CLOSURE REPORT
(ENGINEER'S REPORT)

DESIGN OF FINAL LANDFILL CLOSURE
FOR THE
CITY OF BEACON DENNINGS AVENUE LANDFILL
DENNINGS AVENUE
CITY OF BEACON
DUTCHESS COUNTY, NEW YORK

PREPARED FOR:

CITY OF BEACON
427 MAIN STREET
BEACON, NY 12508

PREPARED BY:

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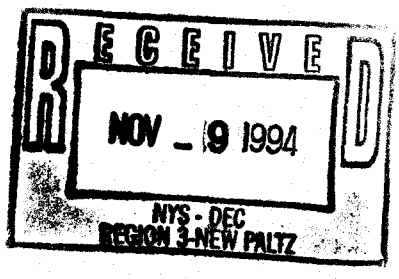

M/A #20275.00

APRIL 1993
REV. OCTOBER 1994

October 28, 1994

Mr. Fawzy I. Abdelsadek, Ph.D., P.E.
Environmental Engineer 2
New York State Department
of Environmental Conservation
21 South Putt Corners Road
New Paltz, New York 12561-1696

Re: Beacon Landfill Closure Plan
Response to Comments
Case # 3-0924/86-03
M/A #20275.00

Dear Mr. Adbelsadek:

The information contained within this correspondence as well as the revised Closure Plan (Engineer's Report dated revised October 1994) and and Drawings, enclosed, will resolve the comments detailed by the August 29, 1994 New York State Department of Environmental Conservation's comment letter and attachment 1. The Closure Plan documents are intended to allow the City to comply with the Consent Orders (COs) and 6 NYCRR Part 360 (rev. 5/28/91) concerning the closure of the Denning's Avenue solid waste facility.

The August 29, 1994 correspondence requested that the response should be in the form of a revised Closure Plan. The responses presented herein are intended to supply the Department with addendum information referencing the closure as well as indicating the location in the revised Closure Plan and closure drawings that the appropriate revisions are located.

Please refer to the revised closure construction schedule at your earliest convenience. The City, in employing force account labor, is intending to proceed with select phases of the closure construction during the remaining weeks of 1994 as they have labor forces available at this time. The City is intending to: perform clearing and grubbing as necessary to perform the work, install an all weather stone access road across the footprint, raise the sanitary manholes and perform the waste relocation. Performing the work at this period will allow for commencement of closure cap construction at the earliest weather permitting date in 1995 as well as reducing the hardship on the distribution of City work forces throughout 1995. The only comments applying to the proposed 1994 work concerns the waste relocation procedures. Please review the waste relocation procedures at your earliest convenience considering the City's proposed scheduling of that work. This response to comment letter duly functions as a notification to the Department of the start of this phase of the closure construction.

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The following response to comments parallel the alpha-numeric sequence of the August 29, 1994 correspondence.

A. Mandate Relief Request:

The variance requests are resubmitted herein on the appropriate forms as requested.

General Variance Conditions:

The following criteria have been met:

1. The City of Beacon has notified the public of the intent to apply for the variances detailed by reading a prepared statement at a City meeting opened to the public.

2. As mentioned in the August 29, 1994 comment letter, the City has satisfied the "stop accepting waste (SAW)" requirement.

3. The City has leased the Denning's Avenue landfill property which presents a minor complication to the "deed provision" requirement. Presently the City attorney is reviewing the City's options for fulfilling this requirement and feels confident that a public filing conforming to the departments requests is feasible. This office will notify the NYSDEC of the progress in this regard and requests that the Department grant conditional approval of the variances based on resolving this final issue.

1. Variance, Top Soil Layer:

The proposed topsoil per variance request is to consist of stripping approximately 3,000 yards of existing topsoil from the existing soil cap which will be blended with approximately 6,000 cubic yards of compost generated from the City's composting program. The compost consists of grasses, leaves and tree/shrub clippings collected by the City reduced in size using a tub grinder and composted for sixty (60) days. This finished compost product has a high organic content and is an excellent soil additive. Considering that it is to be mixed with topsoil stripped from the site, the variance "topsoil" material will support the proposed grassy final cover vegetation.

Written confirmation of the viability of the compost to support grassy vegetation published by the Cornell Cooperative Extension is provided in Appendix F.

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2. Variance, Barrier Protection Layer (BPL):

The City is proposing to apply twelve inches (12") of barrier protection soil over the entire footprint area which will have a geomembrane barrier layer. Accordingly the following information is provided

1. Resubmitted herein is the April 12, 1993 correspondence from the Loft's Seed, Inc. agronomist stating that the six (6") and twelve (12") inch thick subgrade soils will be capable of supporting the proposed seed mixture grasses and that the growth of the seed mixture will not damage the barrier layer.

2. A geomembrane barrier layer is proposed. Under approximately one half of the footprint will be the standard twelve inch (12") thick gas venting layer. This layer's construction utilizes a select granular soil which, due to the permeability requirement and proposed slopes, will provide an adequately drained subgrade condition to preclude frost heave impacts to the geomembrane. The "western half" of the footprint will be underlain by a minimum three inch (3") thick layer of this same select granular material. This three inch layer will also provide adequate subgrade drainage conditions, due to the same permeability and slope criteria previously referenced, preventing frost heave impacts to the barrier layer.

3. Variance, Gas Venting Layer II:

The proposed gas venting system along the "western half" of the footprint has been revised as follows. The trenches have been removed from the design. A minimum of four (4) vents per acre will be installed within the limits shown on the closure drawings, note the demarcation line, which is approximately 5.2 acres thereby requiring a minimum of 21 vents. A three inch (3") thick select granular layer will be placed across this "western half" of the footprint and will perform a threefold function. First the select soil will allow for adequate drainage of the subgrade in accordance with the Department's request for granting the BPL variance request. Secondly, the three inch soil layer will satisfy the geomembrane manufacturer's/installers subgrade gradation recommendation. Finally this three inch layer will act as a gas collection media preventing the build-up of decomposition gases under the four vent per acre area by connecting all gas vent structures with a "blanket" style highly permeable layer.

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1. There is a minimum of four (4) vents per acre proposed for the "western half" of the landfill final cap as previously described. Refer to the Gas Venting System Plan for the locations and number of the proposed vents. Refer to the detail sheet for the "Stand-Alone" Gas Vent Riser detail showing the minimum depth of penetration into the waste to be five feet (5').

2. Quarterly post-closure gas monitoring has been included in the post-closure monitoring and maintenance manual. There are no habitable structures on site or in close vicinity off-site where gas monitoring would be effective thus none is proposed. Post-closure gas monitoring will be performed using the procedures described in the post-closure monitoring and maintenance manual to assure that explosive gases do not exceed twenty-five percent (25%) of the lower explosive limit (LEL) any where along the property line or outside the limits of the footprint. If monitoring levels exceed 25% LEL then the Department will be immediately notified and contingency measures as described in the post-closure monitoring and maintenance manual will be affected.

B. Comments on the Closure Plan(CP):

1. Included in the revised Closure Plan (RCP) is a copy of the December 10, 1992 correspondence from Richard W. Baldwin, P.E., Supervisor of the Landfill Closure Section, Division of Solid Waste which indicates that the Closure Investigation Report (CIR) is approved. A "Conclusions and Recommendations pursuant to the CIR" section has been added to the RCP which details the proposed actions of the landfill closure. Preparation and resubmission of a CIR therefore does not appear necessary pursuant to this previous approval.

2. A construction detail describing the installation of a perimeter anchor trench has been added to the Detail Sheet of the revised construction drawings. This anchor trench will be installed along the entire perimeter of the landfill footprint as described on page 25 of Appendix A (QA?QC Manual) of the RCP.

3. Appendix A (QA/QC Plan) and Appendix C (Specifications) have been revised to reflect the quantity, source, frequency and number of testing, and schedule of placement of the barrier protection and topsoil layers. The revised construction schedule included in Section IV complies with the April 14, 1994 Modified Order on Consent. This information is briefly described in the following section:

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Barrier Protection Layer (BPL):

Estimated quantity required: 10,600 cu. yds. of 3/8" minus material
10,600 cu. yds. of 4" minus material

Source: Local soil mines capable of meeting the specification or "County bid" soil suppliers that the City has access to through previous County bid.

Frequency/Number of Tests: Particle Size (ASTM D422)
3 per source to qualify borrow source
1 per 1,000 cu. yds. delivered
Standard Proctor (ASTM D698)
1 per source
1 per 5,000 cu. yds. delivered
Nuclear Density/Moisture (ASTM D2922)
9 per acre per lift

Note: The testing listed above is recommended for the placement of BPL soils as referenced by Appendix D. Atterburg, Permeability, and Moisture-Density-Permeability tests are not recommended as the percent fines specified would make the performance of Atterburg Limits testing useless and as no permeability standards exist for BPL, none are recommended.

Topsoil Layer:

Estimated quantity required: 9,000 cubic yards

Source: The City will be stripping approximately 3,000 cu. yds. of material from the exist soil cap. The remaining 6,000 cu. yds. will consist of City generated and supplied compost to be blended with the stripped topsoil to create an estimated 9,000 cu. yds. of "topsoil" per the variance request.

Frequency/Number of Tests: No tests are to be performed on the "topsoil" material. The existing topsoil has supported an adequate vegetated cover for the past nine (9) years (since the 1985 installation of the facility's clay and topsoil cap). When this topsoil is stripped and blended with organically rich compost, the soil will certainly support the establishment of a vegetated cover as per the certification from the Cornell Cooperative Extension.

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4. The post-closure monitoring and maintenance manual has been revised to include quarterly post-closure gas monitoring as described previously in section A.3.2. concerning the gas venting layer II variance.

5. Drainage calculations were provided in Appendix D which estimated the peak stormwater runoff volume for the lands contributing to the perimeter drainage ditch. These calculations were performed using the U.S.D.A.-S.C.S. TR-55 methodology and estimated the runoff for the 100 year, 24 hour rainfall event to be 27.92 cubic feet per second (c.f.s.) versus the 76.0 c.f.s. calculated capacity of the proposed ditch. These calculations will be revised to reflect the requested 25 year, 24 hour storm event analysis and included as appendix information of the RCP.

   The cross-section detail of the proposed perimeter drainage swale will be revised to include design/construction views of the final cap and waste mass locations. Also the proposed final centerline (longitudinal) slope and flow direction of the swale will be indicated on the Subgrade Recontouring and Final Grading Plans.

6. The City has determined that the detention pond design is the only timely and credible solution to stormwater management. Included in the drainage description is a copy of an undated contour map that shows the area in question had once discharged stormwater in the route proposed in the RCP. Accordingly this office has prepared addendum information briefly restated below that is included in Appendix C of the RCP.

   1. A detailed staged storage analysis using U.S.D.A.-S.C.S. TR-20 stormwater routing methodology has been provided. This TR-20 routing uses the TR-55 Curve Number and time of concentration descriptions for drainage area DA-1 and routes the collected runoff through the drainage swale and detention pond.

   2. The TR-20 computer model routing of the 25 year, 24 hour storm details the outfall from the detention pond and rip-rap spillway. The hydraulic performance of the perforated riser pipe and rip-rap spillway was calculated outside of the program and input as a cumulative hydraulic-elevation data table into the TR-20. The program input and output is included in Appendix C of the RCP.

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3. A minimal amount of water will percolate through the floor of the detention basin according to the site soils, hydraulic head and residence time of the collected runoff. The RCP contains an estimate of the amount of water to percolate through the basin during the 25 year, 24 hour storm event.

   The site soils in the vicinity of the detention basin are classified as either Made Land or Hudson Silty Clayey Loam according to soil survey mappings. The boring log for MW-5 (by Empire, 5/83) near the proposed detention basin shows grey varved silt and clay at a depth of 5 feet below existing grade which approximates the soils to be encountered in the floor of the basin. Slug tests of monitoring well 85-5 indicated a permeability of 6.8 x 10E-6 cm/sec. in the vicinity of the basin. Minimal runoff infiltraion will result due to these soils.

4. Plan and cross-sectional views of the proposed detention basin structure are included in the revised closure drawings detail sheet.

   The existing topography in the vicinity of the detention basin has been added to the revised closure drawings showing how stormwater runoff drains from the southwestern corner of the property and adjacent lands toward the Fishkill Creek due south of the facility. Also refer to sheet 6 of 10 (Storm Sewer RR Crossing Plan and Profile) from the April 1993, included in the Appendix C, for additional existing topography showing how this area drains to the Fishkill Creek.

7. The trench design and associated detail has been removed from the proposed closure drawings. As previously described in this correspondence, the proposed gas venting system for the "western half" of the landfill will consist of a minimum of four (4) vents per acre with the entire cap subgrade area overlain by a three inch (3") thick layer of select granular soil. This soil will perform a threefold purpose. It will allow for the collection of decompositional gases not directly intercepted by the "stand-alone" gas vents, allow for the geomembrane subgrade to freely drain thus preventing frost heave impacts to the barrier layer and the select granular soil will ensure a subbase acceptable to the geomembrane manufacturer/installer.

   The closure drawings have been revised to include a detail of the interface of the standard 12" gas venting layer and the proposed variance requested gas venting system.

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8. Section 360-2.10 specifically states that a contingency plan must be prepared to address, "contingencies during the construction and operation of a landfill.". In reviewing the language of section 360-2.10 it appears to refer to measures to be applied to operating facilities. Section 360-2.15 which details closure and post-closure criteria makes no apparent reference to section 360-2.10. Discussions with Mr. Abdelsadek concerning the intent of the need for a contingency plan indicate that this section of the RCP is to provide for contingencies during waste relocation and that modification of the Health and Safety Plan (Appendix E of the April 1993 CP) would suffice in this regard.

   The Health and Safety Plan has thus been revised as a Contingency Plan to address; equipment breakdown, air or water contamination due to waste relocation, fires, and spills or releases of toxic materials. As discussed in this comment, the Contingency Plan will address actions to be taken in the event of; on-site personal injury, fires, detection of explosive gases, dust, litter, odor, noise, equipment breakdown, vectors or release of toxic or hazardous substances.

   The Contingency Plan will not address the following issues as they will not arise during the course of waste relocation. Unusual traffic conditions will not be encountered as only dedicated force account labor and equipment will be utilized in the waste relocation and traffic congestion is not an issue. Contamination of public or private water supplies will not occur due to the extremely small area where waste relocation is to occur and the fact that no public or private water supply exists in the vicinity of the work (the City has public water service for the surrounding parcels and there are no wellheads or surface water intake structures in near vicinity to the work). Leachate collection and/or removal system problems will not occur as no such system is proposed within this RCP. Similarly the leachate storage facility being at or above capacity will not occur as no such storage facility is proposed.

9. As discussed previously, the City attorney is considering the options available to the City amend the parcel's deed as they lease the property upon which the landfill exists. The City is also in negotiations with the owner whereby the parcel ownership could be transferred to the City. The City proposes to file a map and information with the county clerk's office as requested by this comment. This office will notify the Department in addendum format as to the progress of negotiations in this regard.

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10. A revised closure construction schedule has been prepared in conjunction with the City and is included in the Section IV of the RCP.

11. There are presently no future uses for the closed site. Any future use for the site considered by the City will not adversely affect the final cover system.

12. With respect to the waste relocation operations the following items are offered to address the comments listed:

    1. A proposed time frame for the waste relocation is included in the resubmitted closure construction schedule as discussed in response #10 above.

    2. The work will be conducted so that the minimal amount of waste is exposed at any one time.

    3. The City has generated a considerable quantity of exempt material from demolition of streets and sidewalks during an on-going community development project. This material will be used as intermediate cover for the relocates wastes to be placed in the northeastern corner of the footprint. Waste relocation procedures slated for the northwestern and northeastern sections of the landfill will generate recontouring material for this designated area. Waste relocation will occur at only one small area at a time and a synthetic tarpaulin cover will be used as daily cover for this area of excavation until "clean" subgrade is encountered. Similarly a second synthetic tarpaulin will be used to cover the relocated "fill" until the proposed subgrade elevations are encountered at which time the intermediate cover will be installed to a minimum thickness of twelve inches (12").

       Waste relocation along the southern sections of the landfill will similarly use tarpaulins to cover the open excavations until "clean" subgrade is encountered. Recontouring soil fill presently imported into the site in this location will be used as daily and intermediate cover.

    4. Intermediate cover soil will be installed as described in items 12.3 above.

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5. One composite sampling for each of the three (3) areas of waste relocation will be conducted to determine if uncontaminated soil exists according to 360-2.18(e) (eff. Oct.9,1993) and pursuant to discussions with Mr. Abdelsadek although the City and this office question the validly of applying October 1993 6NYCRR Part 360 regulations. Each composite sampling will consist of collecting a minimum of five (5) individual soil samples at a depth of approximately two feet (2') below the limit of waste excavation. The location of the five samples will be spaced equidistantly within the limits of waste relocation area. These five (5) samples will be combined to form one (1) composite sample. The composite sample will be tested for Method 8021, 8270, herbicide, pesticide and toxic metals parameters using the TCLP guidelines and compared against the TCLP Extraction Guidance Values. If analytic values do not exceed the noted guidance values then the area will be deemed uncontaminated. Conversely, if significant exceedence of the parameter values are noted then soil excavation will continue to a depth of three feet below the existing grade and the soil sampling protocols repeated or the area will be capped in conformance with the landfill capping system proposed.

The following information is also included to address the waste relocation comments 13.5.a-e listed on page 5 of 6 of the comment letter:

Northwestern Waste Relocation: Wastes encountered along the northwestern area during the waste edge delineations conducted in April 1990 (test pits excavated to determine the footprint edge) consisted predominantly of incinerator ash placed in this location from the old City incinerator. The incinerator was decommissioned in 1975, an estimate of the waste age. It is estimated that approximately 1,200 cubic yards of material will be removed from this area before "clean" subgrade soils are encountered. The depth to groundwater in this area was noted to be approximately eight feet (8') below surface grade according to a nearby monitoring well static water elevations (wells 85-8 and 85-6).

Northeastern Waste Relocation: Wastes encountered in this area also consisted predominantly of incinerator ash mixed with some MSW according to the waste edge delineations. This waste is likely as old as that estimated for the northwestern area. Approximately 2,500 cubic yards of material will be relocated. The groundwater elevation is estimated to be approximately seven feet (7') below surface grade according to the static water elevation from a nearby monitoring well.

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Southern Waste Relocation: Wastes consisted of common bagged MSW, wood debris, some roofing shingles and tree stumps per the waste edge delineations. The landfill stopped receiving waste in 1983 thus this material is at least that old. It is estimated that at least 2,400 cubic yards of material will be relocated. The depth to groundwater is estimated at between approximately five and eight feet below surface grade according to the static water surface elevations for the two monitoring wells along the southern side of the facility.

The Contingency Plan (revised Health and Safety Plan) included in the appendix of the RCP will address the noted safety precautions to be taken.

13. No leachate collection system is proposed at this time because the closure construction measures will effectively isolate waters from the waste mass. Upgrades to the perimeter drainage ditch will effectively channel stormwater runoff from upslope lands away from the facility. The installation of the geomembrane barrier layer with an effective permeability of 1.0x10E-10 cm/sec. or less will effectively preclude surface water percolation into the waste mass.

Estimates of the leachate to be produced from a facility capped with a geomembrane barrier layer have been estimated using the U.S.E.P.A.'s Hydrologic Evaluation of Landfill Performance (HELP) computer model. This information is included in Appendix C of the RCP.

Leachate indicators have been recorded at various monitoring wells for the facility. The RCP proposes to perform the upgrades to the landfill cap and drainage systems, which should render the waste mass relatively impervious to water infiltration, and then monitor the groundwater to verify that a decreasing trend in leachate indicators occurs as predicted. The effective desiccation of the waste mass may take upwards of five years during which time the noted leachate indicators should drop below the MCL for those specific water quality parameters. This five year post-closure monitoring period coincides with the Department's prescribed five year review of the water quality monitoring program per Part 360. A review of the monitoring results will determine if adequate downtrending is occurring or if additional contingency measures should be considered. There are no private or public water supplies in the vicinity of the landfill as Beacon has City-wide public water therefore the monitoring program proposed will

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not endanger human health. Considering the minimal amount of leachate generated by the facility (and the relative small percentage that could be cost-effectively intercepted by a leachate collection system) there does not appear to be a benefit to any additional closure measures at this time. Additionally consider that the proposed closure measures should effectively isolate the waste mass thus rendering any such additional closure measures essentially useless in the near future.

14. As described earlier in this submittal, the quantity, source and testing procedures for the materials to be utilized in the closure construction have been detailed herein and included in the RCP.

15. As discussed earlier in this submission, a leachate collection system is not recommended at this time for the reasons detailed. Correspondingly no revisions to the post-closure monitoring and maintenance manual have been affected in this matter.

    The cover correspondence of the August 29, 1994 comment letter explains that comments concerning the post-closure monitoring and maintenance manual ("environmental monitoring aspects") will be forwarded to the Town in the near future. This office would prefer to make any and all revisions to this document at one time and and due to the lack of a proposed leachate collection system no revisions to this document have been affected.

16. Appendices and other miscellaneous typographical errors have been corrected as noted.

17. The City agrees to all three conditions to comment #17 concerning the importation of petroleum contaminated soil for use as subgrade recontouring.

18. The reference to the closure certification report publication is included in Section IV of the RCP.

If you should have any comments or questions, please do not hesitate to contact this office.

Very truly yours,

MORRIS ASSOCIATES

Jefferson H. Akins, P.E.
Senior Engineer

JHAc4/slt

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APPENDIX B - TECHNICAL SPECIFICATIONS

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APPENDIX D - CONTINGENCY PLAN

APPENDIX E - CLOSURE CONSTRUCTION DRAWINGS

APPENDIX F - VARIOUS CORRESPONDENCES

I. PURPOSE

This Closure Plan details the construction measures and supporting technical data associated with closing the City of Beacon, Dennings Avenue Landfill. The closure of the solid waste facility shall be conducted in conformance with 6 NYCRR Part 360 (rev. 5/28/91), the Orders on Consent and the variances submitted within this report. The variances are applied for as outlined by the Local Government Regulatory Relief Initiative Report (dated November 1992) issued by the New York State Office of Business Permits and Regulatory Assistance (OBPRA) and reviewed by informal workshop conference dated March 1, 1993 by the New York State Department of Environmental Conservation.

Application has been made and approved for this facility to receive State assistance monies under the Municipal Landfill Grant Assistance Program. It is the intention of the City of Beacon, as operators of the facility, to commence and complete the closure on or before the milestone dates listed with the LCSAP contract and Orders on Consent.

II. GENERAL INFORMATION

In 1964 the City of Beacon began operation of its newly constructed incinerator, located on Dennings Avenue, which served as the primary mode of waste disposal for the City. All waste which was not accepted by the incinerator was taken to the Riverfront Landfill where open burning occurred. Such waste included large, bulky metal items, highly combustible industrial waste and non-burnable material.

The closing of the Riverfront site in 1968 due to air pollution problems necessitated the opening of a new Landfill for the disposal of the non-burnable material. The new Landfill was sited, with New York State Health Department guidance on Dennings Avenue.

The City of Beacon Landfill is located at the south end of Dennings Avenue adjacent to and south of the City of Beacon Wastewater Treatment Plant. Immediately north of the treatment plant on Dennings Avenue is the City of Beacon Incinerator Building now being used as the City's recycling center, transfer station and composting facility. The facilities are located such that they are downgradient both topographically and hydrogeologically, from all nearby residential areas. The landfill encompasses approximately 11.5 acres on 16 acres of land leased by the City. The City is presently negotiating the transfer of ownership of the property with the owner as of the preparation of this Closure Plan.

