DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART I - GENERAL

1.01 TEMPORARY SERVICES

A. General: The General Contractor shall provide temporary services at the site of the work throughout the entire period of construction and until the work is completed and maintenance of the cap becomes the PRPs' responsibility.

B. Temporary Heat:
   1. When ambient temperatures require temporary heat for performance of work, as determined by the Construction Manager, provide, maintain and operate a sufficient number of approved portable heaters so the progress of the work is not impeded. Erect temporary enclosure so as to contain the heat in the work area.
   2. Maintain temporary enclosures at a minimum temperature of 50° F., except when a lower temperature is authorized by the Construction Manager or when certain conditions of the Specifications require a higher temperature to be maintained during the performance of certain work.

C. Temporary Water Supply:
   1. Provide an adequate potable water supply at the site during the period of construction either by means of a permanent water supply line or by a temporary water supply line.
   2. Run temporary water supply to a convenient point at the structure(s) as determined by the Contractor and approved by the Construction Manager.
   3. Provide a separate water supply with back flow prevention for personnel trailers and vehicle decontamination structures.

D. Temporary Power and Light:
   1. Provide and maintain a temporary light and power system at the site. Unless specified differently elsewhere in these Specifications, provide single phase, three wire, 110/220 volt temporary service with the necessary distribution facilities and meters, if required.
   2. Provide adequate light at structure(s) to sustain one shift operation. The maximum size motor on temporary power service shall be 5 hp.

E. Temporary Telephone:
   1. Provide temporary telephone service for use of all Contractors, Subcontractors, and the Construction Manager during the course of the project.

F. Temporary Water Control:
   1. At all times during construction, maintain the flow of storm water, naturally occurring water and wastewater in existing facilities and channels affected by the work.
   2. Contractor assumes risk from floods or other causes, and any damages done to the work in progress or to work completed under Contract and shall make repairs and replacements to the satisfaction of the Construction Manager.
   3. Contractor assumes responsibility for damages to property caused by flooding or backflooding of property due to blocking or restriction of storm water passages, natural waterways and wastewater facilities capacity during normal or excessive periods of flow.
   4. The means and methods the Contractor employs to meet above requirements are at his discretion.

1.02 TEMPORARY FACILITIES

The General Contractor shall provide the following temporary facilities.

A. Construction Manager's Field Office:
   1. General: Provide a field office in a location approved by the Construction Manager on or adjacent to the Project Site, for the exclusive use of the Construction Manager and his authorized representatives. The field office shall be equipped and ready for use within fifteen (15) days after the date of the Notice to Proceed. The office shall be a structure or a trailer or combination of trailers approved by the Construction Manager and having a minimum of 500 square feet of floor space. The office shall have adequate heating and cooling systems automatically, thermostatically controlled to maintain a minimum inside temperature of 70 degrees F. during cold weather, and during hot weather cooled down to at least 75 degrees F. The office shall have at least four windows and each window shall be screened and capable of being opened. The office shall have a private entrance door with a suitable lock and two keys; the entrance shall also have a screened door. The office shall have a landing and steps with handrail at each entrance. The Construction Manager shall approve the floor plan for the field office. The office shall include a separate fully partitioned office area for use by the

PRPs. The office shall conform to the Occupational Safety and Health Act of 1970 (PL 91-596).

2. Lighting and Electric Power: Provide adequate electric lighting as required by the Construction Manager, and a minimum of eight electric wall receptacles.
3. Sanitary Facilities: The field office shall be equipped with sanitary facilities (washroom) for the exclusive use of the Construction Manager and his representatives. The washroom shall include a lavatory, flush type water closet, a wall mirror, toilet paper holder, and paper towel container. The washroom shall be suitably enclosed within the field office, equipped with hot and cold running water and connected to a facilities collection tank. The General Contractor shall be responsible for proper disposal of the tank contents during the project.
4. Parking: Provide adequate parking space, adjacent to the field office with a minimum of 3 parking spaces. Provide vehicle ingress and egress to the parking area.
5. Telephone Service: Provide in the field office two private telephone line connections for the exclusive use of the Construction Manager. Pay for all subscription, installation and local calls with an allowance of $200.00 per month for long distance calls. Long distance calls over the $200.00 allowance will be paid for by the caller. In addition provide one dedicated voice grade telephone line for computer facilities or telecopy service.
6. Utilities: All utilities services including water, electricity, sewer, heating, cooling and telephone (to limits previously described) costs shall be paid by the Contractor.
7. Maintenance: Provide daily janitorial service for the field office; furnish, replace and replenish light bulbs, fluorescent tubes, toilet paper, paper towels, soap and bottled water. Wash the office floors and washroom facilities at least once each week. Sweep office floors, empty trash and dust furnishings daily. Wash office windows at the request of the Construction Manager.
8. Furnishings: Provide the following furnishings (which shall remain the property of the Contractor) in clean, neat and operating condition:
   a. Four Calculators; Sharp CS 2302 or equal.
   b. One Copy Machine; Xerox 5028Z or equal.
   c. Four Desks; 3 feet x 5 feet (one with secretarial arm).
   d. Three Desk type swivel arm chairs.
   e. Seven Straight chairs.
   f. One Conference Table; 3 feet by 8 feet.
   g. Three Four-drawer, legal size filing cabinets with lock and key.
   h. Three Book shelves. 60 inch x 30 inch x 8 inch minimum.

i. Six Metal Wastebaskets.
j. One Drafting table; 42 inch x 60 inch, with parallel bar.
k. One Drafting stool.
l. One Plan Rack, sized to hold minimum of 5 sets of plans.
m. One Supply cabinet, double door.
n. One Wall mounted fire extinguisher.
o. One First Aid Kit meeting the requirements of 29 CFR 1910.151.
p. One Bottled Water water cooler, with hot and cold spigots.
q. One 6 cubic foot refrigerator.
r. Four Telephones
s. One Ricoh Rapicom F25 telecopier or equivalent.

B. Electric and Telephone Hookups:
1. Make and maintain electric and telephone hook-ups to the trailers of all other contractors on site. The individual Contractors shall be responsible for monthly utility charges.

C. Temporary Sanitary Facilities:
1. Provide and maintain as required by local laws, temporary toilet facilities for all workmen on the Project. Sanitary facilities shall conform to OSHA requirements.

D. Contractor Provided Work Station. The Contractor shall provide the office with a computer work station and related furniture for the sole use of the PRPs' representative. The work station shall be installed and operational in the temporary Construction Manager field office, and shall include the following minimum equipment:

1. An IBM AT compatible computer including:
a. 386 Micro Processor
b. 387 Math Co-Processor
c. 16 - 20 MHz Clock Speed
d. 4 Megabyte of Random Access Memory (RAM)
e. 1.4 Megabyte Floppy Disk Drive
f. 1.2 Megabyte Floppy Disk Drive
g. 40 Megabyte On-board Hard Disk Storage (Solely for Trustee use
h. Additional Hard Disk Storage as required for Contractor Data (i.e.: Scheduling Software)
i. Internal 2400 Baud Modem
2. An EGA compatible color monitor
3. A Dot Matrix Printer capable of handling 15" wide paper
4. A type 101 keyboard
5. All necessary cables, connectors, mouse and supplies to install the system

6. A 1 KVA Uninterruptable Power Source/Power Filter
7. The following software:
   a. MS-DOS Operating System, Version 4.0 or newer
   b. Informix SQL Database System Version 2.10.00A
   c. Enable Integrated Software Version 2.15 or newer (The Software Group)
   d. Any required software to run the Contractor's CPM

The system shall be installed and operational within 60 days of the contract Notice to Proceed and shall be maintained in operating condition by the Contractor for the duration of the contract. The equipment will remain the property of the Contractor and shall be removed 60 calendar days after completion of the contract. The Contractor shall provide a minimum of 40 hours of training on the use of the work station and its software for up to three of the PRPs' designated representatives.

1.03 PROJECT SIGN

A. General: The Contractor shall provide the project sign on the construction site at a prominent location as determined by the Construction Manager. The project sign shall be four feet high and six feet wide, of 3/4 inch thick exterior plywood. The sign shall be supported by 4 inch by 4 inch posts, placed three feet into the ground. Maintain such sign in good condition throughout the life of the project.
   1. Sign Wording: The Contractor shall obtain the appropriate wording from the Construction Manager.
   2. Color and Details: Use exterior-grade gloss-finish enamel paints. Black letters shall be placed on white background.

PART 2 - MATERIALS

2.01 PORTABLE HEATERS

All heaters shall be UL-approved electric heaters designed to operate in accordance with OSHA safety requirements.

2.02 TEMPORARY WATER EXTENSIONS

Temporary piping, water hoses and controls shall be maintained in leak free condition.

2.03 TEMPORARY POWER EQUIPMENT AND EXTENSION

Provide UL-approved extension cords, temporary wires, outlets and on/off controls.

2.04 TEMPORARY LIGHTS

When required by the Construction Manager, provide UL-approved portable task lights equipped with crash guards in conformance with OSHA requirements.

2.05 TEMPORARY TRAFFIC CONTROL

When required by the Construction Manager, provide barricades, flashing warning lights, torches, reflectors and signs in conformance with the requirements of the Delaware Department of Transportation.

PART 3 - EXECUTION

3.01 REMOVAL

A. When directed by the Construction Manager, the Contractor shall remove temporary services and extensions of such.
B. When directed by the Construction Manager, the Contractor shall remove temporary facilities.
C. When directed by the Construction Manager, the Contractor shall remove project sign.

[END OF SECTION]

DIVISION - GENERAL REQUIREMENTS

SECTION 01600 - SECURITY

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section describes the minimum security measures to be followed by the Contractor. The General Contractor shall supply the necessary qualified personnel and equipment to provide site security. Security shall begin upon initiation of any General Contractor work at the site.

1.02 ENTRANCE CONTROL

Control of all persons and vehicles entering and leaving the project site shall be provided by the General Contractor. The Contractor shall exclude from the site persons not properly identified. The Contractor shall comply, at a minimum, with the following requirements.

A. Personnel List: Maintain a current list of accredited persons and subcontractors and submit a copy of the list to the Construction Manager on request.

B. Entrance Procedure: Require personnel to sign in upon entering the site and to sign out when leaving.

C. Visitors: Allow no visitors without the approval of the Construction Manager except for properly identified USEPA and Delaware DNREC personnel. Visitors shall not be left unescorted. Visitors shall not be permitted to enter active work areas without the expressed permission of the Construction Manager.

D. Visitor Log: Maintain a log of visitors which shall include name, affiliation, and purpose of visit.

E. Liability Release: Require signature of visitors on a form relieving the PRPs and the Construction Manager of the liability of consequences related to potential hazards associates with site entry.

1.03 SITE CONTROL

The General Contractor shall maintain control of the site and shall be responsible for site security.

A. Security Personnel:
   1. General: The Contractor shall provide sufficient security personnel to accomplish the outlined requirements. The Construction Manager shall have the right to approve and reject of the security personnel assigned to the project site at any time during Contractor activities.
   2. Security Emergencies: The Contractor shall conduct coordination visits as directed by the Construction Manager with local law and emergency service officials (i.e., local police or sheriff, state police, emergency medical corps units, fire department, and utility emergency teams) to map out contingency plans for emergency situations.
   3. Security Trailer: The Contractor shall provide a security trailer to shelter the security guard. The facility shall be located as indicated on the Drawings. Light, heat, air conditioning and ventilation must be provided according to applicable codes and regulations. Contractor shall also provide telephone service, desk, and chair.

1.04 SECURITY FENCE

The General Contractor shall install a new site security fence as needed to limit access to the site as specified in Section 02400 - Chain Link Fence And Gates, and as shown on the Drawings.

1.05 LOCKING DEVICES

Keyed-alike padlocks with rubber-encased shanks and keyholes shall be provided for all gates.

1.06 SECURITY PLAN

A. Site Security Protocols: A Security Plan shall be submitted by the General Contractor for review and approval by the Construction Manager. It shall address as a minimum:
   1. Number of Security Personnel.
   2. Personnel Duties.
   3. Personnel Names and Qualifications.
   4. Description of Proposed Daily Security Operations.

5. Description of Security Check Procedures.
6. Description of How Security Breaches Shall be Handled including unauthorized personnel on the site and unauthorized personnel attempting to gain access to the site.
7. Standard Operating Procedures for Responses to Emergency Situations.
8. Communication Systems for both onsite and offsite emergency notifications.

PART 2 - MATERIALS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01700 - MATERIAL HANDLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The General Contractor shall supply all materials and labor to excavate, sample, analyze, backfill, and dispose of surface debris, demolition debris and clearing material discussed in the Specifications. This section describes the minimum requirements the Contractor shall follow. The Contractor shall handle all material in a manner to protect the workers and the public in accordance with all applicable federal, state, and local laws and regulations.

1.02 SUBMITTALS

The General Contractor shall submit for Engineer approval the following items required by this section.

A. Material Handling Plan shall be submitted by the Contractor for review and approval. The Material Handling Plan, at a minimum, shall consist of the Contractor's proposed procedure for safely handling any surface debris, demolition debris, and clearing material. The Contractor shall also describe site procedures to minimize the creation of dust, vapors, odors, and wind blown debris.

B. Spill and Discharge Control Plan: The Contractor shall develop, implement, maintain, supervise, and be responsible for a comprehensive Spill and Discharge Control Plan. This plan shall provide contingency measures for potential uncontrolled spills and discharges of fuel and potentially contaminated water including decontamination water as applicable.

1.03 NON-CONTAMINATED CLEARING MATERIAL

Non-contaminated clearing material consists of cleared vegetation, demolition debris, and surface debris deposited on the existing cap since the close of the landfill. Cleared vegetation shall be separated, and, if necessary, stockpiled at approved locations. Cleared vegetation shall be properly disposed of onsite as approved by the Construction Manager if it is determined by the Construction Manager to be unsuitable as mulch as defined in Section 02370 - Seeding. No cleared vegetation shall be placed

underneath the cap system. As an alternative, the cleared vegetation may be disposed of at an offsite facility as approved by the Construction Manager.

Surface debris and demolition debris shall be disposed of offsite by means approved by the Construction Manager.

1.04 POTENTIALLY CONTAMINATED SOLIDS

The Contractor shall be prepared to institute procedures to protect site workers and the public from potentially contaminated solids encountered and to prevent additional contamination. Potentially contaminated solids excavated and generated during construction shall be disposed of under the cap as directed by the Construction Manager. Any off-site disposal of potentially contaminated solids shall be at no additional cost to the PRPs.

1.05 POTENTIALLY CONTAMINATED LIQUIDS

The Contractor shall collect, store, sample and analyze and properly dispose of potentially contaminated liquids generated or encountered on site during construction.

1.06 SPILL AND DISCHARGE CONTROL

A. Scope: The Contractor shall develop, implement, maintain, supervise, and be responsible for a comprehensive Spill and Discharge Control Plan. This plan shall provide contingency measures for potential uncontrolled spills and discharges of potentially contaminated water. The Contractor shall provide equipment and personnel to perform decontamination measures that may be required to remove spillage from previously uncontaminated structures, equipment, or material.

B. Spill and Discharge Control Plan: Contractor shall submit a Spill and Discharge Control Plan for the Construction Manager's review and approval. The plan shall describe:
   1. Procedures for Containing Dry and Liquid Spills.
   2. Absorbent Material Available on Site.
   3. Storage of Spilled Materials.
   4. Decontamination Procedures. Decontamination procedures may be required after cleanup to eliminate or reduce to an acceptable level traces of the substance spilled. Acceptable levels shall be determined by the Construction Manager. Complete cleanup may require removal of contaminated soils. Personnel decontamination shall include showers and cleansing or disposing of clothing and equipment. All contaminated materials including solvents, cloth,

soil, and wood that cannot be decontaminated must be properly disposed of as approved by the Construction Manager.

C. Spill Incident Report: A written report detailing the uncontrolled spill or discharge shall include at a minimum the cause and resolution of incident, outside agencies involved, and date and time of occurrence, response, and resolution. The report shall be submitted, to the Construction Manager within 48 hours of the incident. The Contractor shall document all spills on the site Drawings and submit the Drawings to the Construction Manager at project completion.

D. Notification: The Construction Manager shall be notified immediately of an spill or uncontrolled discharge.

1.07 VAPOR AND ODOR CONTROL

During any potentially hazardous construction, the Contractor shall implement the Air Monitoring Plan as described in Section 01110 - Air Monitoring. The Contractor shall provide the materials and labor to control objectionable vapors and odor originating from the site. The Contractor shall: limit exposure area; cover exposure area with plastic or suitable soil cover material; or use foam suppressants to reduce odors to acceptable levels.

2.0 RELATED WORK

Section 01006 - Environmental Protection
Section 01100 - Health and Safety
Section 01110 - Air Monitoring
Section 01150 - Measurement and Payment
Section 02055 - Removal and Demolition of Existing Facilities
Section 02200 - Earthwork
Section 02400 - Chain Link Fence and Gates

PART 2 - MATERIALS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01900 - SUBSURFACE INVESTIGATION INFORMATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Limitations of Subsurface Information Included in Contract Documents:
   1. Subsurface information gathered during previous site investigations has been included in the Appendices to the Contract Documents. Logs of the exploratory borings are appended to the Contract Documents. The locations of the borings are shown on the Drawings.
   2. The Contractor hereby distinctly agrees that neither the PRPs nor the Engineer is responsible for the correctness or sufficiency of the information given:
      a. That in no event is this information to be considered as a part of the Contract;
      b. That the Contractor shall have no claim for delay or extra compensation or damage against the PRPs or the Engineer on account of incorrectness of information given; or on account of the insufficiency or absence of information regarding soil or groundwater conditions or obstructions either revealed or not revealed by the Documents or Drawings; and
      c. That the Contractor shall have no claim for relief from any obligation or responsibility under his Contract, in case the location, size or character of any pipe or other underground structure is not as indicated on the Documents or Drawings, or in case any pipe or other underground structure is encountered that is not indicated on the Documents or Drawings.

B. Additional Information
   1. Additional information regarding subsurface conditions may be available from the New Castle County authorities or their agents. The Engineer and PRPs make no representations or guarantees, nor assume any responsibility, regarding the availability, applicability, or accuracy of any such information.
   2. The Contractor hereby distinctly agrees that neither the Engineer nor the PRPs are responsible for the correctness or sufficiency of any such information.

PART 2 - MATERIALS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02055 - REMOVAL AND DEMOLITION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

Work Included: The work consists of the removal of the septic tank associated with the scale house, the former scale, and fence surrounding the support area as shown on the Drawings. Work described in this section shall be performed by the General Contractor.

A. Demolition work, as specified herein, is intended to be performed as preparatory work relative to the performance of the various construction operations of the project.

B. The General Contractor shall contact the utility notification hotline "Miss Utility of Delmarva" (800 282 8555) at least 48 hours before excavating in the vicinity of suspected utilities.

C. The General Contractor shall coordinate demolition of electrical service as required with the New Castle County Department of Public Works.

D. The General Contractor shall ascertain all available information concerning the existence and location of any buried sewer or other utility and phone lines from local authorities.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to removal and abandonment of existing features:
   1. Section 01100 - Health and Safety.
   2. Section 01150 - Measurement and Payment.
   3. Section 01700 - Material Handling.
   4. Section 02200 - Earthwork.

1.03 QUALITY CONTROL

A. Reference Standards

1. Delaware Department of Transportation (DelDOT), Standard Specifications, Specifications for Road and Bridge Construction, latest version.

1.04 SITE CONDITIONS

A. Dust Control: To prevent unnecessary spread of dust during performance of demolition work, thoroughly moisten surfaces and debris as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other work on the site. Water for use in dust control shall be obtained from Contractor's own source.

B. Protection: Exercise care during demolition and removal work to confine demolition operations to the facilities as indicated on the Contract Drawings. The physical means and methods used for protection shall be in accordance with the Overall Site Health and Safety Plan, as applicable. In the event of damage, Contractors will be responsible for replacement and restitution work at no expense to the PRPs.

1. If public safety is endangered during the progress of demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.

2. Signs, signals and barricades used shall conform to requirements of federal, state and local laws, rules, and regulations.

C. Explosives and Blasting: Not permitted.

PART 2 - MATERIALS

2.01 TEMPORARY PROTECTION

Materials needed or required for temporary protection in the form of barricades, fences, enclosures, etc., may be construction materials previously used elsewhere of sound condition and reasonably clean. However, the condition of materials shall meet or exceed the requirements of governing agencies or approving bodies as may be involved with the work. The Construction Manager may reject any used materials deemed inadequate.

2.02 EQUIPMENT, MACHINERY, AND APPARATUS

Equipment, machinery and apparatus (motorized or otherwise) used to perform the demolition and removal work shall be at the Contractor's discretion, but work shall be performed within the limits of the Contract documents.

2.03 EARTHWORK

As specified under Section 02200 - Earthwork.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to performance of the actual work, the Contractor shall carefully inspect the entire site and locate those facilities designated to be removed or demolished.

B. The Contractor shall not begin work of this section without approval to do so by the Construction Manager. The Contractor shall obtain specific approval for each part of the work.

C. The General Contractor shall locate existing exposed and buried active utilities within the limits of work and determine the requirements for their protection.

3.02 PERFORMANCE

A. General: The means and methods of performing demolition operations are the sole responsibility of the Contractors.

B. Excavation and Backfilling: As specified in Section 02200 - Earthwork.
   1. Backfill and restore surfaces in the area of demolished structures using materials as specified herein.

C. Debris Removal: Dispose of demolition debris including the former scale, fence, and septic tank in accordance with Section 01700 - Material Handling.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02060 - MONITORING WELL ABANDONMENT

PART 1 - GENERAL

1.01 DESCRIPTION

Work Included: This work is for the abandonment of existing monitoring wells in the Inert Area, as noted on the Contract Drawings, to be completed by a State of Delaware Licensed Well Driller in the employ of the General Contractor.

A. Abandonment of 8 existing monitoring wells:

Well	Estimated Depth (feet)
MW-1C	30
MW-1S	103
MW-1D	176
DGC-9C	28
DGC-9S	102
DGC-9D	170
MW-A	---
MW-B	---

B. Abandonment, as specified herein, is intended to be performed as preparatory work relative to the performance of the various construction operations of the project in the Inert Area.

C. The General Contractor shall contact the utility notification hotline "Miss Utility of Delmarva" (800-282-8555) at least 48 hours before drilling in the vicinity of suspected utilities, including overhead wires.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to removal and abandonment of existing features:
   1. Section 01100 - Health and Safety
   2. Section 01150 - Measurement and Payment
   3. Section 01700 - Material Handling
   4. Section 02200 - Earthwork

1.03 REFERENCES

A. State of Delaware Department of Natural Resources and Environmental Control, Regulations Governing the Construction of Water Wells, latest version.

PART 2 - MATERIALS

2.01 TEMPORARY PROTECTION

Materials needed or required for temporary protection in the form of barricades, fences, enclosures, etc. may be construction materials previously used elsewhere of sound condition and reasonably clean. However, the condition of materials shall met or exceed the requirements of governing agencies or approving bodies as may be involved with the work. The Construction Manager may reject any used material deemed inadequate.

2.02 EQUIPMENT, MACHINERY, AND APPARATUS

Equipment, machinery and apparatus (motorized or otherwise) used to perform the well abandonment work and subsequent decontamination shall be at the Contractor's subcontractors discretion, but work shall be performed within the limits of the contract requirements. Drill rigs of the type considered acceptable to perform the work required would include both air/mud rotary and hollow stem auger. Mechanical mixing of the grout material is required. Decontamination of the drill rig and ancillary equipment shall be performed using a steam cleaner.

2.03 GROUT MIXTURE

The Contractor's subcontractor shall use a grout mixture consisting of 1 bag of (94 lbs) Portland Type II Cement with three to five pounds of powdered sodium based bentonite clay and five to seven gallons of potable water.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to performance of the actual work, the Contractor's subcontractor shall carefully inspect the entire site and locate those wells designated to be abandoned.

B. The Contractor shall not have their subcontractor begin the work of this section without approval to do so by the Construction Manager.

3.02 PERFORMANCE

A. General: All wells to be abandoned shall be sealed only by a Well Contractor, Well Driller, or Well Driver licensed by the Delaware Department of Natural Resources and Environmental Control.

B. The objective of the well abandonment procedure is to create, in the original borehole the well was placed, and area of hydraulic conductivity as low or lower than that which existed in the subsurface before that borehole was drilled.

C. The General Contractor's subcontractor shall remove all surface outer-protective casings in a careful manner, so as not to obscure the location of the well riser pipe. The well shall be reamed in such a manner as to remove all well riser and screen by creating a borehole as big or slightly bigger than the original borehole the well was implaced in. The new borehole shall extend to the same depth, or slightly deeper than the bottom of the original borehole. The original logs, provided in Appendix E, shall be consulted by the Contractor to help determine this depth.

D. The General Contractor's subcontractor shall grout the new borehole from the bottom up, using the tremie method. The tremie may be separate pipe or the inside of the drill stem (rod) may be used. Grout emplacement must occur at the bottom of the borehole. Grouting is considered complete once grout is seen issuing forth from the top of the borehole (in the annular space around the tremie pipe) at the ground surface.

E. The General Contractor's subcontractor shall check the well within a 48-hour period to check for settlement of the grout; at which time, if settlement has occurred, additional grout will be added until the grout is at the level of the surrounding ground surface. This "topping-off" need not be done with a tremie pipe.

F. The General Contractor and their subcontractor shall be responsible for all forms required for well abandonment by the DNREC. The General Contractor shall provide the Construction Manager with copies of the completed and signed (by the licensed Well Contractor, Well Driller, or Well Driver) Well Completion Reports.

G. The drill rig and ancillary drilling/abandonment equipment shall be steam cleaned prior to and after the abandonment of each well at a location approved by the Construction Manager.

H. All work performed under this section shall be in strict accordance with the State of Delaware Regulations Governing the Construction of Water Wells, the most recent version.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work shall be conducted in accordance with the provisions of Section 01100 - Health and Safety and Section 02200 - Earthwork.

B. Clearing and disposal of the cleared material shall be performed by the General Contractor in accordance with Section 01700 - Material Handling.

C. Definitions
   1. Clearing--Trees, stumps, brush, and other vegetation in areas to be cleared shall be cut off flush with the original ground surface and disposed; surface debris shall be removed and disposed of offsite in accordance with Section 01700 - Material Handling or as otherwise directed by the Construction Manager.

1.02 SITE CONDITIONS

A. Environmental Requirements: Exercise the necessary means and methods to control dust on the site during performance of the work.

B. Burning: On-site burning is prohibited.

C. Protection: Use required protective measures as described in the Overall Site Health and Safety Plan during the felling of trees and debris removal to provide for the safety of employees and others.

D. Explosives and Blasting: Explosives and blasting are not permitted.

1.03 RELATED WORK

A. The following work specified herein is, or may be, related to site preparation:
   1. Section 01100 - Health and Safety.
   2. Section 01150 - Measurement and Payment
   3. Section 01700 - Material Handling.
   4. Section 02200 - Earthwork.

PART 2 - MATERIALS

2.01 FILL MATERIAL

Fill material shall meet the requirements of Site Foundation Fill specified in Section 02200 - Earthwork as applicable.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to performance of the actual work, the Contractor and Construction Manager shall carefully inspect the entire site and locate those objects and the plant life designated to be preserved; large surface debris shall be designated for offsite disposal by the Construction Manager during this inspection.

3.02 PERFORMANCE

A. Clearing: Perform clearing of trees, stumps, roots, brush, and other vegetation within the approximate limits of grading noted on the Contract Drawings.

1. Separate and stockpile large surface debris designated by the Construction Manager to be disposed of off-site.

2. Backfill surface debris to be disposed of onsite into existing depressions as approved by the Construction Manager.

3. Clear, chip as appropriate, and stockpile vegetation. Chipped vegetation may, upon approval by the Construction Manager, be used for mulch or as approved by the Construction Manager. Any vegetation not designated for use as mulch shall be disposed of in accordance with Section 01700-Material Handling.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02150 - GAS VENTING SYSTEM

PART 1 - GENERAL

1.01 The work specified in this section shall include the furnishing of all labor, materials, tools and equipment necessary for the installation of gas vents. Gas vents installed according to this specification shall be used as settlement monitoring points for evaluating quantities of site foundation fill.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to the gas collection system:
   1. Section 01100 - Health and Safety.
   2. Section 01110 - Air Monitoring
   3. Section 01150 - Measurement and Payment
   4. Section 01700 - Material Handling.
   5. Section 02300 - Cap System: General.
   6. Section 02320 - Geosynthetic Clay Liner
   7. Section 02330 - Geomembrane
   8. Section 02340 - Cap Drainage Layer
   9. Section 02350 - Geotextile

1.03 QUALITY ASSURANCE

A. Reference Standards:
   1. American Society for Testing and Materials:
      a. ASTM D 422-72 - Particle-Size Analysis of Soils
      b. ASTM D 1785-89 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
      c. ASTM D 2564-84 - Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
      d. ASTM D 2855-83 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

   2. Delaware Department of Transportation (DelDot), Standard Specifications, Specifications for Road and Bridge Construction, latest revision.

1.04 SUBMITTALS

Samples of material used in construction of gas vents, excluding gravel and grain-size curves of gravel shall be submitted for Construction Manager review.

PART 2 - MATERIALS

2.01 MATERIALS

Materials shall conform to the respective specifications and other requirements presented below.

A. GAS VENT MATERIALS

1. Surface vent pipe shall be nominal 4-inch diameter Schedule 40 PVC. The riser pipe and fittings shall be non-perforated. Other pipe shall be perforated as specified below. Quality of pipe shall be as specified in ASTM D 1785. Piping shall have ends suitable for solvent welds. All pipe, fittings and couplings shall be of compatible materials.

    a. Perforations. Circular holes shall be cleanly cut 3/8 inch in diameter and arranged in rows parallel to the longitudinal axis of the pipe. Perforated pipe shall have no less than rour rows of perforations. Perforations shall be approximately six inches center-to-center along rows. The rows shall be arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket, and perforations shall continue at uniform spacing over the entire length of the pipe. Manufacturer's standard perforated pipe which essentially meets these requirements may be substituted when approved by the Construction Manager.

    b. Joints shall be solvent weld in accordance with ASTM D 2564. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Construction Manager.

    c. Fittings. Fittings shall be of compatible materials, corresponding weight and quality for pipe, and as specified herein.

2. Gravel fill shall consist of hard, tough, durable, uncoated gravel, reasonably free from clay, silt, vegetation or other substances determined by the Construction Manager to be deleterious. The gradation shall conform to Delaware No.57 . The gradation shall be as follows:

Sieve Size	Total Percent Passing
1-1/2"	100
1"	95-100
1/2"	25-60
No. 4	0-10
No. 8	0-5

3. Geotextile Separator shall be as specified in Section 02350: Geotextile.

4. Pipe Boots shall be field or factory-fabricated and compatible with the cap geomembrane.

PART 3 - EXECUTION

3.01 CONSTRUCTION

Gas vents shall be installed in the geosynthetic capped portion of the work area, as shown on the Drawings. The gas vents shall be constructed with a perforated H-shaped section and a non-perforated riser section..

A. LANDFILL GAS VENT INSTALLATION

The gas vents shall be contructed of 4-inch diameter Schedule 40 PVC riser pipe and a tee fitting as shown on the Drawings. The perforated section shall be placed on existing grade at the locations shown on the Drawings. The gas vents shall be covered with gravel fill, as shown on the Drawings. A geotextile separator shall be placed over the gravel fill. The solid riser section shall be vertically aligned, and shall extend to approximately 8 feet above the cap surface. The riser section shall be topped with a tee fitting. In order to prevent water from traveling along the gas vent to below the cap system, and to prevent geomembrane failure from settlement around the riser pipe, pipe boots shall be attached to a 5-inch PVC pipe sleeve, placed around the riser pipe where the vent protrudes through the cap geomembrane. The sleeve will extend above the cap system as indicated on the Drawings. In order to prevent precipitation from traveling between the sleeve and the riser, a geomembrane rain guard will be attached to the riser pipe as shown on the Drawings. The pipe boots shall be compatible with the

geomembrane and shall be attached per the geomembrane manufacturer's recommendations. To facilitate placement of the boots, pipe joints may be added to the riser near the surface of the site foundation fill.

B. DAMAGED VENTS

Any installed gas vents which are damaged as a result of vandalism or remediation activities shall be repaired to their original condition. Vents which cannot be satisfactorily repaired shall be abandoned and replaced at the discretion of the Construction Manager.

3.02 SURVEY

1. All horizontal and vertical position data and initial elevations shall be obtained by a licensed surveyor under contract with the General Contractor or any of his subcontractors who is registered in the State of Delaware. All position data submitted shall bear the seal of the licensed surveyor who obtained the data. Copies of all field notes and survey data, including work performed to reduce field measurements, shall be submitted to the Construction Manager.

2. All survey data shall be submitted to the Contruction Manager within 24 hours of their acquisition.

3. Each gas vent shall be surveyed as soon after installation and prior to site foundation fill placement. Every two weeks thereafter the gas vents shall be surveyed until geosynthetic clay liner placement has been initiated within 200 feet of the setttlement monument or as directed otherwise by the Construction Manager.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02150 - GAS VENTING SYSTEM

PART 1 - GENERAL

1.01 The work specified in this section shall include the furnishing of all labor, materials, tools and equipment necessary for the installation of gas vents. Gas vents installed according to this specification shall be used as settlement monitoring points for evaluating quantities of site foundation fill.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to the gas collection system:
   1. Section 01100 - Health and Safety.
   2. Section 01110 - Air Monitoring
   3. Section 01150 - Measurement and Payment
   4. Section 01700 - Material Handling.
   5. Section 02300 - Cap System: General.
   6. Section 02320 - Geosynthetic Clay Liner
   7. Section 02330 - Geomembrane
   8. Section 02340 - Cap Drainage Layer
   9. Section 02350 - Geotextile

1.03 QUALITY CONTROL

A. Reference Standards:
   1. American Society for Testing and Materials:
      a. ASTM D 422-72 - Particle-Size Analysis of Soils
      b. ASTM D 1785-89 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
      c. ASTM D 2564-84 - Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
      d. ASTM D 2855-83 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

   2. Delaware Department of Transportation (DelDot), Standard Specifications, Specifications for Road and Bridge Construction, latest revision.

1.04 SUBMITTALS

Samples of material used in construction of gas vents, excluding gravel and grain-size curves of gravel shall be submitted for Construction Manager review.

PART 2 - MATERIALS

2.01 MATERIALS

Materials shall conform to the respective specifications and other requirements presented below.

A. GAS VENT MATERIALS

1. Surface vent pipe shall be nominal 4-inch diameter Schedule 40 PVC. The riser pipe and fittings shall be non-perforated. Other pipe shall be perforated as specified below. Quality of pipe shall be as specified in ASTM D 1785. Piping shall have ends suitable for solvent welds. All pipe, fittings and couplings shall be of compatible materials.

   a. Perforations. Circular holes shall be cleanly cut 3/8 inch in diameter and arranged in rows parallel to the longitudinal axis of the pipe. Perforated pipe shall have no less than four rows of perforations. Perforations shall be approximately six inches center-to-center along rows. The rows shall be arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket, and perforations shall continue at uniform spacing over the entire length of the pipe. Manufacturer's standard perforated pipe which essentially meets these requirements may be substituted when approved by the Construction Manager.

   b. Joints shall be solvent weld in accordance with ASTM D 2564. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Construction Manager.

   c. Fittings. Fittings shall be of compatible materials, corresponding weight and quality for pipe, and as specified herein.

2. Gravel fill shall consist of hard, tough, durable, uncoated gravel, reasonably free from clay, silt, vegetation or other substances determined by the Construction Manager to be deleterious. The gradation shall conform to Delaware No.57 . The gradation shall be as follows:

Sieve Size	Total Percent Passing
1-1/2"	100
1"	95-100
1/2"	25-60
No. 4	0-10
No. 8	0-5

3. Geotextile Separator shall be as specified in Section 02350: Geotextile.

4. Pipe Boots shall be field or factory-fabricated and compatible with the cap geomembrane.

PART 3 - EXECUTION

3.01 CONSTRUCTION

Gas vents shall be installed in the geosynthetic capped portion of the work area, as shown on the Drawings. The gas vents shall be constructed with a perforated H-shaped section and a non-perforated riser section.

A. LANDFILL GAS VENT INSTALLATION

The gas vents shall be constructed of 4-inch diameter Schedule 40 PVC riser pipe and a tee fitting as shown on the Drawings. The perforated section shall be placed on existing grade at the locations shown on the Drawings. The gas vents shall be covered with gravel fill, as shown on the Drawings. A geotextile separator shall be placed over the gravel fill. The solid riser section shall be vertically aligned, and shall extend to approximately 8 feet above the cap surface. The riser section shall be topped with a tee fitting. In order to prevent water from traveling along the gas vent to below the cap system, and to prevent geomembrane failure from settlement around the riser pipe, pipe boots shall be attached to a 6-inch PVC pipe sleeve, placed around the riser pipe where the vent protrudes through the cap geomembrane. The sleeve will extend above the cap system as indicated on the Drawings. In order to prevent precipitation from traveling between the sleeve and the riser, a geomembrane rain guard will be attached to the riser pipe as shown on the Drawings. The pipe boots shall be compatible with the

geomembrane and shall be attached per the geomembrane manufacturer's recommendations. To facilitate placement of the boots, pipe joints may be added to the riser near the surface of the site foundation fill.

B. DAMAGED VENTS

Any installed gas vents which are damaged as a result of vandalism or remediation activities shall be repaired to their original condition. Vents which cannot be satisfactorily repaired shall be abandoned and replaced at the discretion of the Construction Manager.

3.02 SURVEY

1. All horizontal and vertical position data and initial elevations shall be obtained by a licensed surveyor under contract with the General Contractor or any of his subcontractors who is registered in the State of Delaware. All position data submitted shall bear the seal of the licensed surveyor who obtained the data. Copies of all field notes and survey data, including work performed to reduce field measurements, shall be submitted to the Construction Manager.

2. All survey data shall be submitted to the Contruction Manager within 24 hours of their acquisition.

3. Each gas vent shall be surveyed as soon after installation and prior to site foundation fill placement. Every two weeks thereafter the gas vents shall be surveyed until geosynthetic clay liner placement has been initiated within 200 feet of the setttlement monument or as directed otherwise by the Construction Manager.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work described in this section shall be performed by the General Contractor.

B. Work in this section consists of any earthwork necessary to construct site structures in accordance with the lines, grades, and dimensions shown on the Drawings.

C. Contractors shall perform all work in accordance with Section 01100 - Health and Safety, and all applicable federal, state, and local laws and regulations.

1.02 RELATED WORK

A. The following work specified herein is, or may be related to Earthwork:

1. Section 01006 - Environmental Protection
2. Section 01100 - Health and Safety
3. Section 01115 - Chemical Data Quality Management
4. Section 01150 - Measurement and Payment
5. Section 01300 - Submittals
6. Section 01400 - Quality Control
7. Section 02100 - Site Preparation
8. Section 02150 - Gas Venting System
9. Section 02220 - Waterways
10. Section 02230 - Roadway Construction
11. Section 02300 - Cap System: General
12. Section 02310 - Test Fill
13. Section 02320 - Geosynthetic Clay Liner
14. Section 02330 - Geomembrane
15. Section 02340 - Cap Drainage Layer
16. Section 02350 - Geotexitle
17. Section 02360 - Cap Cover Layer
18. Section 02370 - Seeding
19. Section 02700 - Settlement Monuments

1.03 QUALITY CONTROL

A. Reference Standards
   1. American Society for Testing and Materials
      a. ASTM D-75, Sampling Aggregates
      b. ASTM D-422, Method for Particle-Size Analysis of Soils.
      c. ASTM D-698, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Moisture, Using 5.5-lb. Rammer and 12-in. Drop.
      d. ASTM D-2216, Method for Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate Mixtures.
      e. ASTM D-2487, Test Method for Classification of Soils for Engineering Purposes.
      f. ASTM D-2922, Test Method for Moisture Content of Soil and Soil-Aggregate In Place by Nuclear Methods.
      g. ASTM D-3017, Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods.
      h. ASTM D-3740, Practice for the Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
      i. ASTM D-4253, Maximum Index Density of Soil Using Vibratory Table.
      j. ASTM D-4254, Minimum Index Density of Soils and Calculation of Relative Density.
      k. ASTM D-4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   2. Delaware Department of Transportation (DelDOT), Standard Specifications, Specifications for Road and Bridge Construction, latest revision.
   3. American Association of State Highway and Transportation Officials.
      a. AASHTO T267, Determination of Organic Content in Soils by Loss or Ignition.
   4. Safety and Health Regulations for Construction, 29 CFR 1926.

