent or more fines. ASTM D 4253 shall be used for soils containing 5 percent or less fines. The maximum laboratory dry density of soils containing between 5 and 15 percent fines shall be determined by the above procedure achieving the highest dry density. Degree of compaction shall be expressed as a percentage of the maximum laboratory dry density obtained by the appropriate procedure as defined above. Percentage of maximum laboratory dry density has been ~~and abbreviated hereinafter below as a percent of laboratory maximum density or percent maximum density.~~

1.3.7 Topsoil

Material obtained from off-site areas suitable for topsoil, is defined as natural, friable surface soil possessing the characteristics of representative soils in the vicinity that produce heavy growth of crops, grass, or other vegetation.

1.4 SUBMITTALS

The following shall be submitted in accordance with SECTION: 01300 - SUBMITTALS:

SD-39, Qualifications

The Contractor shall furnish the qualifications of the commercial testing laboratory who will be performing all testing in accordance with the paragraph, FIELD TESTING CONTROL.

SD-70, Test Reports

The Contractor shall furnish certified test reports and analysis certifying that the satisfactory materials proposed for use at the project site conform to the specified requirements, and for all tests conducted in accordance with the paragraph, FIELD TESTING CONTROL.

SD-91, Records

The Contractor shall notify the Contracting Officer of the opening of excavation or borrow areas in accordance with paragraph, BORROW MATERIAL.

1.5 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.5.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified,

where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

1.5.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 10 tons, with a minimum weight of 300 pounds per inch width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

1.5.3 Tamping Rollers

22.
Tamping rollers shall consist of two or more roller drums mounted side by side in a suitable frame. Rollers operated in tandem sets shall be towed in a manner such that the prints of the tamping feet produced by the tandem units do not overlap. Each drum of a roller shall have an outside diameter of not less than 5 feet and shall not be less than 5 feet nor more than 6 feet in length. The space between two adjacent drums, when on a level surface, shall be not less than 12 inches nor more than 15 inches. Each drum shall be free to pivot about an axis parallel to the direction of travel. Each drum ballasted with fluid shall be equipped with at least one pressure-relief valve and with at least one safety head. The safety head shall be equal to Union Type Safety Heads manufactured by Black, Sivalls and Bryson, Inc., Kansas City, Missouri, with rupture discs suitable for between 50 and 75 pounds-per-square-inch rupturing pressure. The pressure-relief valve is a manually operated valve and shall be opened periodically. Personnel responsible for opening pressure-relief valves shall be instructed to ascertain that valve openings are free from plugging to assure that any pressure developed in roller drums is released at each inspection. At least one tamping foot shall be provided for each 100 square inches of drum surface. The space measured on the surface of the drum, between the centers of any two adjacent tamping feet, shall be not less than 9 inches. The length of each tamping foot from the outside surface of the drum shall be not more than 11 inches and shall be maintained at not less than 9 inches. The cross-section area of each tamping foot shall be not more than 10 square inches at a plane normal to the axis of the shank 6 inches from the drum surface, and shall be maintained at not less than 7 square inches nor more than 10 square inches at a plane normal to the axis of the shank 8 inches from the drum surface. During the operation of rolling, the spaces between the tamping feet shall be maintained clear of materials which would impair the effectiveness of the tamping rollers. The weight of a roller when fully loaded shall be not less than 4,000 pounds per foot of length of drum. The weight of a roller empty shall be not less than 2,500 pounds per foot of length of drum. The loading used in the roller drums and operation of the rollers shall be as required to obtain the desired compaction. If more than one roller is used on any one layer of fill, all rollers so used shall be of the same type and essentially of the same dimensions. Rollers shall be drawn by crawler-type or rubber-tired tractors at a speed not to exceed 5.0 miles per hour. The use of rubber-tired tractors shall be discontinued if the tires leave ruts that prevent uniform compaction by the tamping roller. Tractors used for pulling rollers shall have sufficient power to pull the roller satisfactorily when drums are fully loaded with sand and water. At the option of the Contractor, self-propelled tamping