Prior to the development of the landfill, the Dennings Avenue site was a clay mine supplying raw material for the local brick making industry. The property is surrounded on its south and western sides by railroads owned by Danbury Terminal Railroad Company and Metropolitan Transit Authority, respectively. The landfill is approximately 850 feet east of the Hudson River. The confluence of the Fishkill Creek and the Hudson River is approximately 1500 feet south of the landfill. Approximately 20 feet from the eastern edge of the landfill the ground rises precipitously to the nearby residential area.

In 1975 the incinerator was closed as ordered by the New York State Department of Environmental Conservation (NYSDEC). The Dennings Avenue Landfill thereafter served as the sole waste disposal site for the City of Beacon.

The Landfill accepted not only the non-burnable items rejected by the incinerator but also various industrial wastes from the City's industries, the ash generated by the incinerator and the sludge generated by the wastewater treatment plant. Documentation of the Landfill's operation indicates that the industrial waste was confined to the southern end of the Landfill with the ash and sludge disposed of in the northern end.

In 1983 the City of Beacon received notice that the Dennings Avenue Landfill was suspected of containing hazardous waste. For this reason, the site was included on the New York State Registry of Inactive Hazardous Waste Sites and classified 2a. The United States Environmental Protection Agency has also notified the City that the landfill is included on the CERCLA list of federal sites. In 1990-91, Morris Associates conducted investigations to determine the nature of drums excavated on site in the course of the waste edge determination. Sampling and field work associated with this investigation has been reviewed by the NYSDEC, Region 3 which issued a November 18, 1992 correspondence stating that the site is delisted from the New York State Inactive Hazardous Waste Registry and the City could proceed with standard Part 360 closure.

The Landfill site last received waste in 1985. At that time the site did not meet the New York State standards for solid waste facilities under 6 NYCRR Part 360. The NYSDEC therefore required the City to either upgrade the Landfill to the current standards or permanently close the site. In view of the limited capacity remaining in the Landfill and the high cost of construction to meet the current standards required for continued operation, the City of Beacon decided to close the Landfill.

In October of 1984, the NYSDEC issued a consent order requiring the permanent closure of the Landfill. The City of Beacon agreed to the consent order in which the closure plan prepared by Morris Associates was accepted by the NYSDEC. The closure plan called for the following: use of lime stabilized sewage sludge as part of the Landfill cover; placement of clay having a permeability rate equal to or less than 1×10^{-5} cm/sec as an additional part of the Landfill cover; installation of a gas venting system; the installation of a drainage ditch for the diversion of surface runoff; and the preparation of a hydrogeological study including the installation of groundwater monitoring wells to be used for future monitoring.

Since 1985 the clay cover has been installed along with topsoil and a vegetative cover. A hydrogeologic study was completed in December 1990 and groundwater monitoring for a specified list of parameters has occurred since 1986. The perimeter stormwater runoff diversion swale was installed in 1986. Delays in the construction of the other closure items at the Landfill has occurred due to approvals necessary from Conrail, though the property is now owned by the Danbury Terminal Railroad Company, to allow the installation of a drainage pipe beneath the southerly railroad property.

The City now wishes to complete the closure of the Landfill by upgrading the clay cover and installing the landfill capping system in accordance with the current 6 NYCRR Part

360 standards (rev. 5/28/91), Orders on Consent and submitted variances. This Closure Plan discusses in detail the design and construction of the landfill closure systems.

III. CLOSURE PLAN OVERVIEW

This Closure Plan and subsections of this report, briefly outlined and discussed below, have been prepared to ensure that the closure of the Dennings Avenue landfill is performed in accordance with 6 NYCRR Part 360 (rev. 5/28/91), the revised Orders on Consent and the submitted variances. The closure design is intended to fulfill the requirements necessary to receive State Assistance monies through the Municipal Landfill Closure State Assistance Program.

The Closure Plan consists of the following subsections or documents.

A) Closure Plan:

A discussion of the proposed closure measures for the Dennings Avenue landfill. This section also contains; a summary of the Closure Investigation Report approved December 16, 1992, the variance requests for closure activities as offered through the Local Government Regulatory Relief Initiative work report and discussed at the March 1, 1993 NYSDEC workshop meeting and supporting information.

B) Quality Assurance/Quality Control Plan:

Descriptions of the Quality Assurance/Quality Control (QA/QC) procedures (refer to Appendix A) to be executed ensuring the landfill closure is performed in accordance with the NYSDEC approved plans and documents.

C) Technical Specification:

Technical specifications detailing construction activities associated with the closure of the facility (refer to Appendix B).

D) Contingency Plan (formerly the Health and Safety Plan):

Recommended health and safety protocols to be incorporated into the waste relocation and closure construction phases of the project (refer to Appendix D).

E) Technical Data and Calculations:

Supporting technical data and calculations defining the viability of proposed closure construction operations (refer to Appendix C).

F) Closure Construction Drawings:

Plans of the proposed closure construction drawings and associated details are included in Appendix E of this report.

The Post-Closure Monitoring and Maintenance Manual has been made into a separate, stand alone document and is submitted with the revised Closure Plan.

The Manual includes instructions for monitoring and managing the closed facility to ensure that all components function as designed. Monitoring includes the quarterly sampling and analysis of specified

groundwater monitoring wells, post-closure maintenance and repair, if necessary, of components of the closed facility and quarterly post-closure gas monitoring procedures and protocols.

IV. SCHEDULE FOR SITE CLOSURE AND POST-CLOSURE ACTIVITIES

The Consent Order for the City of Beacon Dennings Avenue landfill is being revised as of the time this report is being prepared. The proposed milestone dates are presented below understanding that they may be subject to revision after publication of this report as required by Region 3 and/or main office NYSDEC.

As discussed earlier in this report, the facility was ordered closed by the NYSDEC in 1984 and as of 1985, has been closed with respect to receipt of solid waste and certain closure construction. The remaining closure activities are proposed to be completed by the dates stipulated by the closure construction schedule plan inserted as a plan size sheet in this section.

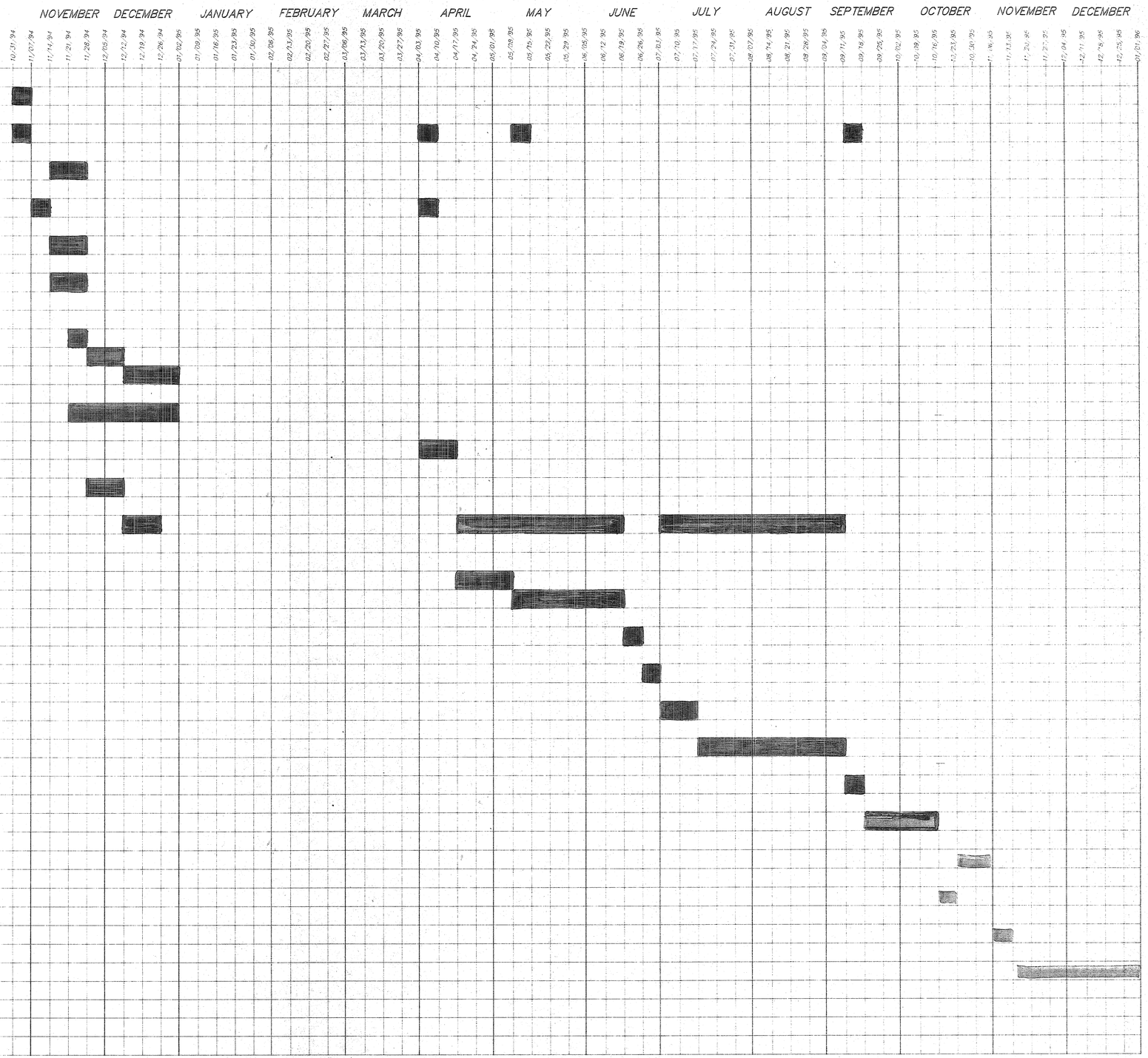
Project Description	Begin Date	End Date
Commence Closure Construction	11-11-95	
Completion of Closure Construction		11-15-95
Submission of Closure Certification Report		12-31-95

The proposed closure construction period, June 1, 1993 through November 15, 1995, is intended to allow for the maximum utilization of force account labor and equipment by

the City. A closure certification report prepared by a professional engineer licensed to practice in New York will be prepared and submitted to the NYSDEC within forty-five (45) days of completion of closure construction on December 31, 1995 whichever date occurs earliest.

Upon completion of the closure construction, the facility shall be inspected monthly as part of the post-closure maintenance program outlined in the Post-Closure Monitoring and Maintenance Manual or separate stand alone document. Quarterly groundwater monitoring of the facility has been performed since December 1986 and shall continue in the post-construction period for a minimum of five (5) years. At the end of the five (5) year period, the results of the monitoring program shall be reviewed by Region 3, NYSDEC to determine what changes in frequency, format or scope of testing may be appropriate. This five (5) year monitoring period will also be utilized to evaluate the effectiveness of the closure construction measures. Quarterly post-closure explosive gas migration and gas venting system monitoring will also be conducted for a period of five (5) years after which time the results will be reviewed with the NYSDEC to determine the adequacy and function of closure construction measures and potential revisions to the post-closure gas monitoring program.

BEACON LANDFILL CLOSURE CONSTRUCTION SCHEDULE



	DESCRIPTION
1	BOUNDARY SURVEY & STAKEOUT
1A	GRADE & STAKEOUT
2	CLEAR & GRUB
3	EROSION CONTROL
4	TOPSOIL – STRIP & STOCKPILE
5	SUBGRADE – STRIP & STOCKPILE
6	WASTE RELOCATION AREAS A B C
7	REINSTALL SUBGRADE COVER
8	INSTALL DETENTION POND & DRAINAGE DITCH REGRADE
9	SANITARY SEWER EXTENSIONS
10	QA/QC TESTING
11	GAS VENTING LAYER/SYSTEM
11A	PODS/INDIVIDUAL VENTS
11B	GEOTEXTILE & "BLANKET" SYSTEM
12	CUT ANCHOR TRENCH
13	PROOF ROLL ENTIRE SITE & GEOMEMBRANE INSTALLER INSPECTS
14	INSTALL GEOMEMBRANE BY OTHERS
15	INSTALL BARRIER PROTECTION LAYER
16	INSTALL ACCESS ROADWAY
17	INSTALL TOPSOIL
18	MISCELLANEOUS FINISH GRADING
19	SEED & MULCH
20	REINSTALL WELLS OR WELL CASING PIPES
21	AS-BUILT SURVEY & PUBLISH CONSTRUCTION CERTIFICATION REPORT

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS
LAND SURVEYORS
397 VIOLET AVENUE
POUGHKEEPSIE, NEW YORK 12601

DRAWING 9427SCHT.DWG
DATE 9/26/94

HUDSON RIVER

NEW YORK CENTRAL R.R.

DENNINGS AVE

SOUTH AVE

NEW HAVEN AVE

FISHKILL CREEK

YORK

SARGENT AVE

WODENETHE DR

ARGENT

HIGHWAY 9

SOUTH AVE

CHERRY

BEACON

MISERICORDIA NOVITIATE

ST. LAWRENCE SEMINARY

CITY OF BEACON DEPT. OF PUBLIC WORKS

SEWAGE DISPOSAL PLANT

INCINERATOR

CHIMNEY

TANK

RADIO TRANSMITTER TOWERS

RUINS

PARKING AREA

CONVEYOR

TENNIS COURTS

FIORENDA SCHOOL

SPILLWAY

RAPIDS

FALLS

GARDEN WALKS

POOL

PRIVATE SANITARIUM

HIGHLAND PREPARATORY SCHOOL

TRAIL

PILES

USC&GS SM "C 57" EL 5.492

USC&GS 6M-CUL EL. 3.921

T-19 A N 543 177.051 E 396 341.993

REV. No.	ZONE	DESCRIPTION	DATE	BY

CITY OF BEACON LANDFILL

CITY OF BEACON, DUTCHESS COUNTY, NEW YORK

DRAINAGE ALTERNATIVES

MORRIS & ANDROS
ENGINEERING CONSULTANTS
367 Violet Avenue, Poughkeepsie, New York 12601

DATE	SCALE	DESIGNED BY: MRG	FILE No.	DRAWING No.
MARCH 1985	1" = 200'	DRAWN BY: JAB	1954	of
		CHECKED BY: PJA		

APPENDIX A

QUALITY ASSURANCE/QUALITY CONTROL PLAN

FOR THE

CLOSURE OF THE

CITY OF BEACON DENNINGS AVENUE LANDFILL
CITY OF BEACON, DUTCHESS COUNTY, NEW YORK

PREPARED FOR:

CITY OF BEACON
427 MAIN STREET
BEACON, NEW YORK 12508

PREPARED BY:

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS
367 VIOLET AVENUE
POUGHKEEPSIE, NEW YORK 12601

PROJECT NUMBER:

20275.00

APRIL 1993
REVISED OCTOBER 1994

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I. INTRODUCTION

This report outlines the Quality Assurance (QA) and Quality Control (QC) Plan (QA/QC) for the construction activities relative to the closure of the Dennings Avenue Landfill in the City of Beacon, Dutchess County, New York. The QA/QC Report is intended to meet the requirements set forth in 6 NYCRR Part 360 - Solid Waste Management Facilities, effective December 31, 1988 and revised on May 28, 1991, the Orders on Consent for the facility and the variances granted to the project as defined by the closure plan section of this report. The objective of this report is to ensure adherence to the construction specifications in accordance with the NYSDEC approved closure plans and documents and said Part 360.

For the purposes of this document Quality Assurance and Quality Control are defined in Part 360 as follows:

"Quality Assurance" means the application of standards and procedures to ensure that a product or facility meets or exceeds desired performance criteria and documentation to verify the results obtained. "Quality Assurance" includes "Quality Control" and refers to actions taken to assure conformity of the construction with the New York State Department of Environmental Conservation (NYSDEC)-approved Quality Assurance Plan, engineering plans, reports and specifications.

"Quality Control" means those actions which provide a means to measure and regulate the characteristics of an item or service to contractual and regulatory requirements. "Quality Control" includes those actions taken before construction to ensure that the materials chosen and workmanship comply with the department-approved Quality Control Plan, engineering plans, reports and specifications.

This report discusses the quality assurance aspects applicable to the construction, manufacturing, fabrication, shipment, building and installation of products included in all phases of the closure construction activities.

II. INVOLVED PARTIES

The following is a brief description of the various parties involved in the closure of the City of Beacon, Dennings Avenue Landfill and their responsibilities.

A. OWNER/OPERATOR

The Dennings Avenue Landfill, operated by the City of Beacon, is charged with the actual closure responsibilities. The terms "owner" and "operator" for the purpose of this report both refer to the City of Beacon and can be used interchangeably. The owner is responsible for employing the appropriate personnel and/or Contractor(s) to close the solid waste facility in accordance with the QA/QC Plan.

B. PROJECT MANAGER

The Project Manager is the official representative of the Owner and is responsible for coordinating field activities. The term "Project Manager" shall equally apply to the terms "Construction Coordinator" or "Resident Engineer".

C. DESIGN ENGINEER

The Design Engineer is responsible for the design and the preparation of construction plans and specifications. The terms "Consultant", "Engineer" and "Designer" shall also refer to the Design Engineer.

For the closure of the Dennings Avenue Landfill, the Design Engineer is Morris Associates, Consulting Engineers. Jefferson H. Akins, P.E., New York State License No. 069679-1 shall be the chief design engineer

for the project. The Engineer, who through his duly authorized subordinates, ensures that the construction project conforms to the Contract Drawings and Specifications.

D. PROJECT DIRECTOR

The Project Director is a Professional Engineer (P.E.) licensed by the State of New York or an authorized representative employed by the Consultant. The Project Director is responsible for ensuring that the construction is completed in accordance with the approved Closure Plans, Documents and Specifications. The Design Engineer, Project Manager and Project Director can be the same person.

E. CONTRACTOR

The Contractor is responsible for the particular contract awarded to the Contractor by the Owner. The Contractor may also refer to force account labor as utilized in the project.

F. GEOMEMBRANE MANUFACTURER

The Geomembrane Manufacturer, "Manufacturer", is responsible for producing or manufacturing the geomembrane rolls. The Geomembrane Manufacturer and the Geotextile Manufacturer may be the same or separate parties.

G. GEOTEXTILE MANUFACTURER

The Geotextile Manufacturer is responsible for the production and manufacture of the geotextile. The Geomembrane Manufacturer and the Geotextile Manufacturer may be the same or separate parties.

H. INSTALLER

The Installer is responsible for the field handling, storage, placement, seaming and other on-site activities relative to the installation of the geosynthetics. Additional responsibilities of the Installer may include transportation of the materials to the site and any anchoring and/or loading required during the installation.

I. TRANSPORTER

The Transporter is responsible for the transportation of the geosynthetics, including rolls of factory produced panels of geomembrane, geotextiles, geogrids, and geonets between the Manufacturer and the site and/or the transportation of the geosynthetic panels between the Manufacturer and the Fabricator and/or the Fabricator and the site.

J. QUALITY ASSURANCE/QUALITY CONTROL CONTRACTOR

The QA/QC Contractor shall be a party or parties, independent from the Manufacturer, Fabricator, Transporter, Contractor, and/or Installer. The QA/QC Contractor shall be responsible for observing and documenting the construction activities relative to construction Quality Assurance and Quality Control. The QA/QC Contractor is in charge of the Quality Assurance/Quality Control Team. The QA/QC Contractor may be the Design Engineer, and/or an independent firm as long as the appropriate levels of experience are met.

1. Quality Assurance/Quality Control Team

a) Quality Assurance/Quality Control Manager(s)

The Quality Assurance/Quality Control Manager(s) is (are) responsible for the QA/QC components of the construction activities. The Project Director may also be the QA/QC Manager if no unusual time constraints demand otherwise.

b) Quality Assurance/Quality Control Monitor(s)

The Quality Assurance/Quality Control Monitor(s) is/are responsible for documentation of construction related activities observed at this site.

K. QUALITY ASSURANCE/QUALITY CONTROL LABORATORY

The Quality Assurance/Quality Control Laboratory shall be responsible for conducting tests on the soils and geosynthetics. The QA/QC Laboratory shall be independent from the Owner, Manufacturer, Fabricator, Transporter, Installer and material source. A single QA/QC Laboratory may be used provided said Laboratory possesses qualified personnel and adequate time exists in the construction schedule to perform all QA/QC procedures properly and promptly. In the event, and likelihood, that one Laboratory is unable to test both the geosynthetics and the soils, individual QA/QC Laboratories shall be used.

III. REQUIRED LEVELS OF EXPERIENCE

A. CONTRACTOR AND CREW

The Contractor has the responsibility of providing services and items that conform to the Quality Assurance/Quality Control requirements detailed in Section IV of the QA/QC Plan, the Contract Drawings and the Construction Specifications. The following subsections identify the minimum qualifications for each Contractor and their associated sub-contractors involved in the closure of the Denning's Avenue Landfill as defined by the Contract Drawings and Specifications.

1. Geosynthetic Contractor

Duties

The Geosynthetic Contractors shall furnish, provide, transport and install the geosynthetics (e.g. - geomembranes, geotextiles, geogrids and/or geonets) needed to complete the closure of the Denning's Avenue Landfill as specified by the QA/QC Plan, Contract Drawings and Specifications. These Contractors are subcategorized into: Geomembrane Manufacturer, Geotextile Manufacturer and Geomembrane Installer.

Level of Experience

The Geosynthetic Contractor shall provide for pre-approval, three (3) copies each of documented proof to the Project Director, of having completed a minimum of three (3) geosynthetic projects involving the installation of at least one million

(1,000,000) square feet of geomembrane, total. In turn the Geosynthetic Contractor shall also provide proof that the Geomembrane Manufacturer, Geotextile Manufacturer, Fabricator and Installer have the following levels of service.

a) Geomembrane Manufacturer

The Geomembrane Manufacturer shall be responsible for the production or manufacture of the geomembrane material. The Geomembrane Manufacturer shall be pre-qualified and approved by the Project Director. The Manufacturer shall submit to the Project Director for approval three (3) copies each of the following qualification information:

(1) Corporate Background information.

(2) Manufacturing capabilities information including:

- daily production quantity
- quality control procedures employed for manufacturing
- material properties with certified test results, including geomembrane samples.

(3) A list of at least three (3) completed projects having involved the installation of a minimum of one million (1,000,000) square feet of geomembrane, total, for which the Geomembrane Manufacturer has manufactured the supplied materials. For each facility,

the following information shall be provided.

- Name and function of project, project location and date of geomembrane installation.
- Names of: Owner, Project Manager, Fabricator and Installer.
- Geomembrane information: thickness, total surface area, and type.
- Any available information on the performance of the geomembrane and lining system at the project location.

b) Geotextile Manufacturer

The Geotextile Manufacturer shall be responsible for the production or manufacture of the geotextile material. The Geotextile Manufacturer shall have sufficient production capacity and qualified personnel to meet the demands for the project. The Manufacturer shall be pre-qualified and approved by the Project Director.

The Manufacturer shall submit to the Project Director for approval three (3) copies each the following qualification information.

(1) Corporate Background Information.

(2) Manufacturing capabilities information including:

- daily production quantity

- quality control procedures employed for manufacturing
- material properties with certified test results, to which geotextile samples are attached.

(3) A list of at least three (3) completed projects involving a minimum of one million (1,000,000) square feet of geotextile, total, for which the Geotextile Manufacturer has manufactured the supplied materials. For each facility, the following information shall be provided.