B. Independent Geotechnical Testing Laboratory: The General Contractor shall engage a qualified independent geotechnical testing laboratory. Evaluation of the laboratory will be based on criteria specified in ASTM D-3740. The General Contractor shall submit documentation showing that the laboratory meets these criteria. Approval of the laboratory will be by the Construction Manager based on compliance with the criteria and an inspection of the laboratory.

1.04 SUBMITTALS

Submit to the Construction Manager results of all testing or other operations as performed in connection with Quality Control requirements.

1.05 EXCAVATION

A. Classification of Excavation Materials:
   1. No consideration will be given to the nature of materials encountered in excavation operations. Therefore, no additional payment will be made for difficulties occurring in excavating and handling of materials.

   2. Any waste materials encountered in excavation operations by the General Contractor shall be handled in accordance with the Overall Site Health and Safety Plan and disposed of on site as a potentially contaminated solid in accordance with Section 01700 - Material Handling.

B. Temporary Protective Construction
   1. Temporary Fence Barricade: Erect and maintain substantial temporary fences surrounding excavation to prevent unauthorized persons from entering such areas.
   2. Excavation Covers: Cover open excavation when work therein is suspended or left unattended, such as at the end of a work day.
   3. Remove temporary protective construction following the completion of backfilling.

C. Explosives and Blasting: Not permitted.

D. Excavation Condition: Condition and results of excavation are solely the responsibility of the General Contractor. Remove slides and cave-ins at whatever time and under whatever circumstance they occur.

E. Excess Materials: The General Contractor shall have no right of property to excavated materials or surface debris removed from the Inert Area surface. This provision does not relieve the General Contractor of his responsibility to dispose of surplus excavated materials in designated areas of the site as directed by the Construction Manager.

PART 2 - MATERIALS

2.01 SITE FOUNDATION FILL

Physical Property Requirements: All material furnished for use as Site Foundation Fill shall meet either of the following requirements.

A. Type 1 Fill: Type 1 Fill shall consist of soils having a maximum of 17 percent passing the No. 200 sieve and a maximum grain-size of three

inches. These materials may be placed in any area of the site up to within 12 inches of the geomembrane portion of the capping system.

B. Type 2 Fill: Type 2 Fill shall consist of soils with a one half-inch maximum grain-size with a maximum of 20 percent passing the No. 200 sieve. These materials shall not be placed when saturated, during precipitation, or when material is frozen.

C. Site foundation fill shall be compacted to at least 90 percent of the Standard Proctor density unless otherwise approved by the Construction Manager.

2.02 SELECT FILL

A. Physical Property Requirements: All material furnished for use as select fill soil shall meet requirements for Type 2 site foundation fill.

2.03 TOPSOIL

All material furnished for use as topsoil shall be obtained from off-site sources and shall be as specified in the DelDOT Standard Specifications, Section 732, Topsoil.

2.04 CHIPPED ORGANIC MATERIAL

The General Contractor at his option and as approved by the Construction Manager may blend finely chipped organic material obtained from clearing operations at the site into the topsoil. No chipped material shall be larger than two inches.

PART 3 - EXECUTION

3.01 ADVANCE SAMPLING AND TESTING

A. General: The General Contractor is responsible for securing sources of fill materials described in Part 2 that contain sufficient quantities of material meeting these specifications. In connection with this requirement, the General Contractor shall perform sampling of proposed borrow in advance of excavation and delivery of materials to the site.

B. Qualifications of Personnel Responsible for Advance Sampling and testing: The General Contractor shall submit to the Construction Manager for approval the qualifications of the person or persons responsible for sampling and testing. Submittals shall include resumes and other documentation demonstrating the experience and knowledge of the personnel in performing the required work. Approval of the personnel will be based on this documentation and personal interviews

in which the personnel will be evaluated in terms of their knowledge of the job requirements, testing standards, and other factors. The Construction Manager reserves the right to reject any personnel not deemed fully qualified for the work. Minimum qualifications for the personnel are as follows:

1. Person in charge shall be a Registered Professional Civil Engineer specializing in geotechnical engineering.
2. Experience shall include investigations and evaluations of borrow sources performed for the construction of highly controlled, engineered fills.

C. Sampling and Testing Requirements: The Contractor shall perform the tests listed in the Quality Control requirements at the end of this section.

D. The General Contractor shall obtain a service permit to comply with federal, state, and local requirements if ASTM D-2922 and ASTM-D-3017 are used.

E. The PRPs reserve the right to have a representative perform any independent tests at the PRPs' expense to corroborate results reported by the General Contractor.

F. No materials shall be delivered to the site that were not obtained within the limits of acceptable materials as determined by the advance sampling and testing program.

3.02 TEST FILL

A test fill area, as described in Section 02310 - Test Fill, shall be constructed.

3.03 EXCAVATION, DELIVERY AND STOCKPILING OF MATERIAL

A. No materials shall be excavated from a borrow area that are located beyond the limits of advance sampling and testing.

B. Dissimilar soil types shall not be mixed during excavation, delivery, or stockpiling unless approved by the Construction Manager. Similar soil types from different sources shall not be mixed during delivery or stockpiling regardless of origin unless approved by the Construction Manager.

C. Excavated and delivered foundation fill materials meeting the requirements specified herein may be immediately placed, spread, and compacted. Stockpiling at the site is also permitted and shall be

coordinated to preload areas as designated to the lines and grades indicated in the Contract Drawings, but no special payment will be made for stockpiling or rehandling. Stockpiles shall not be placed on or above the geosynthetic clay liner.

D. Site foundation fill shall be placed to the final grades and left to consolidate for a period of approximately 30 days. After 30 days, additional site foundation fill, as needed, shall be placed to fill in local settled areas prior to commencing with cap system installation.

E. The top of all stockpiles shall be graded and rolled smooth to prevent infiltration of rainwater.

F. Stockpiles, if used, shall be constructed and maintained in such a manner as to prevent contamination by other materials. Material that becomes contaminated by any cause will not be accepted for placement.

3.04 CONSTRUCTION OF EARTHWORK

A. Placement

1. Place, spread, condition, and compact fill using the equipment and methods established and approved during construction of the test fill.
2. Equipment shall not be operated directly on the geotextile, geonet, geomembrane, or geosynthetic clay liner at any time.
3. Reduce clods down to a maximum of three inches before placement.
4. Compact the fill in lifts no thicker than six inches (compacted, in place thickness) unless otherwise noted. Site Foundation Fill shall be compacted at a moisture content of 2 percent below to 4 percent above the optimum moisture to a density of 90 percent of the maximum dry density as determined by the Standard Proctor unless otherwise approved by the Construction Manager.
5. Do not place material on frozen material.
6. Do not place material when the ambient temperature is below 32 degrees Fahrenheit, or during periods of precipitation unless approved by the Construction Manager.
7. If sections of a lift do not meet the minimum specified moisture content, those sections shall be excavated and either spoiled or placed in a separate area and sprayed and thoroughly mixed with additional water.
8. If sections of a lift exceed the maximum specified moisture content, those sections shall be dried in any effective manner. If workable, this can be done without removal of the material. Soil additives are not permitted.

9. If sections of a lift do not meet the minimum specified dry density, provide additional compactive effort in those sections until the density meets or exceeds the specified minimum. If, in the Construction Manager's opinion, the specified density cannot reasonably be achieved and the functional integrity of the cap will not be compromised, the Construction Manager may accept compaction at densities below the specified minimum.
10. Plan and conduct operations to prevent drying of compacted lifts. Lift sections shall be tested and approved by the Construction Manager prior to the placement of subsequent lifts. Retesting will be required by the Construction Manager in any areas where drying is suspected at no additional cost to the PRPs. Areas failing retests will be remedied at no additional cost to the PRPs.
11. Provide hand compaction at any confined area not accessible to mechanical equipment. Hand compacted material shall meet all specification requirements.
12. Exercise the necessary means and methods to control dust on the site as well as in the off-site work areas.
13. Do not leave the site in a dusting condition following the work of this section. If necessary, employ watering schedule to control the dust.
14. Do not use frozen material in performing the work, and do not place materials on frozen surfaces.
15. When it is necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Truck wheels shall be washed before going on the roadway. In the event that accidental spillage does occur, clear away spillage of materials at no expense to the PRPs.
16. Plan work so as to provide adequate protection during storms with provisions available at all times for mitigating flood damage.
17. In accordance with Section 01006 - Environmental Protection, all earthwork shall be in accordance with the Sediment and Stormwater Management Plan.

B. Finished Elevations and Lines
   1. Construct all fill layers, not including lifts within a layer, to no more than 0.1 feet above or below the elevations specified on the Drawings. The top of each fill layer shall be smooth.

3.05 QUALITY CONTROL TESTING

A. General
   1. Quality Control Testing will be performed in two phases: (1) Advance Testing and (2) Construction Testing.
   2. Testing shall be provided by the approved Independent Testing Laboratory.

3. The Construction Manager shall have the option to select test locations; otherwise, test locations must be approved by the Construction Manager.
4. The Construction Manager will require additional tests beyond the minimum required to be performed whenever materials or construction are questionable.
5. A representative of the PRPs will perform supplemental tests at the PRPs' expense at whatever frequency necessary to verify results submitted by Contractors. Contractors shall furnish samples to the PRPs' representative upon his request. Discrepancies between test results obtained by the PRPs' representative will be resolved to the representative's satisfaction prior to performing any further work.
6. The independent testing laboratory shall use comprehensive record keeping and materials control systems for the various testing phases. The Independent Testing Laboratory shall update and maintain current, at all times, copies of all records for the Contractors and the PRPs' representatives.

B. Advance Testing

1. This testing shall be performed in advance of excavation and delivery and is required to establish that the borrow source contains materials meeting the specifications and to establish the control parameters for compaction. It shall identify the soil types at the borrow area, and it shall establish the range of water contents and densities that are required for compaction control.
2. Perform sampling and testing not less than one week in advance of excavation and delivery.
3. The number of tests to be performed shall be based on the volume of material delivered to the site. The Contractor may vary the number of tests, subject to the approval of the Construction Manager. An initial test shall be taken before any material is delivered to the site. Subsequent tests shall be performed at a rate indicated below for material delivered to the site, or at a rate approved by the Construction Manager. The rates of testing and applicable testing standards are as follows:
   a. Water content: one test every 5,000 cubic yards (ASTM D-2216).
   b. For Site Foundation Fill, Select Fill, and Topsoil, classification includes liquid and plastic limits, and sieve and hydrometer analyses: one test every 5,000 cubic yards (ASTM D-2487, D-422, D-4318).
   c. For Site Foundation Fill and compaction, testing is required at the rate of one test every 5,000 cubic yards (ASTM D-698).
   d. For every 5,000 cubic yards of topsoil, perform one organic content (AASHTO T267).

e. Additional tests shall be conducted whenever the material is variable or changes in character.
f. Submit a one-quart jar sample of material with each set of test results to the Construction Manager.

4. Records and Materials Control System:
   a. Provide records of material compliance tests within 5 days of sampling.
   b. Establish and maintain a control system for excavation and delivery of materials. Functional requirements of the control system are that material compliance is verified in advance of placement and the applicable compaction test results are available at time of material delivery. The control system shall include an identification system to ensure the correct compaction curves are utilized.

C. Construction Testing

1. Site Foundation Fill Layer Testing
   a. This testing shall be performed on each compacted lift of the site foundation fill as it is being constructed. The testing performed on the completed lifts shall be the basis for approval and acceptance by the Construction Manager.

      i. Depressions in the surface of the cleared ground surface shall be filled before general fill placement to provide a relatively flat surface.

   b. The number of tests to be performed will be based on a spacing evenly distributed over each lift.
   c. For each compacted lift the test and maximum spacing, are as follows:
      i. In-place moisture content and density tests on 200-foot centers shall be performed in accordance with ASTM D-2922 and D-3017. The first two feet of site foundation fill shall be compacted in eight-inch loose lifts using five passes of a six-ton, three-wheeled, smooth roller for each lift. If pumping occurs during placement of the first two feet of fill, compaction shall be stopped and the next layer placed. For any given lift within the first two feet that has been successfully compacted in accordance with Paragraph 3.04, all subsequent lifts shall be compacted to the same requirements. Lifts placed after the first two feet of site foundation fill shall be compacted in accordance with Paragraph 3.04.
      ii. Classification (ASTM D-2487, on 400-foot centers includes liquid and plastic limits, and sieve and hydrometer analyses) shall be performed.

d. Records and Material Control Systems

i. Report the station, offset, lift number, and test results for each determination of field density and moisture test. Verbal reports of compliance or noncompliance shall be made immediately upon completion of tests. Furnish written reports within 48 hours of testing.

D. Cap System Geosynthetic Testing

The General Contractor's QC group shall establish testing criteria for the cap system component testing in accordance with the applicable individual component specifications.

3.06 CONSTRUCTION OF EROSION AND SEDIMENT CONTROLS

A. General

The work includes all materials, equipment, and labor for providing, installing, and maintaining erosion and sediment controls, including temporary diversion ditches, hay bale diversions, silt fence, and sediment traps to the lines and grades shown on the Drawings in accordance with Section 01006 - Environmental Protection.

B. Maintenance

The Contractor shall remove sediment from the proposed sediment traps when sediment reaches the required cleanout elevation as shown on the Drawings and as directed by the Construction Manager. This also includes the excavation of sediment from all ditches, inlets, culverts, etc. when accumulation of material hinders flow. Excavated sediment cleared from the traps shall be placed where it will not reenter the sediment traps and will not be transported downstream of the trap. If the material meets the requirements in paragraph 2.01, it may be used as site foundation fill.

3.07 EMBANKMENT CONSTRUCTION

A. This work shall consist of forming embankments with Type I or Type II fill as defined in Paragraph 2.01, in accordance with these specifications, to conform to the lines, grades and cross sections specified on the Drawings.

B. Earthen embankments shall be formed by distributing the materials in successive uniform horizontal layers not exceeding 8 inches in thickness, loose depth, to the full width of the cross section; however, layers less than 8 inches in loose thickness will be required, when necessary, to obtain the specified density.

C. The upper surface of the embankment shall be shaped so as to provide complete drainage of surface water at all times. The forming of ruts will not be permitted.

D. Embankments shall not be constructed upon frozen areas. All snow and ice shall be removed from the area to be covered prior to placement of embankment material.

E. All embankments shall be compacted to a density of at least 95 percent of maximum density as determined by the standard proctor moisture density test, ASTM D698. Field density tests shall be run continuously by the Contractor as the fill is being placed.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02212 - WATERWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This construction shall be done by the General Contractor. All work shall be conducted in accordance with the provisions of Section 01100 - Health and Safety and Section 02200 - Earthwork.

B. The work described in this section consists of construction of a drainage ditch along the perimeter of the landfill; installation of culverts; and construction of sedimentation traps in the northwest and southeast corners of the site.

C. Definition:
   1. Waterway: Unless otherwise specifically qualified herein, a constructed channel which conveys or is designed to convey water.

1.02 RELATED WORK

A. The following work specified herein is or may be related to waterways.
   1. Section 01006 - Environmental Protection
   2. Section 01100 - Health and Safety
   3. Section 02100 - Site Preparation
   4. Section 02200 - Earthwork
   5. Section 02360 - Geotextiles
   6. Section 02370 - Seeding

1.03 REFERENCES

A. Delaware Department of Transportation (DelDOT) Standard Specifications, Specifications for Road and Bridge Construction, latest revision.

1.04 SUBMITTALS

A. Site Foundation Fill - As required under Section 02200 - Earthwork of these Specifications.

B. Geotextile - As required under Section 02360 - Geotextiles of these Specifications.

C. Rock Fill Material - All data on the rock fill material including but not limited to sieve analysis results.

D. Erosion Control Ditch Lining

1. Descriptive data on erosion control ditch lining material including manufacturer's specifications, for approval.

2. Certification of Compliance for the lining material from the manufacturer indicating the material meets the specifications herein.

3. Manufacturer's installation procedures for lining material for approval by the Engineer.

1.05 SITE CONDITIONS

A. Protection: The Contractor shall assume the risks attending the presence or proximity of overhead or underground public utility and private lines, pipes, conduits and the support work, existing structures and property of whatever nature, in or over excavations or adjacent to such excavations. Complete responsibility for replacement and restitution work of whatever nature to the above, as damaged or destroyed by work of this Contract, rests solely with the Contractor and at no expense to the PRPs.

1. Temporary Protective Construction: Erect and maintain without expense to the PRPs, substantial barricades to exclude personnel and vehicles.
2. Protect newly graded areas of the new waterway channel (and the filled waterway channel) from the action of the elements. When settlement or erosion occurs prior to acceptance of the work, make repairs, and re-establish grades to required elevations and slopes at no expense to the PRPs.

PART 2 - MATERIALS

2.01 SITE FOUNDATION FILL

Site Foundation Fill shall meet the requirements as specified in Section 02200 - Earthwork and as approved by the Construction Manager.

2.02 GEOTEXTILE

Geotextile shall be as specified in Section 02360 - Geotextiles.

2.03 GEOTEXTILE SECURING PINS

Geotextile securing pins, or alternate securing method shall be as recommended by the geotextile manufacturer. Securing method shall not damage geomembrane.

2.04 ROCK FILL (RIPRAP)

Rock fill shall meet the material requirements of section 712.02 of the DelDOT Standard Specifications. Rock fill placed in the channel or at the outlet of constructed waterways shall consist of NCSA Class R-3 rock placed as shown on the contract Drawings.

2.05 CULVERT PIPE

Culverts shall be corrugated metal pipe and shall meet the requirements of Section 614 of the DelDOT Standard Specifications as applicable and have the required dimensions as shown on the contract Drawings.

2.06 EROSION CONTROL DITCH LINING

Lining for ditches shall be adequate to prevent erosion. Information on lining material to be used and manufacturer's recommended installation procedures shall be submitted to the Construction Manager and shall be approved by the Engineer prior to ditch construction. Lining material shall be used for all portions of the perimeter drainage ditches and shall be able to withstand velocities of five feet per second and facilitate vegetation establishment. The lining shall also be resistant to potential environmental and chemical degradation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Salvaged Topsoil: Within any areas indicated for waterway grading, strip turf and topsoil to the depth of suitable topsoil material and stockpile for subsequent topsoiling operations.

B. Stockpiling: Place topsoil storage piles within the limits of the project, on well drained land and in locations approved by the Construction Manager.

3.02 PERFORMANCE

A. Erosion control: The General Contractor shall implement erosion control measures in accordance with the requirements of Section 01006 - Environmental Protection before and during performance of work within this Section.

B. Earthwork: Perform to the lines and grades indicated on the Drawings or as otherwise required by the Construction Manager.
   1. During construction of the waterway, perform excavation and filling in a manner and sequence that will provide proper drainage at all times.
   2. Grade waterway to the lines and grades shown on the Drawings and not more than 0.1 feet above or below indicated grade less specified topsoil.
   3. Waterways shall be smooth and free from irregularities.
   4. Correct subgrade irregularities exceeding previously specified tolerance to the Construction Manager's satisfaction either by removing or adding materials as required, followed by rolling until satisfactorily compacted.

C. Geotextile Placement:
   1. Place geotextile on prepared compacted subgrade at locations indicated on the Drawings.
   2. Lay geotextile loosely but free of wrinkles and creases.
   3. Make joint between adjoining sheets with a minimum overlap of 18 inches.
   4. Sheet, or roll ends, may be sewn together with an overlap of 3 inches, otherwise overlap ends a minimum of 18 inches with the upslope roll end lapped over the downslope roll end or overlapped as recommended by the manufacturer, whichever overlap is greater. Overlapped geotextile not

sewn together shall be heat-tacked continuously unless otherwise approved by the Construction Manager.

5. Secure geotextile at intervals not exceeding 5-feet using securing pins with washers. Install securing pins through overlapped geotextile areas regardless of 5-foot interval spacing. Pins and washer sizes shall be consistent with geotextile manufacturer's recommendations. An alternate securing method shall be used where pins may result in damage to underlying geomembrane.
6. Following geotextile placement, inspect for damage and make repairs in accordance with manufacturer's recommendation and to the satisfaction of the Construction Manager.

D. Rock Fill Installation:
   1. Place rock fill to the line, grade, and dimensions shown on the contract Drawings.
   2. Place rock fill on the geotextile by such methods that will not damage the geotextiles.
   3. Should accidental damage occur to the geotextile during rock fill placement, carefully remove the rock fill and make repairs to the geotextile in accordance with the manufacturer's recommendations. All repairs will be made to the satisfaction of the Construction Manager and at no additional expense to the PRPs.
   4. Do not operate construction equipment directly on the geotextile.

E. Culvert Pipe Installation
   1. Culvert Pipe shall be installed at the locations, lines and grades shown on the contract Drawings.
   2. Sections of culvert pipe shall be connected using banding straps as specified in Section 614.04 of the DelDOT Standard Specifications.
   3. Culvert pipe shall be maintained as required under Section 02200 - Earthwork.

F. Sediment Control Structures
   1. Embankments shall be considered of site foundation fill to the lines and grades indicated on the drawings and as specified in Section 02200 - Earthwork.
   2. Spillway structures shall be constructed as indicated in the Drawings. Rock fill placement and pipe installation shall be

as specified in Paragraphs 3.02.D and 3.02.E, respectively. At the completion of the project, the Contractor shall, as directed by the Construction Manager, plug or remove the drainage pipes from the sediment traps and cut the riser pipes to an elevation to be determined by the Construction Manager.

H. Corrections: Correct subgrade irregularities exceeding previously specified limit to the Construction Manager's satisfaction either by removing or adding material as required, followed by rolling until satisfactorily compacted.

3.03 FIELD QUALITY CONTROL

A. Surface Tolerance: Check finished subgrade along the length of the waterway for smoothness and elevation using a method approved by the Construction Manager.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02230 - ROADWAY CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work described in this section shall be performed by the General Contractor.

B. Work in this section consists of all roadway construction to the lines, grades, and dimensions shown on the Drawings.

C. Definitions:

1. Site Access Roadway. Roadway from Grantham Lane into the support area that will provide access to the site during and after construction. The Site Access Roadway is comprised of two sections of road: an existing roadway that will require upgrading and maintenance and a new section of the Site Access Roadway between the existing access road and the support area that will be constructed under a separate contract but will require maintenance and upkeep under this contract.

2. Perimeter Access Roadway. The perimeter access roadway to be used for inspection and maintenance of the completed landfill cap system.

1.02 RELATED WORK

1. Section 01006 - Environmental Protection.
2. Section 01150 - Measurement and Payment.
3. Section 01300 - Submittals.
4. Section 02200 - Earthwork.
5. Section 02350 - Geotextile.

1.03 QUALITY CONTROL

A. Reference Standards

1. Delaware Department of Transportation (DelDOT), Standard Specifications, Specifications for Road and Bridge Construction, latest revision.

2. The Delaware Erosion and Sediment Control Handbook, dated 1989.
3. American Society for Testing and Materials.

ASTM C 88-83	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate (CRD-C 137-77).
ASTM C 136-84a	Sieve Analysis of Fine and Coarse Aggregates.
ASTM C 535-81	Resistance to Degradation of Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM D 75-82	Sampling Aggregates.
ASTM D 422-72	Particle Size Analysis of Soils.
ASTM E 11-87	Wire-Cloth Sieves for Testing Purposes.

1.04 SUBMITTALS.

The Contractor shall submit test results of roadway aggregate as required in paragraph 3.01 of this section. This shall include copies of initial test results for the roadway aggregate and copies of final test results on the constructed roadways.

PART 2 - MATERIALS

2.01 ROADWAY CONSTRUCTION MATERIAL

A. Coarse Material. The coarse material shall be Type B, meeting the requirements of DelDOT Standard Specifications Section 821 for Graded Aggregates.

B. Fine Material. The fine material shall be "RICE" gravel meeting the requirements of DelDOT Standard Specifications Section 813.

C. Base Material. The Base Material shall be Delaware No. 107 and meet the requirements of the DelDOT Standard Specifications Section 813.

2.02 GEOTEXTILE

The geotextile shall meet the requirements of Section 02350 - Geotextile.

2.03 STOCKPILING AGGREGATE.

Prior to stockpiling of aggregate, storage sites shall be cleared and leveled by the Contractor. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Construction Manager so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

PART 3 - EXECUTION

3.01 SAMPLING AND TESTING

Sampling and testing of the roadway aggregate shall be the responsibility of the Contractor and shall be performed at no additional cost to the PRPs. Sampling and testing shall be performed by an independent commercial testing laboratory. Tests shall be performed at the frequency specified hereinafter. Copies of the test results shall be submitted to the Construction Manager as soon as the tests are completed.

A. General. The Contractor shall select the source of materials and perform the initial sampling and testing sufficiently in advance to not delay the work. The Contractor shall control his operations during production and placement of material, so that the materials in the completed course will meet the specified requirements. The Construction Manager may perform verification tests for final approval of the materials in the completed course. All quality control sampling and testing shall be performed as specified herein.

B. Samples. All samples including those required and used by the Contractor for control of his operations shall be representative of the materials being placed. In addition, samples shall be taken from the completed and compacted course. All samples shall be taken in conformance with ASTM D 75 unless otherwise approved or directed by the Construction Manager.

C. Testing. The following tests shall be performed for the Contractor by an approved independent commercial testing laboratory. Testing shall be performed at no additional cost to the PRPs.
   1. Aggregate Gradation (Sieve Analysis) shall be determined in accordance with ASTM C 136, and D 422. Sieves shall conform to ASTM E 11.
   2. Wear (L.A. Abrasion) Test shall be performed in conformance with ASTM C 535.
   3. Soundness shall be determined in accordance with ASTM C 88, using magnesium sulfate.
   4. When a proposed quarry has DelDOT pre-approval for supplying Type B stone or gravel coarse aggregate, L.A. Abrasion and Soundness testing of the aggregate will not be required.

D. Testing Frequency.

1. Initial Tests. Each type of test defined in paragraph 3.01C of this Section shall be performed on the proposed material from each supplier or when visual variations occur in the material from one source. These tests shall be performed prior to commencing construction to demonstrate that the proposed material will meet all specified requirements when furnished.

3.02 ROADWAY CONSTRUCTION

A. The General Contractor will perform all construction specified by the Construction Manager.

B. No excavation into the Inert Area or the Drum Disposal Area will be required as part of roadway construction.

C. Upgrading of Existing Roadway.

1. Grading. The existing roadway shall be graded until area is free of all foreign substances and vegetation. The roadway shall be level and free of holes. The existing roadway shall be proof rolled thoroughly with a 10-ton vibratory compactor approved by the Engineer. The rolling shall begin at the sides and progress to the center. The rolling shall be parallel with the center line of the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels, and continuing until the material does not creep or wave ahead of the roller wheels.

2. Placement of Coarse Material. See Paragraph 3.02 E.

D. Roadway Subgrade.

1. Preparation of Subgrade. Prior to placing aggregate, the subgrade shall be cleaned of all foreign substances and vegetation. The aggregate roadway shall not be constructed on a wet, frozen, or unsuitable subgrade. Unsuitable subgrade material shall be removed at the direction of the Construction Manager. Unsuitable subgrade material is any material that is not capable of supporting a load. The subgrade shall be proof rolled thoroughly prior to the placement of geotextile with a 10-ton vibratory compactor approved by the Engineer. The rolling shall begin at the sides and progress to the center. The rolling shall be parallel with the center line of the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels, and

continuing until the material does not creep or wave ahead of the roller wheels.

E. Roadway Construction.

1. Placement of Geotextile. The separator geotextile shall be placed in accordance with Section 02360 - Geotextiles.
2. Placement of Base Course Material. Prior to placing the coarse material, the base course shall be spread uniformly over the existing subgrade and geotextile as a bed and filler. The base course material shall be spread to a minimum depth of three inches.
3. Placement of Coarse Material. The coarse material shall be spread uniformly on the base course material by approved mechanical stone spreaders to the full width of the base. Spreaders shall be adjusted to spread the loose material to obtain a layer of the required depth after compaction. In areas inaccessible to spreading equipment, the material may be spread directly from trucks provided the distribution is satisfactory to the Construction Manager. All segregated material shall be removed and replaced with well graded material. The coarse material shall not be spread for a distance of more than an average day's work ahead of choking and compacting. Course material shall be placed to achieve a final compacted thickness of six inches.
4. Compacting Coarse Material. The coarse material shall be rolled and thoroughly compacted with vibratory equipment approved by the Construction Manager. The rolling shall begin at the sides and progress to the center. The rolling shall be parallel with the center line of the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels, and continuing until the material does not creep or wave ahead of the roller wheels. Red flags shall be placed at the limits of satisfactorily compacted coarse material. The flags shall be moved ahead by the Contractor as additional material is compacted, and no filler shall be applied to the coarse material in advance of the flag-marked sections.
5. Choking with Fine Material. After the coarse material has been set and keyed by vibration and rolling, spread fine material uniformly over the surface in an amount equal to approximately one-half of that required to fill the voids in the coarse material. Operate the vibrator over the surface in one or more applications to satisfactorily fill the voids; however, do not cause flotation of the coarse aggregate. Use manual methods to fill areas not completely filled by vibration.

6. Compacting and Bonding. After completing the vibration of the fine material, the surface shall be sprinkled with water and rolled. All excess fines forming in piles or cakes upon the surface shall be loosened and scattered by sweeping, exercising care that the fine material is not removed below the top of the coarse aggregate. On the surface, the sprinkling and rolling shall be continued and additional fines applied where necessary until all voids are filled and until a slight wave of grout forms in front of the roller wheels. Brooms attached to the roller, and hand brooms, shall be used to distribute the grout uniformly into the unfilled voids. After the wave of grout has been produced over the entire section of the base course, this portion shall be left to dry. The surface shall be sprinkled and rerolled in succeeding days as required to bond it thoroughly and to secure a satisfactory surface. The quantity of fines and water used shall be sufficient to produce a smooth, hard monolithic surface. Diagonal and cross-rolling shall be performed as directed by the Construction Manager. Sprinklers for this work shall be of a size and design approved by the Construction Manager and shall be mounted on a motor-driven chassis equipped with pneumatic tires.
7. Inspection. After each layer of material has been spread, it shall be inspected by the Construction Manager and all identified irregularities shall be satisfactorily corrected prior to placement of next course.
8. Layer Thickness. The compacted thickness of the roadway shall be as indicated on the Drawings. When a compacted layer of 6 inches or less is indicated, the material may be placed in a single layer; when a compacted thickness of more than 6 inches is required, no layer shall exceed 6 inches when compacted.
9. Edges. The tapered edge of the shoulders shall be constructed in such a manner as the Contractor elects subject to the approval of the Construction Manager, but the finished surface of the shoulders and tapered edges shall conform to the typical sections shown on the Drawings.
10. Smoothness Test. The surface of each layer shall not show deviations in excess of 1-1/2 inches when tested with a 10-foot straightedge applied parallel with and at right angles to the centerline of the area under consideration. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed by the Construction Manager. The Contractor shall test the surface smoothness in the presence of a representative of the Construction Manager at intervals as directed by the Construction Manager.

11. Thickness Control. The Contractor shall control his operations by measurements to insure placement of materials to the thickness specified. Thickness shall be verified by test holes at least 3 inches in diameter through the base course. One depth measurement shall be made for each 2,000 square yards of roadway, or part thereof. Measurements may be made by the Construction Manager for verification of compliance; however, the Contractor shall not depend on such measurements for his control of operations. The completed thickness of the base course shall be within 1/2 inch (plus or minus) of the thickness indicated. Where the measured thickness of the base course is more than 1/2 inch deficient, the Contractor shall correct such areas at no additional expense to the PRPs by scarifying, adding mixture of proper gradation, reblading, and recompacting as directed. Where the measured thickness of the base course is more than 1/2 inch thicker than that indicated on the Drawings, it shall be considered as conforming with the specified thickness requirements plus 1/2 inch. The average job thickness shall be the average of the job measurements determined as specified above but shall be within 1/4 inch of the thickness indicated on the Drawings.

F. Weather Limitations. The roadway base course shall be constructed when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F., the Contractor shall protect all areas of completed base course by approved methods against detrimental effects of freezing. Areas of completed base course damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements at no additional cost to the PRPs.

3.03 STABILIZED CONSTRUCTION ENTRANCE

The Contractor shall construct a stabilized construction entrance at all points of construction ingress and egress, in accordance with the Delaware Erosion and Sediment Control Handbook. A geotextile, meeting the requirements of Section 02350 - Geotextile, shall be placed prior to the placement of the 2-inch stone. The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto Grantham Lane. As directed by the Construction Manager, the Contractor shall clean any sediment accumulated onto Grantham Lane as a result of the construction activities being undertaken at not additional cost to the PRPs.

3.04 MAINTENANCE

A. All access roadways (temporary or permanent) and parking areas shall be the responsibility of the Contractor to maintain in a passable condition from Notice to Proceed until final project acceptance at no additional cost to the PRPs. The Contractor shall provide the required aggregate and drainage provisions to allow work to proceed undelayed.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02300 - CAP SYSTEM: GENERAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. General: This section describes general requirements for cap system installation. Requirements specific to each of the components are given in Section 02310 - Test Fill, Section 02320 - Geosynthetic Clay Liner, Section 02330 - Geomembrane, Section 02340 - Cap Drainage Layer, Section 02350 - Geotextile, and Section 02360 - Cap Cover Layer. Work is to be performed by the General Contractor in accordance with the provision of Section 01100 - Health and Safety.

B. Protection of Construction: Cap system structures, including settlement monuments, shall be carefully maintained and protected during all phases of construction.

C. Settlement and Grading: Settlement or erosion that occurs prior to acceptance of work shall be repaired and grades re-established to the required elevations and slopes at no additional cost to the PRPs. Repair of settled areas shall be as described in this section.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to Cap System: General

1. Section 01100 - Health and Safety
2. Section 01150 - Measurement and Payment
3. Section 02100 - Site Preparation
4. Section 02150 - Gas Venting System
5. Section 02200 - Earthwork
6. Section 02212 - Waterways
7. Section 02310 - Test Fill
8. Section 02320 - Geosynthetic Clay Liner
9. Section 02330 - Geomembrane
10. Section 02340 - Cap Drainage Layer
11. Section 02350 - Geotextile
12. Section 02360 - Cap Cover Layer
13. Section 02370 - Seeding
14. Section 02700 - Settlement Monuments

1.03 REFERENCES

A. Reference Standard
   1. American Society for Testing and Materials
      ASTM D 5321-92 - "Standard Test Method for Determining the Coefficient of Soil-Geosynthetic or Geosynthetic-Geosynthetic Friction by the Direct Shear Method."

B. References for individual cap system components are given in the sections specific to the components.

1.04 SUBMITTALS

A. The Contractor shall submit the following items for each soil described in Section 02200 - Earthwork, Part 2 - Materials, to the Construction Manager for approval:

   1. Topographic map and cross sections of final surface.
   2. Survey data from cross sections.
   3. Sources of borrow material.
   4. Atterberg Limit test results.
   5. Grain-size determination.
   6. Optimum moisture density curves.

B. The Contractor shall submit the following items to the Construction Manager for approval by the Engineer:
   1. Cap System Installation Quality Assurance/Quality Control Plan.
   2. Qualifications of geosynthetic testing laboratory.
   3. Description of Shear Testing Apparatus and Test Procedures.
   4. Shear Friction Test Results.

1.05 REPAIR OF SETTLED AREAS

A. Settled areas requiring repair shall be investigated by the Construction Manager to determine the cause of the displacement. If settlement greater than or equal to 18 inches deep occurs over a 10-foot square or larger area or if investigations reveal that a malfunction of the cap system has caused the displacement (e.g., component failure), the defective items shall be repaired or replaced and the site shall be regraded to original specifications. If settlement to a lesser degree occurs, suitable soil cover shall be placed and compacted on the affected areas to re-establish grades.

1.06 CONTRACTOR'S EXPERIENCE

A. Contractor's Experience: Any Contractor proposing to perform the work hereunder specified shall have demonstrated their ability to do the work by having successfully installed at least 2 million square feet of the geomembrane, at least 1 million square feet of geonet, and at least 2 million square feet of geotextile proposed for use or as specified elsewhere in the Bid Documents, whichever is greater, and can be licensed, certified or otherwise approved by the manufacturer. The geomembrane installer shall submit to the Construction Manager evidence of his previous experience and the manufacturer's approval prior to the start of the work. The General Contractor shall also demonstrate their ability to successfully place soil above a geosynthetic sandwich as required in these specifications. This evidence shall include names of projects, materials used, size of projects, names of contacts and phone numbers.

PART 2 MATERIALS

Materials shall be as specified under Section 02200 - Earthwork and under specifications for the specific cap system components.

2.01 GEOTEXTILE-GEONET-GEOTEXTILE COMPOSITE

The geotextile-geonet-geotextile composite to be installed on slopes greater than 8H:1V shall be comprised of geotextiles and geonet that meet the individual requirements of Section 02350 - Geotextile and Section 02340 - Cap Drainage Layer, respectively. The individual components shall be heat bonded together and provide, as a composite, interface shear friction characteristics as required within these specifications.

PART 3 EXECUTION

3.01 SHEAR FRICTION TESTING

A. General. Prior to placement of any of the cap system materials, one shear friction test shall be conducted for each different interface to determine the friction angles along each of the cap system interfaces. Each test shall be performed for three normal stresses as described below. These tests shall be conducted by an approved laboratory using the actual materials to be placed in the cap system with soil materials compacted to the density required under full-scale construction.

B. Procedure. Friction testing shall be performed in accordance with

ASTM D 5321-92. The maximum shear stress for each test shall be plotted versus the applied normal compressive stress and a best-fit straight line drawn through the data points. The slope of this "failure envelope" is the coefficient of friction at the interface of the materials. Soils and geosynthetic samples used for friction testing shall be saturated. The geotextile and geonet shall be oriented such that the shear force is parallel to the downslope orientation of the geotextile and geonet in the field. Three (3) normal stress values shall be used, (120 psf, 360 psf, and 600 psf).

C. Evaluation of Test Results. Test results shall indicate that the minimum interface friction angle between any adjacent geosynthetic cap components is at least 10 degrees for the cap system to be placed on slopes flatter or equal to 8 horizontal to 1 vertical. For geosynthetics to be placed on slopes greater than 8 horizontal to 1 vertical, the test results shall indicate that the minimum interface friction between any adjacent geosynthetic cap components is at least 26 degrees. These results shall be submitted to the Engineer and approved prior to performance of test fill or placement of any of the cap system components. If tested materials fail to achieve the required minimum friction angle, the Contractor shall select other materials meeting the specifications and repeat the friction testing until cap system components are found that meet the minimum requirement. Repeated test shall be performed at no additional cost to the PRPs.

3.02 The cap system shall be placed upon the cleared surface of the landfill and as required, upon site foundation fill as delineated on the Drawings.

3.03 The cap system on slopes not greater than 8H:1V shall consist of the following components, listed in order of construction.

A. Geosynthetic Clay Liner.
B. Geomembrane.
C. Cap Drainage Layer consisting of a synthetic geonet.
D. Geotextile.
E. Cap cover layer, two feet thick, consisting of:
   1. Select Fill, 18 inches thick.
   2. Topsoil, 6 inches thick.

3.04 The cap system on slopes greater than 8H:1V shall consist of the following components, listed in order of construction.

A. Geosynthetic Clay Liner.
B. Double-sided textured geomembrane.
C. Geotextile-Geonet-Geotextile composite.
D. Cap cover layer, two feet thick, consisting of:
   1. Select Fill, 18 inches thick.
   2. Topsoil, 6 inches thick.

3.05 The surface of the cap shall be seeded as specified under Section 02370 - Seeding.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02310 - TEST FILL

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work specified herein consists of constructing a test section of the landfill cap in advance of production delivery of materials and in advance of full scale cap construction, in order to evaluate and verify the suitability of materials proposed for use and the effectiveness of the proposed placement equipment, procedures and methods of the General Contractor. Performance of the test fill will constitute part of the review and approval process of the Contractor's proposed materials equipment, procedures, and methods, as specified under Sections 02200 - Earthwork, 02320 - Geosynthetic Clay Liner, 02330 - Geomembrane, 02340 - Cap Drainage Layer, 02350 - Geotextile, and 02360 - Cap Cover Layer herein.