rollers conforming with the above requirements may be used in lieu of tractor-drawn tamping rollers. Self-propelled rollers exceeding the empty weight requirements may be used, provided that when the Contracting Officer determines self-propelled roller performance is unsatisfactory, the nominal foot pressure of the tamping feet of the self-propelled roller can be adjusted to approximate the nominal foot pressure of the specified towed rollers for the particular working condition required by the substitution of tamping feet having a face area not exceeding 14 square inches. If the self-propelled rollers cause shearing of the fill or laminations in the fill, the Contracting Officer may direct that the rollers be removed from the fill and that tractor-drawn tamping rollers conforming with these specifications be used. For self-propelled rollers, in which steering is accomplished through the use of rubber-tired wheels, the tire pressure shall not exceed 40 pounds per square inch. Self-propelled rollers shall be operated at a speed not to exceed 5.0 miles per hour. The design and operation of the tamping roller shall be subject to the approval of the Contracting Officer who shall have the right at any time during the prosecution of the work to direct such repairs to the tamping feet, minor alterations in the roller, and variations in the weight as may be found necessary to secure optimum compaction of the earth-fill materials.

1.5.4 Rubber-Tired Rollers

Rubber-tired rollers shall have a minimum of four wheels equipped with pneumatic tires. The tires shall be of such size and ply as can be maintained at tire pressures between 80 and 100 pounds per square inch for a 25,000 pound wheel load during rolling operations. The roller wheels shall be located abreast and be so designed that each wheel will carry approximately equal load in traversing uneven ground. The spacing of the wheels shall be such that the distance between the nearest edges of adjacent tires will not be greater than 50 percent of the tire width of a single tire at the operating pressure for a 25,000 pound wheel load. The roller shall be provided with a body suitable for ballast loading such that the load per wheel may be varied, as directed by the Contracting Officer, from 18,000 to 25,000 pounds. The roller shall be towed at speeds not to exceed five miles per hour. The character and efficiency of this equipment shall be subject to the approval of the Contracting Officer. If the rubber-tired rollers cause shearing of the fill or laminations in the fill, the Contracting Officer may direct that the rollers be removed from the fill and that tractor-drawn tamping rollers conforming with the provisions of subparagraph, Tamping Rollers, be used.

1.5.5 Power Tampers and Vibrating Platforms

Compaction of materials, in areas where it is impracticable to use a roller, shall be performed by the use of approved power tampers or vibrating platforms.

1.5.6 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.5.7 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 12-foot straightedge, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement.

1.6 STOCKPILING MATERIALS

Materials shall be stockpiled in the manner and at locations designated.

PART 2 - PRODUCTS

2.1 BORROW MATERIAL

Borrow material shall be selected to meet requirements and conditions of the particular fill for which it is to be used.

2.1.1 Selection

Borrow materials shall be obtained from sources outside the limits of Government-controlled land. Borrow materials shall be subject to approval. The source of borrow material shall be the Contractor's responsibility. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, shall pay all royalties and other charges involved, and shall bear all the expense of developing the sources, including rights-of-way for hauling.

PART 3 - EXECUTION

3.1 PREPARATION OF GROUND SURFACE FOR FILL

All vegetation, such as trees, stumps, roots, brush, and other vegetation in the area to be cleared shall be cut off flush with the original ground surface. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. In no case will unsatisfactory material remain in or under the fill area. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.

3.2 FILLS AND EMBANKMENTS (OTHER THAN SAND GAS VENT LAYER)

Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Satisfactory material obtained during excavation may be used in forming required fill. Fill shall be satisfactory material and shall be reasonably

free from roots, other organic material, and trash and from stones having a maximum diameters as specified in paragraphs "Satisfactory Bedding Materials" and "Satisfactory Cover Materials". No frozen material will be permitted in the fill. The material shall be placed in successive maximum horizontal layers of 8 inches in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating, as required, to at least one (1) percent above optimum moisture content as determined from laboratory tests specified in paragraph "DEFINITIONS." Moisture content adjustments shall be assisted by using a disk that will penetrate the full loose layer thickness and will scarify the upper two inches of the underlying lift. Disking shall continue until the specified moisture is obtained throughout the layer to be compacted.

3.2.1 Spreading

After dumping, the materials shall be spread by bulldozer or other approved means in approximately horizontal layers over the fill area. At no time will any equipment operate on top of the high density polyethylene liner with out a protective layer of soil as per manufactures recommendation. Unless otherwise directed, the loose thickness of these layers before compaction shall be as specified hereinafter in part 3. The entire surface of any section of the bedding material or cover material layers under construction shall be maintained in such condition that construction equipment can travel to any part of one section. Ruts in the surface of any layer shall be filled satisfactorily before compacting.