- Name and function of project, its location and date of geocomposite installation.
- Name of: Owner, Project Manager, Fabricator and Installer.
- Geotextile information: type (weight/area) and total surface area.
- Any available information on the performance of the geotextile.

c) Geomembrane Installer

The Geomembrane Installer shall be responsible for the field handling, storage, placement, seaming and other on-site activities related to the installation of the geomembrane.

The Installer shall be approved and/or licensed to install the geomembrane by the Geomembrane Manufacturer.

The Installer shall submit to the Project Director the following information for pre-approval:

(1) A copy of the Installer's letter of approval and/or license from the Manufacturer and/or Fabricator.

(2) Corporate background information.

(3) The Installer's capabilities including:

- Equipment list.
- Information on personnel including detailed information on "key" personnel (i.e. - Master Seamer, Site Manager, etc.).
- Estimated average daily production.
- Installer's Quality Control procedures.

(4) Resume of the "chief seamer" to be assigned to this project including dates and duration of employment.

(5) Resume of the field engineer or installation supervisor to be assigned to this project, including dates and duration of employment.

(6) All personnel to be performing seaming operations shall be qualified by experience or by successfully passing

seaming tests. At least one seamer shall have experience seaming a minimum of five hundred thousand (500,000) square feet of geomembrane of the same type specified for this project and using the same seaming equipment and methods to be used for this project.

B. QUALITY ASSURANCE/QUALITY CONTROL PERSONNEL

1. Quality Assurance/Quality Control Manager

Duties

The duties of the QA/QC Manager shall include:

a) Obtain a good knowledge of the project, review the design to verify clarity and completeness of the project.
b) Review of all site-specific documentation including bid documents, proposed lay-outs, and Manufacturer's and Installer's literature.
c) Review and familiarize him/herself with the QA/QC Plan.
d) Attend any meeting between the Contractor(s) and the Owner.
e) Administration of the QA/QC program (assign and manage all QA/QC personnel, review all field reports, and provide engineering review of all QA/QC related issues).
f) Provide quality control of the QA/QC personnel, including site visits.
g) Review all changes to design, plans, and specifications.

h) Review "As-Built" drawings.

i) Review results of all laboratory testing (soil and geosynthetic) for conformance to project specifications.

j) Prepare the Construction Certification Report along with the Project Director and Quality Assurance/Quality Control Monitor(s).

2. Quality Assurance/Quality Control Monitor(s)

Duties

The duties of the QA/QC Monitor(s) shall include:

a) Provide field inspection and logs or reports documenting all geosynthetic installation operations.

These operations to be monitored shall include:

(1) material delivery, unloading, on-site transport and storage.
(2) on-site field conformance testing and sampling of delivered materials for conformance to specifications.
(3) placement conditions and placement (i.e. - subgrade inspection, joining and seaming operations, etc.).
(4) any and all repair operations.

b) Specifically regarding geomembranes the following operations shall be monitored:

(1) trial seams on pre-start-up geomembrane material.

(2) seam preparation, joining and non-destructive testing.
(3) sampling for destructive testing.
(4) field tensiometer testing and sample marking and division for laboratory testing.
(5) repair operations and testing.

c) Visual inspection, by walkover, for any foreign objects left by the Installer.

d) Reporting to the QA/QC Manager any observations of on-site activities that could result in non-conforming product installations or material usage.

e) Providing inspection of on-site earthwork operations. Typical earthwork operations to be monitored will include:
(1) on-site excavation, material haulage to include loading and unloading operations, storage and stockpiling.
(2) on-site field inspection and material sampling intended for testing. This inspection includes the location and marking of all collected samples.
(3) placement of soils, specifically in conjunction with geosynthetic operations to ensure no damage to geosynthetic materials occurs.
(4) soil repair operations.
(5) testing of in-place soil materials (i.e. - density, moisture, etc.)
(6) installation of soil erosion and sediment control measures.
(7) inspection of vegetative support layer dressing, seeding and mulching operations.

f) Provide the QA/QC Manager with logs or reports of monitored earthwork and geosynthetic installation activities. Any earthwork operations that could result in damage to any geosynthetics materials or operations should be promptly reported to the QA/QC Manager.

Level of Experience

QA/QC Monitor(s) shall be QA/QC personnel who have been specifically trained in QA/QC of soil and geosynthetics. This training may include previous geosynthetic QA/QC inspection and/or classroom training of procedures to be used. As a minimum, personnel should be familiar and trained in the use of vacuum box and air lance non-destructive test procedures to identify geomembrane defects and repair procedures. Personnel shall be familiar with soil testing (e.g. - density, permeability, water content) procedures, grading and placement of soils, the use of survey equipment involved in field grading (e.g. - level and rod equipment), and compacting of soils and compaction equipment.

C. QUALITY ASSURANCE/QUALITY CONTROL LABORATORY(S)

Duties

The QA/QC Laboratory (or Laboratories) shall be responsible for conducting the conformance testing to the frequency and type as detailed by the Project Documents, Construction Specifications and QA/QC Plan.

Level of Experience

The QA/QC Laboratory shall demonstrate experience with the various ASTM geosynthetic testing procedures, or approved equivalent, as detailed by the Construction Specifications. The QA/QC Laboratory shall be capable of providing test results within three (3) business days from receipt of samples and shall maintain this processing standard throughout the duration of the project. The QA/QC Laboratory shall demonstrate experience with the various ASTM soil testing procedures, or approved equivalent, as detailed by the Construction Specification. The QA/QC Laboratory shall be capable of providing test results within three (3) business days from receipt of samples and shall maintain this processing standard throughout the duration of the project. The only exception to the minimum time frame for soil test processing shall be for permeability testing which shall be processed with certified results made available within seven (7) calendar days from the receipt of the test samples.

IV. QUALITY ASSURANCE AND QUALITY CONTROL TESTING PROTOCOLS FOR EACH PHASE OF CONSTRUCTION

A. GEOTEXTILE REQUIREMENTS

The fabric shall be non-woven fabric consisting only of polymeric filaments or yarns of polyester, formed into a stable network by needle punching. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, and conform to the Specifications. The average roll minimum value (weakest principle direction) for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the average roll minimum value stipulated herein.

The materials supplied under these Specifications shall be finest quality products designed and manufactured specifically for the purposes of this Work and which have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes.

1. Pre-Construction Requirements

The Geotextile Manufacturer is to provide the Project Director and the Quality Assurance/Quality Control Manager with the following:

- A list of guaranteed minimum average roll value properties for the geotextile specified which meet or exceed the property values detailed by the Construction Specifications.

- A written certified test report from the Geotextile Manufacturer that the delivered fabric meets or exceeds the Specifications for durability, chemical compatibility, and service life.
- Quality Control documentation produced during the manufacturing process of the geotextiles delivered.
- The geotextile shall be colored (not white) to avoid "snow-blindness" of operating personnel at the project site.

2. Construction Requirements

Geotextiles shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers. Geotextile rolls shall be marked or tagged with the following information:

a) Manufacturers name.
b) Product identification.
c) Lot number.
d) Roll number.
e) Roll dimensions.

Additionally, if any special handling is required, it shall be so marked on the geotextile itself (e.g., "This Side Up" or "This Side Against Geomembrane", etc.).

During the shipment and storage, the geotextiles shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

The geotextiles should not be removed from wrapping for more than one (1) day prior to installation. Unless otherwise specified and guaranteed by the Geotextile Manufacturer, the geotextile should be covered with the soil cover or geomembrane cover within ten (10) days of initial placement in order to minimize ultra-violet light (U.V.) exposure at the site.

The Transporter shall be liable for all damages to the materials incurred prior to and during transportation to the site.

To ensure conformance with the Specifications all reported test results for the material shall include the following:

PROPERTY	TESTING METHOD
Weight (oz/yd^2)	ASTM D-3776
Thickness (mils.)	ASTM D-1777
Grab Strength (lbs.)	ASTM D-4632
Puncture Resistance (lbs.)	ASTM D-4833
Trapezoid Tear Strength (lbs.)	ASTM D-4533
Burst Strength (psi)	ASTM D-3786
Permittivity (sec^{-1})	ASTM D-4491
Apparent Opening Size	ASTM D-4751

At a minimum the site should be prepared to the following:

- Tall grasses should be cut off at ground level. Existing topsoil shall be stripped and stockpiled as necessary. Excavations for the gas vent risers shall be performed at the locations and to the dimensions specified.

Subgrade soils shall be graded and smoothed to receive geotextile material. Ruts or surface irregularities deeper than four inches should be filled and leveled to achieve a fairly level site condition.

- The Contractor shall handle all geotextiles in such a manner as to ensure that they are not damaged in any way.

- In the presence of wind, all geotextiles shall be weighted with sandbags, tires or approved equivalent. Such sandbags shall be installed during placement and shall remain until replaced with earth cover material or the overlying layer of geosynthetic. No geotextile placement or installation shall occur in winds exceeding fifteen (15) miles per hour.

- Geotextiles shall be cut using an approved geotextile cutter only. If in place, special care must be taken to protect other geosynthetic materials from damage which could be caused by the cutting of the geosynthetic.

- During placement, care shall be taken to avoid entrapment in the geotextile of stones, excessive dust, or moisture that could damage the geomembrane liner, or generate clogging of drains or the geotextile filters. During placement, care shall be taken not to entrap in the geotextile stones or dirt which could hamper subsequent seaming.

- The QA/QC Monitor(s) shall examine the geotextile over the entire surface, after installation, shall be conducted to ensure that no potentially harmful foreign objects, such as needles, are present. Any foreign objects so encountered shall be removed by the Contractor or the geotextile shall be replaced.

Geotextiles shall be overlapped a minimum of twenty-four (24) inches. If during placement of cover soil, the Contractor cannot maintain an overlap for the geotextiles, sewing will be required.

The Contractor shall pay particular attention at seams to ensure that no earth cover material could be inadvertently inserted beneath the geotextile.

Any sewing shall be done using polymeric thread with chemical resistance properties equal to or exceeding those of the geotextile and of contrasting color to that of the geotextile. Sewing of the geotextile seams shall be made using Stitch Type "401".

Any holes, tears or defects in the geotextile shall be repaired using a patch made from the same geotextile with a minimum of twenty four (24) inches overlap in all directions as measured from the defect.

Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile. The Contractor shall place all soil

material located on top of a geotextile, in such a manner as to ensure:

a) No damage of the geotextile.
b) Minimal slippage of the geotextile on underlying layers.
c) No excess tensile stresses in the geotextile.

3. Post-Construction Requirements

A Construction Certification Report will be submitted to the New York State Department of Environmental Conservation (NYSDEC) no later than forty-five (45) days after the completion of the Landfill Closure. All quality assurance and quality control testing results and documentation will be included in the Construction Certification Report. Any unusual conditions, difficulties, or deviations from the Plans and Specifications occurring during the geotextile installation will be noted in the report.

B. GEOMEMBRANE BARRIER LAYER

1. Pre-Construction Requirements

a) <u>Geomembrane Manufacturing</u>

Prior to installation, the Geomembrane Manufacturer shall provide the Project Director and the QA/QC Manager with the following for approval:

- A properties sheet including, at a minimum, all Specified properties, measured using test methods indicated in the Specifications, or approved equivalent;

- A written certification that property values given in the properties sheet are guaranteed by the Geomembrane Manufacturer.

The Project Director and/or QA/QC Manager shall review the submitted information and verify that:

- The property values certified by the Geomembrane Manufacturer meet or exceed the Construction Specifications.

- The measurements of properties by the Geomembrane Manufacturer are properly documented, and that the test methods used are acceptable.

Prior to delivery of material, the Geomembrane Manufacturer shall provide the QA/QC Manager with one quality control certificate for each roll of geomembrane provided. The quality control certificate shall be signed by a responsible party. The quality control certificate shall include:

- Roll numbers and identification.

- Certification that each geomembrane roll was continuously inspected for sheet surface appearance, knife-cut edge, folds, holes, creases, abrasions, cracks, thin spots, foreign material, or any other damage.

- Results of quality control tests. At a minimum, results shall be given for thickness, tensile strength, and tear resistance, evaluated in accordance with ASTM test methods as indicated in the Construction Specifications or approved equivalent.

b) Transportation and Handling

Transportation of the geomembrane will be performed by the Geomembrane Manufacturer, the Installer, or other party as agreed upon by the Project Director. If geomembrane arrives on site prior to the Installation personnel, the Contractor is responsible for off-loading rolls. Material, when off-loaded, should be placed on a smooth surface free of rocks or any other protrusions which may damage the material.

The following should be verified prior to off-loading the geomembrane:

- Handling equipment used on the site is adequate and does not pose any risk of damage to the geomembrane.

- Personnel will handle the geomembrane with care.

- Any loading/unloading rod delivered to the site prior to the Installers arrival should be kept covered and dry or placed in a storage facility.

Upon arrival at the site, the Installer shall conduct a surface observation of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected. The Installer shall indicate any damage to the Project Director.

c) Storage

The Contractor shall secure storage space in a location (or several locations) acceptable to the QA/QC Manager such that on-site transportation and handling are minimized. Storage space should be protected from adverse weather conditions, theft, vandalism, passage of vehicles, and be adjacent to the area to be lined.

2. Construction Requirements

a) Anchor Trench

The Contractor shall excavate the anchor trench prior to geomembrane placement as shown on the Contract Drawings.

If the anchor trench is excavated in a clay liner susceptible to desiccation, no more than the amount of trench required for the geomembrane to be anchored in one (1) day

shall be excavated (unless otherwise specified) to minimize desiccation potential of the anchor trench clay soils.

Slightly rounded corners shall be provided in the trench where the geomembrane adjoins the trench so as to avoid sharp bends in the geomembrane. No loose soil or inacceptable subgrade conditions shall be allowed to underlie the geomembrane in the anchor trench.

The excavation of the anchor trench will be done in a timely manner. The QA/QC Monitor shall inspect the anchor trench for the following conditions:

- improper depths and widths and orientation,
- desiccation of clay soil liner, if present,
- sharp edges, protrusions, and any other irregularities, and
- loose soil at the bottom of the trench.
- ponded water

b) Geomembrane Placement

Prior to commencement of the installation, the Contractor shall provide the Project Director with a proposed panel layout drawing for approval (i.e., a drawing of the facility to be lined based upon approved engineering drawings). The proposed panel layout drawing is tentative and may be modified by

Contractor only with the Project Director's approval.

In preparing the panel layout drawing(s) the following should be considered. In general:

- Seams should be oriented parallel to the line of maximum slope (i.e., oriented along, not across, the slope).
- In corners and odd-shaped geometric locations, the number of seams should be minimized.

Immediately prior to installation of the designed geomembrane liner, the surface shall be observed by the Contractor, the Installer and the Owner and/or the Owner's representative. The decision to repair cracks, if any, shall be made only by the Project Director. The subgrade shall be walked by the Installer, the Contractor and Project Manager for joint approval. The Installer will sign a certificate of acceptance of the surface condition of the subgrade. The integrity of the underlying soil is the responsibility of the Contractor. The QA/QC Manager will be given a copy of this certificate.

No liner shall be placed upon surfaces not accepted in writing by the Installer.

The uppermost three (3) inches of the subgrade to be covered shall be free from

sharp stones or other hard objects that will not pass a three-eights (3/8) inch screen.

Surfaces to be lined shall be smooth and free of all rocks, sharp stones, sticks, roots, sharp objects, or debris of any kind. The surface should provide a firm, unyielding foundation for the geomembrane with no sudden, sharp or abrupt changes or breaks in grade.

Placement of the geomembrane panels will be according to the approved location and position plan provided by the Installer. Placement will follow all instructions on the boxes or wrapping containing the geomembrane materials which describes the proper methods of unrolling, and/or unfolding rolls and panels. The field panel installation schedule is left to the preference of the Installer and Contractor, but the method chosen must minimize erosion of the underlying soil liner and the potential for wind damage.

Geomembrane placement shall not take place during any excessive precipitation, in the presence of excessive moisture, in an area of ponded water, or in the presence of excessive winds (unless wind barriers are provided).

The method of placement must ensure that:

- No equipment used will damage the geomembrane by handling, trafficking, leakage of fluids, excessive heat, or other means.

- No personnel working on the geomembrane will smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.

- The prepared surface underlying the geomembrane must not be allowed to deteriorate after acceptance and must remain acceptable up to the time of geomembrane placement.

- Adequate temporary loading and/or anchoring (e.g., sand bags, tires), not likely to damage the geomembrane, will be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

- Direct contact with the geomembrane will be minimized. The geomembrane in excessively high traffic areas will be protected by geotextiles, extra sacrificial geomembrane, or other suitable materials.

- Any geosynthetic material in contact with the geomembranes shall be clean and free of debris.

- The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil.

- The method used to place the panels shall minimize wrinkles (especially differential wrinkles between adjacent panels).

Any damage to the geomembrane panels or portions of the panels as a result of placement must be replaced or repaired at no cost to the Owner. The decision to replace or repair any panel or portions of panels will be made by the QA/QC Manager with the consent of the Engineer and/or Project Director.

The QA/QC Monitor will assign an "Identification Number" to each geomembrane panel placed. This number will be consistent with the number used by the Installer. The number system used will be simple, logical and identify the relative location in the field.

The "Identification Number" must be correlated to the roll and lot number written on a predetermined consistent location of each roll installed. This number will be used during destructive sampling, identification and labeling.

The QA/QC Monitor shall record the identification code, location, and date of installation and/or field logs of each field panel. Progress reports are to be submitted to the QA/QC Manager.

A fabricated geomembrane boot shall be installed to fit tightly around a penetrating

gas vent risers or other pipe. The boot shall form an impermeable union between the gas vent riser or other pipe and the geomembrane liner. Seams and materials used at these locations will be carefully constructed and inspected to ensure proper construction has been achieved. Non-destructive testing will be performed on all seams where such testing is possible.

Where the geomembrane material must form a seal with concrete, a non-corrosive batten built into the concrete or other approved means will be used to form the seal.

c) Seaming

The following seaming procedures below shall be implemented, where applicable during installation of the geomembrane. Where material specific procedures are to be followed, an indication of geomembrane type will be made. The following seaming procedures shall be verified by the QA/QC Manager.

- Generally, all seams, whether field or factory, will be oriented parallel to the line of slope, not across slope. This Specification shall be applied to side slopes of the final cap. At liner penetrations and corners, the number of seams will be minimized.

- The area of the geomembrane to be seamed shall be cleaned and prepared according

to the procedures specified by the Geomembrane Manufacturer. Any abrading of the geomembrane will be extended more than one half (1/2) inch on either side of the seam. Care will be taken to eliminate or minimize the number of wrinkles and "fishmouths" resulting from seam orientation.

- Seaming should not proceed in extreme heat (above 40°C\104°F) or extreme cold (below 5°C (41°F) unless trial seam and laboratory test results indicate that the seaming can meet or exceed the Specification requirements. The specified temperature range is for ambient air. In addition, seaming will not be conducted when the geomembrane material is wet from precipitation, dew, fog, etc., or during excessive wind.

- Seams will have an overlap beyond the seam large enough to perform destructive peel tests. Any material used to temporarily bond adjacent geomembrane panels must not damage or leave the geomembrane altered in any manner.

- Seams shall extend up the side slopes and shall be continuous through the anchor trench.

- The rolls of membrane shall be overlapped by a minimum of four (4) inches for fusion welding and three (3) inches for extrusion welding.

- No "fishmouths" shall be allowed within the seam area. Where "fishmouths" or wrinkles at the seam overlaps occur the material shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut "fishmouths" or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches beyond the cut in all directions.

- All cross seams shall be extrusion welded where they intersect.
  For fusion welding, a movable protective layer of plastic may be required to be placed directly below the overlapped membranes being seamed. This is to prevent any moisture buildup between the sheets to be welded and/or to provide consistent rate of speed for the wedge welding device.

d) Trial Seams

Trial seams shall be made on excess geomembrane material as detailed in the Specifications. A one (1) foot by three (3) foot seamed liner sample shall be fabricated with the seam running down the three (3) foot length in the center of the sample. Such trial seaming will be conducted prior to the start of each seaming session, after any shut-down and restart of the seaming equipment, and after any significant change in weather conditions.

From each trial seam sample, two (2) field test specimens shall be taken. The test specimens will be one (1) inch by twelve (12) inch strips cut perpendicular to the trial seam. These specimens shall be peel tested using a field tensiometer, and recorded as pass (failure of liner/parent material) or fail (failure of seam). Upon initial failure, a second trial seam will be made; if both test specimens do not pass, then the seaming device and its operator shall not perform any seaming operations until the deficiencies are corrected and two (2) successive passing trial seam test specimens are produced. Completed trial seam samples cannot be used as portions of a second sample and must be discarded.

The QA/QC Monitor will monitor the trial seam preparation and log the date, time, seaming device, temperature, seamer and pass or fail of the trial seam. Unused portions of the trial seam shall be appropriately labeled and divided by the QA/QC Manager and Installer for future reference.

e) Seam Testing

Non-Destructive Testing

Non-destructive seam testing will be performed on one hundred (100) percent of all field seams. One of the following test methods and procedures shall be used and shall be verified for uniformity and completeness by the QA/QC Monitor:

Vacuum testing will be used on all HDPE and VLDPE seams not tested using air pressure testing. Using an approved vacuum box, the following procedures will be followed:

- apply a soapy water mixture over the seam.
- place vacuum box over soapy seam and form a tight seal.
- create a vacuum by reducing the vacuum box pressure to five (5) psi (35 KPa).
- observe through the vacuum box window any bubbles for a period of approximately fifteen (15) seconds.
- where soap bubbles are observed, mark seam for repair.
- if no soap bubbles appear, close the vacuum valve and open the bleed valve, move vacuum box over the next adjoining seam, overlapping the adjacent tested seam by three (3) inches.
- where hot wedge seaming has been performed, the overlap must be cut back to the weld.
- all vacuum testing will be conducted under the direct supervision of a QA/QC Monitor.
- all areas that are marked as having failed shall be repaired as per the QA/QC Plan and retested. If the seam is accessible to test equipment only prior to final installation then the seam shall be non-destructively tested prior to final installation.

Air pressure testing may be used in place of the vacuum box only if double track, hot wedge welding has been utilized to seam the geomembrane. Using approved pressure testing equipment, the following procedures will be followed:

- seal one (1) end of the air channel separating the double hot wedge welds for the seam to be tested.
- insert pressure needle or other approved pressure feed devices into air channel sealed and created by the double wedge fusion weld.
- energize the air pump to verify the unobstructed passage of air through the channel.
- seal open end and channel, and pressurize the air channel to between twenty-five (25) and thirty (30) psi.
- monitor pressure gauge for approximately five (5) minutes and determine whether pressure.
  is maintained without a loss of more than four (4) psi.
- if the pressure loss exceeds four (4) psi or the pressure does not stabilize, then localize the leak and mark the area for repair.
- air pressure testing shall be witnessed by the QA/QC Monitor.

Destructive Testing

In addition to the non-destructive seam testing, destructive testing shall be

conducted. Test samples shall be taken at a minimum of one (1) for every five hundred (500) feet of seam length or more frequently if deemed necessary by the QA/QC Manager. Sample locations and size will be verified by the QA/QC Manager. Each sample shall be a minimum of twelve (12) inches wide by thirty-six (36) inches in length with the seam to be tested centered lengthwise along the sample.

A thirty-six (36) inch sample shall first be cut or divided into equal thirds with each portion commonly labelled as to identify the test location. One third each will be given to: the Geomembrane Installer, the QA/QC Laboratory for testing, and the Owner or his duly appointed representative for storage and future reference. The one-third (1/3) of the sample that shall be subject to destructive testing shall be cut into two (2) sets of five (5) specimens each. Each specimen shall be one (1) inch wide and twelve (12) inches with the seam centered perpendicular to the twelve (12) inches dimension.