The General Contractor shall at all times conduct test fill work in accordance with the provisions of Section 01100 - Health and Safety, and all applicable federal, state, and local laws and regulations.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to performance of the test fill:
   1. Section 01100 - Health and Safety
   2. Section 01150 - Measurement and Payment
   3. Section 02200 - Earthwork
   4. Section 02320 - Geosynthetic Clay Liner
   5. Section 02330 - Geomembrane
   6. Section 02340 - Cap Drainage Layer
   7. Section 02350 - Geotextile
   8. Section 02360 - Cap Cover Layer

1.03 QUALITY CONTROL

Reference Standards: As specified in Sections 02200 - Earthwork, 02320 - Geosynthetic Clay Liner, 02330 - Geomembrane, 02340 - Cap Drainage Layer, 02350 - Geotextile, and 02360 - Cap Cover Layer.

1.04 SUBMITTALS

A. The General Contractor shall submit for Engineer approval complete details of the following items related to construction of the test fill prior to its construction:
   1. Proposed placement and compaction equipment for each of the constituent materials.
   2. Material processing equipment (if required).
   3. Material wetting and drying equipment (if required).

B. The General Contractor shall also have fulfilled the submittal requirements for each of the materials to be incorporated into the Test Fill.

PART 2 - MATERIALS

2.01 SITE FOUNDATION FILL

As specified under Section 02200 - Earthwork.

2.02 GEOSYNTHETIC CLAY LINER

As specified under Section 02320 - Geosynthetic Clay Liner.

2.03 GEOMEMBRANE

As specified under Section 02330 - Geomembrane.

2.04 CAP DRAINAGE LAYER

As specified under Section 02340 - Cap Drainage Layer.

2.05 GEOTEXTILE

As specified under Section 02350 - Geotextile.

2.06 CAP COVER LAYER

As specified under Section 02360 - Cap Cover Layer.

PART 3 - EXECUTION

3.01 REQUISITE WORK

A. Production delivery of materials is not permitted until the test fill has been completed, tested, and approved.

B. Test fill work shall not be started until site foundation fill (see Section 02200 - Earthwork) has been placed and accepted over an area extending at least 25 feet beyond the minimum test fill lateral limits described below.

C. No test fill shall begin prior to the Construction Manager's approval of all advance submittals by the Construction Manager, the QC Consultant, or as required, the Engineer as specified under Sections 02200 - Earthwork, 02320 - Geosynthetic Clay Liner, 02330 - Geomembrane, 02340 - Cap Drainage Layer, 02350 - Geotextile, and 02360 - Cap Cover Layer, including all required borrow area investigations, testing, and reports.

D. Prior to starting any test fill work, the General Contractor shall have present and operable any materials handling or processing equipment that are proposed to be used during construction of the final landfill cap. Equipment that is found to be unsuitable or ineffective shall be replaced with equipment suitable for the work at no expense to the PRPs.

3.02 TEST FILL COMPOSITION AND DIMENSIONS

A. The test fill shall be constructed at a location approved by the Construction Manager and Engineer. The thickness and relative position of each constituent layer or material shall be the same as that of the final landfill cap.

B. All constituent materials used to construct the test fill shall be obtained from the same source as the materials to be used for subsequent construction of the final landfill cap.

C. The test fill shall be constructed to minimum lateral dimensions of 40 by 100 feet in plan area. Additional test fill construction will be required at no additional cost to the PRPs in the event final placement and compaction procedures and control criteria have not been completely established upon completion of the minimum test fill described above.

3.03 MATERIAL PLACEMENT AND COMPACTION

A. All test fill materials shall be placed and compacted, as applicable, in accordance with the provisions of the applicable material specification.

B. The placement and compaction procedures prescribed in the material specifications may be modified and refined to some degree as a result of test fill work, as detailed below.

3.04 DEVELOPMENT OF PLACEMENT AND COMPACTION PROCEDURES AND CONTROLS

A. Primary purposes of the test fill are to demonstrate that materials proposed for use meet the specification requirements and to establish placement and compaction procedures that will produce acceptable finished products with regard to landfill cap construction. Towards this end the test fill will be used to evaluate a variety of placement and compaction techniques and procedures. As a minimum, the following items relating to cap construction will be evaluated:
   1. Equipment type, size, and speed of operation.
   2. Material lift thickness.
   3. Compaction modes.
   4. Number of compaction equipment passes.
   5. Effectiveness of materials wetting or drying equipment and procedures.
   6. Effectiveness of materials conditioning equipment.
   7. Prevention of damage to geosynthetic materials.

B. The General Contractor shall provide a supervisor experienced in all aspects of material placement and compaction to direct test fill work on a continuous basis. The supervisor shall work with the Construction Manager's representative to direct ongoing material placement procedures and to effect any changes in placement compaction, or handling equipment and procedures which may be directed by the Construction Manager. Manufacturer's representatives for the geosynthetic materials shall be on site during construction of the test fill.

C. The Construction Manager, the QA Consultant, and Engineer will provide a representative on a continuous basis throughout the duration of test fill work to monitor all operations and materials testing, including quality control documentation and inspection procedures, and prescribe modifications to test fill equipment and/or procedures.

D. When the Construction Manager and Engineer are satisfied by test results and monitoring that placement and compaction equipment and procedures have been established which will enable construction of the

final landfill cap to specification, test fill work will be declared completed.

E. Within four weeks of the completion of the test fill, the Engineer will issue a detailed summary documenting the equipment, and procedures that were successfully used in construction of the Test Fill. The General Contractor shall be required to use the same materials, equipment, and procedures in the full scale construction.

3.05 REMOVAL OF TEST FILL

A. After completion of the test fill, the General Contractor shall remove all test fill materials.

3.06 QUALITY CONTROL

A. The Contractor shall provide all testing and quality control equipment and facilities required by Sections 02200 - Earthwork, 02320 - Geosynthetic Clay Liner, 02330 - Geomembrane, 02340 - Cap Drainage Layer, 02350 - Geotextile, and 02360 - Cap Cover Layer of these Specifications.

B. One or more representatives, in accordance with (Section 01400 - Quality Control) of the Contractor's QC inspector shall be onsite full time during construction of the test fill.

C. Testing standards and procedures for testing the various materials in the test fill shall be as specified in Sections 02200 - Earthwork, 02320 - Geosynthetic Clay Liner, 02330 - Geomembrane, 02340 - Cap Drainage Layer, 02350 - Geotextile, and 02360 - Cap Cover Layer of these Specifications.

D. Number of samples and/or tests during construction of a test fill shall be not less than the following minimums:
   1. Site Foundation Fill
      a. Classification and water content on delivered material by ASTM D-2487 and ASTM D-2216 - five
      b. Compaction on delivered material by ASTM D-698 - three
      c. Field density and water content on compacted material by ASTM D-3017 and D-2922 respectively - 25
   2. Cap Cover Layer
      a. Classification and water content on delivered material by ASTM D-2487 and ASTM D-2216 - five
      b. Compaction on delivered material by ASTM D-698 - three

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02320 - GEOSYNTHETIC CLAY LINER

PART 1 - GENERAL

1.01 DESCRIPTION

The work covered in this specification shall include the furnishing of all labor, materials, tools, equipment, and other items necessary for the complete and proper installation of the geosynthetic clay liner (GCL). This specification addresses the manufacturing, manufacturing quality control, shipping and handling, storage, installation, and field quality control of the GCL. All work shall be performed in strict accordance with the lines, grades, cross sections, and dimensions on the project Drawings, or as directed by the Construction Manager.

1.02 RELATED WORK

Work specified in the following paragraph is, or may be, related to this Section:

1. Section 01100 - Health and Safety.
2. Section 01110 - Air Monitoring.
3. Section 01150 - Measurement and Payment.
4. Section 01700 - Material Handling.
5. Section 02300 - Cap System: General.
6. Section 02310 - Test Fill
7. Section 02330 - Geomembrane.

1.03 QUALITY CONTROL

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

American Society for Testing of Materials (ASTM) Publications.

a.	D 1557-90	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54 kg) Rammer and 18-in. (457-mm) Drop.
b.	D 1777 - 75	Thickness of Textile Materials.
c.	D 2922-90	Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).
d.	D 4354-89	Sampling of Geotextiles for Testing.
e.	D 4595-86	Tensile Properties of Geotextiles by the Wide Width Strip Method.
f.	D 4632-91	Grab Breaking Load and Elongation of Geotextiles.
g.	D 4643-87	Water (Moisture) Content of Soil by the Microwave Oven Method.
h.	D 4759-88	Specification Conformance of Geosynthetics.
i.	D 5084-90	Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

B. All standards specified shall be strictly adhered to, including all the latest revisions. Certification for conformance to these specifications for all materials shall be furnished by the Contractor when requested.

1.04 JOB CONDITIONS

The Contractor shall use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Construction Manager and at no additional expense to the PRPs.

1.05 SUBMITTALS

A. Prior to shipment, the Contractor shall submit to the Construction Manager manufacturing quality control documentation on the specified rolls of GCL, demonstrating that all quality control test methods, frequency and acceptance criteria meet the requirements of Table 1.

B. Weekly updated copies of the as-built drawings certified by the QC Inspector indicating patch and seam locations.

PART 2 - MATERIALS

The Contractor should note that materials that do not demonstrate acceptable interface friction angles with adjacent cap components, in accordance with Section 02300 - Cap System: General, shall be considered unacceptable.

2.01 GENERAL

A. The GCL shall be prefabricated in a manufacturing facility with a one lb/sf uniform layer of natural sodium bentonite containing 90 percent sodium montmorillonite sandwiched between two layers of support materials to contain the bentonite. One layer may be a light weight nonwoven needlepunched geotextile which is needle punched through the bentonite into the carrier layer. Support materials used in the manufacturing shall not interfere with the swelling, self-healing or low permeability characteristics of the bentonite.

B. No disassociation of geotextile components from the bentonite core shall occur if the liner is cut, punctured, torn, or hydrated. GCL without the use of nonwoven needlepunched geotextile shall be allowed if approved by the Construction Manager.

2.02 SODIUM BENTONITE

A. The primary component of the GCL is high quality sodium bentonite (montmorillonite) obtained from mines in the western United States.

B. The bentonite used in the manufacture of the GCL must be demonstrated to meet the testing and acceptance criteria listed in Table 1. The testing shall be performed on bentonite obtained from the finished GCL product.

C. Finished GCL Product

1. The finished GCL shall be demonstrated to meet or exceed all of the testing procedures and acceptance criteria listed in Table 1 with the testing frequency listed.

2. Six inch and twelve inch overlap marks shall be marked longitudinally on the GCL by the Manufacturer to assist in obtaining the proper overlap.

3. The finished GCL shall be completely wrapped and adequately secured with a durable plastic protective cover in order to provide protection from ultraviolet degradation and excessive loss of moisture during shipping and storage.

4. *Manufacturer's Minimum Quality Control Testing and* Inspection of finished GCL.

   a. The Manufacturer must perform all the quality control testing at the specified frequency as listed in Table 1.

   b. If the GCL is fabricated with a needle punching process, needle detecting devices shall be present prior to rollup to ensure that no broken needles are present in the final product.

   c. Prior to rolling, the finished product shall be visually inspected over 100 percent of the surface area of the GCL to detect deficiencies in the uniformity of the bentonite. Regions of the product in which a bentonite deficiency is noted shall be removed from the production line.

   d. Each roll shall be weighed upon production. The roll shall be labeled with the following information: weight, length, width, product name, name of the manufacturer, lot number and date of production, which can be cross-referenced to the roll number marked on the label and to the production and quality control data sheets.

E. Bentonite Sealing Compound and Granular Bentonite

1. Bentonite sealing compound (BSC) and granular bentonite (GB) shall be applied to ensure tightness at all penetrations and structures.

2. The BSC and GB shall be supplied by the Manufacturer and shall be comprised of the same bentonite used in the manufacturing of the GCL. The BSC shall be a mixture of non-aqueous liquid suspension agents which create a paste-like texture.

3. The suspension agents used in the manufacture of the BSC shall be non-toxic, water soluble and shall not restrict the bentonite's ability to swell and absorb water upon hydration.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Equipment Required for Installation

The proposed equipment used for storage, handling, and installation shall be submitted to the Construction Manager for Engineer's approval and shall be as recommended by the Manufacturer. The equipment used for installation shall not damage the geosynthetic clay liner.

B. Subgrade Preparation

1. Installation of the GCL shall not begin until a proper subbase has been prepared and tested in accordance with Section 02200 - Earthwork and approved by the Construction Manager.

2. The surface upon which the GCL is to be placed shall be free of standing water and maintained in a firm, clean, and smooth condition during liner installation.

C. Handling and Storage

1. The rolls of the GCL shall be carefully unloaded by the Installer upon arrival at the site. The rolls shall be lifted by a support which is inserted through the roll core. The support shall be designed in accordance with

Manufacturer's recommendations, and shall prevent damage to the edges of the GCL during hoisting.

2. The rolls of GCL shall be stored in their original, unopened, wrapped cover in a clean, dry area. The material shall be stored off the ground on pallets and shall be covered with a heavy, protective tarpaulin or enclosed within a storage facility. Care shall be used to keep the bentonite blanket clean and free from debris prior to installation.

D. Panel Placement

1. As each roll is moved from the storage area the labels shall be removed by the Installer and submitted to the QC Inspector.

2. Dragging of the GCL panels over the surface shall be minimized.

3. The GCL will be placed over the prepared surface in such a manner as to assure minimum handling. Horizontal seams shall never occur on slopes steeper than 8H: 1V. The cover material shall be placed over the GCL during the same day as the placement of the GCL. Only those GCL panels which can be covered that same day shall be unpackaged and placed in position.

4. The GCL shall not be installed in standing water or during rain. The GCL must be dry when installed and must be dry when covered.

5. In areas where wind is prevalent, GCL installation should be started at the upwind side of the project and proceed downwind. The leading edge of the GCL shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

6. The GCL shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the

installation. Stretching of the GCL to fit shall not be allowed. The GCL shall be straightened to smooth out creases or irregularities in the runs.

E. Seaming

1. Once the first run has been laid, adjoining runs shall be laid with a six inch minimum overlap on the longitudinal seams and 24 inches on end seams.

2. GCLs fabricated using a nonwoven needlepunched geotextile shall have seams which are augmented with granular bentonite to insure seam integrity. Granular bentonite shall be dispersed evenly from the panel edge to the lap line at a minumum rate of 1/4 pound per lineal foot continuously along all seams or overlap areas. Accessory bentonite shall be of the same type as the material within the composite liner itself. A non-toxic water-soluble adhesive may be used on seams to keep panels in contact during backfill operations as approved by the Construction Manager and the Manufacturer.

3. All dirt, gravel or other debris shall be removed from the overlap area.

4. Seam overlap on the bottom shall be placed such that the direction of flow is from the top sheet to the bottom sheet to form a shingle effect.

5. On slopes, all runs shall be continuous from crest to toe with the GCL machine direction running perpendicular to the toe. Seams at the base of a slope shall be a minimum of five feet from the toe.

6. If temperatures are higher than 85°F and humidity is low, contraction may occur soon after placement when no confining stress or soil cover is placed. In order to account for the possibility of contraction under these conditions, the longitudinal seam overlap shall be increased to a minimum of twelve inches on longitudinal seams and 36 inches on end seams, or 4 percent of the distance to the next parallel seam, whichever is greater.

F. Patching and Repairs

1. Repair patches in installed GCL shall be overlapped with a minimum twelve (12) inches on all patches. Horizontal patch seams shall be secured with a non-toxic, water soluble adhesive glue as approved by the Construction Manager and the Manufacturer. Patches and repairs shall not be allowed on slopes greater than (8H:1V), unless they are securely anchored with a water soluble adhesive or other approved method. Alternatively, the patches can be placed under the defective liner in order to prevent slippage of the patch.

G. Sealing Around Penetrations

1. The GCL shall be sealed around penetrations, pipes and structures in accordance with the recommendations of the Manufacturer.

2. Bentonite Sealing Compound shall be placed around pipe penetrations, as recommended by the manufacturer.

3. A collar of GCL shall be placed over the Bentonite Sealing Compound to provide a second level of protection and prevent the Bentonite Sealing Compound from being displaced.

SECTION 02320 - GEOSYNTHETIC CLAY LINER
GCL MATERIAL SPECIFICATIONS AND

	PROPERTY	TEST METHOD*	UNITS	VALUE
Bentonite Properties (1)	Sodium Montmorillonite Content	X-Ray Diffraction	%	90 (TYP)
	Free Swell	USP-NF-XVII	ml	27 (MARV)
	Fluid Loss	AP 13 B	ml	12 (MAX. A.R.V.)
	Moisture Content (3)	ASTM D4643	%	20 (TYP)
Physical Properties	Thickness	ASTM D1777	Inches	0.2 (TYP)
	Wide Width Tensile (2)	ASTM D4595	PPI	60 (TYP)
	Grab Tensile (2)	ASTM D4632	LB	90 (MARV)
	Bentonite Content (3) @ 20% moisture	Direct Measurement 12" x Roll Width	LB/SF	0.95 (MARV)
Hydraulic Properties	Permeability A) GCL (2 psi effective stress)	ASTM D5084	CM/SEC	5 x 10(-9) MAX. A.R.V.
	B) 2" Overlapped GCL (without the use of granular bentonite between the seams) (2 psi effective stress)	ASTM D5084	CM/SEC	5 x 10(-9) MAX. A.R.V.
	C) GCL (30 psi effective stress)	ASTM D 5084	CM/SEC	< 5 x 10(-10) (TYP)
	D) Damaged GCL 3 Each, 1" Holes (2 psi effective stress)	ASTM D 5084	CM/SEC	< 5 x 10(-9) (TYP)
	E) GCL Underneath Damaged HDPE Geomembrane (1" Hole) (2 psi effective stress)	ASTM D 5084	CM/SEC	< 5 x 10(-9) (TYP)
	F) After 3 Wet Dry Cycles (2 psi effective stress)	ASTM D 5084	CM/SEC	< 5 x 10(-9) (TYP)
	G) After 5 freeze thaw cycles (2 psi effective stress)	ASTM D5084	CM/SEC	< 5 x 10(-9) (TYP)

PACKAGING	PROPERTY		UNITS	VALUE
Dimensions	Width		FT	12 (MIN)
	Length		FT	100 (MIN)
	Approx. Weight		LB	1500 (TYP)
Protection				Plastic Wrap

*Standard test methods modified where appropriate to facilitate testing a geosynthetic clay liner (GCL).

1. Properties of bentonite removed from finished GCL product.
2. Machine (WARP) direction of primary backing.
3. D 4543 modified wet weight as the denominator.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02330 - GEOMEMBRANE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work in this section consists of furnishing and installing the geomembrane as part of the landfill cap system. The geomembrane shall consist of a VLDPE membrane as specified herein. It shall be installed by the geomembrane installer subcontracted by the General Contractor.

B. Definitions:
   1. Film Tear Bond (FTB) is defined as sheet failure before weld failure.
   2. Panel is defined as an area of geomembrane that is bound by factory or field seams.
   3. Sheeting is defined as an area of geomembrane that has no seams.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to the work specified under this section:
   1. Section 01100 - Health and Safety
   2. Section 01150 - Measurement and Payment
   3. Section 02150 - Gas Control System
   4. Section 02200 - Earthwork
   5. Section 02300 - Cap System: General
   6. Section 02310 - Testfill
   7. Section 02320 - Geosynthetic Clay Liner
   8. Section 02330 - Geomembrane
   9. Section 02340 - Cap Drainage Layer
   10. Section 02350 - Geotextile
   11. Section 02360 - Cap Cover Layer

1.03 QUALITY CONTROL

A. Reference Standards:
   1. American Society for Testing and Materials (ASTM) Standards.
      a. D-413-82 Rubber Property - Adhesion to Flexible Substrate.
      b. D-638-84 Tensile Properties of Plastic.

c. D-746-79 Brittleness Temperature of Plastics and Elastomers by Impact.
d. D-792-86 Specific Density (Relative Density) and Density of Plastics by Displacement.
e. D-816-82 Methods of Testing Rubber Cements.
f. D-1004-66 Initial Tear Resistance of Plastic Film and sheeting. (1981)
g. D-1204-84 Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting at Elevated Temperature.
h. D-1238-86 Flow Rates of Thermoplastics by Extrusion Plastometer.
i. D-1505-85 Density of Plastics by the Density-Gradient Technique.
j. D-1593-81 Nonrigid Vinyl Chloride Plastic Sheeting.
k. D-1603-76 Carbon Black in Olefin Plastic.(1983)
l. D-1693-70 Environmental Stress-Cracking of Ethylene Plastics.(1980)
m. D-3015-72 Microscopical Examination of Pigment Dispersion in Plastic Compounds. (1985)
n. D-4437-84 Standard Practice for Determining the Integrity of Field Seams used in Joining Flexible Polymeric Sheet Membrane (1988).
o. D-4545-86 Standard Practice for Determining the Integrity of Factory Seams Used in Joining Flexible Sheet Geomembrane.

2. National Sanitation Foundation (NSF) Standard 54 for Flexible Membrane Liners, latest revision.

1.04 SUBMITTALS

A. Submit the following items to the Construction Manager for approval by the Engineer :
1. Geomembrane Installer's experience and qualifications.
2. Geomembrane Installer's Quality Control Plan.
3. Descriptive data for geomembrane, including Manufacturer's Specifications.
4. Description of equipment, tools, and machines to be used in performance of the work.
5. Shop drawings for geomembrane installation including anchorage details, seaming details, penetration details, and layout plan.
6. Statement of Qualifications and QA/QC Manual from the geomembrane testing laboratory used for quality control testing.

B. Submit the following items to the Construction Manager for approval:
1. Certificates of compliance for geomembrane.
2. Certified copies of all test reports including all test data.

C. The geomembrane installer shall submit written approval and acceptance of the geosynthetic clay liner, in sections if necessary, before placing geomembrane.

D. The geomembrane installer shall provide the Construction Manager with daily reports of the total amount and location of liner placed, total amount and location of seams completed and seamer and units used, changes in layout drawings, results of test seams, location and results of non-destructive testing, location and results of repair, and location of destructive test samples.

E. Upon completion of the geomembrane installation, the geomembrane installer shall prepare and submit to the Construction Manager a set of "as-built" drawings indicating the location of all destructive samples, repairs, and revisions to details and layout plan. All seam numbers, panel numbers and roll numbers should be noted on the Drawings.

PART 2 - MATERIALS

2.01 VLDPE GEOMEMBRANE

The Contractor shall note that materials that do not demonstrate acceptable interface friction angles with adjacent cap components, in accordance with Section 02300 - Cap System: General, shall be considered unacceptable.

A. Raw Materials: The very low density polyethylene (VLDPE) resin shall be of 100 percent virgin, first quality raw materials, and free of contaminants.

B. VLDPE Sheet Material: Both textured and smooth VLDPE sheet material shall be uniform in color, thickness, size, and surface texture. It shall be free of pinholes, blisters, nodules, blemishes, contaminants, and other imperfections. The sheet material shall also meet the following minimum average roll value standards:

MATERIAL PROPERTIES OF VLDPE

PROPERTY	TEST METHOD	VALUE	
		Non-Textured	Textured
Gauge (mils), nominal	--	40	40
Thickness (mils), minimum	ASTM D-1593	36	36
Density (g/cc), maximum	ASTM D-1505	0.930	0.930
Minimum Tensile Properties (each direction)	ASTM D-638 (Type IV Specimen at 20 in/min) As Modified by NSF 54		
1. Tensile Strength at Break (lbs/in width)		125	45
2. Elongation at break (percent)		800	250
Tear Resistance (lbs), minimum	ASTM D-1004 Die C	10	10
Low Temperature Brittleness (°C)	ASTM D-746	-70	-70
Dimensional Stability (% change), maximum	ASTM D-1204 212°F, 15 min	±3	±3
Resistance to Soil Burial (% change maximum in original value)	ASTM D-3083 (Type IV Specimen at 20 in/min)		
1. Tensile Strength at Break		10	10
2. Elongation at Break		10	10
Environmental Stress Crack (hrs), minimum	ASTM D-1693 (Condition C Modified NSF 54)	1,500	1,500
Melt Index (g/10 minutes), maximum	ASTM D-1238	<1.0	<1.0
Carbon Black Content (percent)	ASTM D-1603	2-3	2-3
Carbon Black Dispersion	ASTM D-3015	A-1 or A-2	A-1 or A-2

C. Factory Seams: All factory seams shall have a minimum shear strength equal to 45 pounds/inch as determined by ASTM D-4545 at or below 500% elongation and shall be FTB. Seams shall have a minimum peel strength equal to 35 pounds/inch as determined by ASTM D-4545 at or below 500% elongation, and shall be FTB.

2.02 HANDLING AND STORAGE

Until installed, factory-fabricated panels or rolls shall be stored on a prepared surface (not wooden pallets) that is lined with geotextile, stacked no more than two rolls/panels high, and shall be protected from the direct rays of the sun under a light-colored, heat-reflective, opaque cover. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage. The Contractor shall be responsible for providing all required care and to assure that the geomembrane is kept in good condition prior to its installation. Any geomembrane found to be damaged shall be replaced with new geomembrane at the Contractor's expense.

2.03 FASTENERS

All clamps, clips, bolts, nuts, or other fasteners used to secure liner around each appurtenance shall have a life span equal to or exceeding the liner.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Geosynthetic Clay Liner: A Geosynthetic Clay Liner shall be installed before installing Geomembrane. See Section 02320 - Geosynthetic Clay Liner. No Geomembrane shall be placed in an area where the geosynthetic clay liner has been subjected to precipitation.

B. Weather Limitations: Unless approved by the Construction Manager, geomembrane shall not be placed or seamed when the ambient temperature is below 40°F or above 100°F. In the event of seaming below 40°F, the Contractor's Installer shall make test seams once every 4 hours, obtain a sample from each test seam, conduct field shear and peel strength tests, and provide certification that these tests meet the minimum specified seam requirements. Placement and seaming shall not be performed during precipitation, in the presence of excessive moisture (e.g. fog, rain, dew), in an area of ponded water, or during excessive winds, as determined by the Construction Manager.

C. Placement of Geomembrane:

1. General: The Contractor's Installer shall furnish the services of a competent field installation supervisor who shall remain on-site and be in charge throughout the geomembrane installation, for panel layout, seaming, patching, testing, repairs, and all other activities of the Installer. The Contractor shall also have a certified NICET QC inspector on-site full-time, independent of the geomembrane installer, to

supervise the installation of the geomembrane, and perform the required quality control sampling in accordance with Section 01400 - Quality Control of these specifications. The geomembrane shall be placed over the prepared surfaces in such a manner as to assure minimum handling. Seams shall be oriented parallel to the line of maximum slope and with the fewest possible number of wrinkles. Where seams must be oriented across the slope, the upper panel shall be lapsed over the lower panel. Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, and foreign material. Adequate loading (e.g., sand bags) shall be placed to prevent uplift of the geomembrane by wind. Any portion of the geomembrane damaged during installation shall be removed or repaired by using an additional piece of geomembrane, as specified in this section.

2. Equipment: All equipment, tools, and machines used in performance of the work shall be approved by the Construction Manager, and the QC inspector prior to commencement of work. This equipment shall be maintained in satisfactory working condition at all times.
3. Appurtenances: Attach geomembrane to gas vents and settlement monument pipes using factory-fabricated geomembrane boots as recommended by the manufacturer and as shown on the Drawings. The number of field seams required in odd-shaped geometric locations shall be minimized. Factory-fabricated pieces (such as boots to be placed around pipes) shall be used as much as possible. All seams shall be carefully visually inspected and shall be vacuum box tested.
4. Anchorage and Penetrations: The geomembrane shall be anchored as recommended by the manufacturer and as shown on the Drawings. All geomembrane penetrations shall be as recommended by the manufacturer.
5. Quality of Workmanship: All joints, on completion of the work, shall be tightly bonded. Any lining surface, which in the opinion of the QC inspector, or the QA Consultant or the Construction Manager, shows injury due to scuffing, penetration by foreign objects, or distress from rough subgrade shall, as directed by the QC inspector, the QA Consultant or the Construction Manager, be replaced or covered and sealed with an additional layer of the proper size at no additional cost to the PRPs.

D. Field Seams in VLDPE Geomembrane: Seaming of factory-fabricated sheets shall be by wedge welding with extrusion welding used only for patching and seaming around appurtenances. Overlap shall be a minimum of 4 inches for wedge welding and extrusion welding, unless a greater width is required for peel tests to be performed on the seam. Welding rods or beads used for extrusion welding shall be VLDPE and the physical properties shall be the same as those of the resin used to manufacture the VLDPE geomembrane. Before making the field seam,

the contact surfaces of the geomembrane shall be thoroughly cleaned to remove all dirt, dust, moisture, and other foreign materials no more than 30 minutes prior to seaming, by methods approved by the Construction Manager and QC inspector. All field seams shall be tested as specified in this section.

E. Repairs to VLDPE Geomembrane (Textured and Non-Textured): Each suspect location, as determined by the QC inspector, the Construction Manager, or the QA Consultant, in seam and non-seam areas shall be non-destructively tested. Each location that fails the non-destructive testing and gouges and other imperfections which do not fail but in the opinion of the QC inspector, the QA consultant or the Construction Manager are suspect, shall be marked by an inspector, and repaired accordingly. Defective seams shall be restarted/reseamed as described for field seams. Extrusion of the flap of a failed fusion weld shall not be permitted. Small imperfections shall be repaired by extrusion cap welding. If the imperfection is larger than 1/4 inch it shall be patched. The patch shall extend 4 to 6 inches beyond the edge of the suspected location. Tears shall be rounded prior to patching. Blisters, blemishes, large holes, undispersed raw materials, contamination by foreign matter and other imperfections as determined by the QA Consultant or the Construction Manager, shall be repaired by patching. Surfaces of VLDPE which are to be patched shall be abraded (no more than 10 percent of thickness) and cleaned no more than 15 minutes prior to the repair. All geomembrane repairs shall be made using patches with rounded corners and of the same VLDPE material. All patched or reseamed areas shall be nondestructively vacuum box tested.

3.02 QUALITY CONTROL

A. Sampling and Testing of Geomembrane at Factory: Sampling and testing shall be performed by an approved commercial testing laboratory or by a laboratory maintained by the geomembrane manufacturer. Prior to shipment of each fabricated geomembrane panel, random samples shall be cut from the panel at the rate of three samples per 40,000 square feet of membrane. These samples shall be approximately 8-1/2" x 11" in size and cut across the factory seam such that each sample includes the full width of the seam. Each sample shall be tagged to identify: 1) date cut; 2) panel from which cut; 3) location in panel; 4) visually inspected by date; and 5) visual inspection comments. One sample for each 40,000 square feet of job lot material shall be tested. Certified test results on each sample shall be submitted to the Construction Manager for the properties specified previously. The remaining sample specimens, along with suitable identification, shall be turned over to the Construction Manager for further testing, if desired,

and permanent record of actual furnished material. All holes resulting from sampling shall be patched with similar geomembrane material using the specified seaming methods. In addition, all factory seams shall be air-lanced, vacuum tested, or air pressure tested (for wedge process), as applicable for the geomembrane prior to shipment. Failed seams shall be documented, repaired, and retested. Results of all seam testing and repair shall be submitted to the Construction Manager for approval.

B. Sampling and Testing of Geomembrane at Jobsite:

1. Inspection of Sheet Installation: Upon delivery, the QC inspector shall verify and document that the material delivered to the site is the same material that was tested at the factory and that the test results indicate that the material meets the material properties specified previously. The Contractor's QC inspector shall conduct a visual inspection of each panel or sheet as it is unrolled and determine if any damage has occurred. The QC inspector shall mark the roll number, panel number and damaged areas immediately after each panel is placed. The QC inspector shall report any damage to the Contractor and Construction Manager. All faulty areas shall be repaired as specified previously.
2. Test Seams: Field test seams shall be conducted on fragment pieces of geomembrane liner to verify that seaming conditions are adequate. Test seams shall be conducted at the beginning of each seaming period, and at the QC inspector's discretion, for each piece of seaming apparatus to be used and for every material combination (e.g. smooth to smooth, smooth to textured, textured to textured) to be welded that seaming period. All test seams shall be made at a location selected by the QC inspector or the QA Consultant in the area of the seaming and in contact with the geosynthetic clay liner. The test seam sample shall be at least 2 feet long with the seam centered lengthwise. Five specimens 1-inch wide shall be cut from each opposite end of the test seam by the QC inspector. The QC inspector shall use a tensiometer to test these specimens for shear in accordance with ASTM D816, Method B, and peel in accordance with ASTM D413, Method A or ASTM D816, Method C. Both sides of a double wedge seams shall be tested for shear and peel. Acceptance criteria for the test seams shall be as described for the destructive seam testing. If a test specimen fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full test seams are achieved. All test seam results shall be recorded by the QC inspector and reported to the Construction Manager daily.
3. Non-destructive testing and Inspection of Field Seams: All double

wedge seams shall be tested by the air pressure method as follows: A double wedge seam section shall be initially pressurized to a pressure of 27 to 30 pounds per square inch (psi) for a period of two minutes. After two minutes, the pressure shall be recorded. After another three minutes, the pressure shall be recorded. The seam is acceptable if the pressure differential over the three minutes is not greater than 3 psi. If the pressure differential exceeds 3 psi, the leak shall be located and the seam repaired. The seam section between the initial pressurization point and the leak shall be retested.

In lieu of the air pressure method, and for extrusion welds, seams shall be tested using the vacuum method and visually inspected in accordance with the procedures defined by ASTM D4437. The procedure is as follows: 1) a solution of water and liquid soap is made; 2) with the solution, wet strip of seam approximately 3 feet long; 3) compress vacuum box over wetted area; 4) switch on vacuum pump to form seal about the bottom; 5) examine seam for soap bubbles; 6) if no bubbles are present, release vacuum after maintaining the required vacuum of 5 psi absolute for 15 seconds and move to next section with a minimum 4-inch overlap; 7) areas where bubbles appear will be marked, recorded, repaired, and retested; and 8) record all test results. All non-destructive test results are to be recorded by the QC inspector and reported to the Construction Manager daily.

4. Destructive Testing of Field Seams: Samples for destructive testing shall be taken at a minimum rate of one sample per 500 feet of seam length. The samples shall be 12 inches wide by 48 inches long with the seam centered lengthwise. The samples shall be cut into three equal length pieces, one piece to be tested by the Contractor's QC inspector, and one piece to be tested by the QA Consultant, and one piece to the Construction Manager to archive on behalf of the PRPs. Each sample shall be marked to indicate roll/panel number, seam number, top sheet, date and time cut, ambient temperature, seaming unit number, name of seaming technician, and welding temperature. Samples shall be tested by an approved independent commercial laboratory in accordance with the procedure, defined by ASTM D4437 and must be film tear bond and produce a shear strength greater than or equal to 80% of the unseamed sheet's tensile strength and a peel strength greater than or equal to 60% of the unseamed sheet's tensile strength. If a seam sample does not pass these standards, then additional 1-inch samples shall be cut a minimum of 10 feet from either side of the original sample, and testing shall be performed on these samples. Five one-inch samples shall be taken from

either side of the test location. Of the five 1-inch wide samples taken from each test location, four must pass. This procedure shall be repeated until a passing test location is obtained. At that point, the complete non-destructively testing procedure shall be repeated. The defective seam shall be capped and retested non-destructively between the locations of passing seam samples. All sampling, test results, and repair work shall be recorded by the QC inspector and reported to the Construction Manager daily.

5. Retesting: The Construction Manager or his designee or QC inspector may require retesting of any portion of the geomembrane including seams at any time damage is suspected, including after placement of geotextile and the cap drainage layer.

C. The Contractor shall be responsible for minimizing gas bubbles under the geomembrane. In the event that bubbles do occur, the geomembrane shall be cut, the gas released, and the cut patched and tested as described above, at no additional cost to the PRPs.

1. At no time shall more than three acres of geomembrane be in place without subsequent cap layers and soil cover.

2. Geomembrane shall be covered with subsequent cap layers and soil within 14 days of its placement.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02340 - CAP DRAINAGE LAYER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work in this section consists of construction of the Cap Drainage Layer comprised of a layer of synthetic drainage material, geonet.

B. The work specified herein shall be performed by the General Contractor. Work shall be conducted in accordance with the provisions of Section 02200 - Earthwork except as noted herein.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to the Cap Drainage Layer:

1. Section 01100 - Health and Safety
2. Section 01150 - Measurement and Payment
3. Section 02150 - Gas Venting System
4. Section 02200 - Earthwork
5. Section 02300 - Cap System: General
6. Section 02310 - Test Fill
7. Section 02320 - Geosynthetic Clay Liner
8. Section 02330 - Geomembrane
9. Section 02350 - Geotextile
10. Section 02360 - Cap Cover Layer

1.03 QUALITY CONTROL

A. References

1. ASTM D-1505 - Density of Plastics by the Density Gradient Technique
2. ASTM D-1603 - Carbon Black in Olefin Plastic
3. ASTM D-4595 - Tensile Properties of Geotextiles by the Wide Width Strip Method.
4. ASTM D-4716 - Constant Head Hydraulic Transmissivity (In-plane flow) of Geotextile and Geotextile Related Products
5. ASTM 405-89 - Standard Specification for Corrugated Polyethylene Tubing and Fittings.

1.04 SUBMITTALS

A. Synthetic Drainage Layer

1. Descriptive data on Geonet including Manufacturer's specifications, for approval.
2. Certificates of compliance for Geonets from the manufacturer indicating that the mateiral meets the specifications herein.
3. Manufacturer's installation procedures for geonet for approval by the Engineer.

PART 2 - MATERIALS

2.01 GEONET

The geonet shall be solid rib extruded made from either polyethylene or high-density polyethylene and shall have a rhomboidal mesh configuration consisting of two sets of parallel strands. The intersecting strands shall form two overlaid sets of continuous deep channels which provide high flow capacity. The geonet shall have a minimum carbon black content of 2 percent as determined by ASTM D-1603 and a minimum density of 0.92 g/cm^3 as determined by ASTM D-1505. Transmissivity of the geonet determined using ASTM D-4716 shall be greater than or equal to $1x10^{-3}$ square meters per second for all slopes. The geonet shall have a minimum roll value tensile strength of 25 lb/in in every direction as determined from ASTM D-4595.

The Contractor should note that materials that do not demonstrate acceptable interface friction angles with adjacent cap components, in accordance with Section 02300 - Cap System: General, shall be considered unacceptable.

PART 3 - EXECUTION

3.01 DELIVERY AND STOCKPILING OF MATERIAL

A. Synthetic Drainage Layer

Loading, transporting, unloading and storing of all materials shall be done in accordance with the recommendations of the manufacturer and with care to prevent damage. No materials shall be dropped or dumped. Materials delivered to the site shall be inspected for damage, unloaded, and stored with the minimum of handling. Geonet shall be stored on a flat surface. covered, and protected against exposure to

direct sunlight or heat. Damaged or dirty materials shall be replaced at

no additional cost to the PRPs.

3.02 CAP DRAINAGE LAYER CONSTRUCTION

A. Synthetic Drainage Layer Placement

1. The geonet shall be installed as recommended by the manufacturer. White plastic ties shall be used to connect adjacent geonet sheets. Spacing and strength of the plastic ties shall be as recommended by the manufacturer.
2. The geomembrane below the drainage layer shall be cleaned prior to installation of geonet. All soil, construction materials, or other debris shall be removed from above the geomembrane, and the surface shall be inspected and approved by the third party QA consultant and the Construction Manager prior to placement of the geonet.
3. The minimum overlap length of each section of geonet shall be four inches.
4. The machine direction of the geonet shall be placed parallel to the slope of the landfill surface.
5. No metal fasteners shall be utilized to connect adjacent geonet sheets.
6. The geonet shall be covered by geotextile immediately after the geonet is placed. No more than 2,000 square feet of geonet may remain uncovered at any one time.

3.03 QUALITY CONTROL

A. Synthetic Drainage Layer

As specified in the Contractor's Quality Control Plan and in accordance with Section 01400 - Quality Control.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02350 - GEOTEXTILE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This work shall consist of furnishing and placing geotextile at locations within or below the landfill cap and under the riprap in perimeter drainage ditches as shown on the Drawings. Geotextile shall be placed between the cap cover layer and the cap drainage layer, and shall be used in connection with drainage work. All geotextile work shall be performed by the General Contractor.