3.2.2 Compaction

Each layer of the landfill cap shall be compacted to the percent maximum of ~~laboratory~~ density. Density of compacted mixture shall be at least 90 percent of laboratory dry maximum density in accordance with ASTM D 1557, Method D for cohesive materials or 95 percent of laboratory maximum dry density in accordance with ASTM D 4253 for cohesionless materials. The first lift of cover material on top of the high density polyethylene liner shall be compacted with the steel-wheeled roller and/or rubber-tired roller as per manufactures recommendation. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with power tampers or vibrating platforms, and shall be shaped and finished by hand methods.

3.2.3 Layer Thickness

Compacted thickness of the bedding material shall be as indicated. No layer shall be in excess of 8 inches in loose thickness nor less than 3 inches in compacted thickness.

3.3 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from finish roller operations, except as otherwise specified. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turving materials. Surfaces shall be finished not more than 0.15 foot above or below the established grade or approved cross section.

3.4 PLACING TOPSOIL

On areas to receive topsoil, the compacted soil shall be scarified to a 2-inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a loose thickness of 8 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Compaction shall be achieved by one complete coverage of a dozer track. Moisture content shall be adjusted as required to facilitate compaction. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from off-site areas.

3.5 FIELD TESTING CONTROL

Testing shall be the responsibility of the Contractor and shall be performed by an Government approved commercial testing laboratory or by the Contractor subject to Government approval. Field density and moisture content tests shall be performed once or fraction there of on every lift placed. Field in-place density shall be determined in accordance with ASTM D 1556 ~~or ASTM D 2167~~. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompactd to meet specification requirements, at no additional expense to the Government. Tests on recompactd areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.5.1 Test Results

A coordinate system (x,y,z) shall be established to report sample locations. All tests including failures shall be reported and submitted to the Contracting Officer within 24 hours of the time of sampling. Only passing tests are acceptable. In the event of a failing moisture or density test a minimum of two passing tests of the suspect area of the fill shall be run. Results shall verify that materials comply with this specification. When a material source is changed, the new material will be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of

unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

3.5.2 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with ASTM D 75.

3.5.3 Sieve Analysis

Before starting work, at least one sample of material to be placed shall be tested in accordance with ASTM C 136 and ASTM D 422 on sieves conforming to ASTM E 11. After the initial test, a minimum of one analysis shall be performed for each 1000 CY of material placed, with a minimum of three analyses for each day's run until the layer is completed.

3.5.4 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with ASTM D 4318.

3.5.5 Classification of Soils for Engineering Purposes

Soils classification shall be performed for each sieve analysis. Soils classification shall be in accordance with ASTM D 2487.

3.5.6 Density Control

The Contractor shall adequately control his compaction operations by tests made in accordance with ASTM D 1556 ~~or ASTM D 2167~~. One in-place density and one in-place moisture test shall be performed per 10,000 square feet, or fraction thereof, of each lift. One in-place density and one in-place moisture test shall be performed per 100 cubic feet, or fraction thereof, for hand compacted areas. Moisture content shall be in accordance with ASTM D 2216 or ASTM D 4643 for determining density. When ASTM D 4643 is utilized, the moisture content should be checked a minimum of once per each ten (10) microwave oven method using ASTM D 2216. The density test hole shall be backfilled and compacted to the required moisture and density of the adjacent fill. Additional tests shall be made as necessary. All test results shall be made available to the Contracting Officer. Acceptance tests may be made by the Government for verification of compliance; however, the Contractor shall not depend on such test for his control of operations. Deficiencies in construction shall be corrected by the contractor at no additional cost to the Government.

3.5.7 Density-Moisture Determinations

Test for determination of maximum laboratory dry density and optimum moisture content shall be performed by the contractor in accordance with the requirements of ASTM D 1557, Method D or ASTM D 4253. ASTM D 1557 shall be used for soils containing 15 percent or more fines. ASTM D 4253 shall be used

for soils containing 5 percent or less fines. The maximum laboratory dry density of soils containing between 5 and 15 percent fines shall be determined by the above procedure achieving the highest dry density. A minimum of one laboratory density test, gradation, and Atterberg limits shall be performed each placement day or fraction thereof. Additional tests shall be run for each material change. ~~Density Moisture Tests shall be run on the same sample on which the in place density test is run. The percent compaction of the fill sample is then calculated from the results of the field and laboratory density tests. The above testing shall include Atterberg limits and grain size determinations and shall be made on the same material as the in place density and moisture test.~~

3.6 PROTECTION

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

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SECTION 02215 - PLASTIC FILTER FABRIC

1. GENERAL

1.1 SCOPE

The work provided for herein consists of furnishing all plant, labor, material, and equipment and performing all operations required for furnishing, hauling, and placing the geotextile, complete, as specified herein and shown on the contract drawings, and maintaining the geotextile until placement of the geocomposite liner is completed and accepted.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM).