One set of specimens shall be subjected to shear strength (ASTM D-4437 as modified by NSF #54) testing and the other set shall be subject to peel strength (ASTM D-413 as modified by NSF #54) testing.

Test samples shall be considered to be passing if a minimum of four (4) of five (5) of the test specimens pass both the shear

strength and peel strength testing as detailed by the Specifications. Acceptable field seams shall be bounded on either side by passing test sample locations.

If a sample fails the destructive testing, meaning that less than four (4) out of five (5) test specimens do not meet either of the seam or peel strength destructive test criteria, then the QA/QC Manager must ensure that:

- the Geomembrane Installer shall reconstruct the seam between a failure test location and a passing test location.
- or the seam path is retraced to an intermediate test location, a minimum of twenty (20) feet from the failure test location, where the destructive test procedures shall be repeated with the cost to be absorbed by the Geomembrane Installer. If this testing passes the destructive seam testing, then the seam only need be reconstructed and/or repaired between this passing test location and the failure test location. If this second test sample fails, then the previously described duties of the QA/QC Manager must be repeated.

If a double track hot wedge welding method is employed, the QA/QC Manager and the Geomembrane Installer must agree on the track weld that shall be subject to the destructive testing. The weld chosen, either "inside" or

"outside", must be consistently tested and passed according to the described criteria.

All holes created by the collection or cutting of the seam test sample shall be immediately patched. The Geomembrane Installer shall be given the option to: reposition the panel and reseam, or add a cap strip. All seams of the reseamed or capped repair at the destructive seam test sample location shall be tested via the appropriate non-destructive method.

f) Liner Repair

The entire geomembrane area, including seam and non-seam areas, shall be examined by the Installer and the QA/QC Monitor for signs of defects, holes, blisters, undispersed raw materials, and any signs of contamination by foreign matter.

The QA/QC Manager and Project Director shall be notified in writing by the Installer of defects or damage of materials or areas and of any proposed repair or corrective action to "fix" the problem.

Each suspect location both in seam and non-seam areas shall be non-destructively tested using the appropriate methods described. Each location which fails the non-destructive testing shall be marked by the Installer and repaired. Work shall not proceed with any materials which will permanently cover locations which have been

repaired until laboratory test results with passing values are available.

Any portion of the geomembrane exhibiting a flaw or failing a destructive or non-destructive test shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Director and Installer. The procedures available include:

PROCEDURE	APPLICATION
Patching	Repair of large holes, tears and areas contaminated by foreign matter.

PROCEDURE	APPLICATION
Grinding and Re-welding	Repair of small sections of extruded seams.
Spot Welding or Seaming	Repair of small tears, pinholes or other minor localized flaws.
Capping	Repair of large lengths of failed seams.
Topping	Repair of inadequate seams which have an exposed edge.

The following conditions shall be met prior to repair:

- The surfaces of the geomembrane section to be repaired shall be abraded no more than one (1) hour prior to the repair.

- At the time of repair all subject areas are to be clean and dry.

- All seaming equipment, procedures, materials and techniques shall be approved prior to the specific repair by the QA/QC Manager, Project Manager and the Contractor.

- Patches or caps shall extend at least six (6) inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least three (3) inches.

During repair, QA/QC Monitor shall verify that the procedures, as well as all non-destructive testing of the repair seams, meet or exceed the Specifications. If the repair is much larger, destructive testing may be required at the discretion of the QA/QC Manager. Any failure of required seams will require that the patch be removed, replaced and retested until passing results are achieved.

All geomembrane repairs will be logged by the QA/QC Monitor, documenting the date, location, type of repair procedures and retesting procedures.

g) Anchor Trench and Cover Material Backfilling

The anchor trench shall be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. The anchor trench shall be backfilled by the Contractor as outlined in the Contract Drawings.

Since backfilling can affect material bridging at the toe of slope, consideration should be given to backfill of the liner at its most contracted state; preferably during the cool of the morning or extended period of over-cast skies. Care shall be taken when backfilling to prevent any damage to the geosynthetics.

All granular materials placed above geomembranes are spread with a minimum uncompacted lift thickness of six (6) inches using tracked equipment with ground pressures not exceeding seven (7) pounds per square inch; no construction equipment will be driven directly on the geomembranes; all rubber-tired vehicles will access construction above geomembranes from temporary access roads built with a minimum of one (1) foot above the liner; and extra geotextile or geomembrane layers may be placed on or beneath high trafficked areas.

Equipment used for placing soil shall not be driven directly on the geomembrane.

Backfilling shall not occur until:

(1) the installation of the geomembrane for the area for backfilling is finished

(2) the adequacy of all seam and repairs, including associated testing, is complete and verified

(3) all documentation for installation is completed, submitted to, and accepted by the QA/QC Manager.

(4) all destructive and non-destructive testing has been performed and meets or exceeds the requirements of the Specifications.

Placement of material should be performed to minimize wrinkles. Equipment operating on the soil cover of a geomembrane surface shall make no sudden turns or stops that could damage the geosynthetic. Equipment operators should be briefed on method of placement and affects to thermal expansion and contraction of the liner.

Material placed on top of the liner should not be back-dumped directly on liner and, in order to avoid the formation of wrinkles, efforts should be made to load the soil so that it comes down on top of the liner rather than being pushed across the sheet. This is done by 1) using appropriate earthwork equipment to place soil ahead of spreading (installed) soil cover, and 2) spreading soil by building a mound at the edge of soil, then

pushing soil up and over the mound causing it to come down in a relatively gentle fashion on the liner.

If a wrinkle forms, every effort should be made to walk the wrinkle out.

Minor "folding over" of wrinkles is acceptable providing an even transition occurs at the tail of the wrinkle. If excessive stress points are created at the tail of the wrinkle, the wrinkle shall be cut out and repaired as previously noted.

3. Post-Construction Requirements

The Geomembrane Installer will prepare and submit, to the Project Director for approval, record drawings illustrating the following information:

- dimensions of all geomembrane field panels
- panel locations referenced to the Contract Drawings
- identify all field seams and panels with the appropriate number or code
- location of all patches, repairs and destructive testing samples.

A record drawing(s) will be submitted for the geomembrane layer constructed.

A final task summary report shall be submitted by the QA/QC Manager upon completion of this phase of the project. This report will be incorporated into the Construction Certification Report to be submitted to the NYSDEC no later than forty-five

(45) days after the completion of the landfill closure. The report is to contain the following information:

a) personnel involved with the project
b) scope of work
c) QA/QC documentation
d) conformance test results

In addition, the report will discuss any unusual conditions, difficulties, or deviations from specifications during the geomembrane installation.

C. BARRIER PROTECTION LAYER

1. Pre-Construction Requirements

The Barrier Protection Layer soil shall be supplied from a pre-approved borrow source, transported to, and stockpiled or installed on-site. Pre-approval testing will consist of submission of three (3) particle size analysis (ASTM D422) which evidence the soil to conform to the specified gradation. Potential borrow sources will also submit one (1) Standard Proctor (ASTM D698) analysis. The material shall consist of medium to coarse textured granular, relatively non-cohesive soils of uniform consistency conforming to the appropriate Specification(s).

2. Construction Requirements

The Barrier Protection Layer soil installation shall not be approved until all testing has been performed, submitted to and accepted by the Project Director and/or QA/QC Manager.

Barrier Protection Soil shall be backfilled on the Barrier Layer in lifts with a minimum thickness of six (6) inches and to a minimum total depth of one (1) foot. At no time after completion of Barrier Layer shall any equipment used for placing Barrier Protection Soil be driven on the Barrier Layer. A minimum thickness of six (6) inches of soil shall be maintained between all installation equipment (i.e. - dozers, trucks, etc.) and the Barrier Layer. Heavily travelled areas such as access roadways and ramps shall have a thickness of at least one (1) foot above the Barrier Layer.

The Barrier Protection Soil shall contain no stones larger than four (4) inches in size in any dimension. At a minimum, the first six (6) inches of soil, depending upon the type of earthwork equipment utilized, shall be free of stones or non-soil debris larger than three-eighths of an inch (3/8") in size in any dimension.

It is estimated that approximately ten thousand, six hundred cubic yards (10,600 cu.yds.) of 3/8" minus and ten thousand six hundred cubic yards (10,000 cu.yds.) of 4" minus soil material will be required to construct the barrier protection layer. Local soil mines or "County bid" soil suppliers accessible by the City and meeting the QA/QC testing specifications will represent the source(s). The following frequency and number of QA/QC tests will be performed during construction of the barrier protection layer.

Test Description	Frequency
Particle size (ASTM D422)	3 per borrow source to qualify.
	1 per 1,000 cubic yards delivered.
Standard Proctor (ASTM D698)	1 per borrow source to qualify.
	1 per 5,000 cubic yards delivered.
Nuclear Density/Moisture (ASTM D2922)	9 per acre per lift.

This QA/QC testing is intended to comply with Appendix D of the City's Order On Consent. The use of Atterburg limits, permeability and moisture-density-permeability testing is not applicable to installation of barrier protection layer soils and is not recommended. Passing criteria for the above listed QA/QC testing is included in the specification section for barrier protection layer soils.

The QA/QC Monitor will visually inspect the soil as it is placed and randomly measure the compacted depth of the Barrier Protection Soil to ensure conformance to Specifications.

3. Post-Construction Requirements

A Construction Certification Report shall be prepared and submitted to the New York State Department of Environmental Conservation no later

than forty-five (45) days after the completion of the landfill closure. The Report shall include the following information concerning this phase of the construction:

a) personnel involved in the project

b) scope of work

c) QA/QC test documentation

d) conformance test results

The report shall also discuss any unusual conditions, difficulties, or deviations from the Construction Specifications during this phase of the project.

D. VEGETATIVE SUPPORT LAYER

1. Pre-Construction Requirements

Vegetative Support Layer is to be obtained from a pre-approved borrow area(s), transported, and stockpiled or installed on-site. The Vegetative Support Layer shall meet or exceed the requirements of the Construction Specifications.

Pre-construction inspection activities will include checking Vegetative Support Layer properties against the Specifications and ensuring that deleterious materials are not included. The subgrade of the Vegetative Support Layer will be the Barrier Protection layer. The Barrier Protection Layer should be checked to ensure that it has been constructed to meet or exceed the Specifications and that all QA/QC testing has been

performed and approved prior to placement of the Vegetative Support Layer.

The Vegetative Support Layer, as proposed by variance application, may consist of a blend of City generated compost blended with topsoil stripped from the site.

2. Construction Requirements

During construction of the Vegetative Support Layer, QA/QC inspection personnel should monitor the uniformity of the application process, observe the placement procedure to ensure that the soil is not overly compacted, and measure the thickness and slopes of the Vegetative Support Layer. QA/QC Monitor(s) should also ensure that care is taken in the vicinity of vents or other protrusions to prevent damage.

It is estimated that approximately nine thousand cubic yards (9,000 cu.yds.) of "topsoil" is required for closure construction. Approximately three thousand cubic yards (3,000 cu.yds.) of topsoil will be stripped from the existing soil cap. The City will supply approximately six thousand cubic yards (6,000 cu.yds.) of City generated compost to be mixed and blended with the stripped topsoil. The use of this material is in conformance with the variance applied within this Closure Plan. The existing topsoil is of adequate quality to support the vegetated cover grasses as the topsoil has done so for the previous nine (9) years. A certification to the adequacy of the compost material to be used is included in

Appendix F of this report. No additional tests are required of the variance "topsoil" soil to be utilized.

3. Post-Construction Requirements

A Construction Certification Report shall be prepared and submitted to the New York State Department of Environmental Conservation no later than forth-five (45) days after the completion of the landfill closure. The report shall include the following information concerning this phase of the construction:

a) personnel involved in the project

b) scope of work

c) QA/QC documentation

d) conformance test results.

E. VEGETATIVE COVER LAYER

1. Pre-Construction Requirements

The following information shall be submitted for approval by the Project Director and/or QA/QC Manager which shall include:

- Personnel involved in seeding and mulching operation and qualifications of the field supervisor.

- List of all seeding and mulching equipment to be utilized in this phase of the construction.

- Fertilizer manufacturer/distribution and appropriate product information.

- Seed distributor/vendor and appropriate product information.

The Contractor shall submit a one (1) pound sample in distributor's/vendor's unopened package with label and seed analysis. This seed shall meet or exceed purity and quality standards as described by the Construction Specifications.

2. Construction Requirements

Seed, fertilizer, lime and physical conditioners shall be delivered in manufacturer's standard size bags, cartons or in bulk with the distributors/vendor's written certification as to the product weight, analysis and name of manufacturer. The seed, fertilizer, lime and physical conditioners shall be stored as directed by the manufacturer and approved by the QA/QC Manager to prevent mechanical or weather damage that would prevent proper distribution. Product damaged as a result of improper transport, hauling, or storage shall be replaced by the Contractor at no cost to the Owner.

Only seed, fertilizer and mulch of a quantity and quality as detailed by the Construction Specifications shall be utilized in this phase of the project.

Any and all: stones (larger than two (2) inches in diameter), litter, debris, and objectionable material shall be removed from the upper three (3)

inches of Vegetative Support Layer. Thoroughly incorporate all soil admixtures (e.g. phosphorus, sulphur, fertilizer, etc) into the upper three (3) inches of the vegetative support layer. Scarify, if necessary, any compacted areas to a three (3) inches depth. Smooth out all bumps, ridges, depressions, and other unsightly variations that may hold water.

Thoroughly incorporate starter fertilizer as detailed in the Construction Specifications into the top one (1) inch of the Vegetative Support Layer by raking or other acceptable manner as approved by the QA/QC Monitor.

Seed shall not be sown if wind velocities exceed five (5) miles per hour. Seed shall be sown at the rate and within the seasonal time frame as detailed in the Constructions Specifications. Hydroseeding is an acceptable application process but mulch shall be mixed with the seed in the hydroseeder. The soil should be moist if hydroseeding is utilized.

Mulch shall be applied to all seeded areas within three (3) days from the completion of the seeding process. Mulch shall be: applied at rates, consist of materials, and be tied down as detailed in the Construction Specifications. Hydromulching will be acceptable and shall be applied at rates and consist of materials as detailed in the Construction Specifications. "Tie downs" are usually not required for hydromulching but may be specified by the QA/QC Manager for steep slopes where erosion concerns or actions warrant its use.

Mulch shall not be applied at such heavy rates or result in heavy patches where young seedlings have difficulty growing through the mulch cover. The QA/QC Manager may request that areas of heavy mulch or patches of heavy mulch be thinned or removed and reapplied at no cost to the Owner.

The Contractor shall be responsible for irrigation of the seedbed as specified by the seed vendor/distributor to promote and secure adequate germination and initial establishment.

The QA/QC Monitor(s) should verify that all vents and any other penetrations through the cover are not damaged by the tilling, additive application processes or other construction procedures.
Timing of seeding is important, particularly for grasses. The QA/QC Monitor should ensure that it occurs during the designated period and that the weather is favorable. For example, seeding should not take place during high wind or rain or when the soil is frozen.

3. Post-Construction Requirements

Final acceptance of the seedbed areas will be granted when a uniform stand of vegetation and acceptable grasses is obtained with a minimum of ninety five percent (95%) coverage. Portions of the seedbed may be accepted at various times at the discretion of the QA/QC Manager and/or Project Director.

Unacceptable areas shall be reseeded and remulched as per the Specifications at the direction of the QA/QC Manager and Project Director at no additional cost to the Owner.

The QA/QC Manager shall prepare a Construction Certification Report of this phase of the landfill closure that shall include:

a) personnel involved with the project

b) scope of work

c) QA/QC documentation and test results.

In addition, this report shall discuss any unusual conditions, difficulties, or discretions from the Construction Specifications or Contract Plans. This report shall be submitted to the New York State Department of Environmental Conservation no later than forty-five (45) days after the completion of the landfill closure.

F. GAS VENT RISERS

1. Pre-Construction Requirements

The QA/QC Monitor shall inspect the gas vent piping prior to installation to ensure that the material meets or exceeds the Specifications.

Select fill to be used in the construction of the individual ("stand alone") gas vent risers will meet the pre-qualification and construction QA/QC testing outlined in the GAS VENTING LAYER (Section G - following) and the Specifications.

2. Construction Requirements

All gas vent locations shall be verified by the QA/QC Monitor prior to installation. The depth of

penetration of the gas vent shall be at least three (3) to five (5) feet, into the waste mass depending on vent location as per plan and detail.

The QA/QC Monitor shall ensure that PVC pipe shall be inserted to the depth required and that it shall be perforated the entire length which penetrates the refuse and Gas Venting Layer.

It is estimated that approximately three hundred and fifty cubic yards (350 cu.yds.) of select granular fill will be required to construct the proposed thirty-two (32) gas vent risers [21 within the "western" variance gas venting system and 11 within the "eastern" standard "blanket" type Part 360 gas venting layer. The source of the material will be local soil mines and/or "County bid" suppliers accessible to the City. The QA/QC testing of the Gas Venting Layer (Section G - following) will be applied to all select granular fill soil borrow sources. Due to the relatively small amount of select granular fill required in construction of the gas vent risers, the pre-qualification QA/QC testing will fulfill the construction QA/QC testing requirements. Additional particle size, Standard Proctor and permeability tests are specified at a rate of 1 per 1,000 to 5,000 cubic yards therefore the gas vent risers will be constructed prior to exceeding a QA/QC frequency threshold. The estimated 350 cubic yards of select granular fill required will be included in the volumetric count necessitating additional QA/QC testing for Gas Venting Layer or three inch (3") "western" variance gas venting system construction.

The QA/QC Monitor shall ensure that the hole excavated is properly backfilled with gas venting Select Fill to the top of the Gas Venting Layer as per the Specifications and Contract Drawings.

3. Post-Construction Requirements

A complete log of the gas vent installation shall be kept and pertinent information transcribed into the Construction Certification Report.

G. GAS VENTING LAYER

1. Pre-Construction Requirements

The Gas Venting Layer soil, either crushed gravel or select granular soil, shall be supplied from a pre-approved borrow source, transported to, and stockpiled or installed on-site. The soil fill shall consist of select granular soil or crushed gravel, as per Plan and Detail, and shall meet the gradation requirements as presented in the Specification.

Pre-qualification of the borrow source(s) will consist of submission of three grain size analysis (ASTM D422), one Standard Proctor analysis (ASTM D698) and one permeability analysis (ASTM D2434) that meets the specifications.

2. Construction Requirements

The Gas Venting Layer construction shall not commence until all pre-qualification QA/QC testing has been performed, reviewed and approved by the Project Director and/or QA/QC Manager.

The QA/QC Monitor(s) will visually inspect the soil or crushed gravel as it is placed and randomly measure the compacted depth to ensure conformance to the Plans, Documents and Specifications.

The uppermost three (3) inches of the gas venting layer soil that shall come in intimate contact with the barrier layer, or three inch (3") soil layer of the variance gas venting system, shall not contain any stones or debris larger than three-eighths of an inch (3/8") in diameter.

It is estimated that approximately thirteen thousand cubic yards (13,000 cubic yards) of select granular fill will be required in the construction of the twelve inch (12") thick "eastern" gas venting layer and the three inch (3") thick "western" variance gas venting system. The same borrow source(s) supplying select granular fill for the construction of the gas vent risers will supply material for the gas vent layer construction therefore meeting the pre-qualifying QA/QC borrow source testing will satisfy QA/QC testing for this section. Construction scheduling dictates the installation of the gas vent risers prior to construction of the gas vent layer. The following frequency and number of QA/QC testing will be performed during construction of the "eastern" gas venting layer:

Test Description	Frequency
Particle Size (ASTM D422)	3 per borrow source 1 per 1,000 cubic yards
Standard Proctor (ASTM D698)	1 per borrow source 1 per 5,000 cubic yards delivered
Nuclear Density Moisture (ASTM D2922)	9 per acre per lift
Permeability (ASTM D2423)	1 per borrow source 1 per 5,000 cubic yards delivered

3. Post-Construction Requirements

A Construction Certification Report shall be prepared and submitted to the New York State Department of Environmental Conservation no later than forty-five (45) days after the completion of the landfill closure. The Report shall include the following information concerning this phase of the construction:

a. personnel involved in the project
b. scope of work
c. QA/QC test documentation
d. conformance test results.

This report shall also discuss any unusual conditions, difficulties or deviations from the Construction Specifications during this phase of the project.

APPENDIX B

TECHNICAL SPECIFICATIONS FOR CONSTRUCTION

FOR THE

CLOSURE OF THE

CITY OF BEACON, DENNINGS AVENUE LANDFILL
CITY OF BEACON, DUTCHESS COUNTY, NEW YORK

PREPARED FOR:

CITY OF BEACON
427 MAIN STREET
BEACON, NEW YORK 12508

PREPARED BY:

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS
367 VIOLET AVENUE
POUGHKEEPSIE, NEW YORK 12601

PROJECT NUMBER:

20275.00

APRIL 1993
REVISED OCTOBER 1994

SECTION LISTING

SECTION 10,000.00	SITE PREPARATION
SECTION 20,000.00	EARTHWORK
SECTION 30,000.00	GEOTEXTILE
SECTION 50,000.00	LANDFILL GAS VENTS
SECTION 55,000.00	GAS VENTING LAYER
SECTION 60,000.00	FURNISHING AND INSTALLING GEOMEMBRANE LINING MATERIAL
SECTION 100,000.00	BARRIER PROTECTIVE COVER LAYER
SECTION 110,000.00	VEGETATION SUPPORT LAYER, SEEDING & MULCH
SECTION 120,000.00	PERIMETER ROAD
SECTION 130,000.00	EROSION CONTROL
SECTION 180,000.00	WASTE RELOCATION AND SUBGRADE RECONTOURING

TECHNICAL SPECIFICATIONS

SECTION 10,000.00

SITE PREPARATION

1.0 GENERAL

1.01 Scope of Work

A. Contractor shall furnish all labor, tools, equipment and miscellaneous related items to prepare the work site for construction as set forth in these Specifications and as called for on the Contract Plans and Drawings.

B. It shall be the responsibility of the Contractor to examine the site of the Work, and after investigation to decide for himself/herself the character of materials to be encountered and all other existing conditions affecting the work. The Contractor shall employ the most efficient method or methods in excavating the materials so encountered. The Contractor will not be permitted to use archaic or inefficient methods or procedures which could result in a request for extra work. Bulldozers, backhoes, scrapers, excavators, loaders, shovels, augers, hand tools, and other equipment may be permitted for use.

1.02 Definitions and Materials

A. Spoil as classified herein is defined as any material, regardless of its source, which is unsuitable for use in the work. Spoil may consist of, but not be limited to, broken pieces of pavement, roots, sod, spongy material, slop, ashes, cinders, slag, pear, woody material, glass, rubbish, rock or any deleterious

material declared to be Spoil by the Project Director. The Contractor shall not at any time during the duration of this Contract, dispose of spoil in a floodway, floodplain, freshwater wetland, or any other water course. All material designated as Spoil shall be disposed of within the limits of the Landfill's new waste edge after closure. Burning of Spoil material at the site is not permitted.

B. Borrow as classified herein is defined as material required for earthwork construction in excess of suitable material available from excavating or grading. Borrow may be necessary even though not shown on the Plans. All Borrow, before being used in the work, must be approved by the Project Director.

2.0 EXECUTION

2.01 Mobilization and Demobilization

A. It shall be the responsibility of the Contractor to furnish and install all Work described herein and in accordance with all provisions of the Contract Plans, Drawings, and Specifications.