B. The General Contractor shall at all times conduct geotextile work in accordance with the provisions of Section 01100 - Health and Safety, and all applicable federal, state, and local laws and regulations.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to geotextile installation:
   1. Section 01100 - Health and Safety
   2. Section 01150 - Measurement and Payment
   3. Section 02150 - Gas Venting System
   4. Section 02200 - Earthwork
   5. Section 02212 - Waterways
   6. Section 02230 - Roadway Construction
   7. Section 02300 - Cap System: General
   8. Section 02310 - Test Fill
   9. Section 02320 - Geosynthetic Clay Liner
   10. Section 02330 - Geomembrane
   11. Section 02340 - Cap Drainage Layer
   12. Section 02360 - Cap Cover Layer

1.03 QUALITY CONTROL

A. Reference Standards
   1. American Society for Testing and Materials
      a. ASTM D-3776 - Mass Per Unit Area of Geotextiles
      b. ASTM D-4751 - Determining Apparent Opening Size of Geotextiles
      c. ASTM D-4632 - Breaking Load and Elongation of Geotextiles

d. ASTM D-4533 - Trapezoid Tearing Strength of Geotextiles
e. ASTM D-3786 - Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Methods
f. ASTM D-4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
g. ASTM D-4491 - Water Permeability of Geotextiles by Permittivity
h. ASTM D-4355 - Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-arc type apparatus)
i. ASTM D-4595 - Tensile Properties of Geotextiles by the Wide Width Strip Method

2. Department of the Army, Corps of Engineers
   a. Civil Works Construction Guide Specifications for Geotextiles used as Filters, CW-02215

1.04 SUBMITTALS

Submit test results and samples for all proposed geotextile materials indicating compliance with all specifications herein. Include documentation from an engineer and Geotextile Manufacturer approved testing agency that all tests were performed in accordance with the specified standard.

PART 2 - MATERIALS

2.01 DEFINITIONS

A. Separator Geotextile is a geotextile used in roadway construction under stone roadway material, drainage ditch lining under riprap, and between the cap system drainage layer and cover layer.

B. Protective Geotextile is a geotextile used above or below the geomembrane layer for protection from the adjacent soil surfaces.

The Contractor should note that materials that do not demonstrate that they will provide acceptable interface friction angles with adjacent components in accordance with Section 02300 - Cap System: General shall be considered unacceptable.

2.02 PHYSICAL PROPERTY REQUIREMENTS

A. Both the separator and protective geotextile shall be a needle-punched non-woven continuous filament geotextile. The geotextile may be either a polyester or polypropylene fabric.

B. The geotextile shall have a minimum fabric weight of six ounces per

square yard as determined by ASTM D-3776.

C. The geotextile shall have an apparent opening size not larger than U.S. Standard Seive Size No. 70, as determined by ASTM D-4751.

2.03 MECHANICAL PROPERTY REQUIREMENTS

A. Both the separator and protective geotextile shall meet or exceed the following mechanical properties:

Grab strength	ASTM D-4632	144 lb.
Wide Width Strength	ASTM D-4595	70 lb./in. MD
		70 lb./in. XMD
Puncture Strength	ASTM D-4833	77 lb.
Trapezoidal Tear Strength	ASTM D-4533	50 lb.
Burst Strength	ASTM D-3786	50 psi
Permittivity	ASTM D-4491	.66 sec^{-1}

B. Both geotextiles shall have an ultraviolet resistance rating of 70% strength retained after 500 hours of exposure as determined by ASTM D-4355.

2.04 Standard steel anchoring pins shall be 18" long x 3/16" in diameter and pointed at one end with a 1 1/2-inch washer head. Alternate anchoring pins or methods may be approved by the Construction Manager. Anchoring pins are not to be used when the geomembrane layer is located below the geotextile layer.

2.05 HANDLING AND STORAGE

A. During periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultraviolet rays, temperatures greater than 140 degrees Fahrenheit, mud, dirt, dust, and debris. Stored geotextile shall be raised off the floor or ground surface and protected from accumulated moisture. To the extent possible, the geotextile shall be maintained wrapped in a heavy-duty covering.

B. Geotextile will be rejected at the time of installation if, in the Construction Manager's or the QA Consultant's opinion, any defects, deterioration or damage was incurred during its manufacture, transportation or storage.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Placement Limits: The Geotextile shall be placed to the limits indicated herein and on the Drawings.

The geotextile shall be used between the cap drainage layer and the overlying cap cover layer, in roadway construction as specified in Section 02230 - Roadway Construction, and in drainage ditch lining as specified in Section 02212 - Waterways.

B. Damaged Materials: Any area of geotextile damaged during construction shall be removed and replaced at no cost to the PRPs with lapping in accordance with these specifications.

C. Geotextile Placement: The area to be covered shall be cleared of any stones greater than one inch in diameter or other debris, and the surface shall be graded to a relatively smooth condition, with all depressions filled.

1. Geotextile shall be placed on the prepared surface approved by the Construction Manager or his designee in a fairly loose and unstretched condition to minimize shifting, puncture and/or tearing. Geotextile shall be secured in place along all overlaps as recommended by the manufacturer and approved by the Construction Manager.
2. All adjacent roll strip edges and roll ends shall be overlapped a minimum of 18 inches and continuously heat-tacked. The direction of the fabric laying operation shall be up and down the slope, and overlap direction at roll ends shall be upslope over downslope.
3. Placement of cap cover layer material shall commence immediately upon approval by the Construction Manager of fabric installation. At no time shall equipment operate directly on exposed geotextile.

[END OF SECTION]

DIVISION 2 SITE WORK

SECTION 02360 - CAP COVER LAYER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work described in this section consists of furnishing materials and constructing the Cap Cover Layer and will be performed the General Contractor. This layer is composed of a 18-inch thickness of a select fill soil and a 6-inch thickness of topsoil as shown on the Drawings.

B. The General Contractor shall at all times conduct Cap Cover Layer work in accordance with the provisions of Section 01100 - Health and Safety, the provisions of Section 02200 - Earthwork and all applicable municipal, state, and federal statutes, laws, and regulations.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to the Cap Cover Layer:

1. Section 01100 - Health and Safety
2. Section 01150 - Measurement and Payment
3. Section 02200 - Earthwork
4. Section 02230 - Roadway Construction
5. Section 02310 - Test Fill
6. Section 02300 - Cap System: General
7. Section 02340 - Cap Drainage Layer
8. Section 02350 - Geotextile
9. Section 02370 - Seeding
10. Section 02700 - Settlement Monuments

1.03 SUBMITTALS

As specified under Section 02200 - Earthwork and Section 02300 - Cap System: General.

PART 2 - MATERIALS

2.01 SELECT FILL SOIL

As specified under Section 02200 - Earthwork.

2.02 TOPSOIL

As specified under Section 02200 - Earthwork.

2.03 CHIPPED ORGANIC MATERIAL

As specified under Section 02200 - Earthwork.

PART 3 - EXECUTION

3.01 ADVANCE SAMPLING AND TESTING

As specified in Section 02200 - Earthwork.

3.02 TEST FILL

As specified in Section 02200 - Earthwork

3.03 CAP COVER LAYER CONSTRUCTION

A. Construction:
   1. Construct the select soil fill as specified under Section 02200 - Earthwork except as noted herein.
   2. Construct the topsoil layer as specified in Section 02200 - Earthwork except as noted herein.

B. Placement

   1. Place the select soil fill in two lifts. The bottom lift shall have a final thickness of 12 inches, and the upper lift shall have a final thickness of 6 inches.
   2. Acceptable chipped organic material shall be thoroughly mixed into the upper lift of select soil fill. Spreading thin layers of material over the placed upper lift and harrowing is a possible mixing method. Concentrations of organic material are not permitted, and the final product must be predominantly select soil fill containing thinly distributed and well-dispersed organic material.

3. Compact the lifts of select soil fill with only the construction traffic that would normally be used for placing and spreading. The compactive effort applied to the soil should equal the effort provided by two passes of a bulldozer. The entire area shall be tracked with a bulldozer.
4. Prepare select soil fill for placement of topsoil by scarifying or roughening the surface.
5. Compact topsoil using a light roller weighing not more than 120 pounds per foot width of roller.
6. Minimize the compactive effort applied to the topsoil as much as possible.
7. Roughen the surface of the topsoil before seeding. Any pattern developed during this process should parallel the slope contours as much as possible.

3.03 QUALITY CONTROL

As specified in Section 02200 - Earthwork.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02370 - SEEDING

PART 1 - GENERAL

1.01 DESCRIPTION

The work specified herein shall be performed by the General Contractor. Variations to the permanent vegetation requirements may be specified in the final Post Construction Maintenance Plan. For bidding purposes the Contractor, shall assume permanent seeding will be applied as described herein.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to seeding:
   1. Section 01100 - Health and Safety.
   2. Section 01150 - Measurement and Payment.
   3. Section 02200 - Earthwork.
   4. Section 02360 - Cap Cover Layer.

1.03 QUALITY CONTROL

A. Source Quality Control: Packaged products shall indicate the manufacturer's guaranteed analysis on each package and arrive on site as originally packaged and unopened.

B. Reference Standards
   1. American Society for Testing and Materials, ASTM C 602, Specification for Agricultural Liming Materials.

1.04 SUBMITTALS

A. Test Reports: Submit laboratory test reports of the soil analysis and supplement recommendations to the Construction Manager for approval prior to adding any soil supplements to the topsoil.
   1. Laboratory reports shall recommend both grade and application rates of fertilizer and such other soil supplements as required.
   2. For every 5,000 cubic yards of topsoil, take one sample and analyze it for organic content according to AASHTO T267.

B. Soil Supplement Product Certification: Submit certificates certifying such products have a guaranteed analysis in conformity with the Construction Manager-approved laboratory soil supplement recommendations report to the Construction Manager for review.

C. Seed Certification: Submit certificates or certifying tags indicating lawn seed mixture, seed purity percentage, seed germination percentage and weed seed content percentage to certify conformity with the Specifications to the Construction Manager for review.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged products to the site in unopened containers with labels intact and legible.

B. Store packaged products in such a manner to prevent moisture damage and other forms of contamination.

1.06 SITE CONDITIONS

A. Environmental Requirements: Do not perform work of this section when soil or weather conditions are unsuitable as determined by the Construction Manager. Unsuitable conditions include moisture saturated or frozen in-place soil and precipitation present or occurring during the work.

B. Seeding Dates: The following dates shall govern permanent seeding; except when environmental conditions warrant, the Construction Manager may extend the seeding dates.
   1. Spring: March 1 to June 1.
   2. Fall: August 1 to October 1.

C. Dust Control: Exercise the necessary means and methods to control dust on the site as well as in the off-site work areas where seeding is required.

PART 2 - MATERIALS

2.01 SOIL SUPPLEMENT MATERIALS

A. Agricultural Liming Materials: Products containing calcium and magnesium compounds capable of neutralizing soil acidity and containing not less than 80 percent of total carbonates. Use liming materials meeting requirements of ASTM Designation C602 and conforming to applicable state liming material regulations.

B. Fertilizer: Commercial fertilizer of uniform composition, free-flowing and in conformity with applicable state fertilizer laws.
   1. As recommended by laboratory soil supplement recommendations report.
   2. As recommended by a local American Association of Nurseries (AAN) member nursery.

C. Noculent: Noculent of uniform composition, free-flowing and in conformity with applicable state regulations.

   1. As recommended by laboratory soil supplement recommendations report.
   2. As recommended by a local American Association of Nurseries (AAN) member nursery.

2.02 LAWN AND SEED MATERIALS

A. Grass Seed: New crop seed, furnished in sealed packages with proof of correct mixture evidenced, age of seed indicated and compliance with applicable state regulations evidenced if required.

B. Mixture No. 1 (permanent seed mix):

COMMON NAME	LATIN NAME	lbs/acre
Permanet Species		
Red Clover	Trifolium pratense	6
White Clover	Trifolium repens	2
Switchgrass	Panicum virgatum	30
Deertongue	Panicum clandestinum	45

C. Mixture No. 2 (temporary seed mix): Use Annual Ryegrass (Lolium Multiflorum) at an application rate of 65 pounds per acre.

D. Lawn Mulch: Straw stalks of any threshed grain or tall hay grass stalks free from seed bearing stalks or roots harmful to lawn growth. Mulch material containing noxious weeds, decomposed material or brittle weed material is not acceptable.

E. Mulch Binder: Mulch binder shall be a water emulsified acrylic resin. It shall be applied at a rate of 50 gal/acre. A mulch binder of similar quality may be used provided it is approved by the Construction Manager.

PART 3 - EXECUTION

3.01 PREPARATION

Topsoil must be applied over an area to be seeded as specified in Section 02360 - Cap Cover Layer before seeding commences.

3.02 PERFORMANCE

A. Placement: Place topsoil over areas indicated for new grading contours. Observe precautions as follows:
   1. Do not place topsoil over areas indicated as roads.
   2. Do not work topsoil while frozen or wet. Do not work topsoil in a dusting condition but moisten it to prevent a dust nuisance.
   3. Scarify subsoil to a depth of two inches for bonding topsoil with subsoil.
   4. On sloped areas, work topsoil into subsoil to blend so as to eliminate slip-planing between the two soils; but leave a sufficient cover of topsoil to ensure seed germination. Perform such blending of soils by ridging or serrating the subsoil on the slopes.

B. Tillage: Till topsoil to a two-inch minimum depth over areas indicated for lawn regardless of type of lawn work performed. Use equipment and methods common to such work.

C. Soil Supplement Addition: The soil supplements for lawn areas, as required according to the Construction Manager-approved laboratory test reports, shall be incorporated into the soil during tillage operations.

D. Seeding: Permanent seeding shall be performed by the first normal period for favorable planting after final grading of the cap cover. The first normal period will be within the time periods in Paragraph: Site Conditions of this Section. No more than five acres of cap shall be exposed with less than a 75 percent stand of grass in the opinion of the Construction Manager at any time during construction. If time periods given in Paragraph: Site Conditions cannot be met, temporary seed as described in Paragraph: Lawn and Seed Materials shall be applied. Sow seed mixtures when air current is low and not more than five days after soil supplements have been applied. Sow seeds in two applications using either mechanical power seeders or mechanical hand seeders. Sow one-half of the seed mixture in one direction over designated areas and the remainder at right angles to the first sowing. Seeding rates as follows:

E. Seed Cover: Imbed seed mixtures into topsoil 1/4 inch using a light drag or rake and moving in directions parallel to the contour lines. Immediately after dragging or raking, compact seeded areas using a cultipacker or similar design lawn roller, weighing 60 to 90 pounds per linear foot of roller, and roll at right angles to existing slopes.

F. Contractor Option: Seeding and soil supplement application may be performed by the hydroseeding method if the Construction Manager approves rates of application, methods, and equipment.

G. Lawn Mulching: Evenly apply mulch over seeded areas not more than 48 hours after seeding. Start mulching at windward side of relatively flat areas, or at the upper part of slopes. Spread mulch in a total coverage at a depth not less than 1-1/2 inches nor more than three inches.

H. Mulch Binding: Immediately following mulch spreading, apply mulch binder to anchor mulch to the soil. The number of passes over the mulch to secure it firmly shall not exceed three passes with maximum applied binder not exceeding 10.0 gallons per 1,000 square feet.

3.03 MAINTENANCE

A. Maintenance operations shall begin immediately after seeding and shall continue throughout the construction time.
   1. Seeded Areas: Keep seed moist continually for proper germination and water thereafter as necessary to prevent drying out or burning. Reseed areas not showing a prompt catch of grass, correct depressions and irregularities and reseed; repeat until a complete coverage is obtained.

B. At conclusion of construction, the Construction Manager will make an inspection of the lawn work to determine condition of acceptance. The Contractor shall make such additional repairs as required by the Construction Manager at no expense to the PRPs.

C. The PRPs herein retains the right to require that the Contractor reseed any and all areas where a satisfactory stand of grass does not exist after the first full growing season after the final permanent seeding has been applied. A satisfactory stand of grass shall be defined as 90 percent coverage of every five acre area having a three inch stand of grass as determined by the step transect method or as otherwise defined by the Construction Manager. The step transect method estimates the percentage of vegetative cover using at least 100 systematically located observation points within the seeded area.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02400 - CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

The work shall include installation of a chain link fence and gates as shown on the drawings and shall be performed by the General Contractor.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to chain link fence work:
   1. Section 01100 - Health and Safety.
   2. Section 01150 - Measurement and Payment.
   3. Section 01700 - Material Handling.

1.03 QUALITY CONTROL

A. Fabricator Qualifications: Continuing member of the Chain Link Fence Manufacturer Institute (CLFMI).

B. Erector Qualifications: Provide at least one person in a supervisory capacity who is skilled and experienced in erecting chain link fence and who readily understands the proposed layout and is completely familiar with current erection practices of the CLFMI. The supervisory person must be present at all times during progress of the fence installation.

C. Design Criteria: Chain link type with top rail and bottom tension wire and single extension arms carrying three strands of barbed wire. Fabric height to six feet and overall height, including barbed wire extension, at seven feet.

D. Reference Standards:
   1. American Society For Testing and Materials:
      a. ASTM A 120; Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
      b. ASTM A 121; Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
      c. ASTM A 123; Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

d. ASTM A 392; Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
e. ASTM A 641; Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

2. Federal Specifications:
   a. Fed. Spec. RR-F-191G, Fencing, Wire and Posts, Metal (and Gates, Chain-Link Fence Fabric and Accessories).
   b. Fed. Spec. RR-F-191/1A, Fencing, Wire and Posts, Metal (Chain-Link Fence Accessories).
   c. Fed. Spec. RR-F-191/4A, Fencing, Wire and Posts, Metal (Chain-Link Fence Accessories).
3. Delaware Department of Transportation (DelDOT), Standard Specifications for Road and Bridge Construction, latest revision.

E. Product Compatibility: Provide chain link fence components products of one manufacturer.

F. Acceptable Manufacturers:
   1. Anchor Fence, Inc.
   2. United States Steel; Cyclone Fence
   3. Allied Fence Products
   4. Or Equivalent

1.04 SUBMITTALS

The submittals described herein shall be submitted to the Construction Manager for review unless stated otherwise.

A. Shop Drawings and Product Data: Manufacturer's published details modified to suit design and field conditions. Manufacturer's descriptive literature and specifications covering the products specified. Descriptive literature shall include installation information.

B. Certificates: Include in submittals certified mill certificates indicating material conformity to yield strengths of these specifications.

C. Master Key System: Describe Function and form of master key system.

PART 2 - MATERIALS

2.01 FABRIC

A. Galvanized Fabric: No. 9 gauge galvanized steel wire having a hot-dipped zinc coating of 1.2 ounce per square foot of wire surface. Fabric interwoven in a two-inch mesh with top and bottom salvage edges both twisted and barbed. Fabric shall conform to ASTM A 392.

B. Galvanized Barbed Wire: Three lines of steel wire with a Class 3 galvanized coating per ASTM A 121. Barbed wire consists of two No. 12 1/2 gauge stranded line wires, with No. 14 gauge round wire barbs in a four-point pattern on three-inch centers.

C. Galvanized Tension Wire: No. 6 gauge coil spring wire galvanized of same quality and process as specified for fabric.

2.02 FRAME WORK AND GATES

A. Galvanizing: Ferrous metal elements of the fence frame and accessories shall receive zinc coating by the hot dip process after fabrication. Metal coated to 1.8 oz. of zinc coating per square foot of surface, in a smooth finish, free from dross, uncoated spots and foreign materials, per ASTM A 123.

B. Frame Work: Roll-formed shapes or tubular members with zinc hot-galvanized coating per ASTM A 123. Frame work is comprised of the following components:
   1. Line Posts: Nominal three-inch roll formed shapes or tubular members fabricated from 50,000 psi minimum yield strength steel and weighing 3.12 lbs. per ft.
   2. End, Pull and Corner Posts: Nominal three-inch roll formed shapes or tubular members fabricated from 42,000 psi minimum yield strength steel and weighing 4.64-lbs. per ft.
   3. Gate Posts: Nominal four-inch steel pipe or tubular members fabricated from 30,000 psi minimum yield strength steel and weighing 9.11 lbs. per ft.
   4. Post Braces: Nominal 1-1/4 inch steel pipe weighing 1.84 lbs. per ft. minimum. with 3/8-inch diameter truss rod and adjustable take-up device. Provide two brace assemblies at each corner post and one brace assembly at each end and gate post.
   5. Top Rail: Nominal 1-1/4 inch steel pipe weighing 1.84 lbs. per ft. minimum.
   6. Barbed Wire Supporting Arms: Designed for three strands and of sufficient strength to withstand without failure, 200 lbs. downward pull at one end of arm. Set arms at 45 degree angle toward outside of site.
   7. Post Tops: Where barbed wire supporting arms are not required cover post ends with pressed steel or malleable iron, weather tight caps designed to permit passage of top rail, as required.
   8. Stretcher Bars: One piece 3/16 x 3/4 inch bar of length equal to full height of fabric. Provide one bar for each gate and end post and two for each corner and pull post. Provide 1/2-inch wide stretcher bar bands spaced not over 15 inches on center to secure stretcher bars to posts.

C. Gate Frame, Swing Type: Nominal two-inch tubular horizontal and vertical members and truss members (as required) assembled by welding. Provide the same fabric as fence and install with stretcher bars and bar ties at 15 inches on center. Provide diagonal cross bracing of 3/8-inch diameter adjustable length truss rods. Attach gate hardware with rivets or by other means which will provide security against removal of gate hardware as follows:

1. Hinges: Pressed steel or malleable iron to suit gate size, non-lift-off type, and offset to permit 180 degree swing. Provide one pair (top and bottom) per gate leaf.
2. Latch: Forked or plunger-bar type to permit operation from either side of gate. Provide padlock eye as integral part of latch. Provide gate stops for pair of gates designed to accept drop rod or plunger bar.
3. Keeper: Provide keeper for each gate leaf which will hold gate leaf in open position until manually released.

D. Padlocks: Provide padlocks conforming to requirements of Fed. Spec. FF-P-106. Key gate padlocks alike and key into master key system. Provide two keys per padlock.

2.03 CONCRETE

Concrete for posts shall conform to Section 812, Class B concrete as defined in the latest revision of the DelDOT Standard Specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Remove existing fencing to the extent indicated by the Drawings for relocation.

B. Maintain existing fencing materials in reusable condition as determined by the Construction Manager.

C. Distorted, deformed or damaged fencing resulting from removal or storage or any other cause will not be permitted for reuse and shall be disposed of as a non-contaminated clearing material in accordance with Section 01700 - Material Handling.

3.02 INSTALLATION

A. Fence installation shall be performed early in the project to control site access. The fence and gate locations shall be as shown on the Drawings.

B. Drill or dig holes for post footings in firm, undisturbed or compacted soil. Holes shall have a diameter equal to three times the diameter of the post. Excavate hole depths approximately three inches deeper than post bottom, with bottom of posts set not less than 36 inches in concrete base. Space posts a maximum of ten feet and minimum of eight feet on center.

C. Place concrete around posts in a continuous pour. Tamp concrete for consolidation. Check each post for vertical and top alignment. Crown top of post footings to shed water.

D. Set keepers, stops, sleeves and other accessories into concrete as required.

E. Install braces so posts are plumb when diagonal rods are under proper tension.

F. Install tension wires before stretching fabric and tie to each post with ties or clips.

G. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tensions after pulling force is released.

H. Thread stretcher bars through fabric, and secure to posts with metal bands spaced not over 15 inches on center.

I. Install three strands of barbed wire parallel on each extension arm on security side of fence. Pull wire taut.

J. Install gates plumb, level and secure for full opening without interference. Install ground-set items in concrete for anchorage as recommended by the fence manufacturer and as detailed. Adjust hardware for smooth operation and lubricate where necessary.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02700 - SETTLEMENT MONUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work consists of furnishing, installing, and protecting settlement monuments in accordance with the provisions of this specification.

B. Definition:

1. Settlement monuments will be used by the PRPs to monitor long term settlement of the completed cap.

1.02 RELATED WORK

A. The following work specified herein is, or may be, related to the work specified under this section:

1. Section 01100 - Health and Safety
2. Section 01150 - Measurement and Payment
3. Section 02200 - Earthwork
4. Section 02320 - Geomembrane Base Layer
5. Section 02340 - Cap Cover Layer
6. Section 02350 - Geomembrane
7. Section 02370 - Seeding

1.03 QUALITY CONTROL

A. Reference Standards

1. Delaware Department of Transportation (DelDOT), Standard Specifications, Specifications for Road and Bridge Construction, latest revision.

PART 2 - MATERIALS

2.01 SETTLEMENT MONUMENTS

The settlement monument shall be constructed as indicated on the Drawings or the Contractor, at his option, may submit for Engineer approval an alternative design.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Within 24 hours of completing site foundation fill placement,at a settlement monument location, as indicated on the Drawings or determined by the Construction Manager, the Contractor shall install the designated settlement monument. A sufficient amount of site foundation fill as determined by the Construction Manager shall be promptly compacted around the base of the settlement monument so that the monument will remain intact during placement of the cap system.

B. Protect the settlement monument from damage during and after installation throughout the duration of the contract. During construction activities, monuments shall be protected by a method approved by the Construction Manager. Any and all damaged monuments shall be repaired or replaced to the Construction Manager's satisfaction at no cost to the PRPs.

3.02 INITIAL SURVEY

A. All horizontal and vertical position data and initial elevations shall be obtained by a licensed surveyor registered in the State of Delaware. All position data submitted shall bear the seal of the licensed surveyor who obtained the data. Copies of all field notes and survey data, including work performed to reduce field measurements, shall be submitted to the Construction Manager.

B. All survey data shall be submitted to the Construction Manager within 24 hours of their acquisition.

C. Each settlement monument shall be surveyed as soon as practical after installation of the cap system.

[END OF SECTION]

DIVISION 2 - SITE WORK

SECTION 02800 - DEMOBILIZATION AND PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The General Contractor shall comply with Section 01400 - Quality Control conditions pertaining to Completion Inspections.

B. Each task identified in the Contract Drawings shall have Construction Manager approval after the Final Acceptance Inspection (Section 01400 - Quality Control).

C. Upon successful completion of all contracted activities as determined by the Construction Manager, the Contractor shall demobilize.

D. Each Contractor is responsible for his documentation and demobilization related to his contracted activities.

E. The General Contractor shall complete the project closeout.

1.02 ROADS, GATES, AND FENCES

A. The General Contractor shall repair permanent access roads and site security fences and gates, if damaged during work activities.

1.03 UTILITIES

A. The General Contractor shall disconnect and remove any remaining temporary utilities.

B. The General Contractor shall submit to the Construction Manager the last utility meter readings.

1.04 TEMPORARY FACILITIES

A. All remaining temporary facilities shall be dismantled and properly disposed of by the General Contractor.

1.05 RELATED WORK

A. Section 01150 - Measurement and Payment
B. Section 01400 - Quality Control

PART 2 - MATERIALS

NOT APPLICABLE

PART 3 - EXECUTION

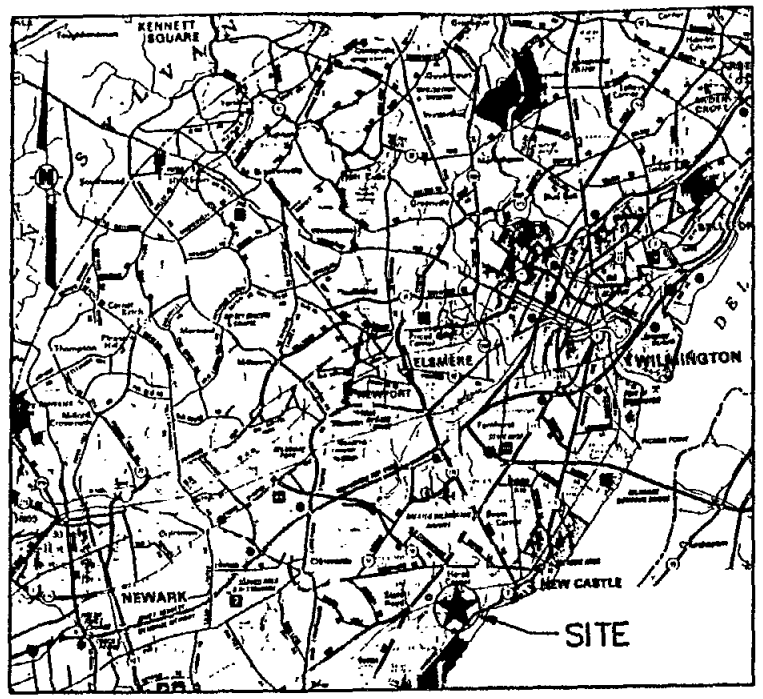
NOT APPLICABLE

[END OF SECTION]

APPENDIX D

CONSTRUCTION DRAWINGS

CAD FILE NUMBER	92-1130-T2
CHECKED BY	
APPROVED BY	
DATE	5-11-93
DRAWN BY	
PLOT	1:1



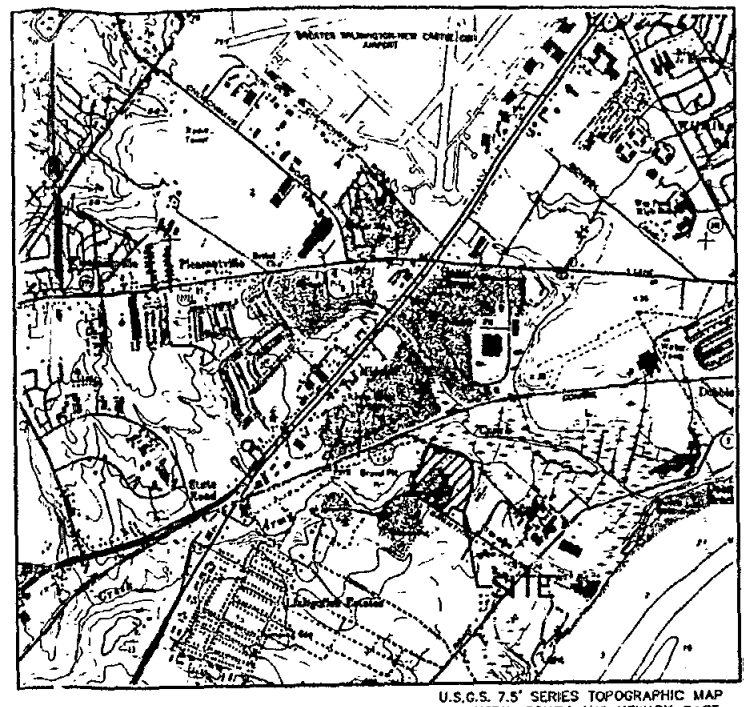
OFFICIAL STATE HIGHWAY MAP.
DELDOT 1988, SCALE: 1"=2 MILES.

LOCATION MAP

SCALE
2 0 2 MILES

LIST OF DRAWINGS

DRAWING NUMBER	CAD FILE NUMBER	DESCRIPTION
1	92-1130-T2	TITLE SHEET - LOCATION AND VICINITY MAPS
2	92-1130-E12	LEGEND
3	92-1130-E3	OVERALL SITE PLAN
4	92-1130-E4	EXISTING SITE PLAN
5	92-1130-E48	INTERMEDIATE GRADING PLAN
6	92-1130-E34	FINAL SITE PLAN
7	92-1130-E35	PLAN OF CAP SYSTEM CROSS-SECTIONS
8	92-1130-E37	WEST-EAST CROSS SECTIONS 1 THROUGH 3
9	92-1130-E38	WEST-EAST CROSS SECTIONS 4 THROUGH 5
10	92-1130-E39	WEST-EAST CROSS SECTIONS 6 THROUGH 7
11	92-1130-E40	WEST-EAST CROSS SECTIONS 8 THROUGH 11
12	92-1130-E43	CAP SYSTEM DETAILS
13	92-1130-E33	PERIMETER DRAINAGE DITCH PROFILES, SHEET 1 OF 2
14	92-1130-E59	PERIMETER DRAINAGE DITCH PROFILES, SHEET 2 OF 2
15	92-1130-E60	EXISTING SITE ACCESS ROAD UPGRADE
16	92-1130-E46	CULVERT DETAILS
17	92-1130-E42	DRAINAGE AND SEDIMENT CONTROL DETAILS
18	92-1130-E49	BENCH DETAIL
19	92-1130-E36	SEDIMENTATION TRAP DETAILS
20	92-1130-E57	PERIMETER ACCESS ROAD #1 PLAN, PROFILE AND DETAIL
21	92-1130-E58	PERIMETER ACCESS ROAD #2 PLAN, PROFILE AND DETAIL
22	92-1130-E41	FENCE AND GATE DETAILS
23	92-1130-E30	GAS VENT AND SETTLEMENT MONUMENT DETAILS



U.S.G.S. 7.5' SERIES TOPOGRAPHIC MAP
WILMINGTON SOUTH AND NEWARK EAST
QUADRANGLES, DELAWARE PHOTOREVISED
1987, SCALE 1"=2000'

VICINITY MAP

SCALE
2000 0 2000 FEET

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

PREPARED FOR

DS&G TECHNICAL COMMITTEE

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		
	DATE OF ISSUE:		

Paul C. Rizzo Associates, Inc.
CONSULTANTS

CAD FILE NUMBER 92-1130-E12

CHECKED BY

APPROVED BY

T. 1-3-93

DRAWN BY

PLOT 1:1

LEGEND

5/7 9	SECTION INDICATOR WITH NUMBER
	CHAIN-LINK SECURITY FENCE
	GATE
	FLOW OR SLOPE INDICATORS
BM-1	BENCH MARK
	CULVERT
	ROCK ENERGY DISSIPATOR
	PROPERTY LINE/MATCH LINE
	EDGE OF WOODS
	STRUCTURE
	UTILITY POLE
	GAS VENT
	APPROXIMATE LIMITS OF INERT AREA
	ACCESS ROAD
PM-1	PERMANENT SETTLEMENT MONUMENT
S S	SILT FENCE
HBD	HAY BALE DIKE
	TEMPORARY DIVERSION DITCH
	TEMPORARY DIVERSION DITCH WITH CHECKDAMS IN COMBINATION WITH SILT FENCE AND/OR HAY BALES
	CHECK DAM
B-1	TEST BORING (INERT AREA)
DGC-1	MONITORING WELL (DUNN GEOSCIENCE CORP.) (TO BE ABANDONED)
MHW-1S	MONITORING WELL (MCLAREN/HART)
MW-A	MONITORING WELL (TO BE ABANDONED)
DGC-4	MONITORING WELL (DUNN GEOSCIENCE CORP.)
	PERIMETER DRAINAGE DITCH

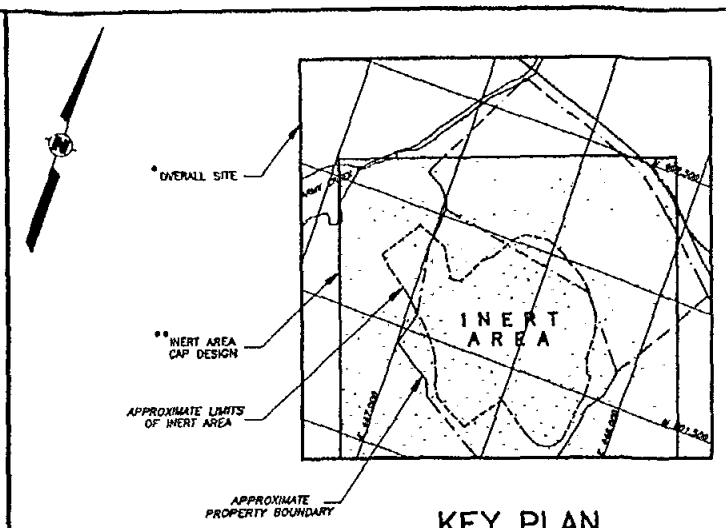
DIA.	DIAMETER
(NTS)	NOT TO SCALE
SCH.	SCHEDULE
(MIN.)	MINIMUM
(MAX.)	MAXIMUM
(TYP.)	TYPICAL
NCSA	NATIONAL CRUSHED STONE ASSOCIATION
STA.	STATION
EL.	ELEVATION
X 20.0	SPOT ELEVATION
	RAILROAD TRACKS
SQ. YD.	SQUARE YARD
CMP	CORRUGATED METAL PIPE
PVC	POLYVINYL CHLORIDE
VLDPE	VERY LOW DENSITY POLYETHYLENE
GCL	GEOSYNTHETIC CLAY LINER
℄	CENTERLINE
ID	INNER DIAMETER
OD	OUTER DIAMETER
OZ.	OUNCE
	APPROXIMATE LIMITS OF FINAL GRADING PLAN [~13.3 ACRES]
	APPROXIMATE LIMIT OF TAX PARCELS

SECTION 10 — SECTION NO.
10 | 11 — DRAWING WHERE SECTION IS SHOWN
DRAWING WHERE SECTION IS CUT

DETAIL 1 — DETAIL NO.
5 | 2 — DRAWING WHERE DETAIL IS SHOWN
DRAWING WHERE DETAIL IS CUT

NOTES:

1. ALL SEDIMENT AND STORMWATER MANAGEMENT CONTROLS SHALL BE INSPECTED BY THE CONTRACTOR AFTER EACH RAINFALL. ALL DAMAGED CONTROLS WILL BE IMMEDIATELY REPLACED OR REPAIRED BY THE CONTRACTOR.
2. SOIL STOCKPILE AREAS SHOULD BE LOCATED ON AREAS WITH LITTLE TO NO SLOPE, WHEN FEASIBLE. THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE CONTROL PRACTICES TO PREVENT THE MIGRATION OF SEDIMENT FROM ALL STOCKPILE AREAS.
3. THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE DUST CONTROL TECHNIQUES AS NEEDED TO PREVENT THE MIGRATION OF WIND BLOWN SEDIMENT FROM ALL SITE AREAS.
4. THE DNREC, SEDIMENT AND STORMWATER MANAGEMENT SECTION MUST BE NOTIFIED IN WRITING (5) DAYS PRIOR TO EARTH DISTURBING ACTIVITIES. FAILURE TO DO SO CONSTITUTES A VIOLATION OF THE APPROVED SEDIMENT AND STORMWATER MANAGEMENT PLAN.
5. THE CONTRACTOR SHALL PERFORM ALL LAND CLEARING, EARTHWORK, AND CONSTRUCTION PURSUANT TO THE APPROVED PLAN. ALL EROSION AND SEDIMENT CONTROL PRACTICES SHALL COMPLY WITH THE DELAWARE EROSION AND SEDIMENT CONTROL HANDBOOK 1989.
6. REVIEW AND OR APPROVAL OF THE SEDIMENT AND STORMWATER MANAGEMENT PLAN SHALL NOT RELIEVE THE CONTRACTOR FROM COMPLYING WITH THE REQUIREMENTS OF THE SEDIMENT AND STORMWATER REGULATIONS, NOR SHALL IT RELIEVE THE CONTRACTOR FROM ERRORS OR OMISSIONS IN THE APPROVED PLAN. ALSO, IF THE APPROVED PLAN NEEDS TO BE MODIFIED, ADDITIONAL SEDIMENT AND STORMWATER CONTROL MEASURES MAY BE REQUIRED AS DEEMED NECESSARY BY THE DNREC.
7. THE CONTRACTOR SHALL PERFORM ALL WORK IN ACCORDANCE WITH ALL APPLICABLE SEDIMENT AND STORMWATER CONTROL REGULATIONS AND BE RESPONSIBLE FOR THE IMPLEMENTATION OF THIS PLAN THROUGHOUT THE PROJECT. AS PART OF THE CONTRACTOR'S PLAN OF OPERATION THAT WILL BE SUBMITTED TO THE CONSTRUCTION MANAGER FOR APPROVAL, THE CONTRACTOR SHALL DETAIL SPECIFIC SEDIMENT AND STORMWATER CONTROLS THAT SHALL BE USED TO CONTROL EROSION. THE CONTRACTOR SHALL INDICATE THE PROPOSED LOCATION OF ALL STOCKPILE AREAS, TEMPORARY DIVERSION DITCHES, AND SEDIMENT BARRIERS FOR EACH LAND DISTURBING ACTIVITY. THE PROPOSED IMPLEMENTATION PLAN FOR THE SEDIMENT AND STORMWATER CONTROLS SHALL REFLECT THE CONTRACTOR'S CONSTRUCTION SEQUENCE.
8. DISTURBED AREAS THAT ARE NOT OR WILL NOT BE ACTIVELY WORKED UPON FOR 14 CALENDAR DAYS AS PART OF A SYSTEMATIC PLAN OF OPERATION SHALL BE TEMPORARILY OR PERMANENTLY STABILIZED. THE CONTRACTOR SHALL NOT MAINTAIN MORE THAN 20 ACRES OF CLEARED AREA AT ANY ONE TIME IF WORK IS NOT ONGOING AS PART OF A SYSTEMATIC PLAN OF OPERATION.
9. THE CURRENT 100 YEAR FLOOD PLAIN BOUNDARY IN THE VICINITY OF THE SITE COINCIDES APPROXIMATELY WITH ELEVATION 10.0 ABOVE MEAN SEA LEVEL AS DELINEATED BY THE "FLOODWAY-FLOOD BOUNDARY AND FLOODWAY MAP, NEW CASTLE COUNTY, DELAWARE, UNINCORPORATED AREAS", PANEL 45 OF 110, EFFECTIVE DATE SEPTEMBER 4, 1986, PREPARED BY FEMA. IT IS NOT ANTICIPATED THAT CONSTRUCTION COMPLETED UNDER THIS PROJECT WILL MODIFY THE 100 YEAR FLOOD PLAIN BOUNDARY.