ASTM-D 123 REV A-90	Standard Terminology Relating to Textiles.
ASTM-D 1683-90	Failure in Sewn Seams of Woven Fabrics.
ASTM-D 3787-89	Bursting Strength of Knitted Goods: Constant-Rate-of-Traverse (CRT), Ball Burst Test.
ASTM-D 4491-89	Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM-D 4533-85	Trapezoid Tearing Strength of Geotextiles.
ASTM-D 4632-86	Breaking Load and Elongation of Geotextiles (Grab Method).

U.S. Army Corps of Engineers.

EM 1110-2-1906	Laboratory Soils Testing.
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2. MATERIALS.

2.1 Geotextile (Plastic Filter Fabric)

The geotextile shall be a non-woven pervious sheet of plastic yarn as defined by ASTM D-123. The geotextile shall meet the physical requirements listed in Table No. 1 of the specifications. The geotextile fiber shall consist of a long chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, ester, amide, or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic if necessary to make the filaments resistant to deterioration due to ultra-violet and heat

exposure. The edges of the geotextile shall be finished to prevent the outer fiber from pulling away from the geotextile.

2.2 Seams

The seams of the geotextile shall be sewn with thread of a material meeting the chemical requirements given above for geotextile yarn or shall be bonded by cementing or by heat. The sheets of geotextile shall be attached at the factory or another approved location, if necessary, to form sections not less than 6 feet wide. Seams shall be tested in accordance with method ASTM D 1683, using 1-inch square jaws and 12 inches per minute constant rate of traverse. The strengths shall be not less than 90% of the required tensile strength (Table 1) of the unaged geotextile in any principal direction.

2.3 Acceptance Requirements

All brands of geotextile and all seams to be used shall be accepted on the following basis. The Contractor shall furnish the Contracting Officer, in duplicate, a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification. If requested by the Contracting Officer, the Contractor shall provide to the Government geotextile samples for testing to determine compliance with any or all of the requirements in this specification. When samples are to be provided, they shall be submitted a minimum of 30 days prior to the beginning of installation of the same geotextile. All samples provided shall be from the same production lot as will be supplied for the contract, and shall be the full manufactured width of the geotextile by at least 10 ft. long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 5 ft. Samples submitted for testing shall be identified by manufacturers lot designation.

2.4 Securing Pins

Securing pins shall be 3/16 inch in diameter, of steel, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 1.5 inches. The lengths of the pins shall be no less than 18 inches.

Table No. 1 - Physical Requirements

Physical Property	Test Procedure	Acceptable Values++
Tensile Strength +(unaged geotextile)	ASTM D 4632 Grab Test using 1 inch square jaws and a 12 inches per minute constant rate of traverse.	100 pound minimum in any principal direction.
Breaking Elongation (unaged geotextile)	ASTM D 4632 Determine Apparent Breaking Elongation.	15 percent minimum in any principal direction.
Puncture Strength +(unaged geotextile)	ASTM D 3787 except polished steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.	40 pound minimum.
Geotextile Permeability	ASTM D 4491 Test Methods for Water Permeability of Geotextiles by Permittivity.	The permeability of the geotextile shall be greater than 0.1 cm/sec.
Equivalent Opening Size (EOS)	Specification Paragraph titled "Determination of Equivalent Opening Size (EOS)".	No coarser than the U.S. Standard Sieve No. 70.
Tear Strength	ASTM D 4533 Trapezoidal Tear Strength.	40 lbs. minimum in any principal direction.

+Unaged geotextile is defined as geotextile in the condition received from the manufacturer or distributor.

++All numerical values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the minimum in the table).

2.5 SHIPMENT AND STORAGE

During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultra-violet rays, temperatures greater than 140 degrees fahrenheit, mud, dirt, dust and debris. To the extent possible, the fabric shall be maintained wrapped in a heavy duty protective covering.