B. The Plans and Specifications are intended to complement each other and any detail or item shown on one, but not not the other, shall be assumed to be shown on both and shall be binding as if called for by all. When a conflict appears between the two, it shall be assumed that the higher quality item or method will take precedent. While the Plans and Specifications are assumed to be complete in all major items and details, it is assumed that the Contractor is competent and expert in his field; therefore, no effort has been made to show each and every detail or item required for a complete installation.

C. Mobilization and demobilization as herein defined shall mean transportation and delivery to the job site and/or staging areas (with setting up as required) and all: tools, machinery, vehicles, temporary shops, sheds, shelters, offices, sanitary facilities and such other materials, appurtenances and devices as may be necessary to properly and efficiently perform all Work set forth in documentation relating to this Contract and with none of the herein mentioned items being regarded as a component part of the completed Contract.

D. Also included in this Specification is the provision that all items listed above, together with other items of like nature, whether or not herein mentioned, shall be removed from the work site or staging areas by the Contractor when no longer needed in the Work, with determination of need being made by the Project Director.

E. Any item, mentioned herein, which has been inadvertently or otherwise removed from the area or areas above described, while still needed in the work as determined by the Project Director, will be sufficient cause for all project Work being halted until the item so noted is returned to the work or staging site by the Contractor at his own expense.

F. The Work required to provide facilities and services as set forth in this Specification shall be carried out in a safe and workmanlike manner, in full conformity with all relevant laws, codes and ordinances and with special attention being given to any act which might adversely affect the environment.

2.02 Clearing and Grubbing

A. Clearing and grubbing as defined under this specification shall mean to cut, dredge, remove and dispose of all protruding debris, trees, logs, limbs, stumps, brush, shrubs, roots, vegetation, snow, ice, and all other objectionable material within the limits of work as so indicated on the Plans and Drawings. All items removed under this specification shall be declared "Spoil".

B. All areas, trees, vegetation and other such items designed to remain, shall be protected from damage by all construction operations by erecting suitable barriers and protective devices, and in the event of damage, immediately make all necessary repairs and replacements.

C. Contractor shall schedule and conduct his operations to minimize erosion of soils and to prevent silting and muddying of streams, rivers, wetlands, impoundments and land adjacent to or effected by the work. Erosion control measures may include but not be limited to: water diversion structures or ditches, sedimentation basins or traps, berms, staked hay bales, and seeding, mulching, covering with netting, or sodding disturbed areas. The area of soil exposed by construction at any one time should be kept to a minimum and final restoration should be carried out as soon as possible following completion of construction.

D. All trees that are obstructive and left standing with broken branches shall be pruned properly. The three (3) cut method should be used on all branches larger than two (2) inches at the cut. The branch collar on all branches whether living or dead should not be damaged.

The three (3) cut method is defined as follows: First cut the underside of the branch through six (6) inches or more from the tree. Cut through the branch two (2) inches or more further out from trunk. The final cut should be made by placing the shears or saw in front of the branch bark ridge and cutting downward and slightly outward. Do not paint the wounds. Where roots are cut or damaged, apply wet burlap to prevent drying out. Explosives are not permitted for clearing and grubbing operations.

2.03 Site Grading

A. Site grading as defined under this Specification shall mean to rough grade the site to the lines, grades, and elevations as indicated on the Plans and Drawings. Finished surfaces shall be reasonably smooth, compacted, and free from irregular surface changes. Unless otherwise specified, the finish graded material shall be equivalent to that ordinarily obtainable from either a blade grader or scraper operations.

B. The area to be capped shall also be free of trees, shrubs, bushes and other grassy vegetation that will interfere with placement and compaction of the Landfill Cap. The Contractor shall use an agricultural plow to turn under vegetation on those areas as required by the Project Director. Heavy or woody growth, large roots and stumps shall be removed. After plowing, the area shall be adequately disked to a level condition. Other methods of turning under the existing vegetation will be subject to the review and approval of the Project Director. The Contractor must obtain the Project Director's approval for alternate methods prior to performing the Work. Upon completion of disking, the

area shall be recompacted using adequately sized rollers before placing landfill cap materials. Subgrades shall conform to the requirements of appropriate Specifications.

C. The soil components of the cover system must be placed on a slope of no less than four (4) percent to promote positive drainage.

D. Surfaces shall be level upon which embankments are to be constructed. Where existing ground is left undisturbed, plow the surface and blend with the first layer of embankment material to provide a satisfactory bond of the embankment with the existing surface.

E. Topsoil shall be stripped to its full depth within all areas to be excavated or graded and preserved in storage piles onsite for reuse. Keep topsoil separate from all other materials and store free of roots and other undesirable materials. Apply appropriate erosion control measures to the stockpile topsoil (e.g. perimeter silt fencing, hay bales, temporary vegetation cover, etc.) if stockpile is to remain for more than thirty (30) days (as defined in Section 130,000.00 - Erosion Control).

F. Materials which are required to be stored shall be stored in an orderly manner and at a sufficient distance away from banks of excavations and trenches to avoid overloading and prevent slides or cave-ins. Do not store materials on, over, or adjacent to structures or utilities which may collapse due to the added weight.

END OF SECTION

SECTION 20,000.00

EARTHWORK

1.0 GENERAL

1.01 Scope of Work

A. Earthwork as defined herein shall be providing all labor, material, and equipment required for excavating, filling, compacting, stockpiling, grading, spreading, and disposal of suitable and unsuitable soil, and auxiliary work such as pumping, draining, and protecting in accordance with the Contract Documents and other items as may be called for from the Plans, Specifications and Drawings.

1.02 Definitions and Materials

A. Earth as classified herein shall be defined as all materials, such as sand, gravel, clay loam, ashes, cinders, muck, soft or disintegrated rock, roots, or pieces of timber, not requiring blasting, barring or wedging from their original beds, and specifically excludes all ledge or bed rock, and individual boulders or masonry larger than one-half cubic yard in volume.

B. Spoil as defined in Section 10,000.00 - Site Preparation: 1.02A.

C. Borrow as defined in Section 10,000.00 - Site Preparation: 1.02B.

D. Rock as classified herein, is defined as being sandstone, limestone, granite, quartzite, slate, hard

shale, or similar material in masses more than one-half (1/2) cubic yard in volume, or in ledges four (4) inches or more in thickness, which requires blasting for its practical and effective removal. Should rock be encountered in two (2) or more ledges, each ledge being not less than three (3) inches in thickness and with interlying strata of earth, or clay or gravel not more than twelve (12) inches thick in each stratum, the entire volume between the top of the ledge and the bottom ledge will be classified as rock.

Concrete paving, or other types of permanent paving, sidewalks, walks, curbs, and gutters, will not be considered as rock excavation. Frozen material will not be considered as rock excavation.

E. Shale is herein defined as a definitely stratified or laminated clay or sandy clay formation resulting from the solidification of clay, mud, or silt and which is sufficiently hard and dense to require blasting for its practical, efficient and economical removal. Shale is herein referred to as rock.

F. Embedment material is the material which forms the contact between a pipe being laid in a trench, the trench wall and the foundation upon which it rests. As classified herein, it shall mean clean, durable, sharp angled fragments of uniform quality, crushed stone which conforms to the New York State Department of Transportation (DOT) Material Designation 703-0201, Size Designation 1 and whose gradation conforms to NYSDOT Designation 703-4, Item One (1) and/or as approved by the Project Director.

G. Filter fabric as defined in Section 30,000.00 - Geotextile: 1.02A.

H. Run-of-bank gravel, as defined herein, shall mean a naturally occurring mixture of stones and/or sandy soil particles, of varying sizes, which are generally the result of glacial deposition. Run-of-bank gravel may also be referred to as "R-O-B" or "bank run gravel." Run-of-bank gravel may also be integrated mixture of somewhat spherically shaped and flattish type, round edged stones of like nature. No stone shall exceed three (3) inches in its greatest dimension. Colors may vary depending on geographical locations. Run-of-bank gravel shall be free of overburden, refuse, debris, plant growth, woody vegetation, organic substances, loam or silt, and such other deleterious materials. All run-of-bank gravel shall be approved by the Project Director prior to its use. No run-of-bank gravel shall be placed within four (4) inches of the bottom of a pavement course, sidewalk slab, or concrete curb.

I. Foundation material, as defined herein, shall be a selected, graded gravel conforming to New York State Department of Transportation (DOT) Specification 304-2.02, Type 4. All materials shall be well graded from coarse to fine and free from organic or other deleterious materials.

Gradation shall conform to the table below:

Sieve Size Designation	Percent Passing By Weight
2 inch	100
1/4 inch	30 - 65
No. 40	5 - 40
No. 200	0 - 10

Not more than thirty (30) percent, by weight, of the particles retained on a one-half (1/2) inch sieve shall consist of flat or elongated particles. A flat or elongated particle is defined herein as one which has its greatest dimension more than three (3) times its least dimension.

Foundation material shall be used under concrete formwork, pavement course, sidewalk slab, concrete curb or similar work.

2.0 EXECUTION

2.01 Excavation

A. All trenches shall be excavated to the line, grade, and typical section as shown on the Plans and Drawings, including any deviation(s) which may have been approved by the Project Director and shall comply with all applicable regulations, laws and ordinances then in force at the time and place of construction.

B. Trenches shall not be opened for more than three hundred (300) feet in advance of the completed line, pipe, or sewer, nor left unfilled for more than one hundred (100) feet in the rear thereof without consent of the Project Director. Excavation of the trench shall be fully completed at least twenty (20) feet in advance of the pipe laying or construction of the invert unless specifically permitted otherwise.

C. Limits (over excavating)

Excavations shall be made to the dimensions and elevations indicated on the Plans and Drawings. Should unsuitable material be encountered at elevations indicated, excavation shall be carried to such greater depths as may be required to provide adequate bearing capacity. Should excavation through error be carried to a greater depth or size than indicated or required, such additional depth or size shall be filled with embedment material to the proper elevation or size. Embedment material shall be placed in lifts not greater than six (6) inches and compacted to a minimum of ninety (90) percent Standard Proctor Density. All expense required to correct this "error" shall be borne by the Contractor.

D. Removal of Improved Surfaces

Before any excavation is made, improved surfaces such as bituminous or Portland cement concrete pavement, lawns, etc., existing over the area of the proposed trench shall be removed. Before removal of such material is attempted, that part of the surface being removed shall be separated from the part which is to remain by the use of tools and methods that will result in a clean line of separation between the two sections. Pavement saws, power chisels, spades, etc., capable of cutting through the material being removed shall be used. Under no circumstances shall a pavement be struck or lifted until the section over the proposed excavation can be removed without damage to the adjacent pavement. Material so removed shall be classified as "SPOIL" (Section - 1.02B).

E. Trench Width

Trench width at the ground surface may vary depending on depth, type of soil and position of surface structures, but in general the minimum clear width of trench, sheeted or not sheeted, measured at the springline of the pipe to be installed, should extend twelve (12) inches from each side of the pipe. The minimum clear width of the trench at the top of the pipe should be equal to the pipe outside diameter plus two (2) feet. In cases where the trench is exceptionally deep or where extra thick sheeting, bracing, or other systems of trench support are required, the Contractor shall vary these trench widths. The Contractor will not be permitted to use methods of excavation which cause excessively wide trenches, undue disturbance of existing pavement or unreasonable interference with traffic.

F. Trench Bottom

The trench bottom shall be smooth and free from stones, clods, frozen soil or any deleterious material which will hamper the installation of pipes, conduits, structures and appurtenances. In most installations where the pipe to be laid does not exceed twelve (12) inches in diameter, the trench should be undercut by machine and brought up to grade by the use of granular embedment material (Section -1.02F) or other material approved by the Project Director. Where an unstable (flowing) soil condition is encountered in the trench bottom, such as may be found when excavating below groundwater level or in weak or non-cohesive soils, such conditions shall be stabilized before any attempt

is made to install pipe or other appurtenances in the trench. The method used to obtain this stabilization shall be with the use of a Filter Fabric (Section - 1.02G) and/or approved by the Project Director.

G. Dewatering

Where conditions are such that running or standing water occurs in the trench bottom, or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps, siphons, well-points, or previous underdrain bedding or other suitable means until the pipe has been installed and sufficient backfill has been placed over the pipe to prevent flotation of the pipeline.

Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least twenty-four (24) hours after placement, and no stream of water shall be allowed to flow over such Work until such a time as the Project Director may permit.

Water pumped or drained from excavations, or any sewers, drains, or water courses encountered in the work, shall be disposed of in a suitable manner without injury to adjacent property, the Work under construction or to pavements, roads, and drives.

The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or storm water. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment

contained in the water to allowable levels, as determined by appropriate State Agency and/or publication and/or Standard. The Project Director shall approve the location of all site settling basins as per N.Y.S. Guidelines for Urban Erosion And Sediment Control. No water shall be discharged to sanitary sewers. Sanitary sewage shall be pumped to sanitary sewers or shall be disposed of in an approved manner.

Upon completion of the section wherein the operations have been performed, the Contractor shall remove from the catch basins, sumps, ditches or water courses, all mud, silt, debris, and other accumulations discharged to these various locations. The Contractor is responsible for leaving them in a condition similar to that which existed prior to his operations. Proper erosion control measures shall be employed, so as to minimize siltation and erosion in and adjacent to the area of the work.

H. Trench Support

Where an unstable (flowing) soil condition is encountered in the trench wall, such as may be found when excavating below ground water level or in weak or non-cohesive soils, such conditions must be stabilized before any attempt is made to install pipe, manholes, catch basins or other appurtenances in the trench. The method used to obtain this stabilization is dependent upon the cause and severity of the condition. The Contractor may use tight or skeleton sheeting, stay bracing, or trench jacks to support the trench during pipe laying operations, but the method shall be subject to review and approval by the Project Director before

any support system is adopted. Under certain conditions it may be necessary to leave sheeting in place to prevent migration between material used beneath and around the pipe and trench wall material. Timber sheeting, when used below the top of the pipe, shall be driven approximately two (2) feet below the bottom of the pipe and where there is a possibility that "pulling" the sheeting might result in a collapse of the trench wall and a widening of the trench at the top of the conduit before backfill can be placed, the Project Director may direct that all or a part of the sheeting be left in place. The Project Director may also direct that sheeting be cut off and left in place approximately one and one-half (1 1/2) feet above the top of the pipe, if there is a possibility that removal of the sheeting would leave a void in the embedment material between the pipe and the trench wall after embedment material has been compacted. Steel sheeting, because of its thinness, and when properly installed, may be withdrawn with about the same factor of safety against settlement of the surfaces adjacent to the trench wall as that for timber sheeting left in the trench. Removal of bracing between sheeting shall be carried out as backfilling proceeds and in a manner that does not relax trench support.

I. Storage and Disposal of Suitable Material

All excavated material, which is suitable and approved for backfill or fill, shall be placed in storage piles until it can be used in the Work. It shall not be placed close to the sides of excavations, where the weight of the material could create a surcharge on such sides, whether seeded or not. Locations for storage

shall be as provided by the Contractor. Hydrants under pressure, water and gas valves, manhole covers, fire and police call boxes, or other utility controls shall be left unobstructed and accessible at all times. Gutters shall be kept open or other satisfactory provisions made for street drainage. Natural water courses shall not be obstructed and unless otherwise approved, stockpiles shall not obstruct adjacent streets, walks or driveways. Excavated material in excess of that required for backfill, fill, topsoil or other purposes, as shown or directed, including any stored surplus, shall remain the property of the Owner and stockpiled as directed by the Project Director, unless the Contractor is directed in writing to dispose of said material.

J. Disposal of Unsuitable Material

All unsuitable or excess excavated material shall be classified as "SPOIL" (Section - 1.02B).

K. Conflicting Obstruction

Certain conflicting obstructions may be encountered in excavating trenches relative to this classification which may or may not be shown on the Plans and Drawings. Such obstructions may be, but are not limited to, public, private, or utility owned surface or sub-surface structures such as water, sewer or gas lines; electric, telephone or cablevision cables, conduits, boxes or vaults; manholes, catchbasins, cesspools or septic tanks; all, some, or none of which may be in current use. The Contractor shall be responsible for all conflicting surface and sub-surface structures, utilities and obstructions. He/she shall

bear all expense arising from obstructions encountered and shall perform all locating or causing to be located, protection, repair of damage, and necessary removal, adjustment and relocation. When a conflicting publicly or privately owned utility is required to be relocated by its owner, the Contractor shall cooperate with the utility owner, and the Contractor shall locate, excavate, protect and expose the utility at his expense. The Contractor shall not be due claims for damages arising from any delays encountered thereby.

L. Pavement Separation

Saw cutting shall be carried out on all joints to be severed from the existing pavement. Any disturbed pavement not specified herein or approved in writing by the Project Director, shall be replaced in accordance to the Town of Fishkill and/or East Fishkill Highway Specifications or to the satisfaction of the Superintendent of Highways. The Contractor shall furnish the necessary labor, equipment, and material required for the pavement restoration.

M. Dust Control

Provision shall be made at the job site to control the amount of airborne dust resulting from construction operations by minimal wetting of debris and other materials and the immediate work area with appropriate spraying agents or other means acceptable to the Project Director and the New York State Department of Environmental Conservation.

2.02 Rock Excavation

A. When "Rock" is encountered during excavation, the Contractor shall excavate as required for construction of the proposed project as shown on the Plans and Drawings, in the following subsequent manner:

1. Ripping (from Back Hoe or Track Equipment)
2. Hoe Ram

Under no conditions shall blasting or the use of explosives be permitted in the course of excavation of rock or other materials.

The Project Director shall review and approve each method of rock removal for sufficiency before allowing the next alternative technique to commence.

It shall be the responsibility of the Contractor to employ the most efficient method or methods in removing the rock so encountered. He/she will not be permitted to use archaic or inefficient methods or procedures which could result in a request for payment for extra work.

Any projection of rock that will be nearer than six (6) inches to any part of a pipe, conduit or other appurtenance or structure after such properties have been installed, shall be removed.

All rock material so removed shall be classified as "SPOIL" (Section - 1.02B).

B. Excavation Near Combustible Gas Pipes

1. If in the course of any such excavation or other work, damage or the potential thereof is occasioned to any utility facility used in the transmission or distribution of gas, electricity, water, steam, telephone or telegraph, whether by direct contact, undermining of soil or other support thereof, or otherwise, the person having direction or control of such work shall promptly take all reasonable measures necessary to protect individuals and the public from loss or the potential thereof and shall immediately notify the person, corporation or municipality owning or operating such utility of such damage or potential damage to its facilities. Neglect on the part of the person having direction or control of such works, responsible for any damage or potential damage to such facilities (a) to take such safety precautionary measures as are necessary or reasonably required promptly or (b) to immediately notify the Owner or operator of the utility facility involved of damage or potential damage to its facilities, damage to its facilities, occasioned by such a person or under his direction or control, shall be a violation of this Section and constitute a misdemeanor. Nothing herein contained shall preclude or prevent recovery of monetary damages by the Owner or operator of the utility facility involved or by any other person suffering damage from the disruption of utility services occasioned by excavation or other work in the vicinity thereof.

2.03 Backfilling

A. General

After the pipe has been installed, inspected and/or referenced by the Project Director, the trench shall be backfilled in conformance to the following Specifications and as shown on the Plans and Drawings for a typical pipe and accessory installation. In generally, material removed from the excavation is suitable for final backfill, provided, however, that such material is free of sod, roots, spongy material, refuse or garbage, pieces of pavement, frozen clumps, lumps or clods of soil, mush, clay, cinders, slag, ashes, rubbish, rocks or pieces of rock measuring more than six (6) inches in any one direction. In no case shall the excavation be backfilled with material which contains more than twenty (20) percent of rock, unless well blended with other acceptable material. If the material excavated is not acceptable to the Project Director, the excavation shall be backfilled with run-of-bank gravel (Section - 1.02H) or other material approved by the Engineer. Run-of-bank gravel shall be placed to a total thickness conforming to the Specifications, Plans and Drawings for that item, in equal lifts, with no one (1) lift exceeding a minimum of eight (8) inches in uncompacted thickness. Each lift shall be compacted to ninety (90) percent Standard Proctor Density before the next lift is placed. Regardless of the type or kind of backfill used, material shall not be placed in lifts exceeding eight (8) inches in depth and each lift shall be compacted to ninety (90) percent Standard Proctor Density (ASTM-D698) before the next lift is placed. The last two lifts before grade level shall be six (6) inches and compacted to the density indicated.

B. Initial Backfill

Twelve (12) inches of selected gravel conforming to embedment material (Section - 1.02F) shall be carefully placed in the trench in two equal lifts, with each lift being evenly hand-leveled from trench wall to trench wall and carefully compacted to ninety (90) percent Standard Proctor Density (see ASTM D698 or AASHTO T99). When rock is encountered, the amount of embedment material (Section - 1.02F) shall be a minimum of six (6) inches and conform to ninety (90) percent Standard Proctor Density.

C. Final Backfill Under Improved Surfaces

Under improved surfaces and shoulders of streets, roads, aprons, curbs and walks, final backfill material shall be placed in lifts not exceeding eight (8) inches in depth and each lift compacted to ninety (90) percent Standard Proctor Density (ASTZM-D698) before the next lift is placed in the trench. The last lifts before grade level shall be compacted to ninety-five (95) percent Standard Proctor Density and consist of nine (9) inches or R-O-B (Section - 1.02H), placed in two (2) equal lifts, and three (3) inches of foundation material conforming to (Section 1-02I). The final lifts shall be leveled to correspond with adjacent surfaces within plus or minus one (1) inch after compacting.

D. Final Backfill Under Lawns, Open Fields and Unimproved Rights-of-Way

Final backfill material used under lawns, open fields and unimproved rights-of-way need not be as carefully

selected as the material specified for use under improved surfaces, but material containing roots, slop, spongy material, pieces of pavement, frozen lumps of soil, mush, clay, rubbish or rocks measuring more than six (6) inches in any one direction, will not be considered acceptable. Unless otherwise ordered by the Project Director, mechanical compaction as called for under improved surfaces will not be required. Material shall be deposited in lifts and machine spread until the surface layer can be rolled with the placement equipment. Unless topsoiling and seeding is to follow, the surface shall be mounded and maintained by filling all sunken areas until final acceptance of the work. In areas where seeding is to follow, the top four (4) inches to six (6) inches of the trench shall be backfilled with topsoil.

E. Backfilling on Slopes

In trenches on slopes, the "French Drain" effect on fill which has not been completely consolidated may result in surface or groundwater washing out soil from under or around the pipe, thus reducing or eliminating support of the pipeline. Where such conditions are present, lifts in the final backfill shall be reduced to four (4) inches in depth with each lift being compacted as called for in this specification. Under conditions where the slope is extreme, the Project Director may order the installation of concrete collars, keyed into the trench sides and foundation as a precaution against pipeline failure.

END OF SECTION

SECTION 30,000.00

GEOTEXTILE

1.0 GENERAL

1.01 Scope of Work

A. The Contractor shall furnish all labor, tools, equipment and miscellaneous related items to install the geotextile filter fabric as set forth in these Specifications and as called for on the Contract Plans and Drawings. The intent of the geotextile material application is that it be incorporated into the landfill final cover, perimeter roadway and associated systems to serve as protective, drainage, filtration, separation, and slope stability layers as shown in the Contract Plans. The handling, manufacture, placement, etc. of all Geotextile shall also conform to the Quality Assurance/Quality Control Plan written for the closure of the landfill.