KEY PLAN

SCALE

400 0 400 FEET

* OVERALL SITE DEPICTED ON 1"=80' SCALED DRAWING (SEE DRAWING NO. 3)
**INERT AREA CAP DESIGN DEPICTED ON 1"=60' SCALED DRAWINGS (SEE DRAWING NOs. 4, 5, & 6)

TOPOGRAPHY REFERENCES:

1. TOPOGRAPHIC SURVEY OF THE SITE HAS BEEN PREPARED FROM AERIAL SURVEYS TAKEN BY AERIAL DATA REDUCTION ASSOCIATES, INCORPORATED ON MARCH 20, 1991. HORIZONTAL CONTROLS ARE BASED ON THE STATE PLANE COORDINATE SYSTEM. ALL ELEVATIONS REFER TO MEAN SEA LEVEL DATUM (NATIONAL VERTICAL GEODETIC DATUM).
2. STRUCTURE ELEVATIONS ARE BASED ON THE REFERENCED TOPOGRAPHY; THE ACCURACY OF THESE ELEVATIONS IS EQUAL TO ONE-HALF THE CONTOUR INTERVAL EXCEPT IN AREAS IDENTIFIED AS "DENSE BRUSH" OR "DENSE WOODS".

PLANIMETRIC FEATURES REFERENCE:

THE LOCATION OF THE PROPERTY LINE AND EXISTING SITE FEATURES WERE PROVIDED BY TAYLOR, WISEMAN, & TAYLOR, DATED JANUARY 5, 1993. ORIGINAL SCALE: 1"=80'.

NOTES:

1. ELEVATONS SHOWN ARE BASED ON N.G.V.D. 1929.
2. COORDINATES SHOWN ARE BASED ON THE DELAWARE STATE PLANE COORDINATE SYSTEM.
3. HORIZONTAL AND VERTICAL CONTROL WERE ATTAINED IN THE FIELD UTILIZING GLOBAL POSITIONING SYSTEM TECHNIQUES AND WERE REFERENCED FROM FIRST ORDER MONUMENTATION ON ROUTE 13 IN NEW CASTLE COUNTY.
4. PROPERTY LINES SHOWN ARE VERY APPROXIMATE IN NATURE AND WERE PLOTTED FROM DEED BOOK 88 PAGE 586.
5. BEARINGS AND DISTANCES SHOWN ARE AS PER DEED.
6. TAX PARCEL NUMBERS AND OWNERSHIP INFORMATION TAKEN FROM LATEST TAX RECORDS IN THE NEW CASTLE COUNTY RECORDER OF DEEDS OFFICE.
7. BENCHMARK LOCATIONS PROVIDED BY TAYLOR, WISEMAN, & TAYLOR.

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

LEGEND

PREPARED FOR:

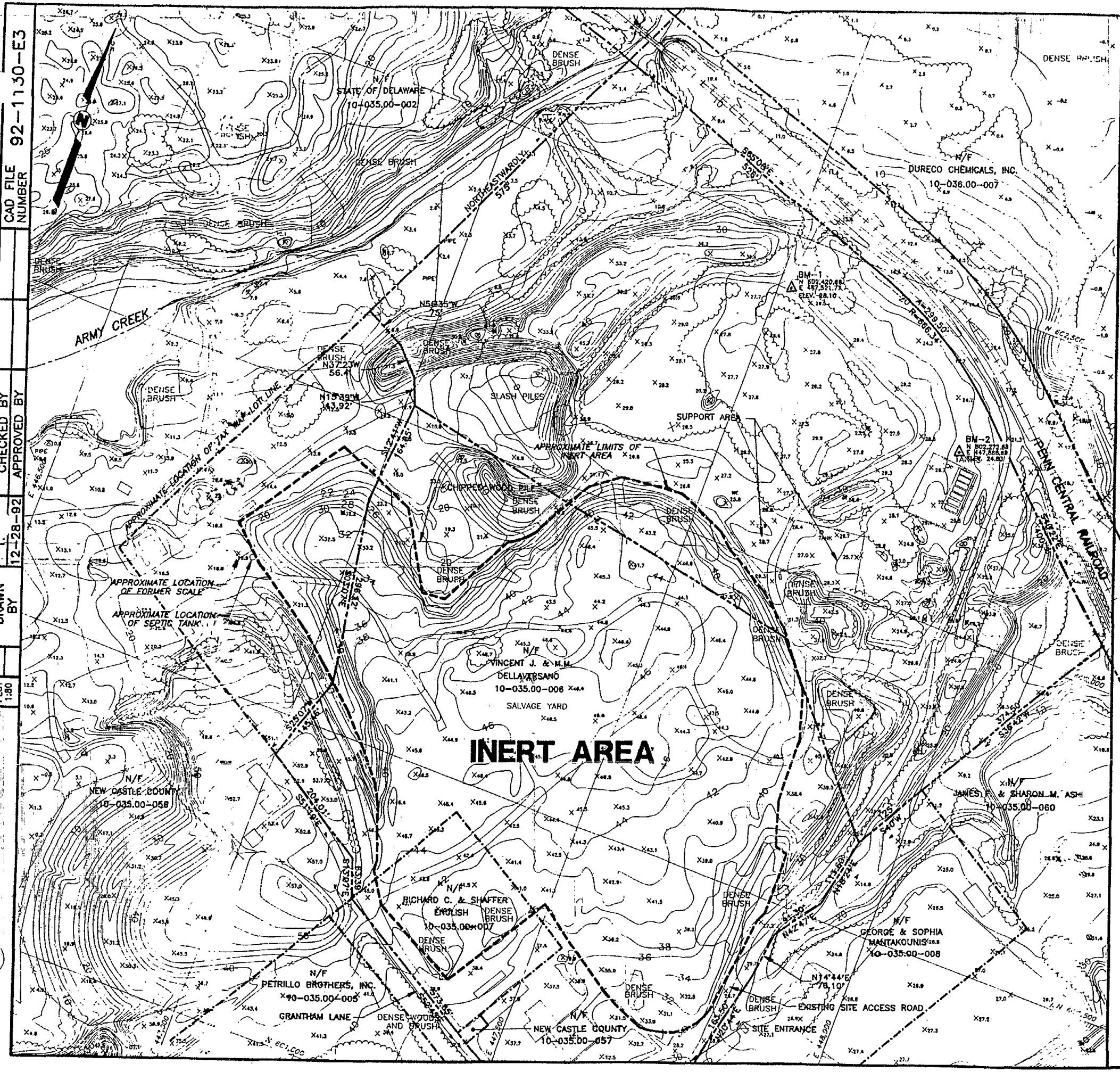
DS&G TECHNICAL COMMITTEE

Paul C. Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 2

AR303968

CAD FILE NUMBER	92-1130-E3
CHECKED BY	
APPROVED BY	
12-28-92	
DRAWN BY	
PLOT 1:80	



GENERAL NOTE:

1. SEE DRAWING NUMBER 2 FOR REFERENCES FOR THE PROPERTY LINES, AND TAX PARCEL INFORMATION.

NOT FOR CONSTRUCTION

2' CONTOUR INTERVAL

SCALE

80 0 80 160 FEET

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

OVERALL SITE PLAN

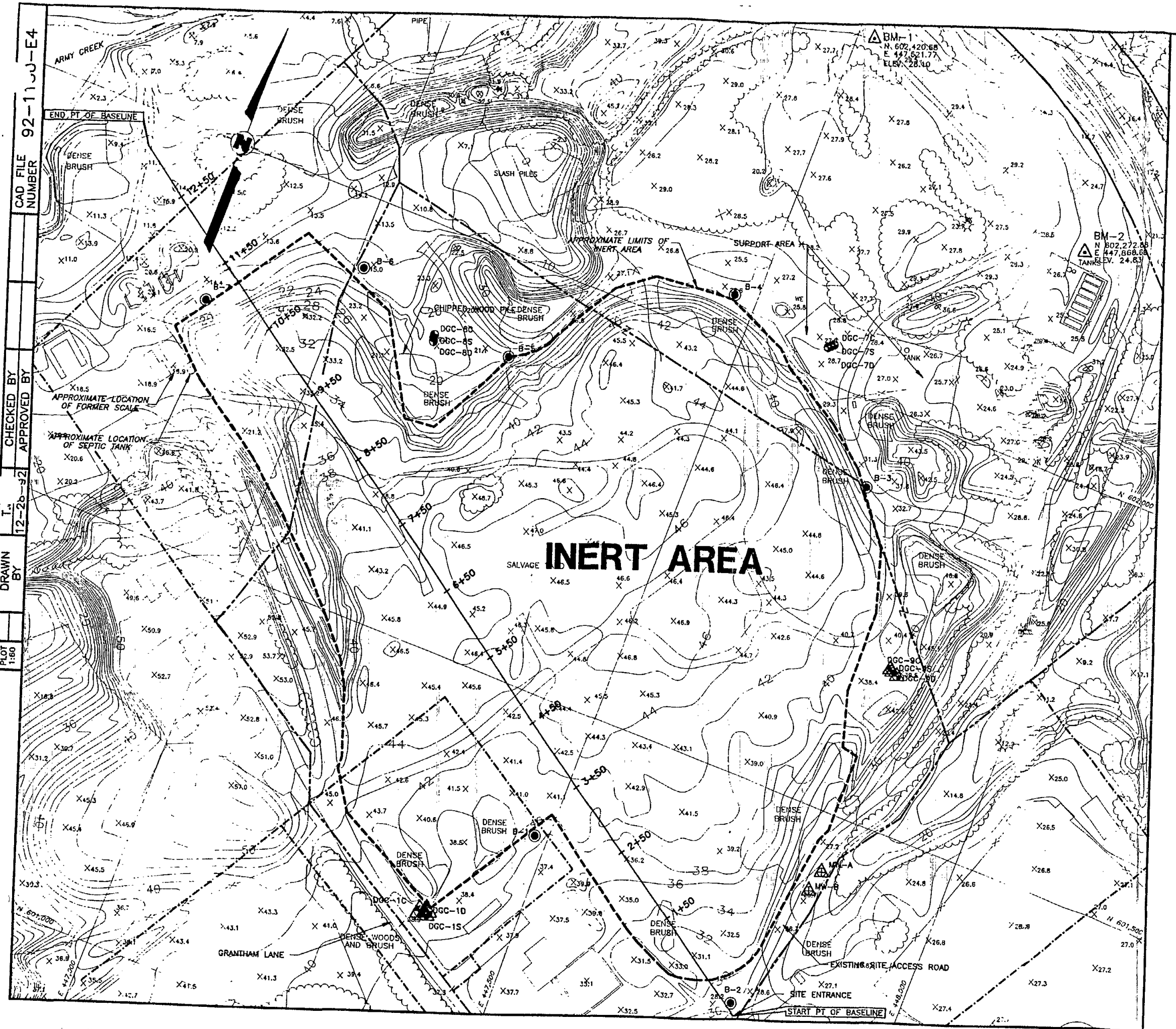
PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C. Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 3

CAD FILE NUMBER 92-11-3-E4
CHECKED BY
APPROVED BY
DRAWN BY 12-28-92
PLOT 1:60



BASELINE COORDINATE INFORMATION	
START PT	N 601,216.91 E 447,801.96
END PT	N 601,953.84 E 446,698.50

GENERAL NOTE:

1. SEE DRAWING NUMBER 2 FOR TOPOGRAPHY REFERENCES.

NOT FOR CONSTRUCTION

2' CONTOUR INTERVAL

SCALE

60 0 60 120 FEET

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

EXISTING SITE PLAN

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 4

CAD FILE NUMBER 92-1130-E48

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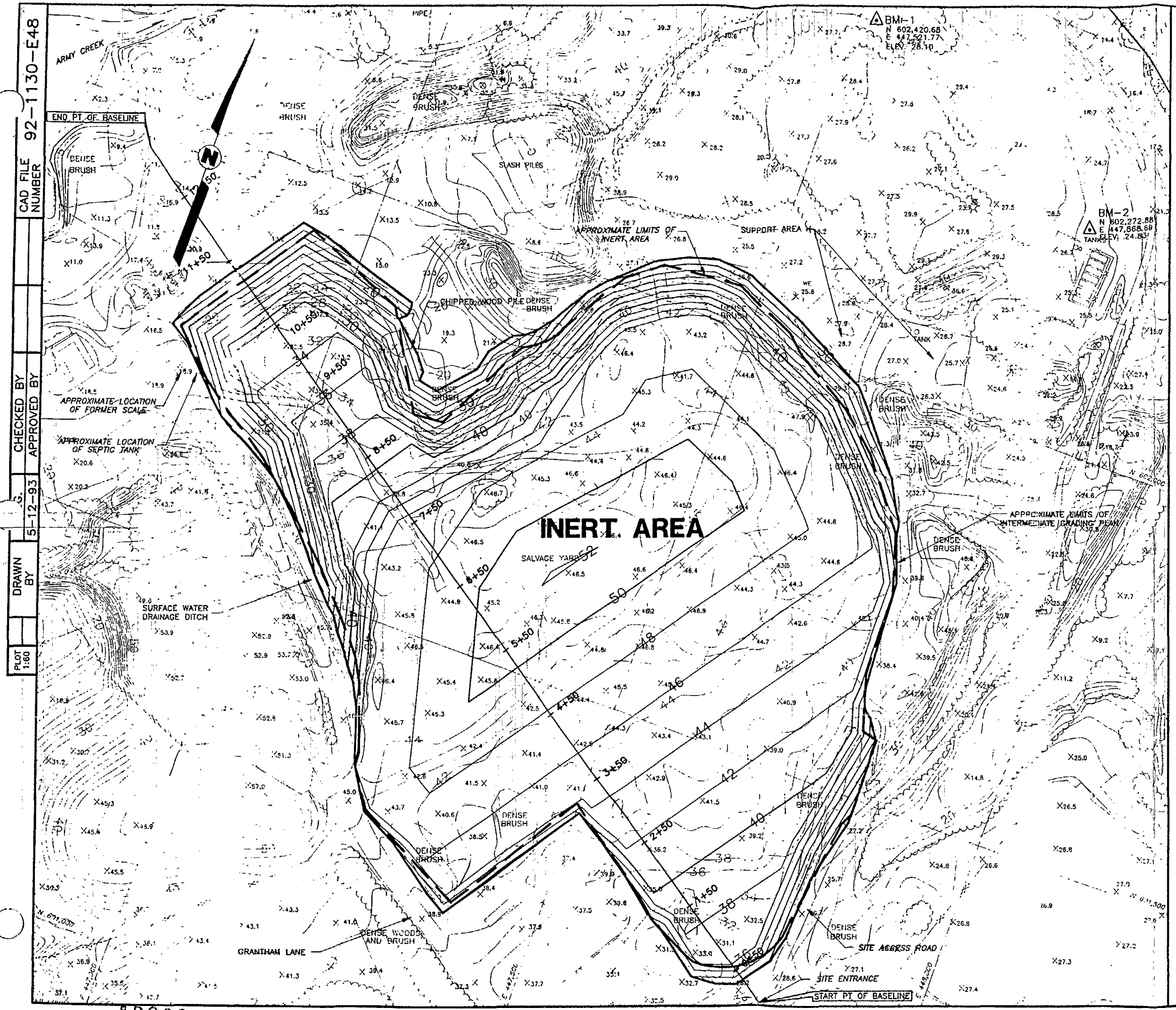
APPROVED BY	
DRWG.	5-12-93
DRAWN BY	
PLOT	1:60



BASELINE COORDINATE INFORMATION		
START PT	N 601,216.91	E 447,801.96
END PT	N 601,953.84	E 446,698.50

GENERAL NOTE:

1. SEE DRAWING NUMBER 2 TOPOGRAPHY REFERENCES.

NOT FOR CONSTRUCTION

SCALE

60 0 60 120 FEET

2' CONTOUR INTERVAL
THIS DRAWING IS NOT TO BE SCALED

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

INTERMEDIATE GRADING PLAN

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C. Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 5

AR303971

CAD FILE NUMBER	92-1130-E34
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APPROVED BY	
5-9-93	
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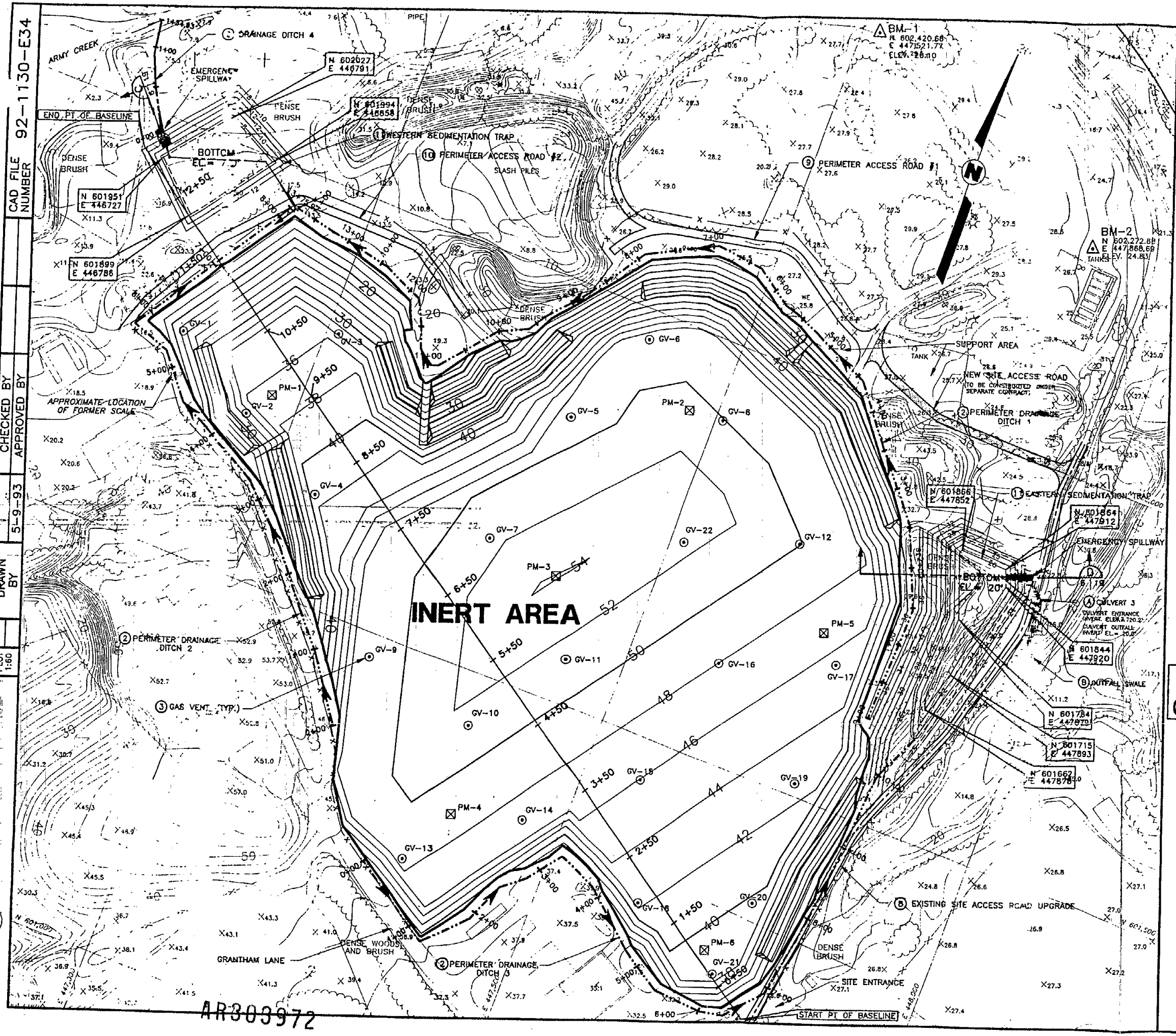
PLOT 1:60	



BASELINE COORDINATE INFORMATION	
START PT	N 601,216.91 E 447,801.96
END PT	N 601,953.84 E 446,698.50

GENERAL NOTE:

1. SEE DRAWING NUMBER 2 FOR TOPOGRAPHY REFERENCES.

SPECIFIC NOTES:

(1) SEE DRAWING NUMBER 20 FOR FENCE AND GATE DETAILS.

(2) SEE DRAWING NUMBER 13 FOR PERIMETER DRAINAGE DITCH PROFILES.

(3) SEE DRAWING NUMBER 21 FOR GAS VENT AND SETTLEMENT MONUMENT DETAILS.

(4) SEE DRAWING NUMBER 12 FOR CAP SYSTEM DETAILS.

(5) SEE DRAWING NUMBER 14 FOR CULVERT DETAILS.

(6) SEE DRAWING NUMBER 17 FOR SECTION AND DETAILS OF THE SEDIMENTATION TRAP.

(7) SEE DRAWING NUMBER 16 FOR BENCH DETAIL.

(8) SEE DRAWING NUMBER 15 FOR EXISTING ACCESS ROAD UPGRADE.

(9) SEE DRAWING NUMBER 20 FOR PERIMETER ACCESS ROAD #1.

(10) SEE DRAWING NUMBER 21 FOR PERIMETER ACCESS ROAD #2.

(11) SEE DRAWING NUMBER 19 FOR SEDIMENTATION TRAP DETAILS.

(A) SEE DRAWING NUMBER 16 FOR CULVERT DETAILS.

(B) THE OUTFALL SWALE SHALL HAVE UNIFORM GRADE FROM THE CULVERT OUTFALL TO THE EXISTING DRAINAGE PATH. THE OUTFALL SWALE SHALL BE 10 FEET WIDE, 1 FOOT DEEP, AND SHALL BE LINED WITH 9" NCSA R-3 RIPRAP.

2' CONTOUR INTERVAL

SCALE

60 0 60 120 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVE
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

FINAL SITE PLAN

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 6

CAD FILE NUMBER 92-1130-E35

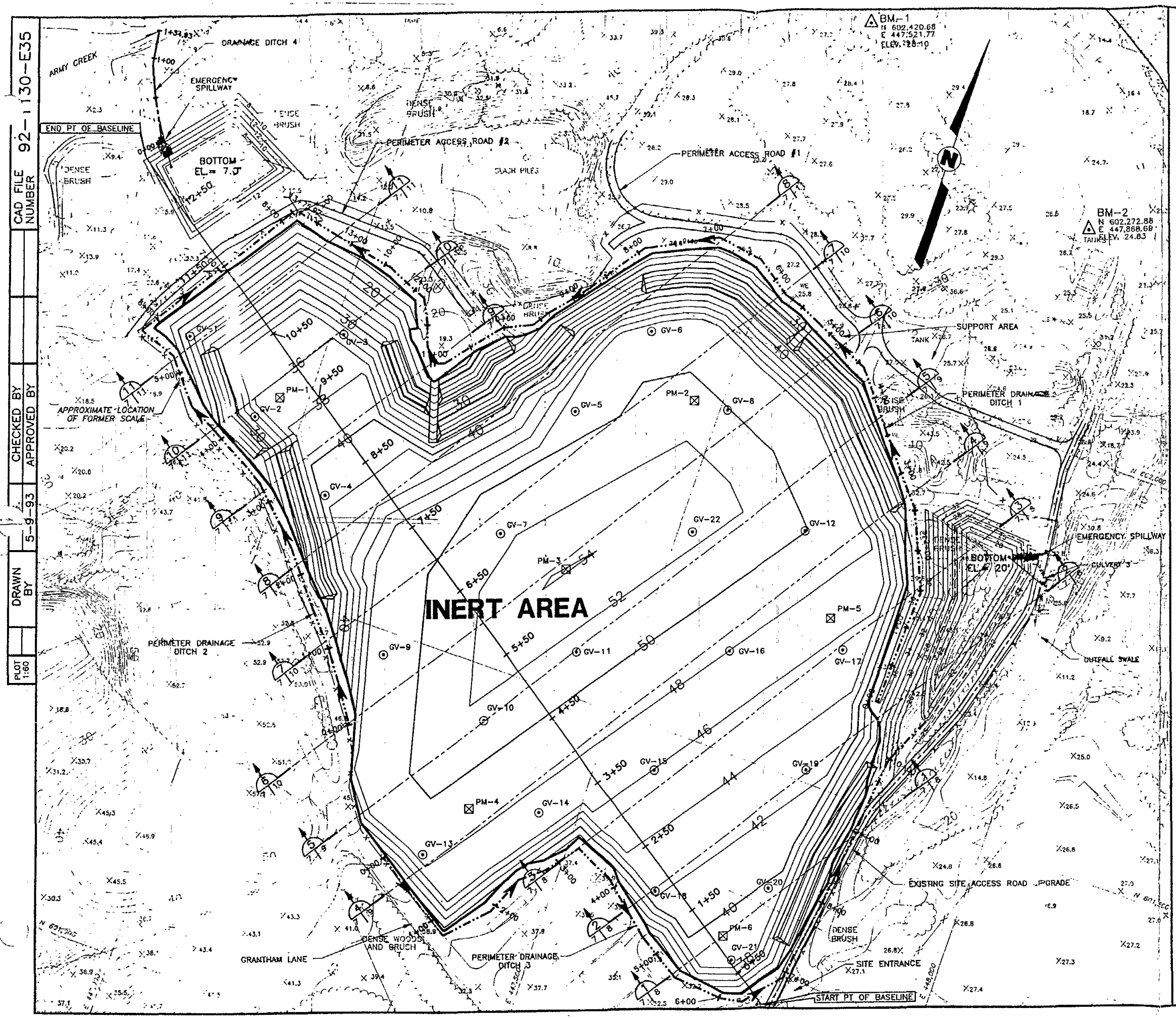
CHECKED BY

APPROVED BY

5-9-93

DRAWN BY

PLOT 1:60



BASELINE COORDINATE INFORMATION	
START PT	N 601,216.91 E 447,801.96
END PT	N 601,953.84 E 446,698.50

NOT FOR CONSTRUCTION

2' CONTOUR INTERVAL

SCALE

60 0 60 120 FEET

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

PLAN OF CAP SYSTEM
CROSS-SECTIONS

PREPARED FOR:

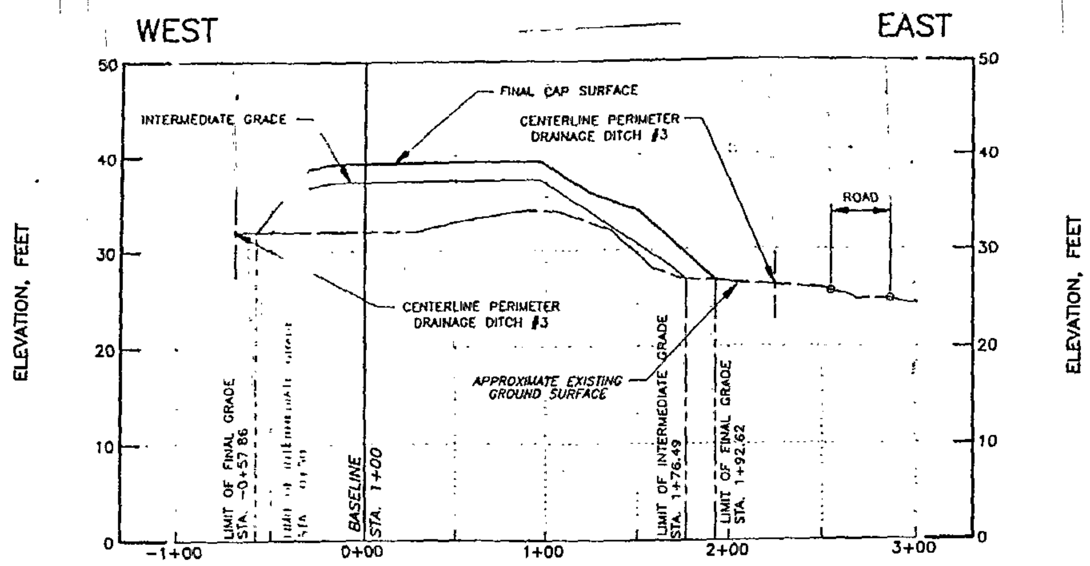
DS&G TECHNICAL COMMITTEE

Paul C. Rizzo Associates, Inc.
CONSULTANTS

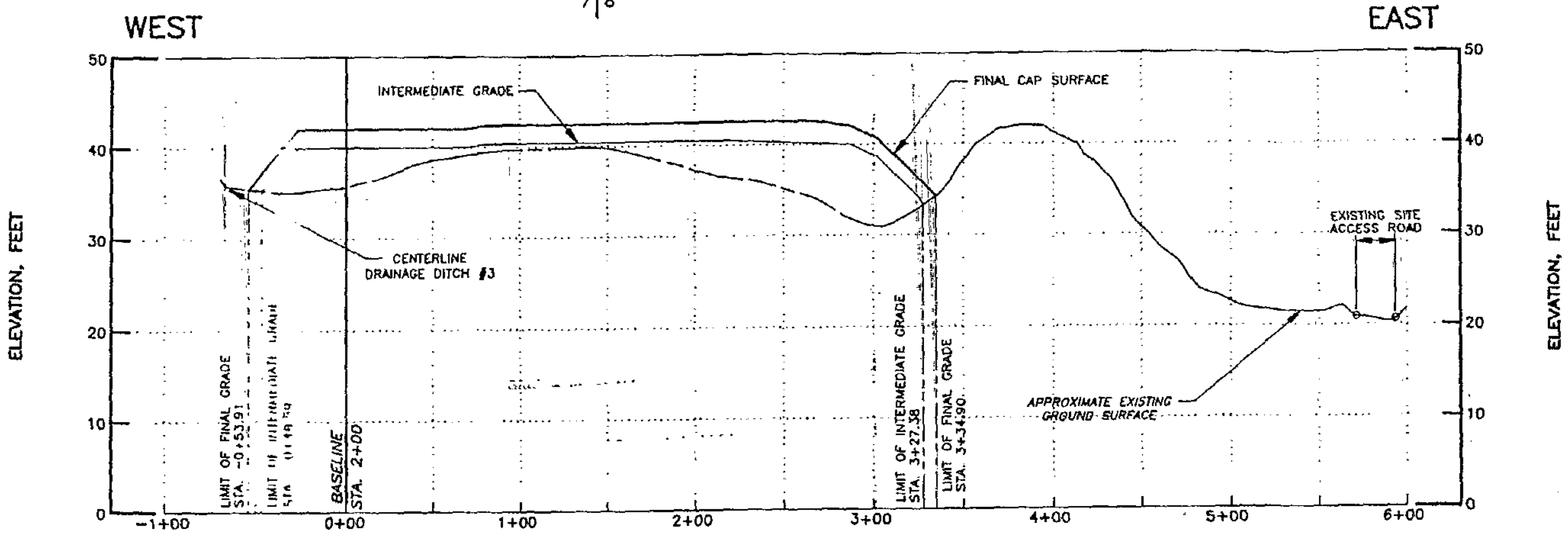
DRAWING NO. 7

AR303973

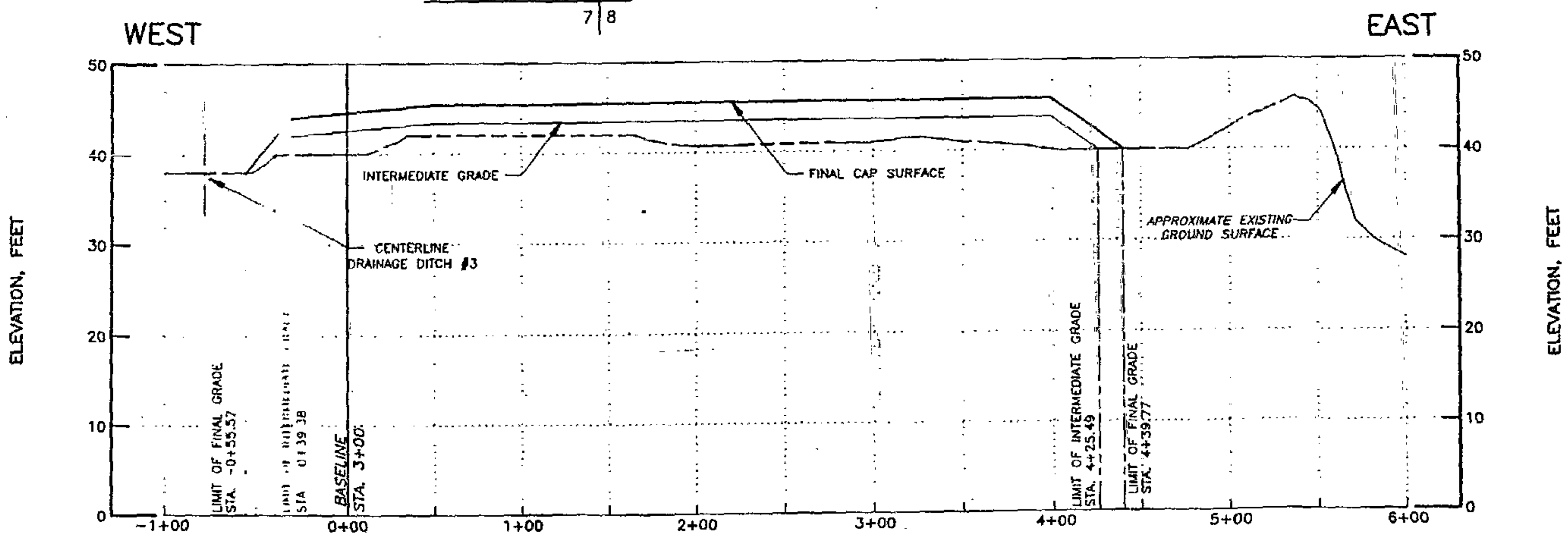
PLOT 1:50		DRAWN BY	[illegible] .G. 5-10-93	CHECKED BY / APPROVED BY			CAD FILE NUMBER	92-1130-E37



SECTION 1 7|8



SECTION 2 7|8



SECTION 3 7|8

5X VERTICAL EXAGGERATION

HORIZONTAL SCALE: 50 0 50 100 FEET

VERTICAL SCALE: 10 0 10 20 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED

REVISIONS

PROJECT:
INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:
WEST-EAST CROSS SECTIONS
1 THROUGH 3

PREPARED FOR:
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 8

AR303974

CAD FILE NUMBER	92-1130-E38
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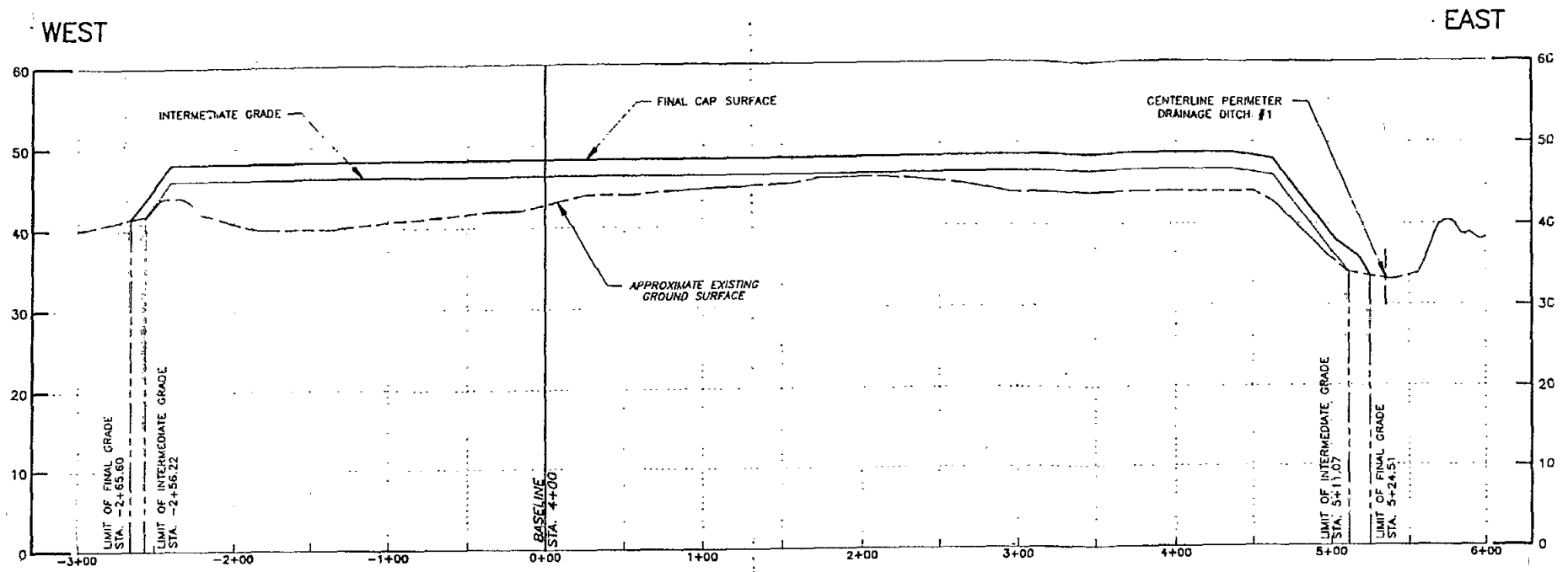
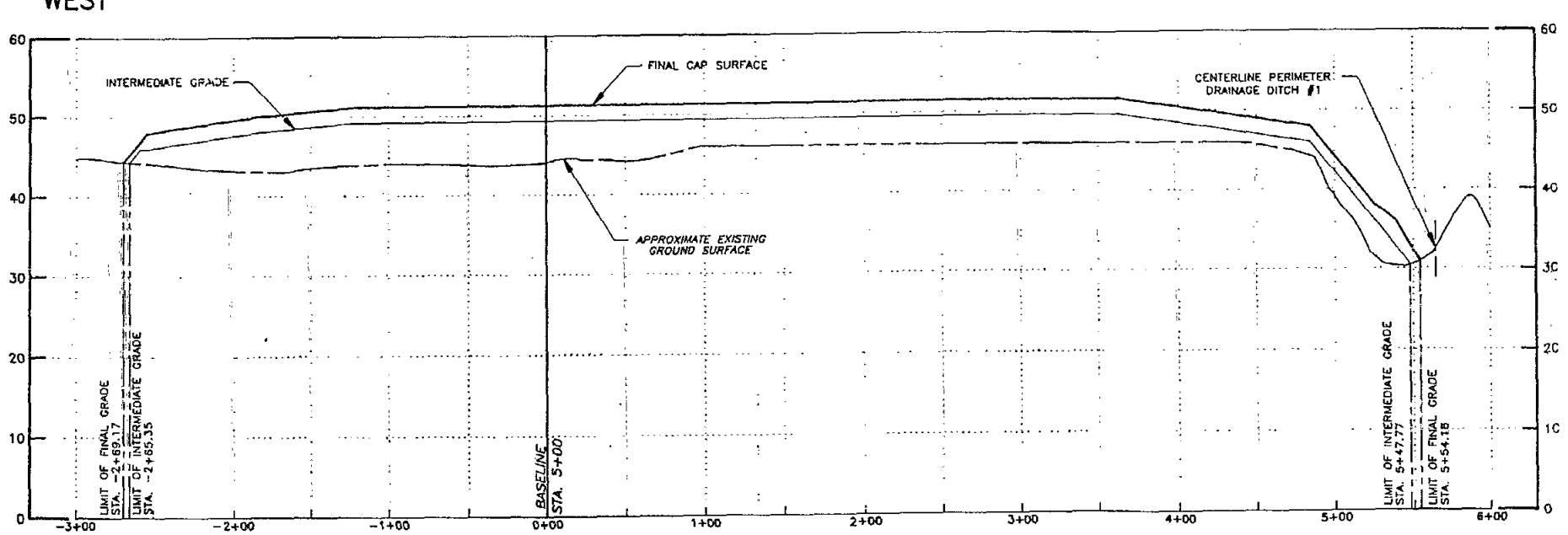