3. INSTALLATION OF THE GEOTEXTILE

The geotextile shall be placed in the manner and at the locations shown on the drawings. At the time of installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage. The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions, debris and soft or low density pockets of material. The geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide a minimum width of 12 inches of overlap for each joint. Temporary pinning of the textile to help hold it in place until the geocomposite liner is installed shall be allowed. The geotextile shall be protected at all times during construction from contamination by surface runoff and any geotextile so contaminated shall be removed and replaced with uncontaminated geotextile. Any damage to the geotextile during its installation or during placement of the geocomposite liner shall be replaced by the Contractor at no cost to the Government. The work shall be scheduled so that the covering of the geotextile with a layer of the specified material is accomplished within 7 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. The geotextile shall be protected from damage prior to and during the placement of the geocomposite liner or other materials. Before placement of the geocomposite liner or other materials, the Contractor shall demonstrate that the placement technique will prevent damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

4. QUALITY CONTROL.

4.1 General

The Contractor shall establish and maintain quality control for the work covered in this section of the Technical Provisions to assure compliance with contract requirements and maintain quality control records for all construction operations including but not limited to the following:

- (1) Field inspection of materials.
- (2) Placing of fabric and securing pins.
- (3) Protection of fabric.

Two (2) legible copies of these records, as well as the records of corrective action taken, shall be furnished the Government as directed by the Contracting Officer.

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BIDDING SCHEDULE
(To be attached to SF 1442)

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
1.	Landfill Cover, Complete	Job	Sum	***	\$ _____
2.	Demolition, Barbed Wire Fence, Grading, All Other Work Not Separately Listed	Job	Sum	***	\$ _____
3.	Certified Final Survey on Site.	Job	Sum	***	\$ _____
3.	Final As-Built Drawings	Job	Sum	***	\$ <u>1000.00</u>
TOTAL AMOUNT					\$ _____

NOTES:

1. Bidders must bid on all items.

2. ARITHMETIC DISCREPANCIES: (APR 1984)

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

(1) Obviously misplaced decimal points will be corrected;

(2) Apparent errors in addition of lump sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids. (EFAR 14.201/90)

3. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid schedule must be stated. If

it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.

4. PROGRESS PAYMENT REQUESTS made by the Contractor pursuant to the provisions of Contract Clause, PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS, shall be submitted on ENG FORM 93 to the billing office as designated on Block 26, Standard Form 1442, Solicitation, Offer and Award, back. ENG FORM 93 shall be submitted to that office on the 1st of each month in appropriate form and certified. A copy of ENG FORM 93 and Certification (SWA 739-R) are attached at the end of the Contract Clauses. Xeroxed copies of the form shall be furnished on that same date to the Corps of Engineers offices designated at the Pre-Construction Conference.

SECTION 01380 - CONSTRUCTION PHOTOGRAPHY

1. The Contractor shall photograph the progress of construction during all stages of construction. Photographs shall be 4" x 6" color. Contractor shall provide the Government a photo album including all photographs taken during the extent of the project.

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SECTION 01400

CONTRACTOR QUALITY CONTROL SYSTEM

1. CONTRACTOR QUALITY CONTROL (ER 1180-1-6) (JUL 1986).

1.1 General. The Contractor shall establish and maintain an effective quality control system in compliance with the Contract Clause entitled "INSPECTION OF CONSTRUCTION". The quality control system shall consist of plans, procedures, and organization necessary to provide materials, equipment, workmanship, fabrication, construction and operations.

1.2 Coordination Meeting. Before start of construction, the Contractor shall meet with the Contracting Officer (CO) or his authorized representative (ACO) and discuss the Contractor's quality control system.

1.3 Quality Control Plan:

1.3.1 General. The Government will consider an interim plan for the first 15 days of operation. However, the Contractor shall furnish for acceptance by the Government, not later than 10 days after receipt of Notice to Proceed, the final Contractor Quality Control (CQC) Plan with which he proposes to implement the requirements of Contract Clause entitled "Inspection of Construction". If the Contractor fails to submit an acceptable QC plan within the time herein prescribed, the CO or ACO may withhold funds from progress payments in accordance with the Contract Clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS" until such time as the Contractor submits an acceptable final plan.

1.3.2 The Quality Control Plan. This plan shall include as a minimum, the following:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgement that the CQC staff shall implement the three phase control systems for all aspects of the work specified and shall report to the project manager or someone higher in the Contractor's organization.

b. The name, qualifications, duties, responsibilities and authorities of each person assigned a QC function.

1.3.3 Acceptance of Plan. Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC plan, staffing and operations as necessary to obtain the quality specified.

1.3.4 Notification of Changes. After acceptance of the QC plan, the Contractor shall notify the CO in writing of any proposed change. Proposed changes require approval by the CO or ACO.