1.02 Definitions and Materials

A. Filter Fabric as herein defined to be utilized for the landfill construction may be described as a non-woven, needlepunched, continuous filament, polymeric geotextile of specific weight. The geotextile shall be colored (not white) to avoid "snow-blindness" of operating personnel at the project site. The fiberous structure of the geotextile must be able to withstand handling, placement and long-term loads associated with landfill construction and the following typical specification values are given as guidelines for selecting non-woven continuous filament geotextile

Final selection and material approval will be made by the Project Director.

Prior to the installation or delivery of a geotextile, the Manufacturer shall provide to the Project Director a list of guaranteed "minimum average roll values" for the geotextile (the minimum average roll value is the minimum value obtained from the average values of the sampled rolls). In addition, the Manufacturer will provide the Project Director with a written certification stating the properties of each geotextile material roll meets or exceeds the guaranteed properties submitted.

Geotextile fabric shall be capable of withstanding thirty (30) days of sunlight without measurable deterioration. The Geotextile shall have an average weight of eight ounces per square yard (8.0 oz/s.y.) and designed to ensure that the soil particles and/or gravel fills do not pass through the filter.

The geotextile shall be marked if placement orientation is critical, (i.e., if one side of the fabric should contact the geonet, geomembrane, geogrid, etc.) then such a side shall be clearly indicated.

B. The non-woven geotextiles shall meet or exceed to the minimum average roll values below:

SPECIFICATION LIMIT

PROPERTY	8 OZ./SQ.YD.	TEST METHOD
- Weight (oz/s.y.)	8.0	ASTM D-3776
- Thickness (mils)	90	ASTM D-1777
- AOS (sieve size)	120 - 70	ASTM D-4751
- Mullen Burst Str. (psi)	350	ASTM D-3786
- Tensile Grab Str, (lbs)	225	ASTM D-4632
- Grab Elongation, (%)	> 50	ASTM D-4632
- Puncture Str. (lbs.)	100	ASTM D-4833
- Trapezoid Tear Str. MD/CD (lbs.)	100	ASTM D-4533
- Permittivity (sec^{-1})	1.4	ASTM D-4491

The Manufacturer shall submit to the Project Director documentation that guarantees the above physical properties and demonstrates chemical compatibility of the geotextile materials with the intended application. Such documentation shall include chemical compatibility testing results.

1.03 Qualifications

A. Manufacturer

The Manufacturer of the geotextiles will be responsible for the production and delivery of rolls of the products, and will be a well established corporation with more than three (3) years experience in the manufacture of geotextiles.

B. Installer

The Installer of the geotextiles will be experienced in field handling, storing, deploying, seaming, wind damage control and all other aspects of geotextile installation. The Installer or Contractor shall be responsible for on-site transport of all geotextile materials.

The Installer must have verification of training in the installation of geotextile. This may include a formal endorsement or approval and/or license from the geotextile Manufacturer.

Prior to confirmation of the contractual agreements, the Installer will provide the Project Director for approval with the following written information:

a. Copy of Installer's letter of approval or license by the Manufacturer.

b. Corporate background and information.

c. Description of installation capabilities, including:

- information on equipment and personnel
- average daily production anticipated
- quality control procedures employed

d. Resume of the field engineer or installation supervisor to be assigned to this project, including dates and duration of employment.

2.0 EXECUTION

2.01 Installation

A. Delivery

Each roll of geotextile shall bear a label which identifies the following:

- Manufacturer's name
- product identification
- unique roll and lot number
- roll dimension

The geotextile shall be marked if placement orientation is critical, (i.e, if one side of the fabric should contact the geonet, geomembrane, geogrid, etc.) then said side shall be clearly indicated.

The delivery of the geotextiles to the Project Site shall be the responsibility of the Contractor, Installer or Manufacturer(s). The Contractor must make all arrangements and provide all equipment for the unloading of the material upon delivery. The Contractor, Installer or Manufacturer(s) will be liable for all damages to the materials incurred prior to and during transportation to the site.

B. Storage and Handling

Handling, storage and care of the geotextile materials prior to and following installation at the site, is the responsibility of the Contractor. The Project Director shall approve adequate storage space locations. The Contractor will be liable for all damages to the

materials incurred prior to final acceptance of the installed lining system by the Project Director.

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. To that effect, geotextile rolls shall be shipped and stored in relatively opaque and watertight wrappings or approved equivalent. Geotextiles shall not be exposed to precipitation prior to being installed.

C. Placement

The placement of geotextiles will not be conducted during adverse weather conditions. Geotextiles will be kept dry during storage and up to the time of deployment. During windy conditions, all geotextiles will be secured with sandbags or an equivalent approved anchoring system. Removal of the sandbags (or equivalent means of temporary securing) will only occur upon placement of an overlying soil layer.

On slopes, geotextiles shall be anchored in the anchor trench or attached to geotextiles already installed on the top portions of the landfill; then rolled down the slope in such a manner as to continually keep the material in tension.

Proper cutting tools will be used to cut and size geosynthetic materials. Extreme care will be taken while cutting in-place geosynthetics, to obviate concerns of damaging underlying geomembrane liners or geosynthetic materials.

During the placement of geotextiles, all dirt, dust, sand or mud must be kept off to prevent clogging. If excessive contaminant materials are present on the geotextile, it must be swept clean as directed by the QA/QC Monitor.

D. Seaming or Joining

1. Geotextiles will be seamed using a twenty-four (24) inch overlap.

2. Repair of tears, holes or defects in the geotextile will require the following procedures:

   - A patch made from the same geotextile will be overlapped in place with a minimum of twenty four (24) inch overlap in all directions as measured from the hole, tear or defect.

E. Post-Construction

Upon completion of the installation, the Installer will submit the warranty obtained from the Manufacturer/ Fabricator and/or the installation warranty.

F. Warranty

The Manufacturer/Installer shall provide a written warranty stating a five year (5) duration of time during which the geotextile materials are specifically provided or performed under this Contract shall be free from defects. Said warranty shall apply to normal use and service the the Owner as described and shown on the

Contract Drawings and specifically excludes mechanical abuse or puncture by machinery, equipment, or people, exposure of the liner to harmful chemicals or catastrophe due to earthquake, flood or tornado. Such written warranty shall provide for the total and complete repair or replacement of the defect or defective area of lining materials upon written notification and demonstration by the Owner of the specific nonconformance of the lining material or installation with the Project Specifications. Such defects or nonconformance shall be repaired or replaced within a reasonable period of time at no cost to the Owner provided that portion of the area in question has been made available to the Manufacturer/Installer and that such areas have been cleared of all liquids, sludges, dirt, sand or gravel.

END OF SECTION

SECTION 50,000.00

LANDFILL GAS VENTS

1.0 GENERAL

1.01 Scope of Work

The Contractor shall furnish all labor, tools, materials equipment and miscellaneous related items for the complete installation of the landfill gas vents as set forth in these Specifications and as called for on the Contract Plans and Drawings.

1.02 Definitions and Materials

A. Polyvinyl Chloride Pipe (PVC), as classified herein, shall mean a strong, rigid thermoplastic pipe constructed primarily of extruded polyvinyl chloride resin with minimum additions of stabilizers, pigments and lubricants. Materials shall conform to ASTM D-1784-78 PVC and six inch (6") diameter Schedule 40 pipe, to be utilized in this application, shall have dimensions and tolerances conforming to ASTM D-1785-86.

B. Select Fill, (also termed select granular fill) as defined herein and Section 50,000.00 - Landfill Gas Vents Section: 1.02B, shall be a clean, wash, sound, free from coatings and organic material, coarse sand or gravel, shall possess a minimum coefficient of permeability of 1×10^{-3} centimeters per second and have a maximum of five (5) percent by weight passing the number two hundred (200) sieve and will have a maximum particle size to not be greater than three-eights of an inch (3/8") in any dimension.

The gradation shall conform to the following:

Sieve	% Passing
3/8"	100
No. 40	5-65
No. 200	0-5

2.0 EXECUTION

2.01 Installation

A. The Contractor shall be responsible for construction of the landfill gas vents and shall include excavation of refuse and/or earth, installation of six (6) inch diameter schedule 40 PVC gas vent pipe with gooseneck and perforated section, and placement and compaction of select granular fill material as indicated on the Drawings and Specifications and as indicated by the Project Director.

B. The landfill gas venting risers shall be installed at a minimum rate of one (1) vent per acre for the "eastern" half of the facility and a rate of four (4) vents per acre for the "western" variance gas venting system half of the facility. The vents will be keyed into the proposed gas vent systems as indicated by the Plans, Documents and Specifications.

C. Landfill gas vents shall be: installed at a depth of three (3) feet for the "eastern" half of the facility into the waste and five (5) feet into the waste for the "western" variance gas vent system and will be exposed at least three (3) feet above final elevation of the landfill cover system, and be fitted with a goose neck cap or other equivalent cap to allow effective venting.

D. Landfill gas venting risers shall be backfilled with select fill in accordance with all provisions on the Contract Plans, Drawings, Specifications and as indicated by the Project Director.

E. The Contractor shall maintain the installed gas vents free of any obstruction (e.g. cave-in, backfill, etc.) and damage during placement of the soil layers and until final acceptance of the Work as required by this Contract.

2.02 Field Testing and Quality Control

A. The Contractor shall retain a commercial soil testing firm approved by the Project Director to perform all testing requirements specified in this Section. Results of all testing shall be certified by a soil scientist and submitted to the Project Director. The Contractor will also be accountable for the cost of testing as a result of materials or workmanship failing quality control testing protocols by an independent laboratory approved by the Owner.

B. Quality Control Test

The QA/QC Laboratory and/or soil borrow source, prior to placement, shall test a sample of select fill for use in constructing the gas vents in accordance with the following laboratory tests:

- three (3) grain size (ASTM-D422) analysis as a pre-qualification of the borrow source. The material shall have a maximum of five (5) percent by weight passing the number two hundred (200) sieve, no appreciable percentage of particles larger than three-eights of an inch (3/8") in diameter and shall not be gap graded. The

Contractor shall have performed one grain size analysis at his/her cost for every one thousand (1,000) cubic yards of select fill delivered.

- one (1) standard proctor analysis (ASTM D) will be required as a pre-qualification submission. Additional Standard Proctor analysis will be performed at a rate of one test per 5,000 cubic yards of soil delivered.

- one (1) initial permeability test, possessing a minimum permeability of 1.0×10^{-3} cm/sec, in accordance with ASTM-D2434 will be submitted as a pre-qualification submission. Additional permeability tests will be performed at a rate of one per 5,000 cubic yards delivered and will meet the permeability stated.

Additional tests may be conducted if, in the opinion of the Project Director or the QA/QC Manager, the quality of the select fill has changed.

END OF SECTION

SECTION 55,000.00

GAS VENTING LAYER

1.0 GENERAL

1.01 Scope of Work

The Contractor shall furnish all labor, tools, materials equipment and miscellaneous related items for the complete installation of the landfill gas venting layer as set forth in these Specifications and as called for on the Contract Plans and Drawings.

1.02 Definitions and Materials

A. Geotextile Filter Fabric, as defined by Specification 30,000.00, 1.02A. This eight ounce per square yard (8 oz./sq.yd.) filter fabric will meet or exceed the material specifications defined in Specification 30,000.00, 1.02B.

B. Select Granular Fill shall be clean, sound, free from coatings and organic material, coarse sand or gravel with a minimum coefficient of permeability of $1x10^{-3}$ cm/sec. and have a maximum of five (5) percent by weight passing the number two hundred sieve and a gradation appreciably equivalent to:

Sieve	% Passing
3/8"	100
No. 40	5-65
No. 200	0-5

2.0 EXECUTION

2.01 Installation

A. The Contractor shall be responsible for installation of the geotextile underliner and a twelve inch (12") thick layer of select granular fill in the "eastern" half of the facility and a three inch (3") thick layer of select granular fill across the "western" half of the facility as described by the Gas Venting System Plan subsequent to the installation of the landfill gas vent risers.

B. Approximately 11,000 cubic yards of select granular material will be required for the twelve inch (12") thick gas venting layer across the eastern half of the facility. Approximately 2,100 cubic yards of select granular fill will be required for the three inch (3") thick subgrade layer spread across the "western" half of the facility. This material will be supplied by local soil mines or from" County bid" suppliers accessible to the City that can meet the QA/QC testing criteria of this section.

C. The Contractor will install the three inch (3") thick subgrade layer across the limits of the "western" half of the facility in one three inch thick lift. This material will be placed and compacted to ninety percent (90%) Standard Proctor (ASTM D698) so that a smooth, even surface results and according to the appropriate

procedures defined within Section 20,000 - Earthwork. No geotextile is required in this "western" half of the facility for this work.

D. The eight ounce per square yard (8 oz./sq.yd.) geotextile filter fabric rolls will be laid out across the limits of the "eastern" half of the facility so that continuous coverage results. The fabric panels will be laid out perpendicular to the existing slopes to the greatest extent possible. Twenty-four inch (24") wide overlaps between panels will result where any two panels abut and according to all applicable procedures defined within Section 30,000.00 - Geotextile.

E. The select granular fill for the "eastern" half of the facility will be laid down in one lift resulting in a compacted thickness of a minimum thickness of twelve inches (12") in depth as measured from the geotextile fabric underliner. The Contractor will place and compact the select granular material so that a minimum compaction of ninety percent (90%) of the Standard Proctor (ASTM D698) results. The resulting surface shall be a smooth and even without sharp breaks in grade.

2.02 Field Testing and Quality Control

A. The Contractor and/or borrow source(s) will supply the following pre-qualification testing as prepared by a commercial soil testing laboratory to be approved by the Project Director.

Pre-Qualification Testing

Test Description	Number of Tests
Particle Size Analysis (ASTM D422)	3 per borrow source
Standard Proctor (ASTM D698)	1 per borrow source
Permeability (ASTM D2423)	1 per borrow source

These tests will evidence the select granular to meet the material definitions as described in this Section or will be cause for retesting or rejection.

B. The following Quality Control testing will be affected to the material supplied and installed to the number and frequency described below with the results submitted to the Project Director for review and approval.

Test Description	Frequency/Number of Tests
Particle Size Analysis (ASTM D422)	1 per 1,000 cubic yards delivered
Standard Proctor (ASTM D698)	1 per 5,000 cubic yards delivered
Permeability (ASTM D2423)	1 per 5,000 cubic yards delivered
Nuclear Density Moisture (ASTM 2922)	9 per acre per lift

Additional tests may be required by the Project Director and/or QA/QC Monitor if the quality of the delivered or placed product is in question.

Testing Criteria:

The particle size analysis will show that the delivered select granular fill appreciably meets the gradation specified by Section 1.02 of this part. The permeability testing will be performed on grab samples of the delivered product as remolded and compacted to 90% Standard Proctor density. The permeability will not be less than 1.0×10^{-3} cm/sec. The Standard Proctor testing will be affected to calibrate field testing of density and moisture of the installed fill. The Nuclear Density/Moisture field testing will evidence that the material has been installed to a minimum density of 90% Standard Proctor and within five percentage (5%) points above or below optimum moisture content.

C. Any quality control testing evidencing sub-standard results will be cause for the rejection of the delivered fill and/or the replacement, or appropriate field reworking of the installed fill.

END OF SECTION

SECTION 60,000.00

FURNISHING AND INSTALLING GEOMEMBRANE LINING MATERIAL

1.0 GENERAL

1.01 Scope of Work

The Contractor shall furnish all labor, tools, equipment, and miscellaneous related items to furnish and install the geomembrane lining material as set forth in these Specifications as called for on the Contract Plans and Drawings. The intent is for the geomembrane lining material to be incorporated into the landfill capping system to serve as a protective, envelope layer, as shown on the Contract Plans.

1.02 Definitions and Material

A. Geomembrane Lining Material, as herein defined to be utilized for the Work, may be described as a forty (40) mil. High Density Polyethylene (HDPE) or Very Low Density Polyethylene (VLDPE) lining material designed and manufactured specifically for the purpose of landfill capping and closure.

The Manufacturer of the lining material described hereunder shall have previously demonstrated his ability to produce this membrane by having successfully manufactured a minimum of one million square feet (1,000,000 sq.ft.) of similar liner material.

The Manufacturer shall be listed by the National Sanitation Foundation (NSF) Standard 54 as meeting all the requirements for manufacturing HDPE, and/or VLDPE.

The geomembrane lining material shall be manufactured by SLT North America, Inc. or approved equivalent.

B. Sheet/Quality

The Geomembrane Manufacturer shall provide the Project Director with the following information for approval regarding sheet quality and properties.

- A material physical properties sheet including, at a minimum, all specified properties, measured using test methods indicated in the Specifications, or approved equivalent.

- Certification that the sheeting shall be uniform in color, size, thickness and shall be free of deep gas checks, holes, blisters, surface divots, windows, undispersed raw materials, or any sign of contamination by foreign matter and shall not exhibit cold flow. Any such defects shall be repaired using the extrusion fusion welding technique in accordance with the manufacturer's recommendation.

C. Roll Quality

The Geomembrane Manufacturer shall, prior to shipment provide the Project Director with a Quality Control certificate for each roll of geomembrane provided. The Quality Control Certificate will be signed by a responsible party employed by the Geomembrane Manufacturer, such as the production manager and shall include:

- Roll numbers and identification.

- Documentation certifying the geomembrane was continuously inspected for uniformity, damage, imperfections, holes, cracks, thin spots, improper material ingredient mixing and foreign materials.

- Sampling results of quality control tests; as a minimum, results will be given for thickness, tensile strength, and tear resistance evaluated in accordance with the methods indicated in the Specifications or approved equivalent methods.

D. Specification Limit

The geomembrane lining material to be employed shall have minimum average property values conforming to one of the appropriate tables shown below:

Table 1: Textured HDPE Geomembrane

Property	Specification Value	Test Method
Specific Gravity (g/cc)	≥ 0.93	ASTM D792 Method A
Carbon Black Content (%)	2-3	ASTM D1603

Property	Specification Limit	Test Method
a. Mechanical		
Thickness	40 mil +\-10%	ASTM D1593

	Property	Specification Value	Test Method
b.	Tensile Properties		
	Tensile Strength at Break (lbs/in. width)	150	ASTM D638
	Tensile Strength At Yield (lbs/in. width)	100	ASTM D638
	Elongation at Break (%)	600	ASTM D638
	Elongation at Yield (%)	10	ASTM D638
	Tear Resistance (lbs.)	28	ASTM D1004 Die C
	Puncture Resistance (lbs.)	50	FTMS 101 Method 2065

Property	Specification Value	Test Method
Environmental Stress Cracking (min. hrs.)	>1,500	ASTM D1693 (10% Lgepal, 50°C)
Low Temperature Brittleness (degrees F)	<-100	ASTM D746 Proc. B
Dimensional Stability (each direction & change max.)	+/-2	ASTM D1204 212°F 1 Hour

Table 2: Textured VLDPE Geomembrane

Property	Specification Value	Test Method
Specific Gravity (g/cc)	>0.915	ASTM D792/D1593
Carbon Black Content (%)	2-3	ASTM D1603
Thickness	40 mils ± 10%	ASTM D751/D1593
Tensile Strength at Break (lbs./in.width)	150	ASTM D638
Elongation at Break (%)	750	ASTM D638
Tear Resistance (lbs.)	24	ASTM D1004
Puncture Resistance (lbs.)	40	FTMS 101C/2065
Environmental Stress Crack Resistance (min. hrs.)	>2000	ASTM 1693
Low Temp. Brittleness (deg. F)	<-100	ASTM D746
Dimensional Stability (each direction & change max.)	± 2%	ASTM 1204 @ 212° F, 1 hr.

1.03 Qualifications

A. Geomembrane Manufacturer

The Geomembrane Manufacturer will be responsible for the production of geomembrane rolls from resin, and will have sufficient production capacity and qualified personnel to meet the demands of the project.

The Manufacturer will submit to the Project Director, for pre-approval, the following qualification information:

1. Corporate background and information.

2. Manufacturing capabilities including:

   - daily production quantity available for this Contract
   - quality control procedures for manufacturing
   - list of material properties including certified test results, to which geomembrane samples are attached.

3. A list of at least three (3) completed facilities, totaling a minimum of one million (1,000,000) square feet, for which the Manufacturer has manufactured geomembrane. For each facility, the following information will be provided:

   - name and purpose of facility, its location and date of installation
   - name of Owner, Project Manager, Fabricator (if any), and Installer

- thickness of geomembrane, surface area of geomembrane manufactured.
- available information on the performance of the lining system and the facility.
- samples of fabricated seams and a certified list of minimum values of seam properties and employed test methods.

B. Geomembrane

The Installer will be responsible for field handling, storing, deploying, seaming, temporary restraining (against wind), and other site aspects of the geomembrane liner installation. The Installer may also be responsible for transportation of these materials to the site and for anchoring systems.

The Installer will be trained and qualified to install all geomembrane and will be approved and/or licensed by the Geomembrane Manufacturer and/or Fabricator.

Prior to confirmation of any contractual agreements, the Installer will provide the Project Director, for pre-approval, the following written information:

1. Copy of Installer's letter of approval or license by the Manufacturer and/or Fabricator.

2. Corporate background and information.

3. Description of installation capabilities, including:
   - information on equipment and personnel
   - average daily production anticipated
   - quality control procedures.

4. A list of at least three (3) completed facilities, totaling a minimum of one million (1,000,000) square feet for which the Installer has installed geomembrane of the type for this project. For each installation, the following information will be provided:

   - name and purpose of facility, its location and date of installation
   - name of Owner, Manufacturer, Fabricator (if any), and name of contact at the facility who can discuss the project
   - name and qualifications of the supervisor(s) of the Installer's crew(s)
   - thickness of geomembrane and surface area of the installed liner
   - type of seaming and type of seaming apparatus used
   - available information on the performance of the lining system and the facility.

5. Resume of the "master seamer" to be assigned to this project, including dates and duration of employment.

6. Resume of the field engineer or installation supervisor to be assigned to this project, including dates and duration of employment.

7. A Panel Layout plan showing the proposed placement and orientation of the geomembrane panels.

All personnel performing seaming operations will be qualified by experience or by successfully passing seaming tests. At least one seamer will have experience seaming a

minimum of five hundred thousand (500,000) square feet of geomembrane of the type for this project, using the same type of seaming apparatus in use at the site.

2.0 EXECUTION

2.01 Installation

A. Delivery

Prior to delivery, the Contractor and/or Installer shall submit to the Project Director for approval a construction drawing(s) illustrating the following aspects of the geomembrane installation:

- panel or sheet layout
- location and orientation of field seams
- any variances from the Contract Drawings
- any required details

The layout must be reviewed and approved by the Project Director prior to installation. All plans and details will be dimensional and of adequate scale to be used during construction.

Each roll of geomembrane shall bear a label which identifies the following:

- Manufacturer's name
- Product identification
- Lot number
- Roll or field panel number
- Directions to unroll the material
- Roll dimension (length, width, thickness of the roll or factory panel).

A geomembrane shall be marked if placement orientation is critical, (i.e, if one side of the fabric should contact the geonet, textile, geogrid, etc.) then said side shall be clearly indicated.

The delivery of the geomembrane to the Project Site shall be the responsibility of the Contractor, Installer or Manufacturer(s). The Contractor must make all arrangements and provide all equipment for the unloading of the lining material upon delivery. The Contractor, Installer or Manufacturer(s) will be liable for all damages to the materials incurred prior to and during transportation to the site. The Contractor shall notify the Project Director at least twenty-four (24) hours in advance of the anticipated delivery time.

B. Storage and Handling

Handling, storage and care of the geomembrane materials prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall secure adequate storage space in a location or locations acceptable to the Owner and sufficiently near the subgrade to be lined to minimize additional handling. The storage area should be protected from weather, theft, vandalism, passing vehicles, and other hazards which create a source of potential damage to the liner. The Contractor will be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Owner.