SECTION 4
7 | 9



SECTION 5
7 | 9

5X VERTICAL EXAGGERATION

HORIZONTAL SCALE

50 0 50 100 FEET

VERTICAL SCALE

10 0 10 20 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

WEST-EAST CROSS SECTIONS
4 THROUGH 5

PREPARED FOR:

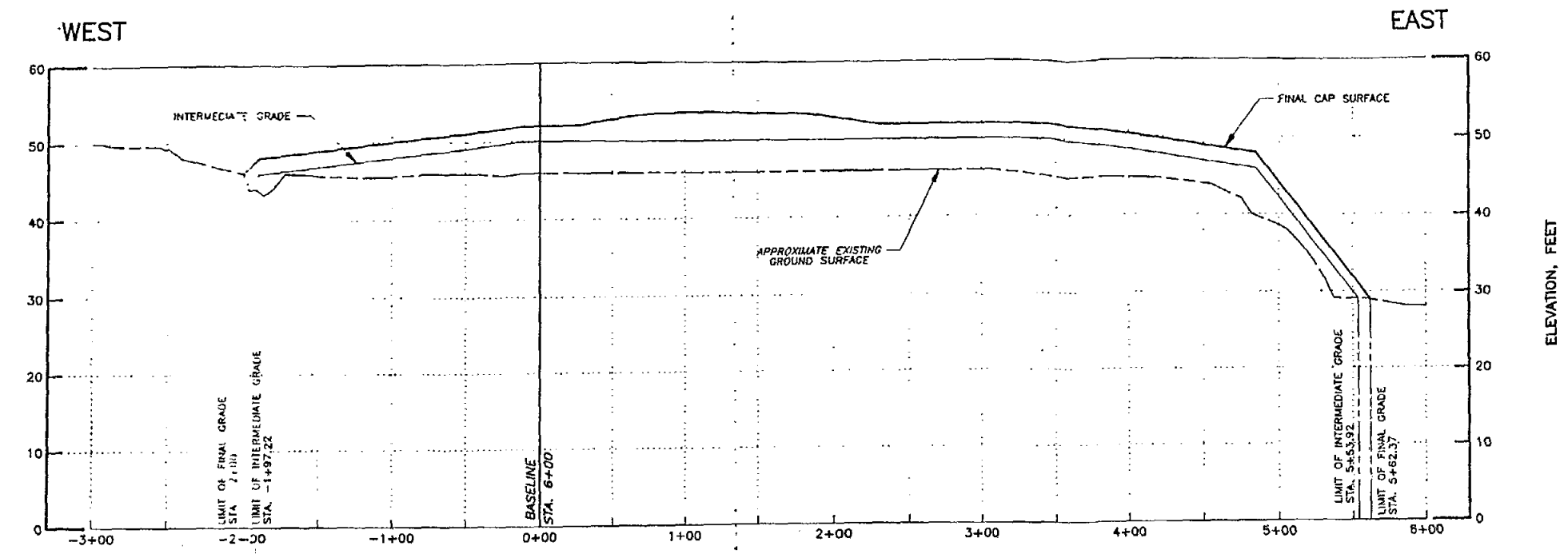
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

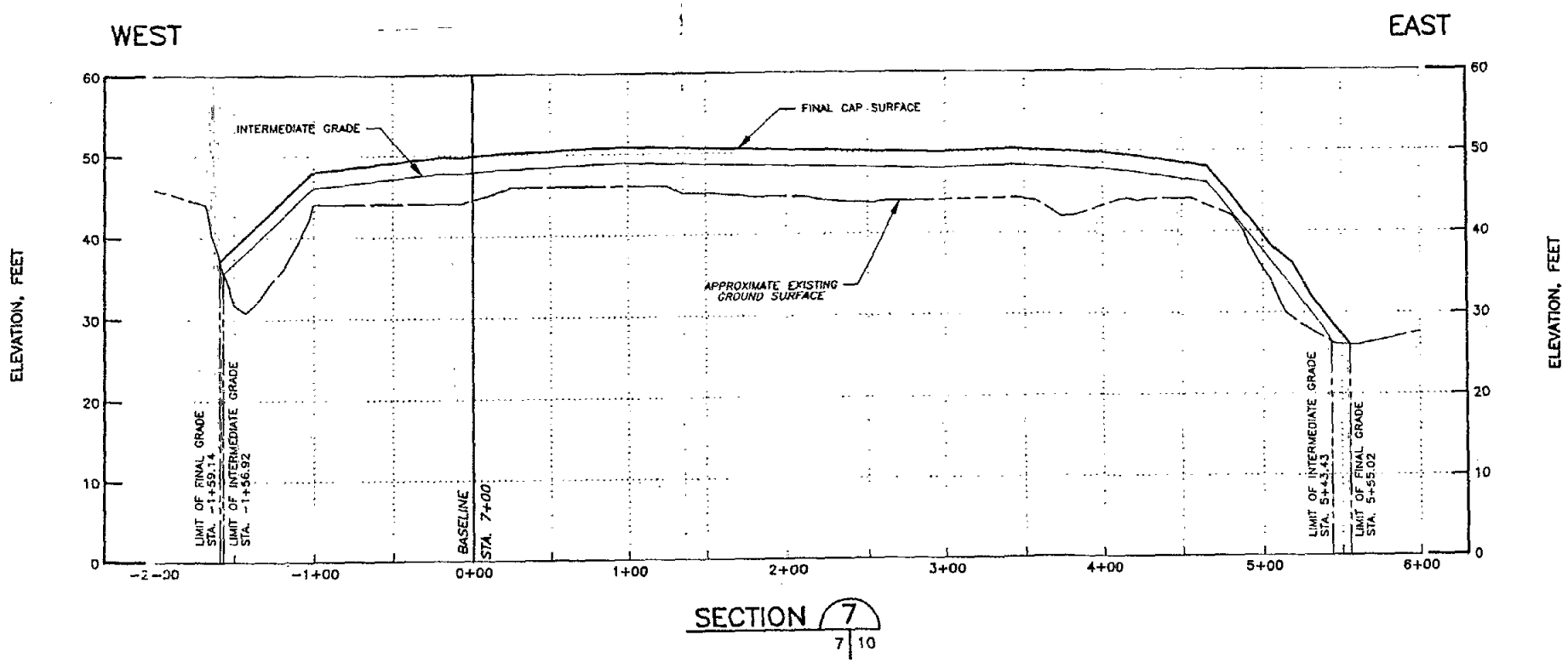
DRAWING NO. 9

CHECKED BY		
APPROVED BY		
3.	5-10-93	
DRAWN BY		
PLOT 1:50		

CAD FILE NUMBER 92-1130-E39



SECTION 6
7 | 10



SECTION 7
7 | 10

5X VERTICAL EXAGGERATION

HORIZONTAL SCALE
50 0 50 100 FEET

VERTICAL SCALE
10 0 10 20 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:
INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:
WEST–EAST CROSS SECTIONS
6 THROUGH 7

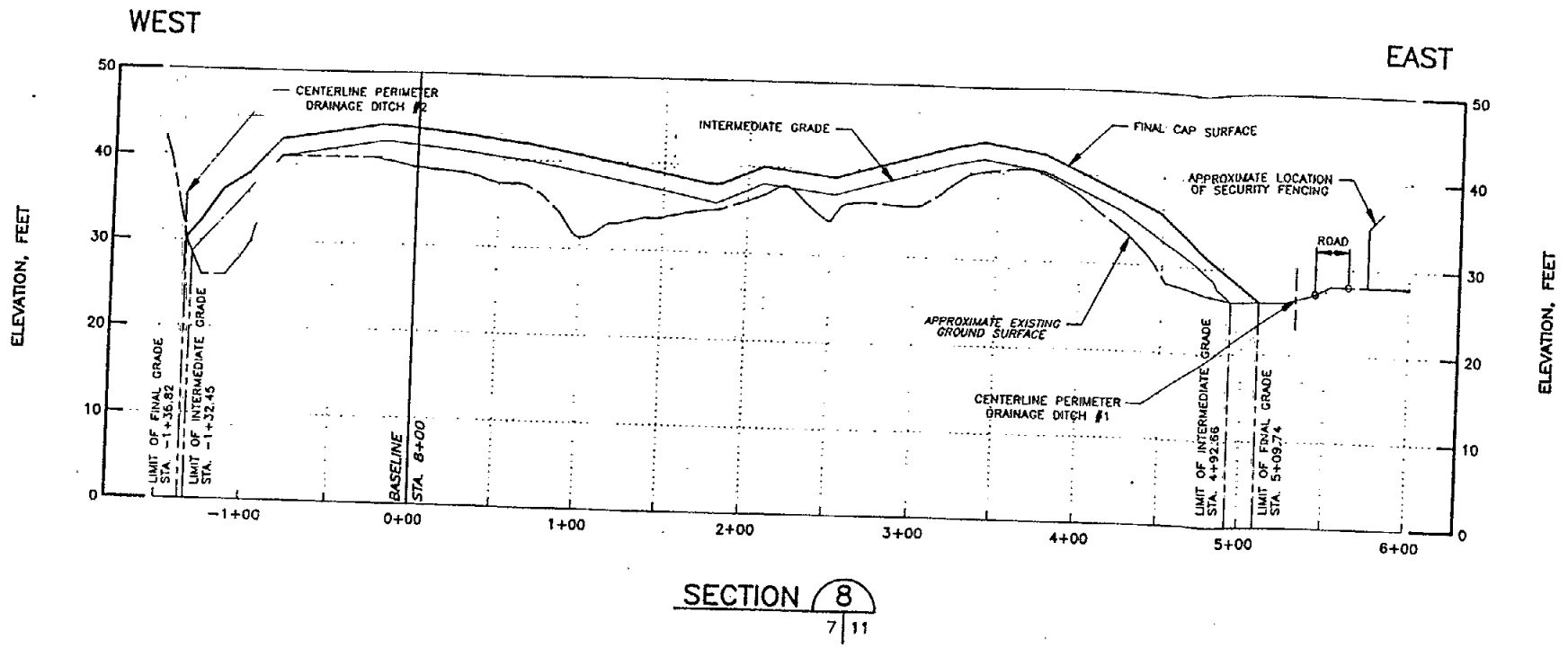
PREPARED FOR:
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

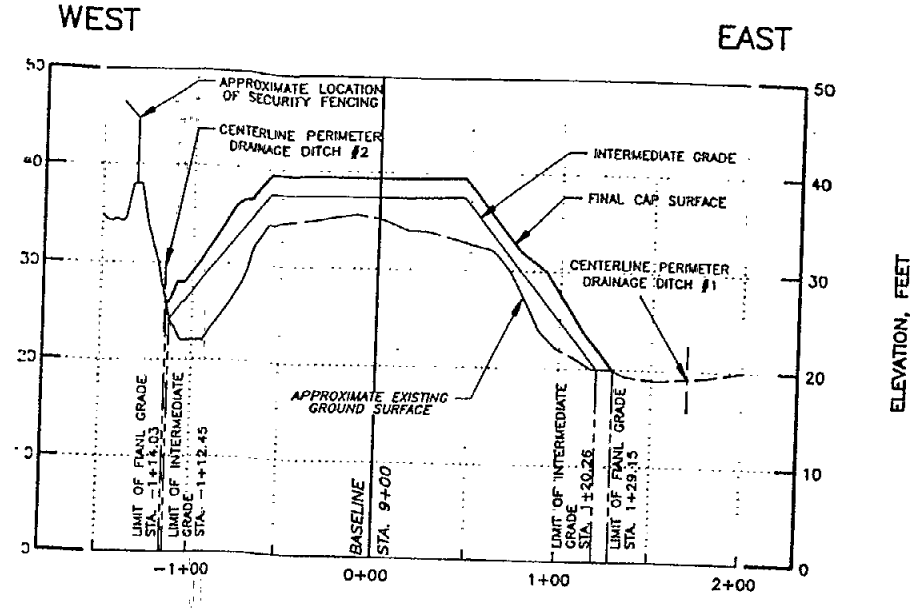
DRAWING NO. 10

AR303976

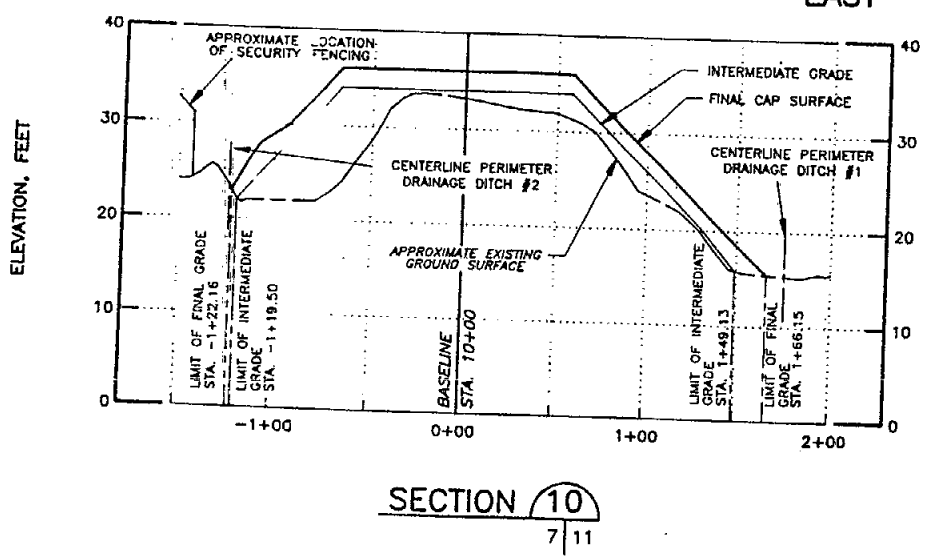
CAD FILE NUMBER	92-1130-E40	
CHECKED BY		
APPROVED BY		
DRAWN BY	J.J.G.	5-10-93
PLOT 1:50		



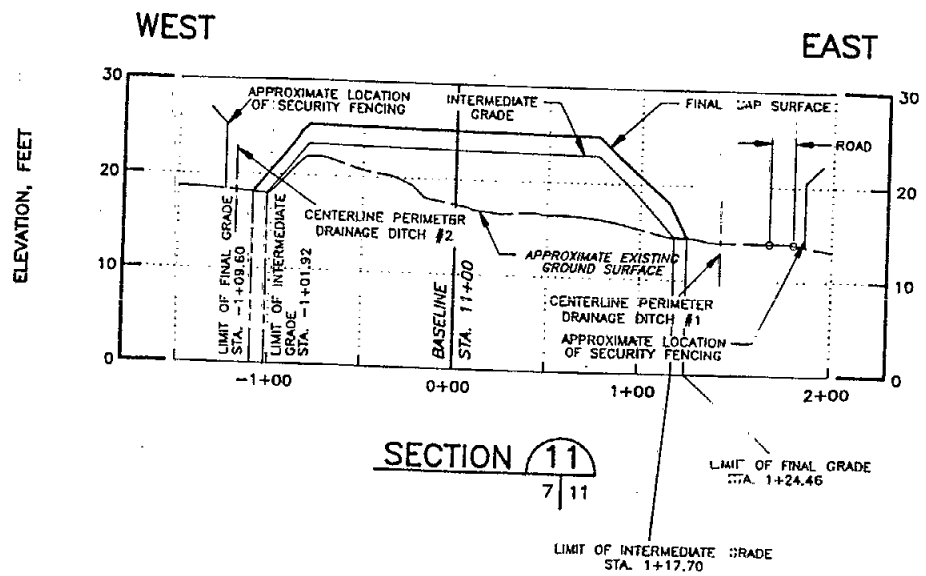
SECTION 8
7 | 11



SECTION 9
7 | 11



SECTION 10
7 | 11



SECTION 11
7 | 11

5X VERTICAL EXAGGERATION

HORIZONTAL SCALE
50 0 50 100 FEET

VERTICAL SCALE
10 0 10 20 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:
INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:
WEST–EAST CROSS SECTIONS
8 THROUGH 11

PREPARED FOR:
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO.
11

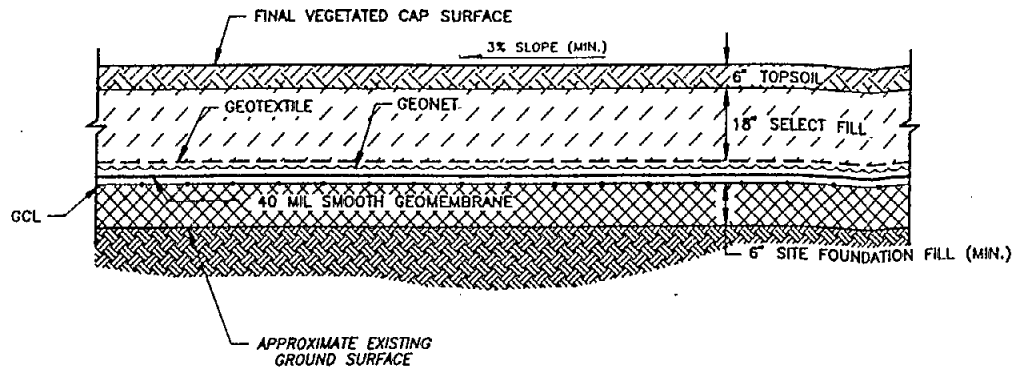
CAD FILE NUMBER 92-1130-E43

CHECKED BY

APPROVED BY 5-11-93

DRAWN BY

PLOT 1:1

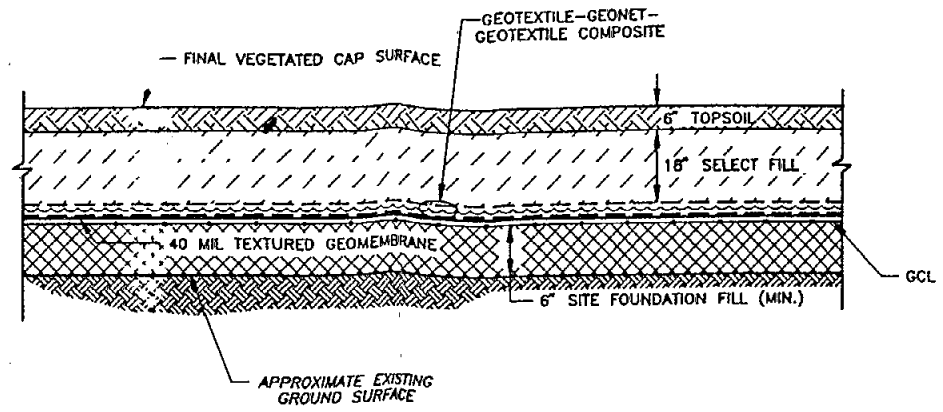


DETAIL 1

TYPICAL SECTION OF CAP SYSTEM ON SLOPES

NOT STEEPER THAN 8H:1V

(NTS)

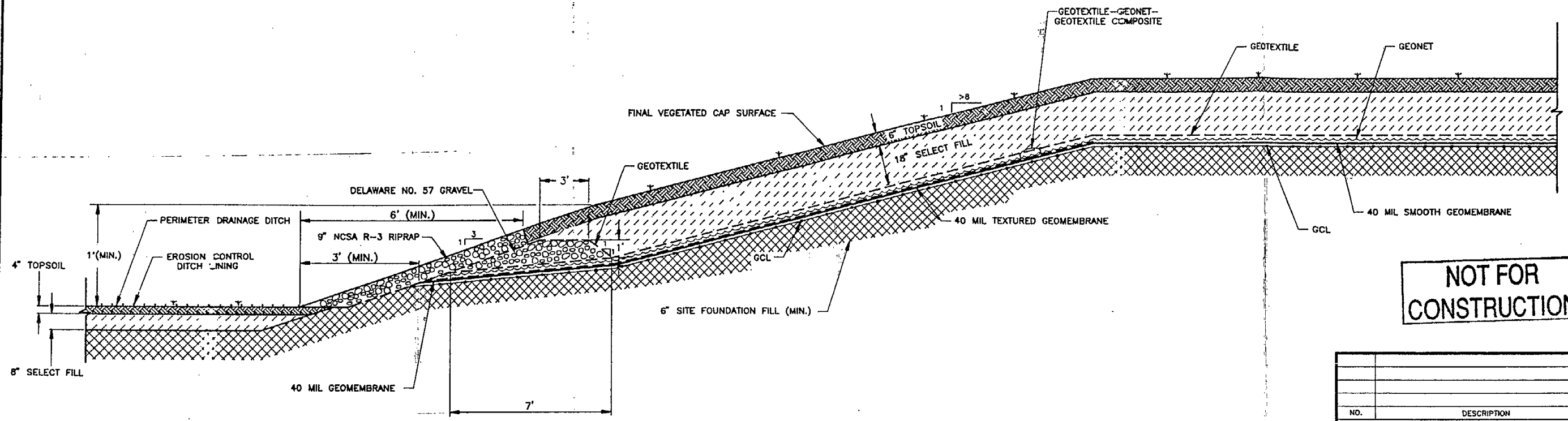


DETAIL 2

TYPICAL SECTION OF CAP SYSTEM ON SLOPES

STEEPER THAN 8H:1V

(NTS)



DETAIL 3

TYPICAL END SECTION ALONG PERIMETER DRAINAGE DITCH

(NTS)

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

CAP SYSTEM DETAILS

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 12

AR303978

CAD FILE NUMBER 92-1130-E33

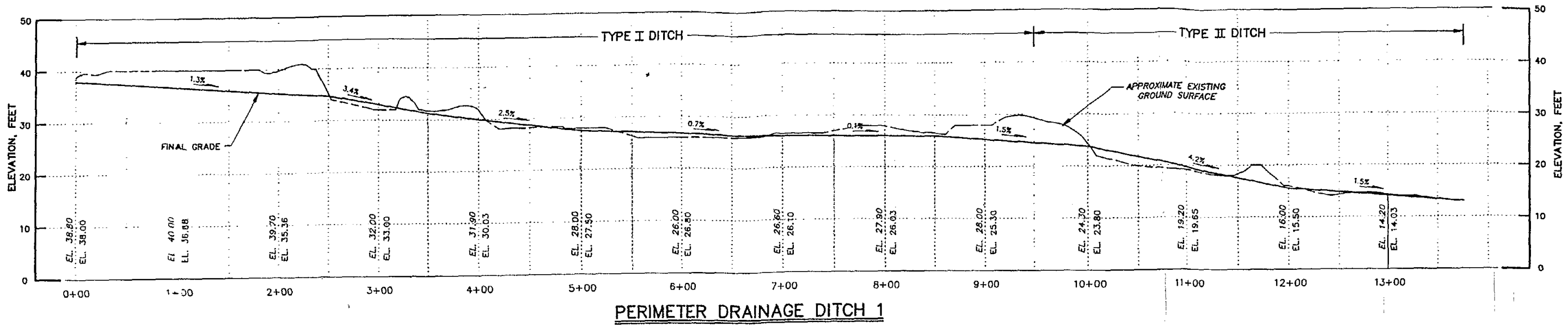
CHECKED BY

APPROVED BY

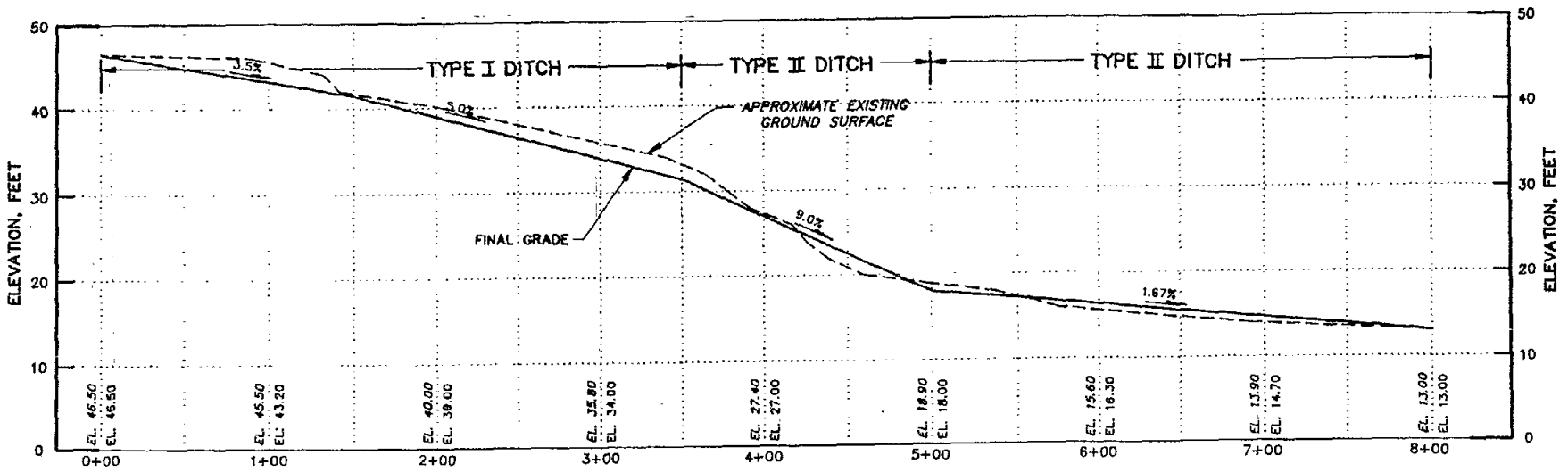
DRAWN BY

PLOT 1:1

5-6-93



PERIMETER DRAINAGE DITCH 1



PERIMETER DRAINAGE DITCH 2

LEGEND:

EL. 34.00	*EXISTING GROUND SURFACE ELEVATION*
EL. 34.00	FINAL GRADE ELEVATION

5X VERTICAL EXAGGERATION

HORIZONTAL SCALE
50 0 50 100 FEET

VERTICAL SCALE
10 0 10 20 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

PERIMETER DRAINAGE
DITCH PROFILES
SHEET 1 OF 2

PREPARED FOR:

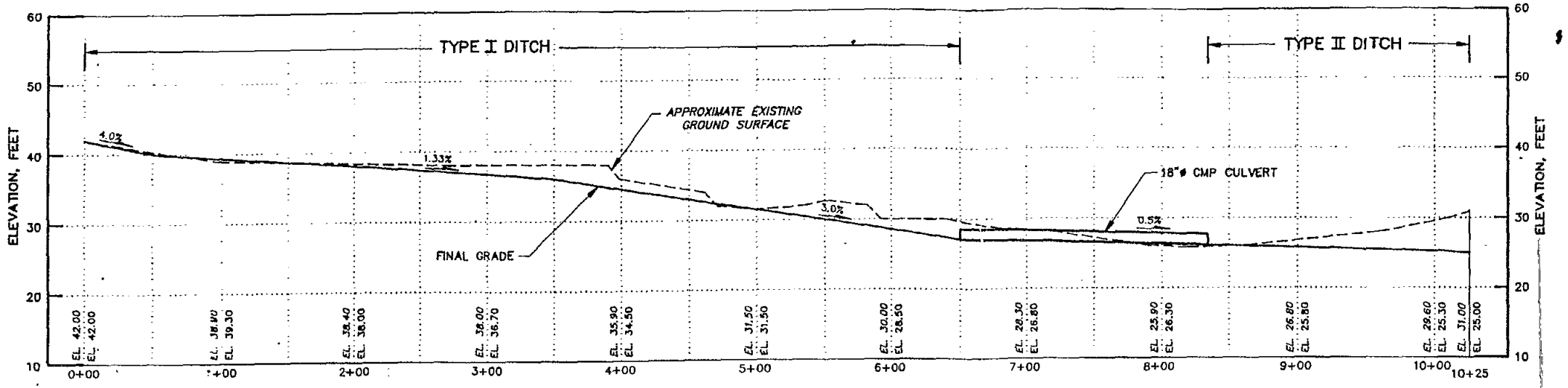
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

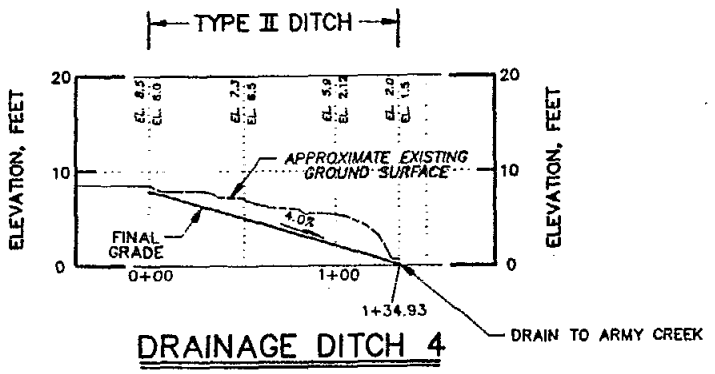
DRAWING NO. 13

AR303979

CAD FILE NUMBER	92-1130-E59
CHECKED BY	
APPROVED BY	
DRAWN BY	
PLOT 1:1	
DATE	7-19-93



PERIMETER DRAINAGE DITCH 3



DRAINAGE DITCH 4

LEGEND:

EL. 34.00	*EXISTING GROUND SURFACE ELEVATION*
EL. 34.00	FINAL GRADE ELEVATION

5X VERTICAL EXAGGERATION

HORIZONTAL SCALE
50 0 50 100 FEET

VERTICAL SCALE
10 0 10 20 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:
INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:
PERIMETER DRAINAGE DITCH PROFILES SHEET 2 OF 2

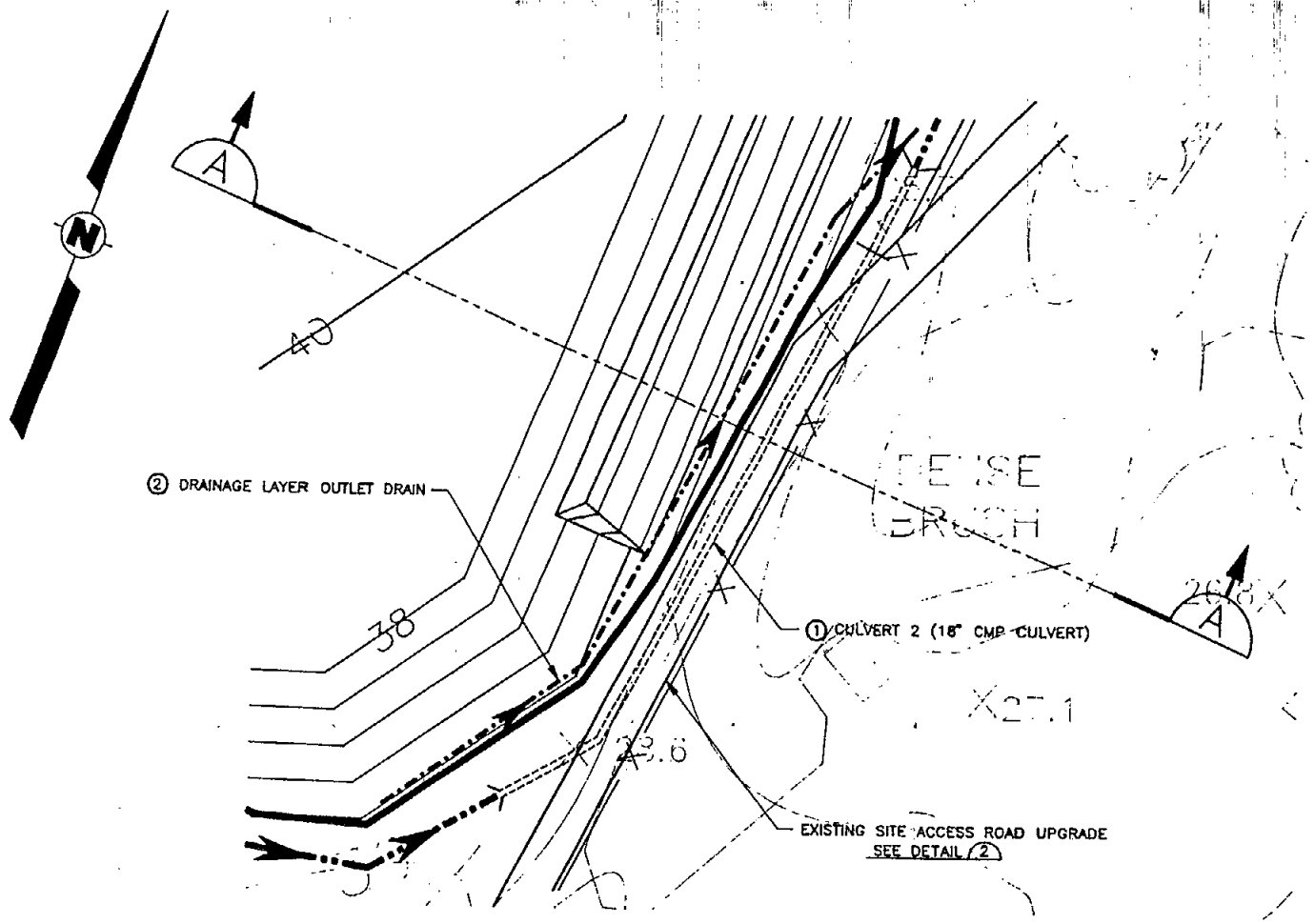
PREPARED FOR:
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 14

AR303980

CAD FILE NUMBER	92-1130-E60
CHECKED BY	
APPROVED BY	
DATE	7-19-93
DRAWN BY	
PLOT 1:20	

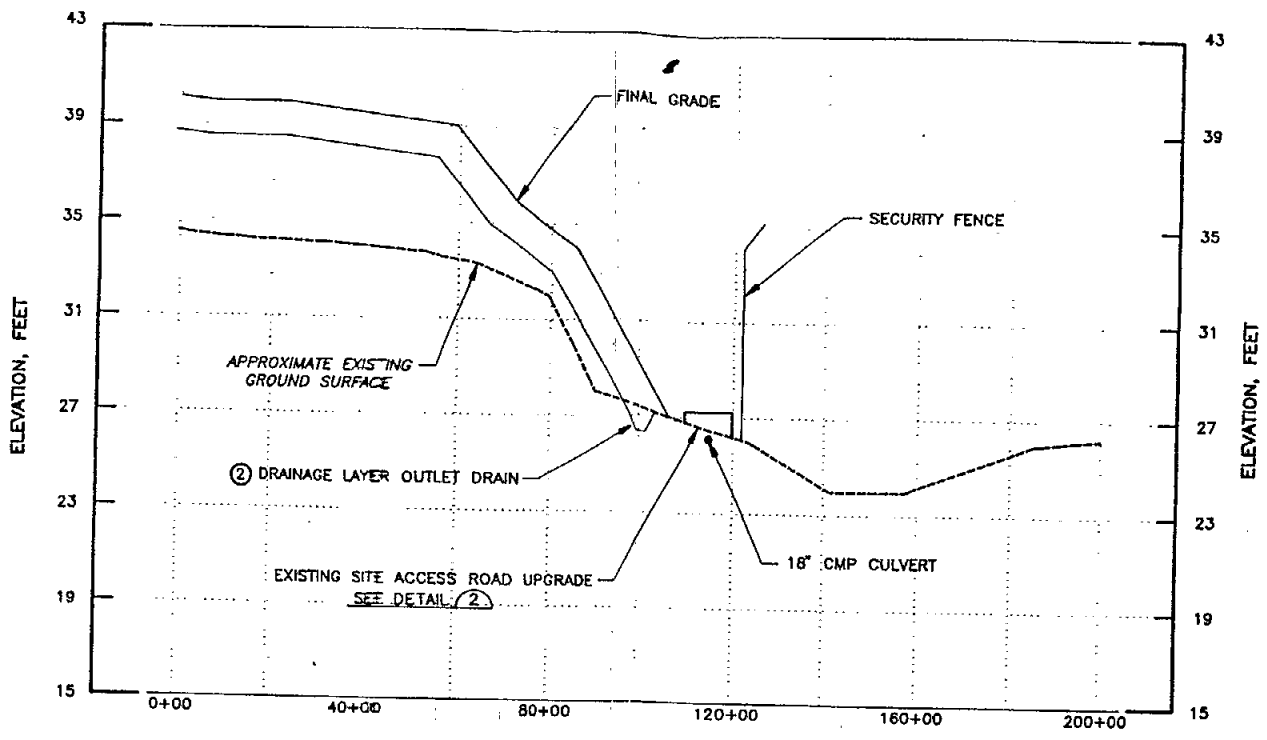


DETAIL 1

PLAN VIEW– CULVERT 2

SCALE

20 0 20 40



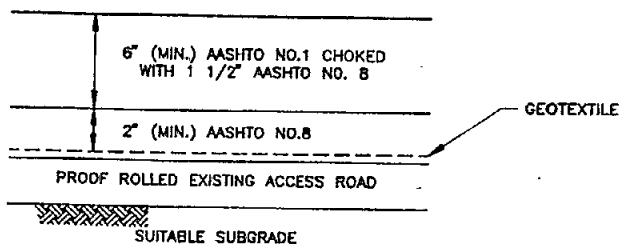
SECTION A

HORIZONTAL SCALE

20 0 20 40 FEET

VERTICAL SCALE

4 0 4 8 FEET



DETAIL 2

EXISTING SITE ACCESS ROAD UPGRADE

SPECIFIC NOTES:

① SEE DRAWING NUMBER 16 FOR CULVERT DETAILS.

② SEE DRAWING NUMBER 17, DETAIL 6, FOR DRAINAGE OUTLET.

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE

DRAWING TITLE:

EXISTING SITE ACCESS ROAD UPGRADE

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

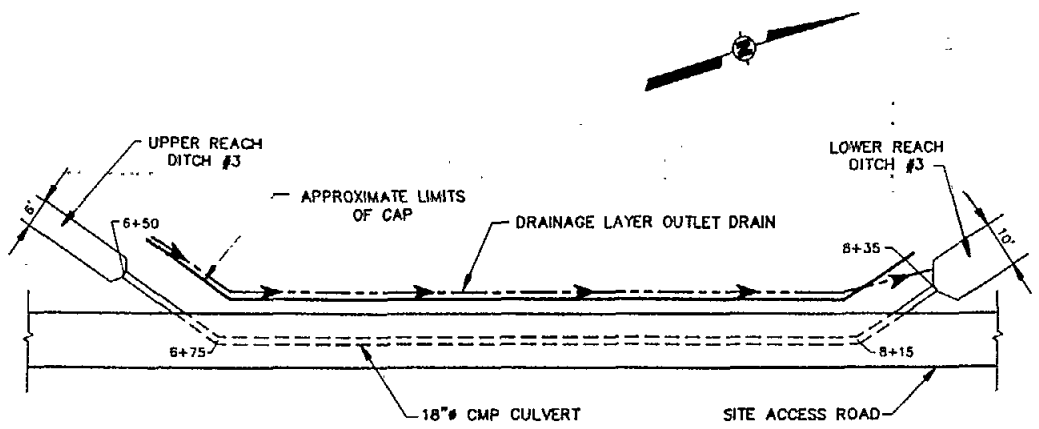
Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 15

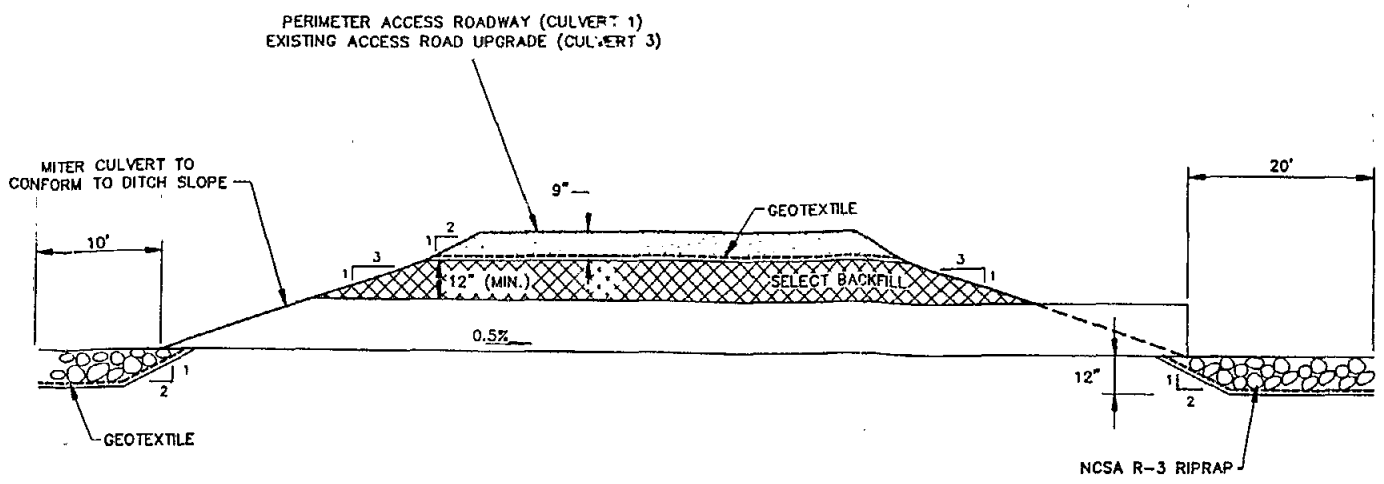
AR303981

CAD FILE NUMBER 92-1130-E46

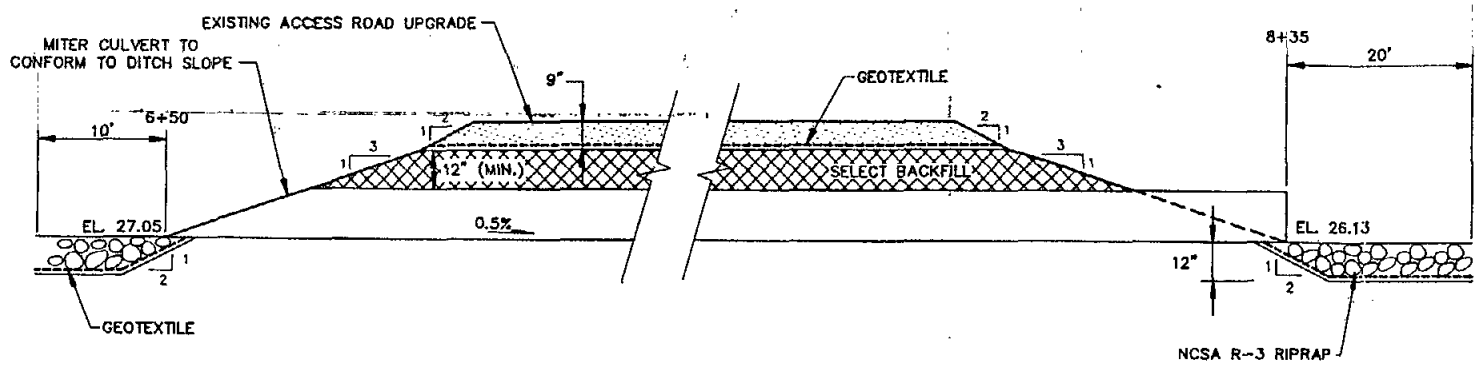
CHECKED BY	
APPROVED BY	
T.E. Jan 93	
DRAWN BY	5-12-93
PLOT 1:1	



PLAN VIEW – CULVERT 2
(NTS)



CULVERTS 1 AND 3 (TYP.)
(NTS)



PROFILE – CULVERT 2
(NTS)

CULVERT	MATERIAL	DIAMETER (INCHES)	LENGTH (FEET)	SLOPE (%)	PEAK FLOW (CFS)
1	CMP	30	35	0.5	22
2	CMP	18	185	0.5	6
3	CMP	18	20	0.5	3

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED

REVISIONS

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE

DRAWING TITLE:

CULVERT DETAILS

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 16

AR303982

CAD FILE NUMBER 92-1130-E42

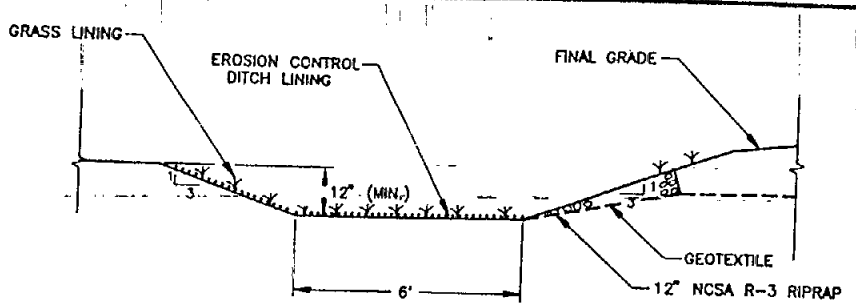
CHECKED BY

APPROVED BY

T... 5-11-93

DRAWN BY

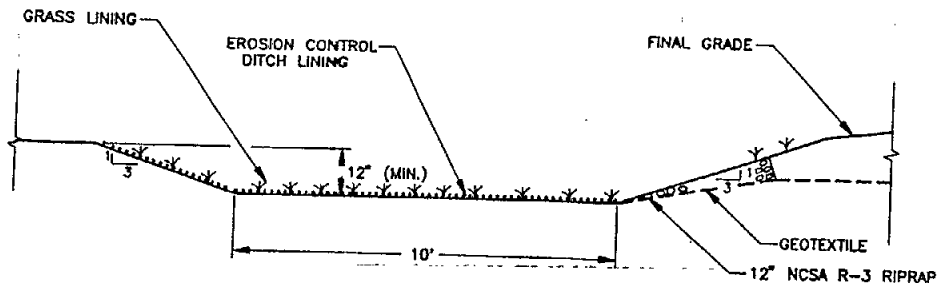
PLOT 1:1



DETAIL 1

TYPE I GRASS-LINED PERIMETER DRAINAGE DITCH

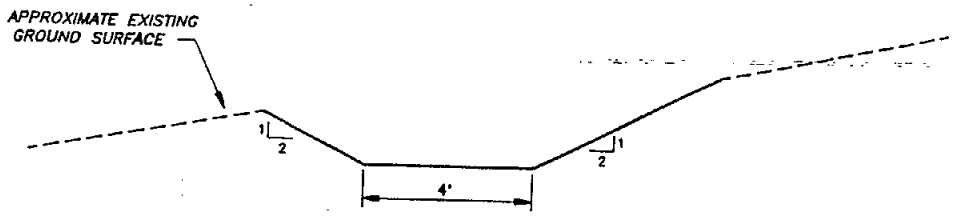
(NTS)



DETAIL 2

TYPE II GRASS-LINED PERIMETER DRAINAGE DITCH

(NTS)



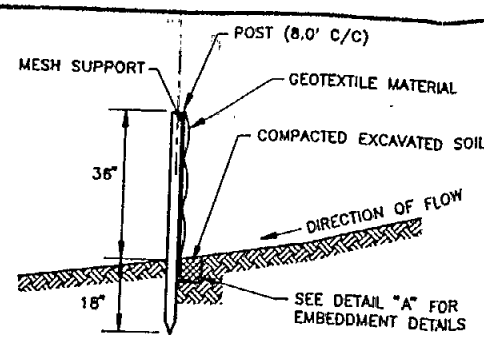
DETAIL 3

TYPICAL TEMPORARY DIVERSION DITCH

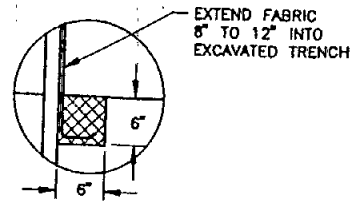
(NTS)

NOTES:

1. ALL TEMPORARY SWALES SHALL HAVE UNINTERRUPTED POSITIVE GRADE TO AN OUTLET WITH A MINIMUM OF EROSION.
2. DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SEDIMENT TRAPPING DEVICE.
3. DIVERTED RUNOFF FROM A UNDISTURBED AREA SHALL NOT OUTLET DIRECTLY INTO A STABILIZED AREA AT A EROSIVE VELOCITY.
4. ALL TREES, BRUSH, STUMPS OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE SWALE.
5. THE SWALE SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH IMPEDE NORMAL FLOW.
6. FILLS SHALL BE COMPACTED BY EARTH MOVING EQUIPMENT.
7. ALL EARTH REMOVED AND NOT NEEDED ON CONSTRUCTION SHALL BE PLACED SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE SWALE.
8. PERIODIC INSPECTION AND REQUIRED MAINTENANCE MUST BE PROVIDED AFTER EACH RAIN EVENT.
9. TEMPORARY DIVERSION DITCHES SHALL BE STABILIZED.



ELEVATION



DETAIL A

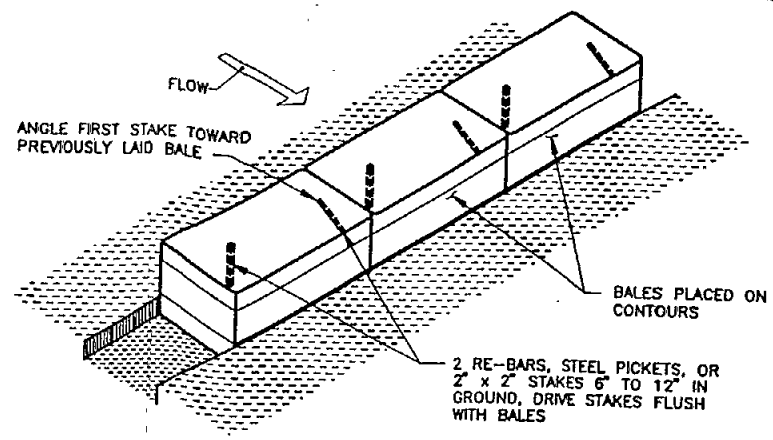
DETAIL 4

SILT FENCE

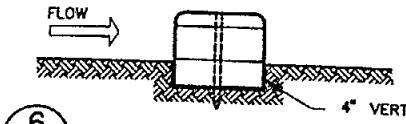
(NTS)

NOTES:

1. POST SHALL BE 2" X 2" WOOD STAKES PLACED A MAXIMUM OF 8.0' CENTER TO CENTER.
2. GEOTEXTILE MATERIAL TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
3. WHEN TWO SECTIONS OF GEOTEXTILE MATERIAL ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY 6" AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.
5. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE AS NEEDED OR AS REQUIRED BY THE CONSTRUCTION MANAGER.



ANCHORING DETAIL



EMBEDDING DETAIL

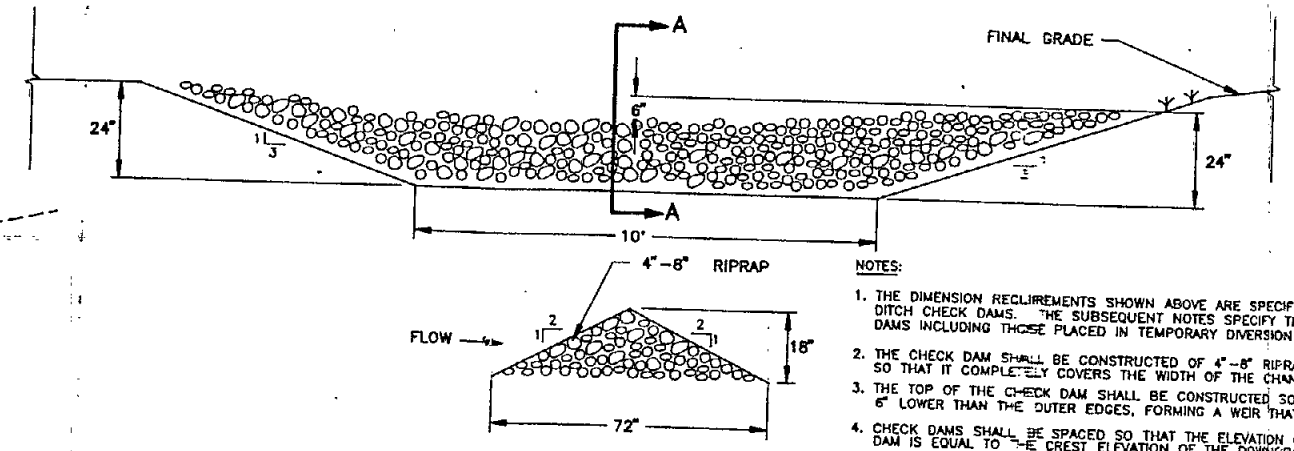
DETAIL 6

HAY BALE DIKE

(NTS)

NOTES:

1. BALES SHALL BE PLACED AT THE TOE OF A SLOPE OR ON THE CONTOUR AND IN A ROW WITH ENDS TIGHTLY ABUTTING THE ADJACENT BALES.
2. EACH BALE SHALL BE EMBEDDED IN THE SOIL A MINIMUM OF 4" AND PLACED SO THE BINDINGS ARE HORIZONTAL.
3. BALES SHALL BE SECURELY ANCHORED IN PLACE BY STAKES OR RE-BARS DRIVEN THROUGH THE BALES. THE FIRST STAKE IN EACH BALE SHALL BE ANGLED TOWARD PREVIOUSLY LAID BALE TO FORCE BALES TOGETHER. STAKES SHALL BE DRIVEN FLUSH WITH THE TOP OF THE BALE.
4. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
5. BALES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
6. 100-FOOT SPACING BETWEEN HAY BALE DIKES IS REQUIRED. MAXIMUM AREA BEHIND 100-FOOT LENGTH OF BALES SHALL NOT EXCEED 0.25 ACRES.
7. THE CONTRACTOR SHALL NOT INSTALL HAY BALES IN AREAS WHERE THE STAKES MAY PENETRATE THE GEOSYSTHETIC COMPONENTS OF THE CAP SYSTEM.



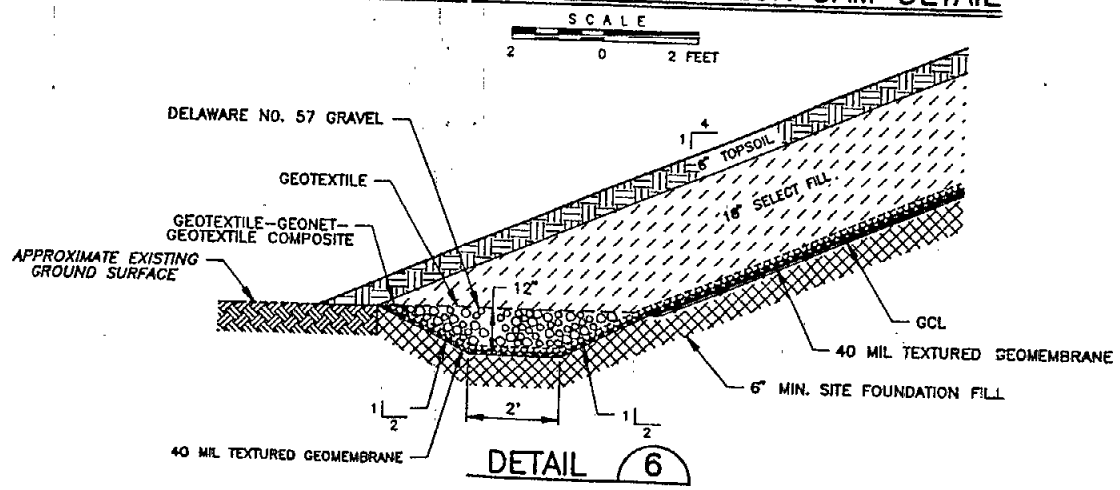
SECTION A-A

DETAIL 5

PERIMETER DRAINAGE DITCH CHECK DAM DETAIL

NOTES:

1. THE DIMENSION REQUIREMENTS SHOWN ABOVE ARE SPECIFIC TO THE PERIMETER DRAINAGE DITCH CHECK DAMS. THE SUBSEQUENT NOTES SPECIFY THE REQUIREMENT FOR ALL CHECK DAMS INCLUDING THOSE PLACED IN TEMPORARY DIVERSION DITCHES.
2. THE CHECK DAM SHALL BE CONSTRUCTED OF 4"-8" RIPRAP. THE RIPRAP SHALL BE PLACED SO THAT IT COMPLETELY COVERS THE WIDTH OF THE CHANNEL.
3. THE TOP OF THE CHECK DAM SHALL BE CONSTRUCTED SO THAT THE CENTER IS APPROXIMATELY 6" LOWER THAN THE OUTER EDGES, FORMING A WEIR THAT THE WATER CAN FLOW ACROSS.
4. CHECK DAMS SHALL BE SPACED SO THAT THE ELEVATION OF THE TOE OF THE UPGRADIENT DAM IS EQUAL TO THE CREST ELEVATION OF THE DOWNGRADIENT DAM.
5. CHECK DAMS SHALL BE CLEANED WHEN SEDIMENT ACCUMULATES TO 1/2 OF THE ORIGINAL HEIGHT OF THE CHECK DAM.
6. CHECK DAMS SHALL BE REMOVED WHEN VEGETATION IS ESTABLISHED OR AS DIRECTED BY THE CONSTRUCTION MANAGER.



DETAIL 6

DRAINAGE LAYER OUTLET DRAIN

(NTS)

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED

REVISIONS

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:

DRAINAGE AND SEDIMENT CONTROL DETAILS

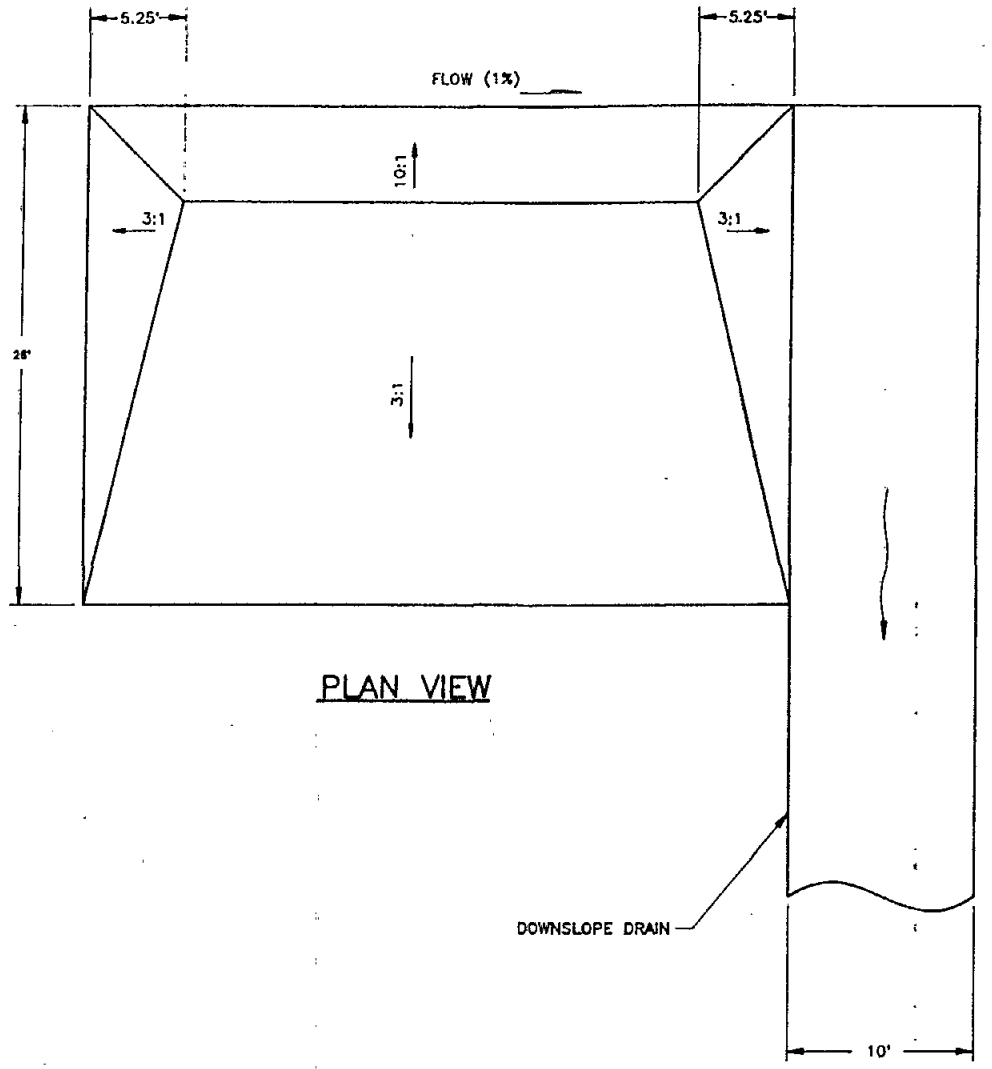
PREPARED FOR:

DS&G TECHNICAL COMMITTEE

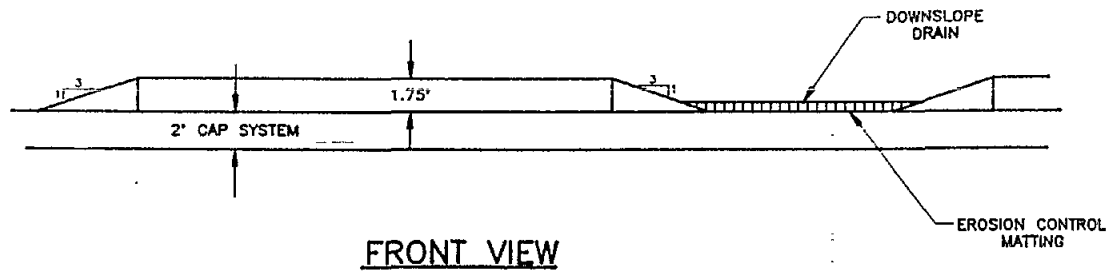
Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 17

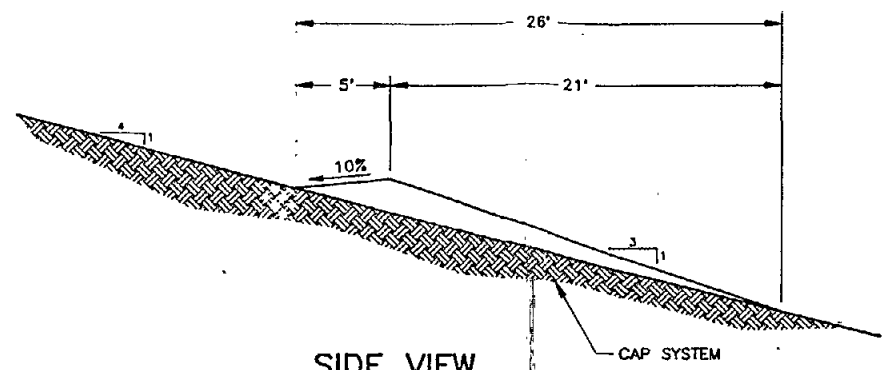
CAD FILE NUMBER	92-1130-E49
CHECKED BY	
APPROVED BY	
T.J.G.	5-13-93
DRAWN BY	
PLOT	1:5



PLAN VIEW



FRONT VIEW



SIDE VIEW

SCALE
5 0 5 10 FEET

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:
INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:
BENCH DETAIL

PREPARED FOR:
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO.
18

AR303984

CAD FILE NUMBER 92-1130-E36

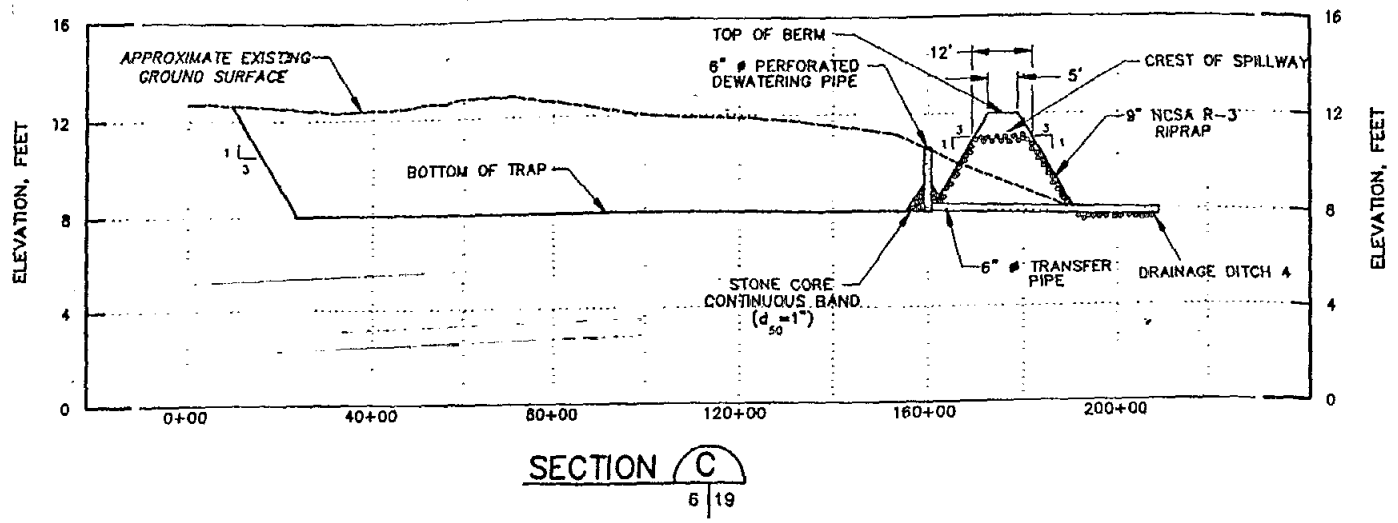
CHECKED BY

APPROVED BY

TEJ/MM 5-10-93

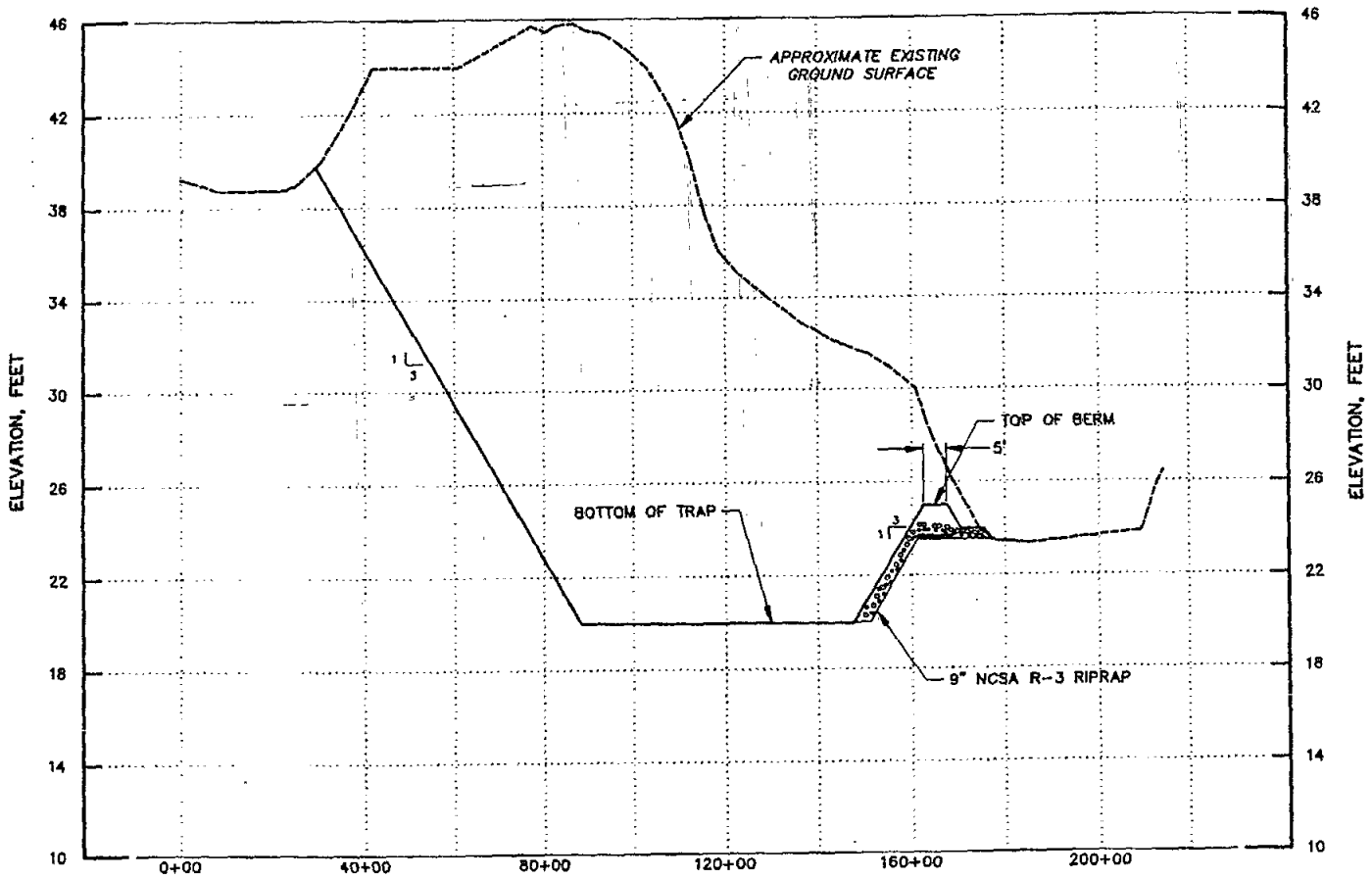
DRAWN BY

PLOT 1:1



SECTION C
6 | 19

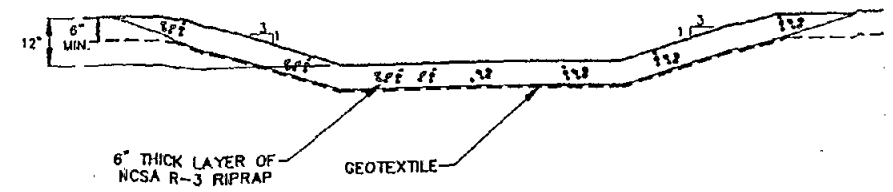
WESTERN SEDIMENTATION TRAP



SECTION D
6 | 19

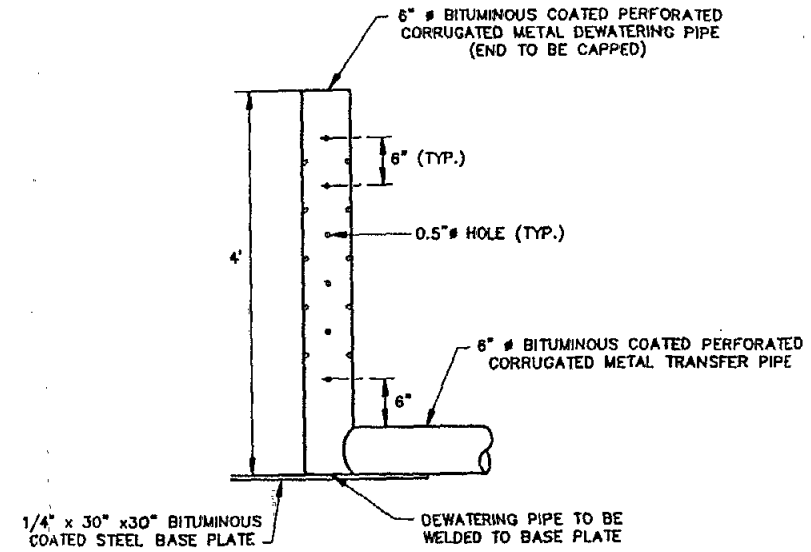
EASTERN SEDIMENTATION TRAP

	TOP OF BERM ELEV.	CREST OF SPILLWAY ELEV.	BOTTOM OF BERM ELEV.	TOP OF DEWATERING PIPE ELEV.	WIDTH OF SPILLWAY AT CREST	WIDTH OF SPILLWAY AT TOP OF BERM
WESTERN SEDIMENTATION TRAP	12.0'	11.0'	7.0'	11.0'	6.0'	12.0'
EASTERN SEDIMENTATION TRAP	25.0'	24.0'	20.0'	24.0'	5.0'	11.0'



SEDIMENTATION TRAP OUTLET SPILLWAY AT BERM

(NTS)



SEDIMENTATION TRAP DEWATERING PIPE

(NTS)

5X VERTICAL EXAGGERATION

NOT FOR CONSTRUCTION

HORIZONTAL SCALE
20 0 20 40 FEET

VERTICAL SCALE
4 0 4 8 FEET

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:
INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE

DRAWING TITLE:
SEDIMENTATION TRAP DETAILS

PREPARED FOR:
DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc. CONSULTANTS

DRAWING NO. 19

	CONTRIBUTING DRAINAGE AREA (ACRES)	AVAILABLE STORAGE VOLUME (CUBIC FEET)	REQUIRED STORAGE VOLUME (CUBIC FEET)
WESTERN SEDIMENTATION TRAP	8.13	30,056	29,268
EASTERN SEDIMENTATION TRAP	6.76	26,136	24,408

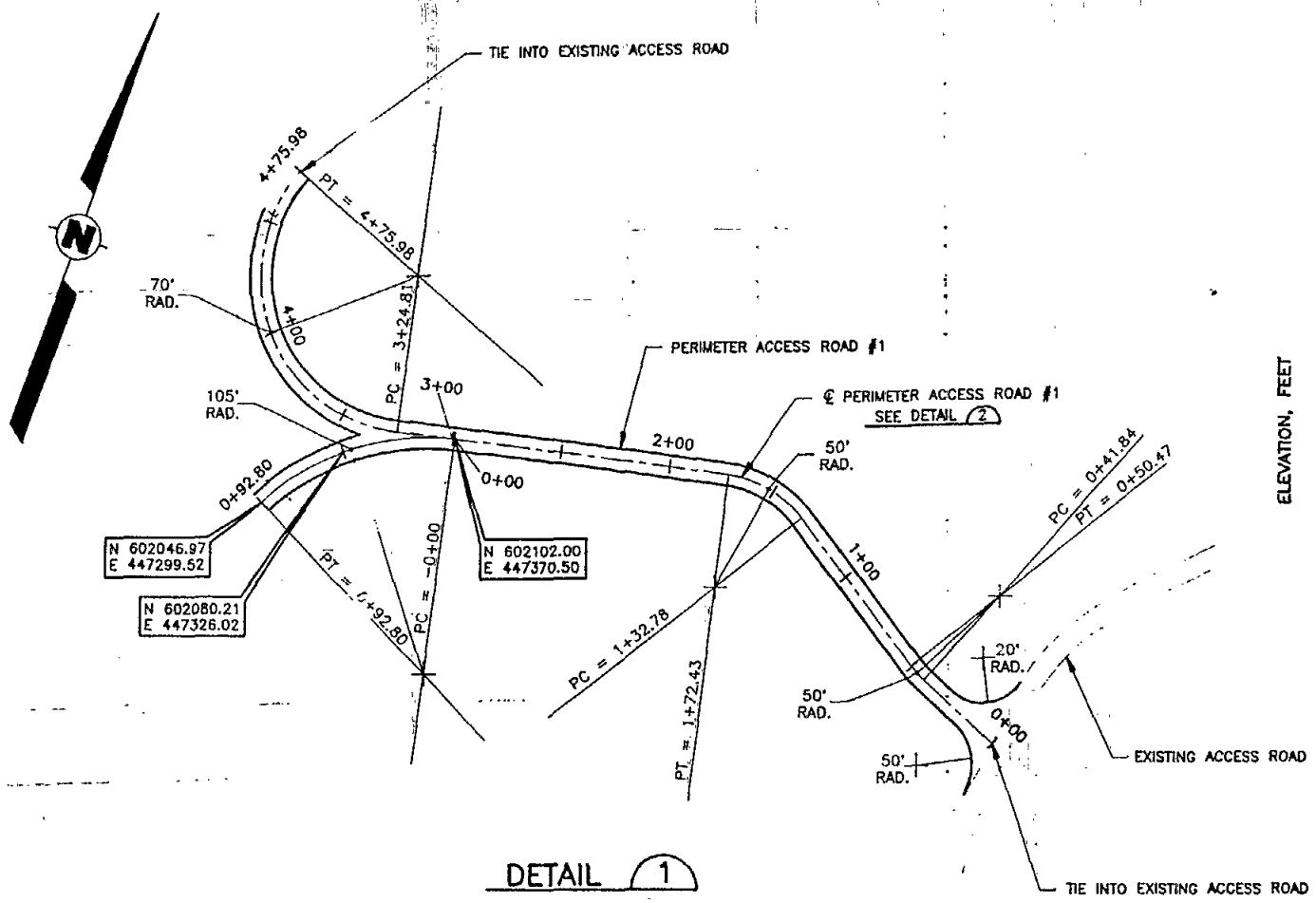
CAD FILE NUMBER 92-1 — E57

CHECKED BY

APPROVED BY

DRAWN BY

PLOT 1:40

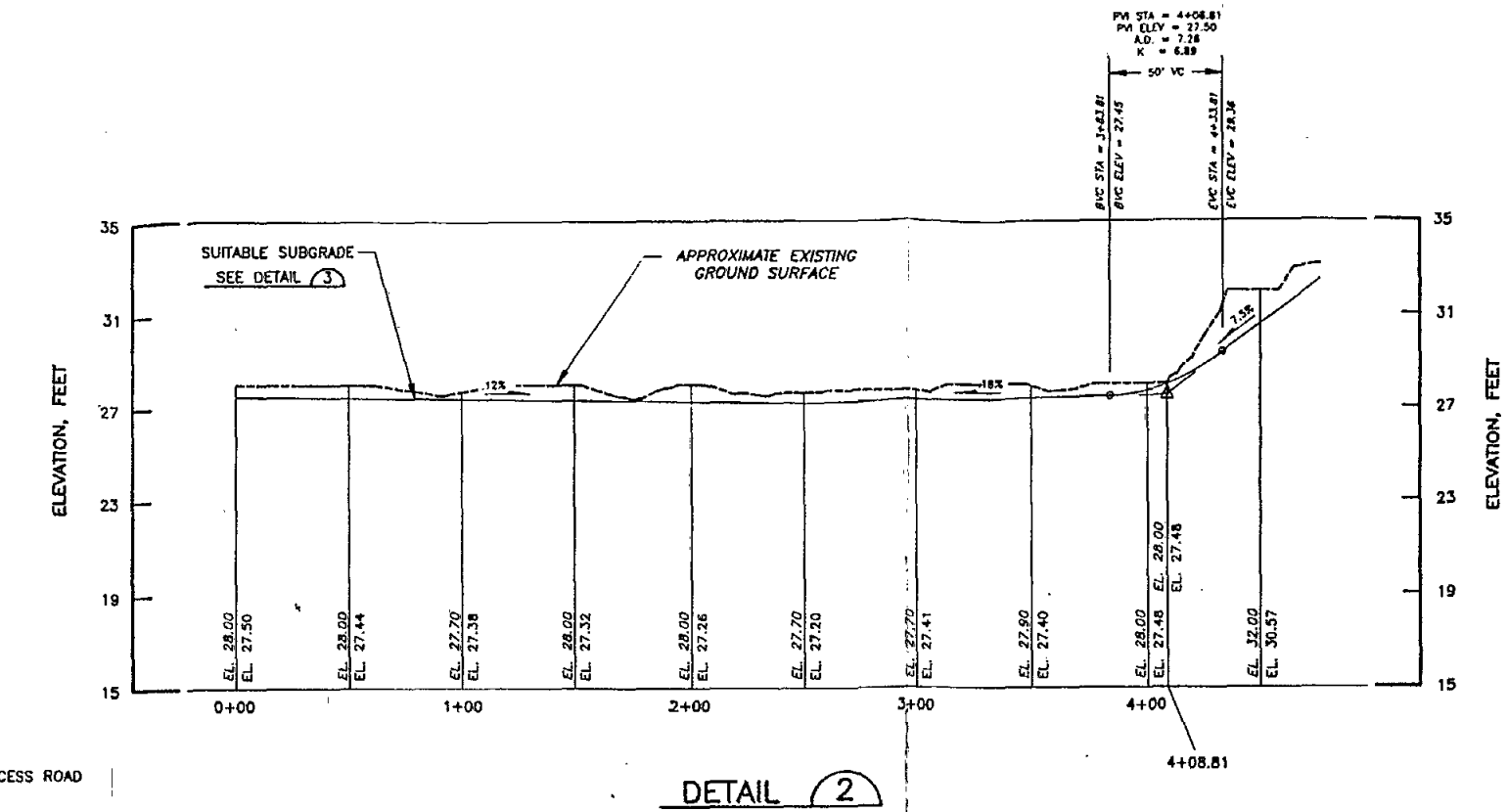


DETAIL (1)

PLAN VIEW OF PERIMETER ACCESS ROAD #1

SCALE

40 0 40 80 FEET



DETAIL (2)