C. Subgrade Preparation

The geomembrane installation shall be performed on a firm, smooth, soil surface constructed according to the Specifications. Surfaces to be lined shall not contain sharp stones, or any other deleterious material

larger than three-eights of an inch (3/8") in diameter that may puncture or cause damage to the liner. The subgrade shall provide a firm, unyielding foundation for the membrane with no sudden, sharp, or abrupt changes or breaks in grade and be sufficient to permit the movements of vehicles and welding equipment over the subgrade without causing rutting or other deleterious effects.

No geomembrane will be placed onto an area which has standing water or excessive moisture or which has cracked due to desiccation. The Contractor shall be responsible for appropriate methods of moisture control. The Installer shall certify in writing that the final soil surface (subgrade) on which the membrane is to be installed is acceptable and conforms to the Specifications. No loose soil shall be allowed to underlie the geomembrane in the anchor trench.

D. Placement

The geomembrane liner materials will be deployed according to the following procedures:

1. Placement of the geomembrane panels will be according to the approved Panel Layout plan provided by the Installer. Placement will follow all instructions on the boxes or wrapping containing the geomembrane materials which describe the proper methods of unrolling, and/or unfolding rolls and panels. The field panel installation schedule is left to the preference of the Contractor, but the method chosen must minimize erosion of the underlying soil liner and the potential for wind damage.

Field panels shall be installed using any one or combination of the following schedules: All field panels are placed prior to field seaming (in order to protect the subgrade from erosion by rain or wind); or field panels are placed one at a time, and each field panel is seamed immediately after its placement (in order to minimize the number of unseamed field panels). The method used to place the panels shall minimize wrinkles (especially differential wrinkles between adjacent panels).

2. The method of placement must ensure that

- No equipment used will damage the geomembrane by handling, trafficking, excessive heat, leakage of petroleum products and by-products, or other means.
- No personnel working on the geomembrane will smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.
- The prepared surface underlying the geomembrane must not be allowed to deteriorate after acceptance and must remain acceptable up to the time of geomembrane placement.
- The placement of geomembrane will not be conducted during adverse weather conditions. Welding shall not take place during any precipitation, in the presence of excessive moisture, in an area of ponded water or winds exceeding fifteen (15) miles per hour.
- Adequate temporary loading and/or anchoring (i.e., sand bags, tires, etc.), not likely to damage the geomembrane will be placed to

prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

- Direct contact with the geomembrane will be minimized; i.e., the geomembrane in excessively high traffic areas will be protected by geotextiles, extra geomembrane, or other suitable materials.

3. Any damage to the geomembrane panels or portions of the panels as a result of placement shall be replaced or repaired at no cost to the Owner. The decision to replace or repair any panel or portions of panels will be made by the Project Director.

4. The anchor trench shall be excavated by the Contractor to the lines and widths shown on the Contract Drawings and as directed by the Project Director, prior to geomembrane placement. When the anchor trench is excavated in a clay liner susceptible to desiccation, no more than the amount of trench required for the geomembrane to be anchored in one (1) day shall be excavated to minimize erosion potential of the anchor trench clay soils. Slightly rounded corners shall be provided in the trench where the geomembrane adjoins the trench so as to avoid sharp bends in the geomembrane. No loose soil shall be allowed to underlie the geomembrane in the anchor trench. Since backfilling the anchor trench can effect material bridging at the toe of the slope, consideration should be given to backfill the liner at its most contracted state; preferably

during the cool of the morning or extended period of over-cast skies. Care shall be taken when backfilling the trench to prevent damage to the geosynthetics.

5. The Installer shall assign an "identification number" to each geomembrane field panel placed. A field panel is the unit area of geomembrane which is to be seamed in the field; a field panel is a roll or a portion of roll cut in the field. This number will be consistent with the number used by all QA/QC personnel. The numbering system used will be simple, logical and identify the relative location in the field.

F. Seaming

The seaming procedures below shall be implemented, where applicable, during installation of the geomembranes. Where material specific procedures are to be followed, an indication of geomembrane type will be made. The seaming procedures are as follows:

1. Generally, all seams whether field or factory will be orientated parallel to the line of slope, not across slope. This Specification applies to side slopes. All horizontal seams will be a minimum of five feet from the toe of the side slopes. At liner penetrations and corners the number of seams will be minimized.

2. The area of the geomembrane to be seamed shall be cleaned and prepared according to the procedures specified by the material manufacturer. For HDPE

any abrading of the geomembrane will not extend more than one-half inch on either side of the weld. Care will be taken to eliminate or minimize the number of wrinkles and "fishmouths" resulting from seam orientation.

3. Seaming will not proceed in extreme heat (above 40°C/104°F) or extreme cold (below 5°C/41°F) conditions. The specified temperature range is for ambient air. This restriction may be waived if the Installer can obtain and submit for approval documentation and testing results from the Manufacturer which conclusively demonstrates that seam quality is not significantly impacted by extreme temperature conditions. In addition, seaming will not be conducted when geomembrane material is wet from precipitation, dew, fog, etc., or during excessive wind.

4. Seams will have an overlap beyond the weld large enough to perform destructive peel tests, but not exceed five (5) inches. Any material used to temporarily bond adjacent geomembrane panels must not damage or leave the geomembrane altered in any manner.

5. Trial seams will be made on excess geomembrane material. A one (1) foot by three (3) foot seamed liner sample will be fabricated with the seam running down the three (3) foot length in the center of the sample. Such trial seaming will be conducted prior to the start of each seaming succession or every five (5) hours, and when seaming geomembrane after any significant change in weather conditions. From each trial seam, two

(2) sample field test specimens will be taken. The test specimens will be one (1) inch by twelve (12) inch strips cut perpendicular to the trial seam. These specimens will be shear and peel tested using a field tensometer, and recorded as pass (failure of liner material) or fail (failure of seam). Upon initial failure, a second trial seam will be made; if both series of test specimens do not pass, then the seaming device and its operator shall not perform any seaming operations until the deficiencies are corrected and two (2) successive passing trial seam test specimens are procured. Completed trial seam samples cannot be used as portions of a second sample and must be discarded.

6. Seams up side slopes will be continuous through the anchor trench. No fishmouths shall be allowed within the seam area. Where fishmouths occur, the material shall be cut, overlapped and an overlap weld (lap joint) shall be applied. Where necessary, patching using the same liner material will be welded to the geomembrane sheet.

7. Acceptable seaming methods for geomembrane are:

   - extrusion welding using extrudate with identical physical, chemical and environment properties
   - hot wedge welding using a proven fusion welder and seamer.

G. Seam Testing

1. Non-destructive seam testing will be performed on one hundred (100) percent of all field seams. The purpose of nondestructive tests is to check the continuity of the seams. It does not provide information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming. The following test methods and procedures may be used:

   a. Vacuum testing will be used on all seams not tested using air pressure testing. Using an approved vacuum box, the procedures below will be followed:

      - apply a soapy water mixture over the seam
      - place vacuum box over soapy seam and form a tight seal
      - create a vacuum by reducing the vacuum box pressure to five (5) psi (35 KPa)
      - observe through the vacuum box window any bubbles
      - where bubbles are observed, mark seam for repair
      - move vacuum box further down seam overlapping tested seam by three (3) inches
      - where hot wedge seaming has been performed, the overlap must be cut back to the weld
      - all vacuum testing will be reviewed by the QA\QC Monitor.

b. Air pressure testing may be used in place of the vacuum box if double track hot wedge welding has been utilized to seam geomembrane. Using approved pressure testing equipment, the procedures below will be followed:

- seal one end of the air channel separating the double hot wedge welds
- insert pressure needle into air channel at this end
- seal open end of channel, and pressurize the air channel to twenty-five (25) psi
- monitor pressure gauge for three (3) minutes and determine whether pressure is maintained without a loss of more than two (2) psi
- if the pressure test fails, then localize the leak and mark the area for repair
- air pressure testing will be reviewed by the QA\QC Monitor.

2. Destructive Seam Testing

a. Laboratory Destructive Seam Testing

Destructive seam testing shall be performed at intervals of one sample for every five hundred (500) linear feet of weld or at the Project Director's discretion. The purpose and intent of these tests are to check that welds are fully integrated with each other and to evaluate seam strength. Destructive testing of seams is very important since it

provides the only direct evaluation of seam strength and bonding efficiency which indicates seam durability. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming. The seaming technician shall not be informed in advance of the locations where the seam samples shall be taken. Seams should be stronger than the material. The QA/QC personnel shall perform bonded seam shear strength and seam peel adhesion tests (ASTM D4437, as modified by Annex A) at the locations indicated by the Project Director. The total sample size will be thirty-six (36) inches by twelve (12) inches and each sample shall be marked with a sample number, date, ambient temperature, and welding machine number.

The sample shall be divided into three (3) portions and distributed as follows:

- Installers sample (12 inches x 12 inches)
- QA\QC Laboratory's sample (12 inches x 12 inches)
- Owner's sample for archive storage (12 inches x 12 inches).

Ten (10) specimens will compose a set, with half of these being tested for peel and the other half for shear strength. Each specimen will be one (1) inch wide and twelve (12) inches long with the field seam located six (6) inches from either end.

Test specimens will be considered passing if the minimum values below are met or exceeded for four (4) of the five (5) test specimens. All acceptable seams will lie between two (2) locations where samples have passed.

Textured HDPE Geomembrane Field and Factory Seams:

Property	Specification Limit	Test Method
Bonded Shear Seam Strength (lb/in. width)	FTB, 105/or/90% of tensile strength @ yield	ASTM D4437 (As Modified By Annex A)
Seam Peel Adhesion (lb/in.width)	Film Tear Bond, 80% or 70% of tensile strength @ yield	ASTM D4437 (As Modified By Annex A)

Textured VLDPE Geomembrane Field and Factory Seams:

Bonded Shear Seam Strength (lbs./in.width)	FTB, 110 or 80% of tensile strength, whichever greater	ASTM D4437
Seam Peel Adhesion (lb./ in. width)	FTB, 95 or 65% of tensile strength, whichever greater	

NOTE: Shear and peel seam tests shall be based upon specification value or percentage of tensile strength at yield of parent material, whichever is greater.

Shear testing applies a tensile stress from the top sheet through the weld and into the bottom sheet. A minimum stress level is specified in order to protect against legitimate tearing of a thin portion of polymer in the weld (as might occur if the weld is off center).

The peel test indicates whether or not the sheets are continuously and homogeneously connected through the seam. Peel testing technique peels the top sheet back against the overlapped edged of the bottom sheet in order to observe how separation occurs.

If the polymer material tears (film tear bond), then this indicates that a fully integrated connection between top and bottom sheets. With a fully integrated, continuous connection through the seam, no weld bead/sheet or sheet/sheet interface exists. Such an interface might be separated by absorbed chemicals, causing failure of the seam.

The minimum stress levels are necessarily lower than tensile yield strengths because of the different configuration of the test specimens during destructive testing. Bending moments come into play along with straight tensile stresses especially as the sheets are bent pack in peel. These bending moments depend on the shape of the welds which vary even within the same welding technique. The minimum stress values are based on the average performance values of passed weld specimens tested in the laboratory.

B. Field Destructive Seam Testing

Hand tensiometer testing shall be carried out at the ends of each seam. These (2) two field samples shall have a dimension of one (1) inch wide by twelve (12) inches with the seam centered and perpendicular to the longest dimension. Both samples must pass to qualify for laboratory testing or to continue with additional seams. Failure of these specimens will require correcting the seaming device and repair to the preceding seam according to the testing failure procedure.

1. Destructive Test Failure

The QA/QC personnel shall ensure that the following procedures apply whenever a sample fails a destructive test:

- seam is reconstructed between any two passed test locations.

-or-

- The welding path is retraced to an intermediate location (ten feet (10') maximum from the point of the failed test in each direction) and a second sample is taken for an additional field test. If these additional samples pass the field test, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is reconstructed between these location. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

All seams must be bounded by two locations from which samples passing the laboratory destructive tests have been taken.

The QA\QC personnel shall document all actions taken in conjunction with destructive test failures (e.g. capping of failed seam area).

If double track welding is used, the Project Director and the Installer must agree on the track weld that will be used in the destructive testing. The weld chosen, "inside" or "outside, must be consistently tested and pass according to the criteria above.

All holes created by the Installer cutting out destructive samples will be patched with an oval patch of the same material welded to the membrane using extrusion welding. The patch seams will be tested using a vacuum box and using the procedures described above. Work will not proceed with materials covering the geomembrane, until passing results of destructive testing have been achieved and results submitted to and approved by the Project Director.

C. Liner Defects And Repair

1. Identification

The Installer and QA\QC Monitor shall examine all seams and non-seam areas of the geomembrane for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. Any defective/damaged materials shall be identified

via a deficiency report and actions taken to resolve or correct the problem shall also be recorded for use in the Construction Certification Report.

The report shall identify all defects, holes, blisters, undispersed raw materials, signs of contamination by foreign matter, unacceptable welds and other unsatisfactory conditions. The repair/corrective action to "fix" the problem shall also be recorded in the report.

2. Evaluation

All suspect locations in seam and non-seam areas shall be non-destructively tested. The Installer shall mark and repair each location which failed the non-destructive testing. Work shall not proceed with any materials which will cover locations which have been repaired, until passing laboratory test results are available.

3. Repair Procedures

Any portion of the geomembrane exhibiting any imperfections, flaws, construction damage or destructive and non-destructive test failures shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Director and the Installer. The appropriate methods and procedures available include:

- patching--used to repair large holes, tears, and contamination by foreign matter;

- buffing, grinding, and re-welding--used to repair small sections of extruded seams;
- spot welding or seaming--used to repair small tears, pinholes, or other minor localized flaws;
- capping--used to repair large lengths of failed seams;
- topping--used to repair areas of inadequate seams which have an exposed edge;
- removing bad seam and replacing with a strip of new material welded into place.

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired and require abrading shall be patched within one hour of the abrasion procedure.
- All surfaces shall be clean and dry at the time of repair.
- All seaming equipment shall be approved by the QA\QC Monitor and Installer for repairing procedure.
- The Project Director and Installer shall approve, in advance, any specific repair procedures, materials, and techniques.
- All defects that are patched shall have the patch overlap the edge of the defect by a minimum of six (6) inches and all corners of patches shall be rounded edges (no corners) with a radius of at least three (3) inches. In the case of a large patch, the underlying geomembrane shall be cut appropriately to avoid trapping gases and moisture between the two sheets.

- During repair, the QA\QC Monitor shall review the procedures as well as all non-destructive testing of the repair seams. If the repair is very large, destructive testing may be required at the discretion of the QA\QC Manager. Any failure of repaired seams will require that the patch be removed, replaced and retested until passing results are achieved. Each major repair requiring a patch or cap shall be identified on the "as-built" drawings prepared by the Installer.

D. Material Placement And Contact With Geomembrane

Placement of soils, sand, or other types of earth cover on top of the liner shall not be performed until all destructive and non-destructive testing has been performed, submitted to and approved by the Project Director.

A geotextile or other cushion approved by the Project Director and Installer shall be installed between angular aggregate and the geomembrane. All granular material placed immediately above the geomembrane shall conform to the same type and gradation requirements of the subgrade previously defined and be spread with a minimum initial lift of six (6) to ten (10) inches, depending on earthwork equipment involved. No construction equipment used for placing soil shall be driven directly on the geomembrane. In heavily trafficked areas, such as temporary access ramps, soil thickness shall be a minimum of one (1) foot above the liner.

Placement of material shall be performed to minimize wrinkles in liner. Equipment operators shall be briefed on method of placement and affects to thermal expansion and contraction of the liner. If a wrinkle forms, every effort shall be made to walk the wrinkle out. Minor folding over of wrinkles is acceptable providing an even transition occurs at the tail of the wrinkle. If excessive stress points are created at the tail of the wrinkle, the wrinkle should be cut out and repaired.

Material placed on top of the liner shall be back-dumped on the liner and (in order to avoid the formation of wrinkles) efforts shall be made to load the soils so that it comes down on top of the liner rather than being pushed across the sheet. This shall be done by:

- Using appropriate equipment to place soil ahead of spreading soil cover.
- Spreading soil by building a mound at the edge of soil, then pushing soil up and over the mound causing it to come down on the liner.

Avoid undue stress on liner at all times and cover material shall be pushed up side slopes, never down. A worker shall walk alongside earth moving equipment and remove all rocks, stones, roots or other debris that could cause damage to the liner. Equipment operator(s) shall avoid sharp turns or quick stops that could pinch or tear the liner.

All cover soil placed above the initial lift of cover soil shall: consist of soil and stone with no particles larger than four inches (4") in diameter, be free of trash or deleterious material and be placed so the final thickness of cover soil above the geomembrane is no less than twelve inches (12") in depth.

J. Post-Construction

The Installer will prepare and submit, to the Project Director, Record Drawings illustrating the following information:

- dimensions of all geomembrane field panels
- panel locations referenced to the Contract Drawing Plans
- identify all field seams and panels with the appropriate number or code
- location of all patches, repairs and destructive testing samples

A Record Drawing(s) will be submitted for each geomembrane layer constructed.

The geosynthetics lining system shall be accepted or rejected prior to the installation of cover soil; verification of the adequacy of all seams and repairs including associated testing shall be complete, and all documentation for installation is completed, and submitted for approval to the Project Director.

K. Warranty

The Manufacturer/Installer shall provide a written warranty stating a twenty (20) year duration of time

during which the liner materials specifically provided or performed under this Contract shall be free from defects. The Manufacturer/Installer shall also provide a two (2) year installation warranty to the Owner. Said warranties shall apply to normal use and service by the Owner as described in the Post-Closure Monitoring and Maintenance Manual and shown on the Contract Drawings and specifically excludes mechanical abuse or puncture by machinery, equipment, or people, exposure of the liner to harmful chemicals or catastrophe due to earthquake, flood or tornado or other such "Acts of God". Such written warranties shall provide for the total and complete repair or replacement of the defect or defective areas of lining materials upon written notification and demonstration by the Owner of the specific nonconformance of the lining material or installation with the project specifications. Such defects or nonconformance shall be repaired or replaced within a reasonable period of time at no cost to the Owner provided that portion of the areas in question has been made available to the Manufacturer/Installer and that such areas have been cleared of all liquids, sludges, dirt, sand or gravel.

END OF SECTION

SECTION 100,000.00

BARRIER PROTECTION SOIL LAYER

1.0 GENERAL

1.01 Scope of Work

A. The Contractor shall provide all labor, materials, equipment, and services necessary for, and incidental to, furnishing, placing, compacting and testing the barrier protection layer as shown on the Contract Drawings and as specified herein.

B. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.

C. The Engineer will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.02 Definitions and Materials

A. Select granular fill to be installed in intimate contact with the geomembrane barrier layer shall be sound, durable, smooth, non-angular, sand, gravel, stone, soil or blends of there materials free from organic, frozen

or other deleterious materials and conforming to the following gradation requirements:

Sieve	% Passing
3/8"	100
No. 40	5 - 65
No. 200	0 - 5

1. Fines passing the No. 200 sieve shall be non-plastic.

2. This select granular fill shall be utilized to construct and install the first lift of the barrier protection soil layer. The uncompacted lift thickness shall be a minimum of six inches (6") in depth and shall depend on the type of earthwork equipment utilized. The Project Director shall approve the earthwork equipment to be utilized and make lift thickness recommendations accordingly.

3. It is estimated that approximately 10,600 cubic yards of select granular fill will be required for construction of the six inch (6") thick lift placed in intimate contact with the geomembrane. This material will be supplied by local soil mines or "County bid" suppliers accessible by the City that can meet the quality control testing criteria listed herein.

B. The second and remaining lifts of barrier protection soil shall consist of sound, durable, sand, gravel, stone, soil or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the following gradation requirements.

Sieve Size	% Passing
4"	100
1/4"	30 - 75
No. 40	5 - 40
No. 200	0 - 10

1. Fines passing No. 200 sieve shall be non-cohesive.

2. The "second lift" and successive lifts of layer soil to be placed above the select granular fill barrier protection soil, shall be installed such that the final, compacted, installed thickness of the entire barrier protection soil layer is a minimum of twelve inches (12") in thickness.

3. It is estimated that approximately 10,600 cubic yards of 4" minus fill will be required for the construction of the "second" six inch (6") lift of the barrier protection layer. This material will be supplied by local soil mines or "County bid" suppliers accessible to the City that can meet the quality control testing criteria listed herein.

2.0 EXECUTION

2.01 Installation

A. The barrier protection soil layer shall be installed in a fashion that is not harmful, deleterious or cause damage to the function of, or material components and auxiliary systems of, the barrier (geomembrane) layer.

B. Do not place fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water or extraneous debris.

C. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones or soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced.

D. The distribution of materials throughout the barrier protection layer shall be such that the layer will be free from lenses, pockets, streaks, and layers of materials differing substantially from the surrounding materials.

E. The placing of material shall be done so as to obtain a layer of uniform thickness without spaces between successively deposited loads.

F. Compaction of each layer shall proceed in a systematic, orderly, and continuous manner as to ensure the specified coverage by the compaction equipment.

G. Materials which cannot be compacted by the approved rolling compaction equipment because of interferences shall be compacted with smaller approved compactors to a density at least equal to the density achieved in adjacent areas by the rolling compaction equipment and methods. Single pad vibratory base plate compactors shall weight not less than 200 lbs. and have a vibration frequency not less than 1600 cycles per minute.

H. Should the fill surface become rutted or uneven subsequent to compaction, it shall be releveled and recompacted before placing the next layer of material.

I. Fill on landfill side slopes shall be placed in lifts parallel with the sloping surface.

J. Place fill materials in layers not more than ten inches (10") in loose depth. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with ten inches (10") as a maximum lift height.

K. All fill shall be thoroughly and satisfactorily compacted to at least ninety percent (90%) of the standard Proctor maximum dry density of the material used (ASTM D-698). Moisture content shall be between, plus or minus, five percent (5%) of optimum moisture content.

L. Where fill must be moisture conditioned before compaction, uniformly apply water to the surface of each layer of fill. Prevent ponding or other free water on the surface subsequent to, or during, compaction operation.

M. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to the specified density. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.

N. Rolling compaction equipment shall be heavy smooth drum in vibratory equipment capable of achieving the intended result. Any equipment not originally manufactured for compaction purposes and equipment which is not in proper working order will not be approved. Furnish manufacturer's specifications covering data not obvious from a visual inspection of the equipment and necessary to determine its classification and performance characteristics.

O. Compaction equipment shall make a minimum of 4 complete passes over the entire area of each lift.

P. The Contractor shall grade partially completed fill areas for drainage and thoroughly compact and smooth the surface at the end of each workday.

Q. For areas not accessible to heavy rolling compaction equipment, fill materials shall be placed in horizontal layers not to exceed 6 inches in loose thickness and compacted with smaller rolling compaction equipment or hand operated equipment, as approved by the Engineer.

R. The final surface of the barrier layer shall be uniform and suitable for placement of the next subsequent layer.

2.02 Field Testing and Quality Control

A. The QA/QC Laboratory shall perform testing of barrier protection layer fill materials to insure compliance with these specifications.

B. Pre-qualification testing will be submitted for each borrow source. Testing will consist of three (3) particle size analysis (ASTM D422) and one Standard Proctor (ASTM D698). Particle size will conform to the gradation specified in Section 1.02.