PROFILE ALONG ℄ PERIMETER ACCESS ROAD #1

HORIZONTAL SCALE

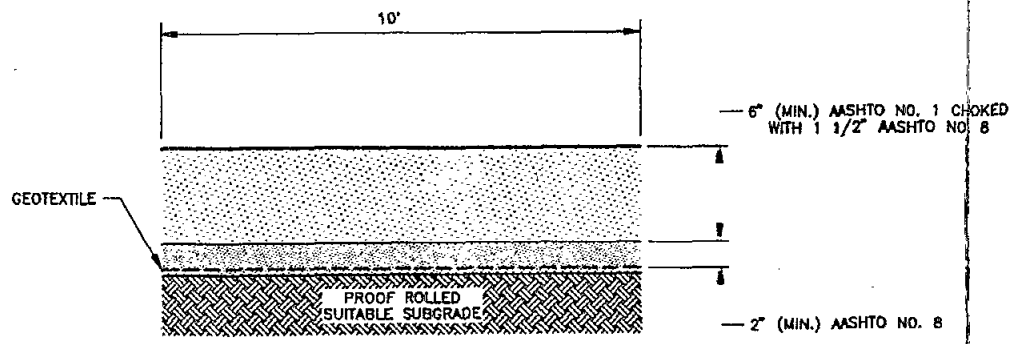
40 0 40 80 FEET

VERTICAL SCALE

4 0 4 8 FEET

℄ PERIMETER ACCESS ROAD #1 STAKEOUT DATA

STATION	NORTH	EAST
0+00	602,057	447,647
0+50	602,077	447,601
1+00	602,104	447,559
1+50	602,129	447,516
2+00	602,123	447,467
2+50	602,112	447,418
3+00	602,101	447,418
3+50	602,095	447,320
4+00	602,118	447,277
4+50	602,164	447,260
4+75.98	602,190	447,265



DETAIL (3)

COMMON PERIMETER ACCESS ROAD

(NTS)

LEGEND:

EL. 28.00 *EXISTING GROUND SURFACE ELEVATION*

EL. 27.50 SUBGRADE ELEVATION

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE

DRAWING TITLE:

PERIMETER ACCESS ROAD #1
PLAN, PROFILE AND DETAIL

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 20

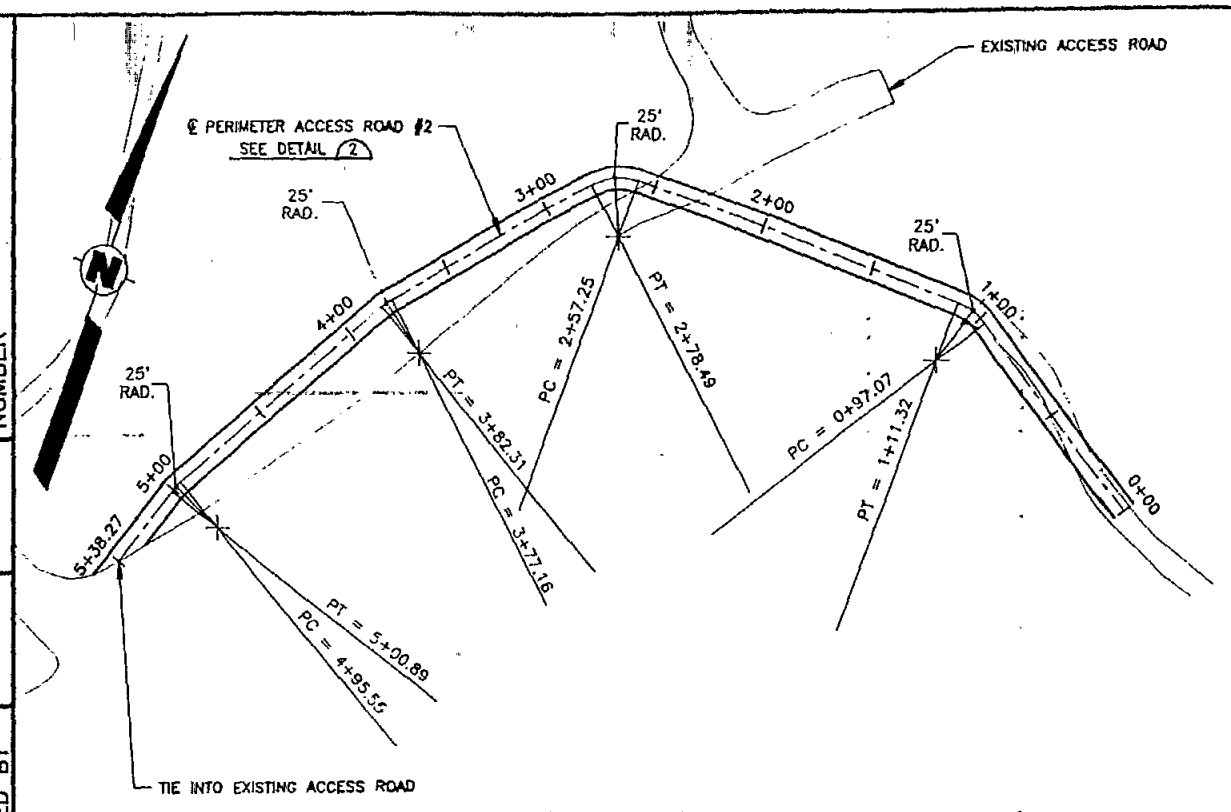
AR303986

CAD FILE NUMBER 92-11 E58

CHECKED BY | APPROVED BY

DRAWN BY T.J. 7-15-93

PLOT 1:40

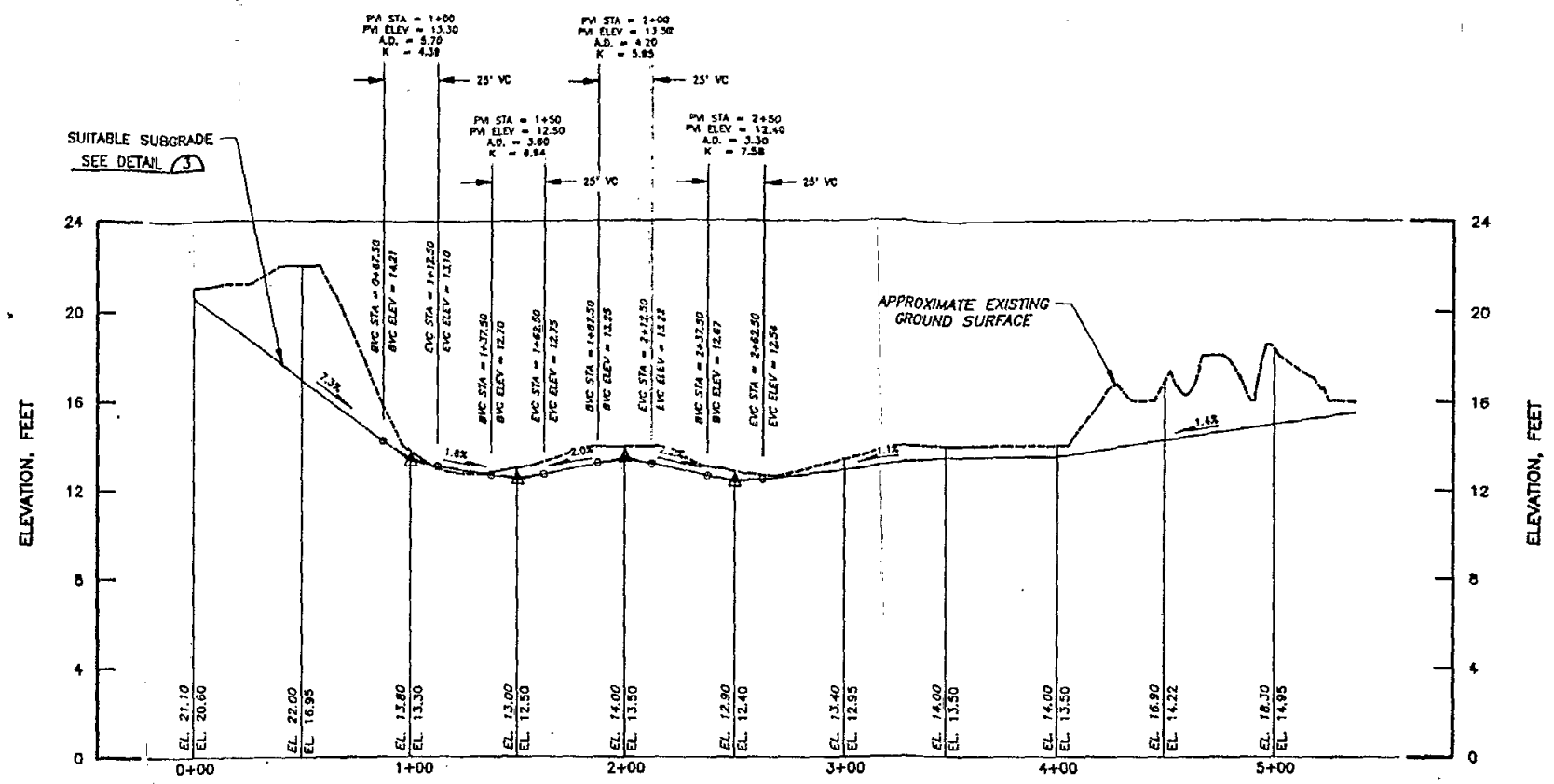


DETAIL 1

PLAN VIEW OF PERIMETER ACCESS ROAD #2

SCALE

40 0 40 80 FEET



DETAIL 2

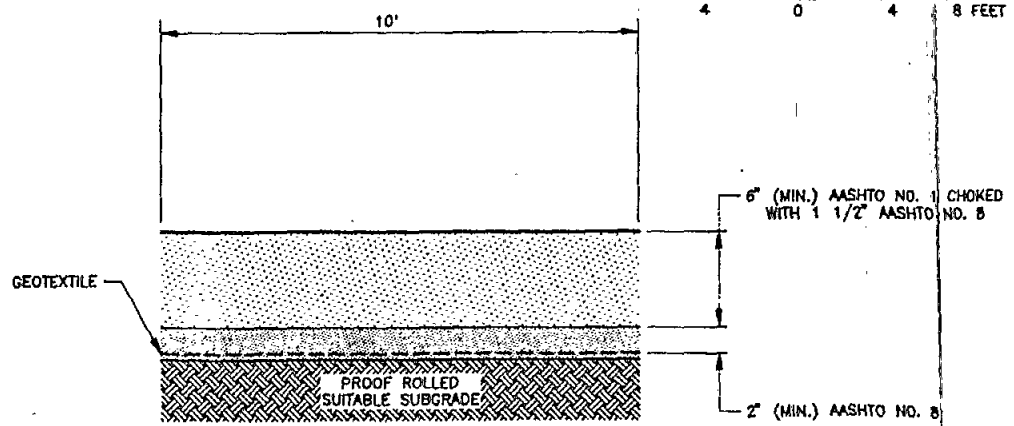
PROFILE ALONG ℄ PERIMETER ACCESS ROAD #2

HORIZONTAL SCALE

40 0 40 80 FEET

VERTICAL SCALE

4 0 4 8 FEET



DETAIL 3

COMMON PERIMETER ACCESS ROAD

(NTS)

℄ PERIMETER ACCESS ROAD #2 STAKEOUT DATA

STATION	NORTH	EAST
0+00	601,907	447,158
0+50	601,935	447,116
1+00	601,962	447,074
1+50	601,965	447,025
2+00	601,966	446,975
2+50	601,966	446,925
3+00	601,942	446,884
3+50	601,905	446,851
4+00	601,865	446,821
4+50	601,822	446,795
5+00	601,778	446,771
5+38.27	601,742	446,759

LEGEND:

EL. 28.00 *EXISTING GROUND SURFACE ELEVATION*

EL. 27.50 SUBGRADE ELEVATION

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:

INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE

DRAWING TITLE:

PERIMETER ACCESS ROAD #2
PLAN, PROFILE AND DETAIL

PREPARED FOR:

DS&G TECHNICAL COMMITTEE

Paul C. Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO. 21

AR303987

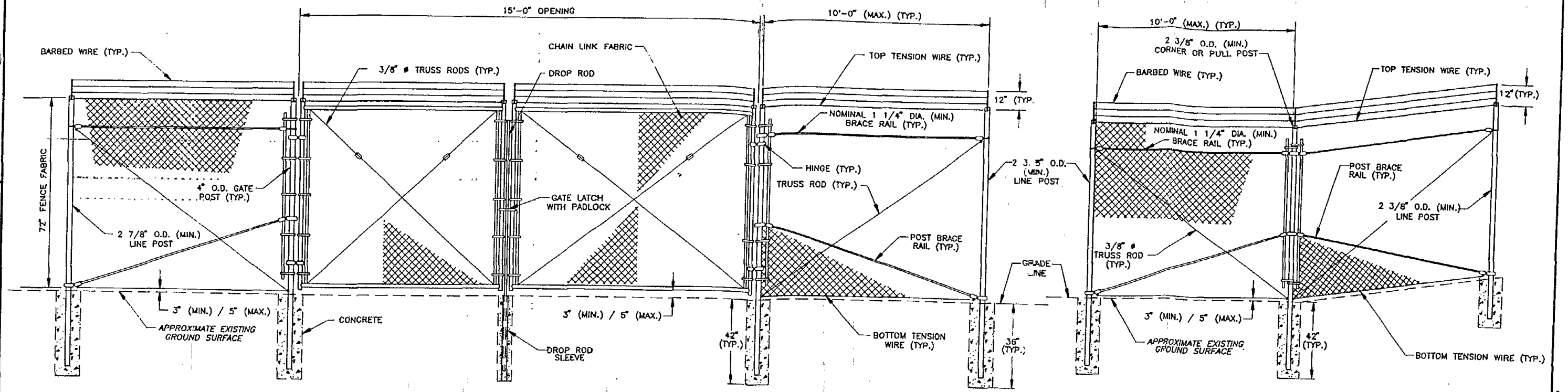
CAD FILE NUMBER 92-30-E41

CHECKED BY

APPROVED BY 5-11-93

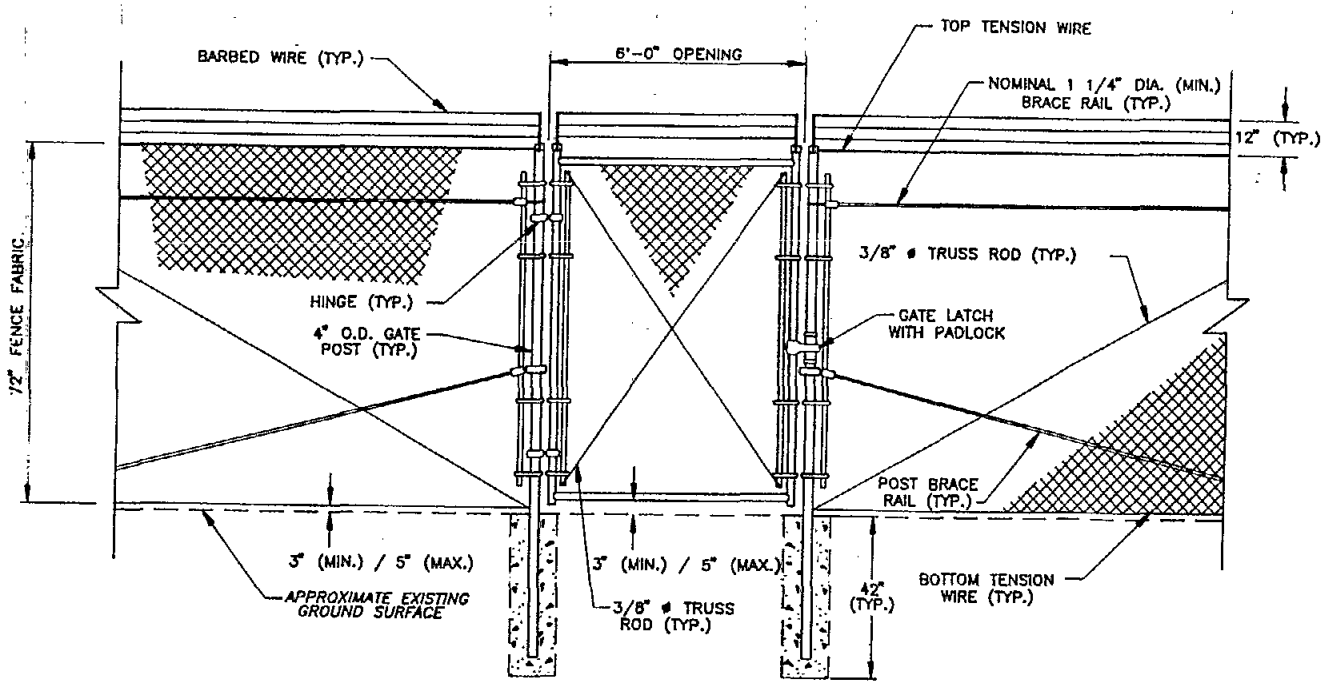
DRAWN BY

PLOT 1:1



VEHICLE GATE
(NTS)

CORNER OR PULL POST DETAIL
(NTS)



PERSONNEL GATE
(NTS)

GENERAL NOTES:

1. DETAILS SHOWN ARE TO CLARIFY AND ILLUSTRATE REQUIREMENTS GIVEN IN THE SPECIFICATIONS AND ARE NOT INTENDED TO LIMIT OTHER TYPE OF FENCE SECTIONS AND METHODS OF INSTALLATION.
2. GATE FRAMES SHALL BE ASSEMBLED USING HEAVY FITTINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER RIGID CONSTRUCTION OF ALL GATES.
3. VEHICLE GATE SHALL BE CONSTRUCTED WITH DROP ROD AND PADLOCK.
4. CONCRETE FOR POSTS SHALL CONFORM TO SECTION 812, CLASS B CONCRETE AS DEFINED IN THE LATEST REVISION OF THE DELDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION

NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

PROJECT:
INERT AREA CAP DESIGN
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

DRAWING TITLE:
FENCE AND GATE DETAILS

PREPARED FOR:
DS&G TECHNICAL COMMITTEE

Paul C. Rizzo Associates, Inc.
CONSULTANTS

DRAWING NO.
22

AR303988

APPENDIX E

DUNN GEOSCIENCES
MONITORING WELL BORING LOGS

BAN.DOC/93

AR303990

AR303992

Light gray & orange tan & pink red mottled Silty Clay, trace (-) fine Gravel

AR303994

APPENDIX E

DUNN GEOSCIENCES
MONITORING WELL BORING LOGS

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-1c
PROJECT Delaware Sand and Gravel Landfill RI		
CLIENT DNREC, State of Delaware		SHEET 1 OF 1
DRILLING CONTRACTOR Warren George, Inc.		JOB NO. 560-2-4453
PURPOSE Monitoring Well Installation - Phase II		ELEVATION 39.07' amsl

GROUNDWATER			CASING	SAMPLE	CORE	DATUM land surface
DATE	TIME	DEPTH	CASING	TYPE		None Taken	DATE STARTED 2/25/86
				DIAMETER			DATE FINISHED 2/25/86
				WEIGHT			DRILLER Tony Tirro
				FALL			INSPECTOR Glenn Combes

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
						E.O.B. 30'	
						Lockable steel protective casing	
5						Grout (cement and bentonite)	0 - 13.5'
						Bentonite seal	13.5- 16.5'
						Sand pack (Morie #1)	16.5- 29.0'
						Sand fill	29.0- 30.0'
						Stick up PVC	1.93'
						Riser (Sch. 40, flush joint, 4" PVC)	1.93 - 21.3'
						Screen (Sch. 40, flush joint, 10-slot PVC)	19 - 29'
10							
15							

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-6102	TEST BORING LOG	BORING NO.
PROJECT Delaware Sand and Gravel Landfill RI		DGC-1s
CLIENT DNREC, State of Delaware		SHEET 1 OF 1
DRILLING CONTRACTOR A. C. Schultes & Sons Inc.		JOB NO. 560-1-4033
PURPOSE Monitoring Well Installation - Phase I		ELEVATION 38.60' amsl

GROUNDWATER					CASING	SAMPLE	CORE	DATUM land surface
DATE	TIME	DEPTH	CASING	TYPE	Mud Rot			DATE STARTED 3/8/85
				DIAMETER	8.75"			DATE FINISHED 3/8/85
				WEIGHT				DRILLER Albert Hammond
				FALL				INSPECTOR Rodney Sutch

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
5						E.O.B. 103'	
						Lockable steel protective well casing	
						Grout (cement & bentonite)	0-85'
						Bentonite seal	85-88'
						Sandpack (#1 Morie Sand)	88-103'
10						Stickup PVC	1.61'
						Riser pipe (sch. 40, flushjoint, 4" PVC	+1.61 - 90'
						Screen (sch. 40, 20 slot, flushjoint, 4" PVC)	90 - 100'
15							

'INN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO.
PROJECT Delaware Sand and Gravel Landfill RI		DGC-1d
CLIENT DNREC, State of Delaware		SHEET 1 OF 8
DRILLING CONTRACTOR A. C. Schultes & Sons Inc.		JOB NO. 560-1-4033
PURPOSE Monitoring Well Installation - Phase I		ELEVATION 38.80' amsl

GROUNDWATER					EXISTING	SAMPLE	CORE	
DATE	TIME	DEPTH	CASING	TYPE	Mud Rot	S-S		DATUM land surface
3/8/85	8:10	41.5'		DIAMETER	8.75"	2"O.D.		DATE STARTED 3/5/85
				WEIGHT		down the rod		DATE FINISHED 3/7/85
				FALL		sampling		DRILLER Albert Hammond
								INSPECTOR Rodney Sutch

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
		S-1				cbl & G fill (~ 1') cobble & Gravel fill	didn't attempt a SS sample
5		S-2		SW		Br cmfS, 1(+)$, t(+)mfG	Rec = .5 Dry
10		S-3		SW		Tn1tbr cmfS, t(-)$, t(-)fG	Rec = .6 Dry
						Tan light brown coarse to fine SAND, trace (-) Silt, trace (-) fine Gravel	
		S-4		SP		Ltbr cm(+)fS, t$	Rec = .7 Dry

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-1d
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 2 OF 8
CLIENT DNREC, State of Delaware		JOB NO. 560-1-4033

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
20		S-5		SP GP		20.5 OrBr cm(+)fS, t$ OrBr fG l, cmfS, t$	Rec = .6 Moist
25		S-6		GW		Orbr $c^{(+)}$mfS, $t^{(-)}$$, a mfG Orange brown coarse (+) to fine Sand trace (-) Silt, and medium to fine Gravel	Rec = .3 WET sample may have been wash
						(COLUMBIA)	
30		S-7		ML-CL		(UPPER POTOMAC) Or & ltgr C&S alt lyr; frqt bk pkt (lignite?), frqt mica grains, lower section c$	Rec = .9 Moist
35		S-8		GW CL		Br mfG s, cmfS, l grbrCy$ 35.8 Ltgr & rd mtld $yC	Rec = 1.1 WET lg cbl @ 36'
40		S-9		CL		Ltgr & ortn & pink rd mtld $yC, $t^{(-)}$ fG	
						Light gray & orange tan & pink mottled Silty Clay, trace (-) fine Gravel	

GUINN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-Id
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 3 OF 8
CLIENT DNREC, State of Delaware		JOB NO. 560-1-4033

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
45		S-10		CL		Rd-purple rd & lt gr mtld $yC, frqt br $yC prt (very stiff clay)	Rec = .9 Dry
						Red to purple red & light grey mottled Silty Clay, frequent brown Silty Clay partings	
50		S-11		CL		Gr$yC; grCy$lyr, frqt bk pkt (∿ 1mm) (very stiff C)	Rec = .9
55		S-12		CL		Ltgr $yC w frqt pkt & seams rd & dkgn $yC (very stiff C)	Rec = .9 Dry
						Light grey Silty Clay with frequent pockets & seams red & dark green Silty Clay	
60		S-13		CL		Ltgr C&$; frqt bk pkt (∿ 1mm) (very stiff C)	Rec = .8 Dry
65		S-14		CL		Ltgr $yC; frqt bk pkt (∿ 1mm) (lignite ?) (very stiff C)	Rec = 1.1
						Light grey Silty Clay; frequent black pockets (∿ 1mm) (lignite ?) (very stiff Clay)	

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-1d
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 4 OF 8
CLIENT DNREC , State of Delaware		JOB NO. 560-1-4033

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
75		S-15		CL		Lt gr $yC; frqt S seam w abundant Lignite fgmts (very stiff C)	Rec = 1.0 WET
78		S-16		CL SP		Lt gr $yC - 75.3 Lt gr fS, l$	Rec = .6 WET
80						lignite	
		S-17		CL		- 80.3 Lt gr $yC w lignite fgmt	Rec = .6 WET
85		S-18		CL		Dk gr $yC (hard C) Dark grey Silty Clay (hard Clay)	Rec = 1.0
90							
		S-19		SP		Lt gr - tn fS, t(-)$; lyr bk lignite fgmts, quartz Sand	Rec = .3 WET

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-1d
PROJECT Delaware Sand and Gravel Landfill		SHEET 5 OF 8
CLIENT DNREC, State of Delaware		JOB NO. 560-1-4033

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
		S-20		SP		Lt br fS, t(-)$ (quartz sand) Light brown fine SAND, trace (-) Silt (quartz sand)	Rec = .3 WET (over 200 blows)
100		S-21		SP		Lt br fS, t(-)$ (quartz sand)	Rec = .2 WET (over 200 blows)
105		S-22		SP		Lt br mfS, t(-)$ (quartz sand)	Rec = .2 (200 blows)
110		S-23		CL		Ltgr & rd mtld SyC; or tn Cy$ seam (hard C) Light grey & red mottled Silty CLAY; orange tan Clayey Silt seam (hard clay)	Rec = 1.0
115		S-24		SP		Or-tn mfS, t(-)$	Rec = .2 WET

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-1d
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 6 OF 8
CLIENT DNREC , State of Delaware		JOB NO. 560-1-4033

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
120		S-25		SP		Wt-ltgr-or fS, t(-)$; frqt bk S seam, quartz sand except for bk S seam	Rec = .3 WET
125		S-26		SP		Wt-tn-br m(+)fS, t(-)$; quartz sand White to tan to brown medium (+) to fine SAND, trace (-) Silt; quartz Sand	Rec = .3 WET
130		S-27		SP		Ltbr-tn c(+)mfS, t(-)$, t fG; ltgr & pink $yC seam	Rec = .5 WET
135		S-28		SP		Wt-lt gr fS, t(-)$	Rec = .2 WET
140		S-29		SP		Wt-tn fS, l$; lt gr $yC seam White to tan fine SAND, little Silt; light grey Silty Clay seam	Rec = .5 WET

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-6102	TEST BORING LOG	BORING NO. DGC-Id
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 7 OF 8
CLIENT DNREC, State of Delaware		JOB NO. 560-1-4033

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
145		S-30		SP		Ortn $mf^{(+)}S$, $t^{(-)}$$	Rec = .2 WET
150		S-31		SP		Ltbrtn fS, $t^{(-)}$$; Wt-ltgr fS & $ seam	Rec = .3 WET
						Light brown tan fine SAND, trace (-) Silt white to light grey fine Sand & Silt seam	
155		S-32		SP		Br yw mf S, $t^{(-)}$$; rd br fS & $ seam	Rec = .3 WET
160		S-33		SP		Lt br mfS, $t^{(-)}$$	Rec = .2 WET
						Light brown medium to fine SAND, trace $^{(-)}$ Silt.	
165							No sample taken

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-1d
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 8 OF 8
CLIENT DNREC, State of Delaware		JOB NO. 560-1-4033

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
170						(UPPER POTOMAC)	
						(MIDDLE POTOMAC (?))	No sample taken Clay detected in drilling at 170'
175							
		S-34		CL		Dk gr & rd pink mtld SyC; very stiff, 2 lt gr & red pink thn SyC lyr - soft	Rec = .9 WET
						E.O.B 176' (sampled to 177')	
						Lockable steel protective casing	
						Grout (portland cement & bentonite)	0-125'
						Upper bentonite seal	125-128'
						Sand pack (#1 Morie Sand)	128-143.5'
						Lower bentonite seal	143.5-146'
						Sand fill	146-176'
						Stick up (PVC)	0.85'
						Riser pipe	+0.85 - 130'
						Screen (Sch. 40, flush joint, 4", 20 slot PVC)	130 - 140'

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO.
PROJECT Delaware Sand and Gravel Landfill RI		DGC-9c
CLIENT DNREC, State of Delaware		SHEET 1 OF 1
DRILLING CONTRACTOR Warren George, Inc.		JOB NO. 560-2-4453
PURPOSE Monitoring Well Installation - Phase II		ELEVATION 39.90' amsl

GROUNDWATER					CASING	SAMPLE	CORE	DATUM land surface
DATE	TIME	DEPTH	CASING	TYPE	Mud Rot	N/A	N/A	DATE STARTED 3-24-86
				DIAMETER	8"			DATE FINISHED 3-24-86
				WEIGHT				DRILLER Tony Tirro
				FALL				INSPECTOR Duane A. Wanty

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
						E.O.B. 28'	
						Lockable steel protective casing	
						Grout (cement and bentonite)	0-11'
						Bentonite seal	11-14'
						Sand pack (Morie #1)	14-28'
						Stick up (PVC)	1.75'
10						Riser (sch. 40, flush joint, 4" ID PVC)	+1.75 - 16'
						Screen (sch. 40, flush joint, 4" ID slot 10 PVC)	16 - 26'
15							
20							

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO.
PROJECT Delaware Sand and Gravel Landfill RI		DGC-9s
CLIENT DNREC, State of Delaware		SHEET 1 OF 1
DRILLING CONTRACTOR Warren George, Inc.		JOB NO. 560-2-4453
PURPOSE Monitoring Well Installation - Phase II		ELEVATION 39.90' amsl

GROUNDWATER					CASING	SAMPLE	CORE
DATE	TIME	DEPTH	CASING	TYPE			
				DIAMETER			
				WEIGHT			
				FALL			

DATUM land surface
DATE STARTED 3-21-86
DATE FINISHED 3-24-86
DRILLER Tony Tirro
INSPECTOR Duane A. Wanty

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
							no sampling
						E.O.B. 102'	
						Lockable steel protective casing	
5						Grout (cement and bentonite)	0-75'
						Bentonite seal	75-78'
						Sand pack (Morie #1)	78-102'
						Stick up (PVC)	1.61'
10						Riser (sch. 40, flush joint, 4" ID PVC)	+1.61 - 80'
						Screen (sch. 40, flush joint, 4" ID slot 10 PVC)	80 - 100'
15							

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-9d
PROJECT Delaware Sand and Gravel Landfill RI		
CLIENT DNREC, State of Delaware		SHEET 1 OF 8
DRILLING CONTRACTOR Warren George, Inc.		JOB NO. 560-2-4433
PURPOSE Monitoring Well Installation -- Phase II		ELEVATION 39.90' amsl
GROUNDWATER	CASING / SAMPLE / CORE	DATUM land surface
DATE / TIME / DEPTH / CASING	TYPE: Mud Rot. / Split Spoon / N/A	DATE STARTED 3-6-86
	DIAMETER: 8" / 2" or 3"	DATE FINISHED 3-7-86
	WEIGHT: / 140# or Slip Jars	DRILLER R. Gregory
	FALL:	INSPECTOR G. Combes

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
		S-1	7 8 9 9	SP		Br m(-)f(+) S, a(+) S&C; rts	Rec = 1.2' Moist HNU=Ambient=0.5 ppm 140# hammer
5		S-2	3 3 2 1	ML		Br S&C s(-). vfS; rts	Rec = 1.5' Moist HNU=Ambient 140# hammer
10		S-3	3 3 3 4	ML		Or Br S&C s, vfS	Rec = 1.5' Moist HNU=Ambient 140# hammer
						Oranze Brown SILT and CLAY some. fine SAND	
15		S-4	2 2 - -	ML		Or Br S&C s, c(-)f(+) S	Rec = 1.4' Moist HNU=Ambient 140# hammer

DUNN GEOSCIENCE CORPORATION
THAM, NEW YORK (518) 783-8102

TEST BORING LOG

BORING NO. DGC-9d

PROJECT Delaware Sand and Gravel Landfill RI

SHEET 2 OF 8

CLIENT DNREC, State of Delaware

JOB NO. 560-2-4453

DEPTH IN FT. / CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
	S-5	2 3 4 6	ML SW		0-0.7 Br S&C t. fS 0.7-1.5 Rd Br c(-)m(-)f(+)S, t(-)S	Rec = 1.5' WET HNU=Ambient Slip Jar
					Red Brown coarse to fine SAND	
	S-6	5 7 7 8	SW		Rd Br & Rd c(-)mf(+)S, s(+) cm(+) fG ---27.0'--- (COLUMBIA) (UPPER POTOMAC)	Rec = 1.2' WET HNU=Ambient Slip Jar
	S-7	4 9 8 10	CH		Lt Gr & Rd SyC; variegated	Rec = 1.5' Moist HNU=Ambient 2" Split Spoon
	S-8	2 2 3 6	CL		Lt Gr & Rd C&S; variegated	Rec = 2.0' Moist HNU=Ambient 2" Split Spoon
	S-9	4 5 5 7	CH		Lt Gr & Rd C&S; variegated	Rec = 1.8' Moist HNU=Ambient 2" Split Spoon

DUNN GEOSCIENCE CORPORATION ALBANY, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-9d
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 3 OF 8
CLIENT DNREC. State of Delaware		JOB NO. 560-2-4453

CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
	S-10	2 3 4 5	CH		Rd Gr SyC; lyrs Gr S; occ prts Gr S	Rec = 2.0' Moist HNU=Ambient
	S-11	9 6 6 11	CL		Gn Br & Lt Gr & Rd S s(+), SyC; variegated; lyr c(-)mfS; lignite	Rec = 1.8' Moist HNU=Ambient
	S-12	6 7 9 11	CL		Br & Gr S&C l(-), mS; silt nodules	Rec = 2.0' Moist HNU=Ambient
					Red and Grav CLAY and SILT: variegated	
	S-13	4 5 12 14	CL		0-1.0' Lt Gr & Rd SyC; variegated 1.0-1.9' Gr & Yw CyS	Rec = 1.9' Moist HNU=Ambient
	S-14	8 8 10 12	MH		Br & Yw c S; frqt lyrs Gr SyC; occ lyr Gr vfS	Rec = 2.0' WET HNU=Ambient

YN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO. DGC-9d
PROJECT Delaware Sand and Gravel Landfill RI		SHEET 4 OF 8
CLIENT DNREC, State of Delaware		JOB NO. 560-2-4453

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
5		S-15	6 3 8 9	CH		Gr S; occ lyr Gr SyC; occ lyr Gr vfS	Rec = 2.0' Moist HNU=Ambient 2" Split Spoon
10		S-16	6 9 14 16	CH		Dk Gr C&S; lyr Gr vfS, a(-) S	Rec = 1.8' WET HNU=Ambient 2" Split Spoon
15		S-17		SM		Lt Gr vfS, a(-)c S; lyr Gr C&S; lyr lignite	Rec = 1.8' WET HNU=Ambient 3" Split Spoon
20		S-18	8 14 20 29	SM		Gr vfS, a S; frqt prts lignite	Rec = 1.0' WET HNU=1.0 ppm 3" Split Spoon
		S-19	8 16 [illegible] 27	SM		Dk Gr & Yw vfS, a(-)S; frqt prts lignite	Rec = 1.5' WET HNU=Ambient 3" Split Spoon

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TEST BORING LOG

BORING NO. DGC-9d

PROJECT Delaware Sand and Gravel Landfill RI

SHEET 5 OF 8

CLIENT DNREC. State of Delaware

JOB NO. 560-2-4453

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
		S-20	10 17 23 31	SP		Br & Or Rd f S ; prt Lt Gr SyC; planar bedding	Rec = 1.4' WET HNU=Ambient 3" spoon
		S-21	5 7 7 11	SP		Or Br & Gn Br m f(+)S; lyr Gr m S	Rec = 0.8' WET HNU=Ambient 2" spoon
		S-22	9 17 20 29	CH SP		0-0.8 Rd & Gr SyC; frqt pkts Rd & Bk vfS, a c$; variegated 0.8-1.4 Or Br & Yw vfS ; prt hard Bk iron?	Rec = 1.4' WET HNU=Ambient 3" Spoon
						Orange Brown and Gray coarse(-) to fine(+) SAND: seams Light Gray Silty CLAY	
		S-23	11 22 16 19	SP		Br & Yw Or f S; prt hard Bk iron?	Rec = 1.4' WET HNU=Ambient 3" Spoon
		S-24	15 23 25 31	SP		Or Br & Wh f S; planar crossbedding; micaceous	Rec = 1.3' WET HNU=Ambient 3" Spoon

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?ATHAM, NEW YORK (518) 783-6102

TEST BORING LOG

BORING NO. DGC-9d

PROJECT Delaware Sand and Gravel Landfill RI

CLIENT DNREC, State of Delaware

JOB NO. 560-2-4453

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
		S-25	13 21 28 33	SW		Br & Or Br cmf S, s(-)mfG; occ seams Lt Gr $yC; micaceous	Rec = 1.2' WET HNU=Ambient
		S-26	16 24 27 30	SW		Or Br cm(+)f S	Rec = 1.5' WET HNU=Ambient
		S-27	15 20 30 33	SW		Lt Br c(+)mf(-)S; seams Lt Gr $yC	Rec = 1.7' WET HNU=Ambient
		S-28	12 18 23 33	ML		Lt Gr & Yw & Or $; prts Lt Gr $yC; micaceous	Rec = 1.55' Moist HNU=Ambient
		S-29	15 [illegible] [illegible] 37	ML		Lt Gr c $ t, vfS; occ prts Lt Gr $yC; micaceous	Rec = 1.1' WET HNU=Ambient

Light Gray Clayey SILT

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TEST BORING LOG

BORING NO. DGC-9d

PROJECT Delaware Sand and Gravel Landfill RI | SHEET 7 OF 8

CLIENT DNREC, State of Delaware | JOB NO. 560-2-4453

DEPTH Ft.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
143		S-30	9 14 20 22	MH		Lt Gr CyS; lyr C&S (at bottom)	Rec = 1.8' WET HNU=Ambient
153		S-31	10 22 29 35	SW		Lt Br Gn & Yw & Rd cmfS, l(-)mf G	Rec = 1.2' WET HNU=Ambient
						Gray and Yellow coarse to fine SAND, trace fine Gravel	
163		S-32	12 25 28 33	SW		Gr & Yw Wh cm(+)fS, tfG	Rec = 1.6' WET HNU=Ambient
173		S-33	17 20 24 31	SW		Gr & Wh & Yw c(-)mf(+)S, frqt seams Lt Gr SyC	WET HNU=Ambient
						∿ 163' Driller states gravel	(UPPER POTOMAC)
						∿ 164' Driller states Clay	(MIDDLE POTOMAC)
183		S-34		ML		0-1.2 Dk Gr C&S; occ lyr Gr S, t(-)vfS, t(-)fG, lignite 1.2-1.6 Rd CyS l(-), vfS	No Rec with 2" Spoon Rec = 1.6' with 3" Spoon Moist
						Red CLAY and SILT little(-), fine SAND	

DUNN GEOSCIENCE CORPORATION
LATHAM, NEW YORK (518) 783-8102

TEST BORING LOG

BORING NO. DGC-9d

PROJECT Delaware Sand and Gravel Landfill RI

SHEET 8 OF 8

CLIENT DNREC, State of Delaware

JOB NO. 560-2-4453

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSIFICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
170			8 8 12 22	CH		Lt Gr & Rd CSS; variegated	Rec = 1.4 Moist HNU=Ambient used 2" spoon
						E.O.B. 170 (sampled to 172)	
						Lockable Steel Protective Casing	
						Grout (portland cement and bentonite)	0-142'
						Bentonite Seal	142-145'
						Sand Pack (Morie Sand)	145-157'
						Sand Fill	157-170'
						Stick up (PVC)	1.99'
						Riser pipe (sch. 40, flush joint, 4"ID PVC)	+1.99 - 145'
						Screen (sch 40, flush joint, 4"ID, .010" slot PVC)	145 - 155'

APPENDIX F

CERTIFICATE OF COMPLIANCE

McLaren Hart

PROJECT COORDINATOR'S CERTIFICATE OF COMPLIANCE

FINAL DESIGN REPORT - INERT AREA CAP

I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete.

SIGNED: _____

Michael A. Barbara, P.E.
Project Coordinator - Delaware Sand and Gravel TSC

DATE: July 19, 1993

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