C. In-place density and moisture content tests shall be performed on in-place fill material in accordance with ASTM D 1556, D 2167 or D 2922. In-place density and moisture shall be determined at a depth of three inches (3") below grade. At least nine (9) tests shall be performed per acre per lift. Field test locations shall be subject to approval or relocation by the Project Director.

D. QA/QC testing during construction will consist of one particle size analysis (ASTM D422) to be performed for each 1,000 cubic yards delivered and one standard proctor compaction test (ASTM D698) to be completed for every 5,000 cubic yards of material delivered.

E. The Project Director may direct additional test to establish gradation, Atterberg limits, permeability, maximum density, in-place density, and water content as required by working conditions, or changes in borrow source material at the Contractor's expense.

F. Acceptance Criteria:

1. Acceptance Criteria: The criteria for acceptability of in-place fill shall be in situ dry density and moisture content. Minimum dry density for all fill shall be ninety percent (90%) of the standard Proctor maximum dry density. The in-place moisture content shall be between five percent (5%) dry and five percent (5%) wet of optimum ad determined by the standard Proctor compaction method (ASTM D-698). If a test fails to qualify, the fill shall be further reworked, compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

Clean Up:

A. Provide and maintain protection of newly filled areas against damage. Upon completion of when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing if any.

B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.

C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

END OF SECTION

SECTION 110,000.00

VEGETATION SUPPORT LAYER, SEEDING AND MULCH

1.0 GENERAL

1.01 Scope of Work

The Contractor shall furnish all labor, tools, materials, equipment, and miscellaneous related items for placement of soil, seed and mulch materials in the areas and to the depths and grades detailed by the Contract Drawings, Specifications and as directed by the Project Director. Vegetation support layer materials will be used in the construction of the vegetation support layer.

1.02 Definitions and Materials

A. Vegetation Support Layer Soils, as defined herein, shall be a natural soil, free from refuse, material toxic to plant growth, and similar objects larger than two inches (2") in any dimension. Sod and herbaceous growth such as grasses and weeds need not be removed, but shall be thoroughly broken up and mixed with the soil during handling operations.

The intent of the vegetation support layer is to permit development of a substantial and sustainable vegetation cover over the capped landfill area. It is not the intention of the specification to require "lawn" quality topsoil.

The City will supply approximately six thousand cubic yards (6,000 cu.yds.) of compost to be blended with approximately three thousand (3,000 cu.yds.) of existing topsoil to be stripped from the site. Approximately nine thousand cubic yards of "topsoil" is required for the work.

B. Grass seed, as defined herein, shall be fresh, re-cleaned of the latest crop year, and be mixed in the proportions of the species specified and shall conform to Federal and State standards. Each grass type mixture shall meet or exceed the minimum percentage purity and germination listed for that type of grass.

For open fields or non-developed areas, the following seed mixtures shall be used:

Common Name	Proportioned By Weight	Percent Purity	Percent Germination
Clemfine Tall Fescue	40%	95	95
Weeding Lovegrass	20%	95	95
Reliant Hard Fescue	10%	95	95
Jamestown Chewings Fescue	10%	95	95
Palmer Perennial Ryegrass	10%	95	95
White Clover	5%	95	95
Blackwell Switchgrass	5%	95	95

Plant seed mix only between April 1st to May 31st or August 16th to October 15th or as specified by the Seed Vendor. Seed shall be spread at a rate of four (4) pounds per one thousand (1,000) square feet or one hundred fifty (150) pounds per acre or as specified by the Seed Vendor. Lime requirements and other soil admixtures for seeding operations may be determined by a vegetation support layer analysis conducted by an approved agricultural extension service.

The balance of material in an acceptable seed mixture, other than specified pure live seed shall, for the most part, consist of non-viable seed, chaff, hulls, live seeds of crop plants and harmless inert matter. The percentage of weed seed shall not exceed one percent (1%) by weight for the mixture.

All seed mixtures furnished under this Item shall be mixed by the Vendor and shall be delivered in standard sized bags of the Vendor, showing the weight, analysis and Vendor's name. All seed shall be properly stored by the Contractor at the site of the Work and any seed damaged during storage shall be replaced at no expense to the Owner.

C. Commercial fertilizer (10-10-10) shall contain not less than ten percent (10%) nitrogen, ten percent (10%) available phosphoric acid and ten percent (10%) water soluble potash. The fertilizer shall be inorganic or a combination of inorganic and organic substances. The fertilizer requirements for seeding operation may also be determined by a vegetative support layer analysis conducted by an approved agricultural extension service. Commercial fertilizer will be installed at a rate of thirty (30) pounds per one thousand (1,000) square feet.

Commercial fertilizer shall be delivered in original bags of the Manufacturer, showing weight, analysis and the name of the Manufacturer.

If the commercial fertilizer is not used immediately after delivery, the Contractor shall store it in a place approved by the Manufacturer, in such a manner that its effectiveness will not be impaired.

D. Mulch, as defined herein, shall be a protective covering spread on the ground of new plantings to reduce evaporation and erosion, control weeds, or to improve the soil and plantings, as approved by the Project Director.

1. Hay shall be mowing of acceptable herbaceous growth which is free from noxious weeds and other deleterious materials. Hay shall be sufficiently seasoned and shall have a moisture content not greater than fifteen percent (15%).

2. Straw shall be stalks of oats, wheat, rye or other such crops which are free from noxious weeds and other deleterious materials. Straw shall be sufficiently seasoned and shall have a moisture content not greater than fifteen percent (15%).

2.0 EXECUTION

2.01 Installation

Placement of the vegetative support layer will be above the completed barrier protective cover soil layer. The vegetative support layer shall have a minimum uncompacted thickness of six inches (6") and not be spread if unworkable conditions exist such as excessive moisture, frost, or other deleterious conditions. After the vegetative support layer is spread, all large stiff clods, rocks, roots or other foreign matter larger than two inches (2") in any dimension shall be cleared and disposed of by the Contractor so that the finished surface is ready for seeding.

2.02 Seeding and Fertilizing

Grass seed shall be sown from April 1st to May 31st or August 16th to October 15th, unless in a favorable season, and upon written permission of the Project Director that the seeding period is extended. All seeding shall be done in dry or moderately dry soil and at times when the wind does not exceed a velocity of five miles per hour (5 mph). All seeding application shall be avoided during rain and a twenty-four (24) hour curing period is required with the

soil temperature being higher than forty-five degrees Fahrenheit (45° F). The soil shall be moist when a hydroseeder is used for applying seed mixture.

When the vegetative support layer grading is completed, and just before seeding, the areas to be seeded shall be loosened to a depth of two inches (2") and mixed with fertilizer or other admixtures at the rate as determined by the Cornell Cooperative Extension of Dutchess County or approved agricultural extension service and as directed by the Project Director. Commercial fertilizer shall be evenly applied at a rate of thirty (30) pounds per one thousand (1,000) square feet. The seeds shall be sown by hand or by an approved machine, in such manner that a uniform stand will result. After the seed is sown, the seeded areas shall be covered with 110 bales of mulch per acre, total application being no less than two (2) tons per acre, in a uniform blanket to provide ninety percent (90%) coverage.

Truck mounted equipment that leaves ruts in the finished seed bed <u>is not</u> acceptable unless the Contractor performs the Work in such a manner as to leave the barrier protection soil layer and vegetative support layer intact as designed and without ruts. If this method is to be used, the Contractor must get prior approval of the Project Director.

2.03 Hydroseeding

Apply seeding materials with a hydroseeder pre-approved by the Project Director that is specifically designed for hydroseeding.

Fill tank with water and agitate while adding seeding materials. Use sufficient fertilizer and seed to obtain the specified application rates. Add seed to tank after

fertilizer has been added. Maintain constant agitation to keep contents in homogenous suspension. Prolonged delays in application or agitation that may be injurious to the seed will be the basis of rejection of material remaining in the tank.

Uniformly distribute a slurry mixture of water and seed or water, seed and fertilizer at a minimum rate of fifty-seven (57) gallons per one thousand (1,000) square feet. Quality Assurance/Quality Control personnel may order the amount of water per area increased if distribution of seeding material is not uniform.

At no time shall mulch be added to the seed and water or seed, water and fertilizer mixture. Mulching or hydromulching shall be performed separately from hydroseeding.

2.04 Maintenance and Protection

The Contractor shall maintain, water and protect all seeded areas until final acceptance of the vegetated surfaces and Seeding portion of the Contract.

A mulch anchoring method shall be used if site is subjected to high winds, and be comprised of Terra Tack II (45 lbs.) or Aerospray 70 (60 gal/ac) or approved equivalent and applied according to Manufacturer's instructions. Maintain mulch as required, repair all washouts by raking, reseeding and re-mulching as needed until final acceptance.

Final acceptance will not be made until a uniform stand or a stand capable of regeneration and succession sufficient to assure ninety-five percent (95%) coverage of the areas planted is obtained in all newly seeded areas. The Project

Director, at his discretion, may accept a portion or portions of the Work at various times.

Upon final acceptance of a seeded area by the Project Director, the Owner will assume responsibility for maintenance and protection of that area.

Any seeded areas which are unacceptable, and which fail to show a uniform stand of grass from any cause, shall be reseeded as defined by this Section except the fertilizer shall be applied at one-half the original rate. The seeding shall be repeated until the seeded areas are satisfactorily covered with grass. The cost to reseed, refertilize and establish vegetation in such areas shall be performed at no additional cost to the Owner.

2.05 Field Testing and Quality Control

No laboratory testing is required during vegetative support layer construction; visual inspection and approval by the QA\QC Monitor and Project Director will be required. Responsibility of establishing a vegetated cover as described herein shall be the quality control criteria.

END OF SECTION

SECTION 120,000.00

PERIMETER ROAD

1.0 GENERAL

1.01 Scope of Work

A. The Contractor shall furnish all labor, tools, materials, equipment and miscellaneous related items for the complete installation and placement of road subbase course as set forth on the Contract Plans and Drawings, and as directed by the Project Director.

B. The Work shall consist of the placing of Subbase Course and/or Granular Fill in accordance with the New York State Department of Transportation Specifications dated January 2, 1985, and any addenda to these specifications issued after that date. The thickness of Subbase Course and/or Granular Fill shall be as shown on the Drawings, or as established by the Project Director.

1.02 Definition and Material

A. Road Subbase Course, as defined herein, shall conform with the following:

Type 4 Subbase Course - NYSDOT Item No. 304.05 or approved equivalent.

B. Geotextile fabric as defined by Section 30,000.00 will be required; eight ounce per square yard (8 oz./s.y.) geotextile.

2.0 EXECUTION

2.01 Installation

A. Geotextile fabric will be installed immediately above the barrier protection layer to the limits of the perimeter road as shown on the Final Grading Plan.

The road subbase course material shall be spread in horizontal layers above the geotextile so that the maximum thickness of any layer after compaction shall not exceed six (6) inches. Compaction shall be by traveling vibrators or other approved method and shall be to a density of ninety percent (90%) of the dry density as determined by the Standard Proctor Test, plus or minus five percent (± 5%). Each layer shall be thoroughly compacted before placement of overlying layers.

END OF SECTION

SECTION 130,000.00

EROSION CONTROL

1.0 GENERAL

1.01 Scope of Work

A. Work covered by this section includes the control of erosion, siltation, and sedimentation.

B. Project Requirements

1. Take every reasonable precaution and do whatever is necessary to avoid any erosion and to prevent silting of rivers, streams, lakes, reservoirs, impoundments, and drainage ditches, and swales.

2. The exposure of uncompleted cut slopes, embankments, trench excavations, and graded areas shall be kept as short as possible. Initiate seeding and other erosion control measures on each segment as soon as reasonably possible.

3. Should it become necessary to suspend construction for any length of time, shape all excavated and graded areas in such a manner that runoff will be intercepted and diverted to points where minimal erosion will occur. Provide and maintain temporary erosion and sediment control measures, such as berms, dikes, slope drains, silt stops, and sedimentation basins, until permanent drainage facilities and erosion control features have been completed and are operative.

4. Fine material placed or exposed during the Work shall be so handled and treated as to minimize the possibility of its reaching any surface waters. Use diversion channels, dikes, sediment traps, or any other effective control measures.

   Before water is allowed to flow into any ditch, swale, or channel, install the permanent erosion control measures in the waterway so that the waterway will be safe against erosion.

5. Provide silt stops wherever erosion control measures may not be totally capable of controlling erosion, such as in drainage channels and where slopes may exist.

6. Take special precautions in the use of construction equipment to minimize erosion. Do not leave wheel tracks where erosion might begin.

7. Unless specifically required in the Contract Documents, the operation of mechanized equipment in watercourses is not permitted. Where work is required in watercourses, minimized the movement of equipment in the waters and remove falsework, pilings, debris, and other temporary work as soon as construction will allow.

8. Wherever an appreciable number of crossings of live streams are necessary, provide temporary culverts or bridges to allow equipment to cross them without fording them. Disturbance of lands and waters outside the limits of construction is prohibited, except as may be found necessary and approved by the Project Director.

9. The requirements of this Section also apply to project related construction activities away from the project site, such as at borrow pits, off-site storage areas, and haul and work roads.

10. Mulching shall follow seeding operations by not more than seventy-two (72) hours.

11. Should any protective measures employed indicate any deficiencies or erosion taking place, immediately provide additional materials or employ different techniques to correct the situation and to prevent subsequent erosion.

12. Continue erosion control measures until the permanent measures have been sufficiently established and are capable of controlling erosion on their own.

13. Comply with all Federal, State, and local laws, ordinances, rules, and regulations.

1.02 Quality Control

A. Provide at least one (1) person who shall be present at all times during erosion control operations and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all Work performed under this section.

B. Material Manufacturers and Vendors shall be reputable, qualified firms regularly engaged in producing the required types of materials.

C. Protect and maintain all areas disturbed by the Work, such that erosion is adequately controlled and silt and sediments are not allowed to flow into any watercourse, onto adjacent properties, or into storm drains until disturbed surfaces are protected by installed hardened and/or vegetated surfaces.

1.03 Definitions and Materials

A. Hay and Straw Mulch

1. General: Hay and straw mulches shall be reasonably free from swamp grass, weeds, twigs, debris, and other deleterious material, and free from rot, mold, primary noxious weed seeds, and rough or woody materials. Mulches containing mature seed or species which would volunteer and be detrimental to the permanent seeding, or would result in overseeding, or would produce growth which is aesthetically unpleasing, is not permitted.

2. Hay Mulch: Properly aired native hay, Sudan grass hay, broomsedge hay, legume hay, or similar hay or grass mowings. When air-dried in the loose state, the contents of the representative bale shall lose not more than fifteen (15) of the resulting air-dry weight of the bale. Apply at the rate of two (2) tons per acre, or at one and one-half (1.5) tons/acre when a net or a mulch stabilizer is used with the mulch.

3. Straw Mulch: Threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed. Apply at the rate of two (2) tons per acre or at one and one-half (1.5) tons/acre when a net or a mulch stabilizer is used with the mulch.

4. Hydro-Mulch: Hydro Applied Mulch shall consist of: colored wood cellulose fiber product specifically designed for use as a hydro-mechanically applied mulch. Weight based on ten (10) percent moisture content.

5. Mulch Stabilizers: "Curasol" applied at the rate of forty (40) gallons/acre, Dow "Mulch Binder" applied at the rate of forty-five (45) gallons/acre, or asphalt binder, AASHTO M140, Type SS-1 or RS-1 as applicable, applied at the rate of four hundred (400) gallons/acre or approved equivalent.

6. Temporary Type Mulch Nets: Paper yard, approximately 0.65 inches in diameter, woven into a net with approximate openings of seven eights (7/8) inches by one-half (1/2) inch and weighing about 0.20 lbs/S.Y. or approved equivalent.

7. Permanent Type Mulch Nets: "Vexar" or "Erosion-Net" plastic or nylon mesh netting with approximate openings of three eights (3/8) inch by three fourths (3/4) inch or approved equivalent.

B. Mattings/Blankets

1. Nomenclature: The various materials under this paragraph are sometimes referred to as "matting" and "blankets". These words are interchangeably used throughout this section, but the meanings shall be the same.

2. Jute Matting: Undyed and unbleached jute yarn woven into a uniform open, plain weave mesh, furnished in rolled strips conforming to the following physical requirements:

Width: 48", ±1"
: 78 warp ends per width of cloth
: 41 weft ends per yard
Weight: 1.22-1.80 lbs/L.Y., ±5%

3. Excelsior Matting: Uniform web of interlocking wood excelsior fibers with a backing of mulchnet fabric on one side only. The mulchnet shall be woven of either twisted paper chord or cotton cord. Excelsior matting shall be furnished in rolled strips and shall conform to the following physical requirements:

Width: 36", ±1"
Weight: 0.80 lbs./S.Y., ±5%

4. Erosion Control Mulching Blanket: "Hold/Gro" by Gulf States Paper Corp., or approved equivalent.

5. Staples: No. 11 (or heavier) plain iron wire, made from at least twelve inch (12") lengths of wire bent to form "U" of one and one-halfinches (1 1/2") to two inches (2") in width or approved equivalent. Use longer staples for loose soils or where otherwise required.

C. Seed and Sod for Erosion Control

1. For temporary control: annual or perennial quick germinating rye grass.

D. Hay Bales For Erosion Control

1. Rectangular shaped bales of hay or straw, weighing at least forty (40) pounds per bale, free from primary noxious weed seeds and rough or woody materials.

E. Silt Fences

1. "Geofab Silt Fence" by Mercantile Development, Inc., "Mirafi 100X" by Celanese Fibers Marketing Co., or an approved equivalent.

2.0 EXECUTION

2.01 Hay and Straw Mulching

A. Install hay or straw mulch immediately after each area has been properly prepared. When permanent seed or seed for erosion control is sown prior to placing the mulch, place mulch on seeded areas within seventy-two (72) hours after seeding. Project Director may authorize the blowing of chopped mulch provided that ninety-five (95) percent of the mulch fibers will be six inches (6") or more in length and that it can be applied in such a manner that there will be a minimum amount of matting that would retard the growth of plants. Hay mulch should cover the ground enough to shade it, but the mulch should not be so thick that a person standing cannot see the ground through the mulch. Remove matted mulch or branches.

B. Where mild winds may blow the mulch, or when ground slopes exceed fifteen percent (15%), or when otherwise required by the Project Director to maintain the mulch firmly in place, apply a system of pegs and strings, a chemical stabilizer, or temporary type netting to the

mulch. Unless otherwise directed, remove the strings, netting, and excess mulch prior to the acceptance of the work.

C. Where high winds exist (≥15 mph), or heavy rainstorms are likely, or where ground surfaces are steep, or where other conditions require, apply temporary type netting over the mulch and take whatever measures are necessary to maintain the mulch firmly in place.

D. Unless otherwise specified, the use of permanent type netting is not permitted without the prior approval of Engineer.

2.02 Matting/Blankets - General

A. The use of mulch with matting is not permitted, however, a four (4) to six (6) inch overlap of mulch over the edge of matting is permissible.

B. Prepare surfaces of ditches and slopes to conform to the grades, contours and cross sections shown on the Drawings and finish to a smooth and even condition with all debris, roots, stone, and lumps raked out and removed. Loosen the soil surface to permit bedding of the matting. Unless otherwise noted, place seed prior to the placement of the matting.

C. Unroll matting parallel to the direction of flow of water and loosely drape, without folds or stretching, so that continuous ground contact is maintained.

D. In ditches and swales, and on slopes, each upslope and each downslope end of each piece of matting shall be placed in a six (6) inch trench, stapled at twelve (12) inches on center, backfilled, and tamped.

Similarly, bury edges of matting along the edges of catch basins and other structures. Project Director may require that any other edge, exposed to more than normal flow of water, be buried in a similar fashion.

E. Tightly secure matting to the soil by staples driven approximately vertically into the ground, flush with the surface of the matting. In driving the staples, take care not to form depressions or bulges in the surface of the matting.

F. Decrease the specified spacing of staples when varying factors, such as the season of the year or the amount of water encountered or anticipated, requires additional anchoring.

G. Refer to the following paragraphs for additional requirements on the placement and stapling of matting.

2.03 Jute Matting

A. Where strips are laid parallel or meet, as in a tee, they shall be overlapped at least four (4) inches. Overlap ends at least six (6) inches, shingle fashion.

B. Space check slots, built at right angles to the direction of flow water, so that one (1) check slot or one (1) end occurs within each fifty (50) feet of length of slope. Construct check slots by placing a tight fold of matting at least six (6) inches vertically into the ground. These shall be tamped the same as the upslope ends.

C. Press jute matting onto the ground with a light lawn roller or other satisfactory means.

D. On slopes flatter than one vertical to four (1:4) horizontal, place staples not more than three (3) feet apart in three (3) rows, for each strip, with one (1) row along each edge and one (1) row alternately spaced down the center. On grades one vertical to four (1:4) horizontal or steeper, place staples in the same three (3) rows, but spaced two (2) feet apart. On lapping edges, double the number of staples, with the spacing halved. Ends of matting and all required check slots shall have staples placed every foot. Matting placed adjacent to boulders or other obstructions shall be stapled with no spaced between the staples.

E. Spread additional seed over jute matting, particularly those locations disturbed by the building of slots.

2.04 Excelsior Matting

A. Where strips of excelsior matting are laid end to end, butt the adjoining ends.

B. When adjoining rolls of excelsior matting are laid parallel to one another, butt the matting snugly.

C. On slopes flatter than one vertical to four (1:4) horizontal, place the staples not more than three (3) feet apart in three (3) rows, for each strip, with one (1) row along each edge and one (1) row alternately spaced down the center. On grades one vertical to four (1:4) horizontal or steeper, place staples in the same three (3) rows, but spaced two (2) feet apart. Ends of matting shall have staples placed every foot. Matting placed adjacent to boulders or other obstructions shall be stapled with no spaces between the staples.

2.05 Erosion Control Mulching Blanket

A. Where one roll ends and second roll begins, the upslope piece shall be brought over the end of the downslope roll so that there is a twelve (12) inch overlap, placed in a four (4) inch deep trench, stapled at twelve (12) inch on center, backfilled, and tamped.

B. On slopes where two (2) or more widths of blanket are applied, the two (2) edges shall be overlapped four (4) inches and stapled at twelve (12) inch intervals along the exposed edge of the lap joint.

C. Staple the body of the blanket in a grid pattern with staples three (3) feet on center, each way.

2.06 Seed for Erosion Control

A. Seeding for erosion control shall be carried out in accordance with the Specifications, Plans and Documents.

B. Areas which will be regraded or otherwise disturbed later during construction may be ordered to be seeded with rye grass to obtain temporary control. The seed shall be sown at the rate of approximately one hundred twenty (120) pounds per acre, on the pure live seed basis.

2.07 Hay Bales and Silt Fences

A. Provide hay bales or silt fences, as required, for the temporary control of erosion and to stop silt and sediment from reaching surface waters, adjacent properties, or entering catch basins, or damaging the work.

B. Stake the hay bales to hold them firmly in place. Use a sufficient number of bales to accommodate runoff without causing any flooding and to adequately store any silt, sediment, and debris reaching them.

C. Erect silt fences and bury bottom edge in accordance with the manufacturer's recommended installation instructions. Provide sufficient length of fence to accommodate runoff without causing any flooding and to adequately store any silt, sediment, and debris reaching it.

D. Leave hay bales and silt fences in place until permanent erosion control measures have stopped all erosion and siltation.

2.08 Hydroseeding

A. Apply seeding materials with a hydroseeder pre-approved by the Project Director that is specifically designed for hydroseeding.

B. Fill tank with water and agitate while adding seeding material. Use sufficient fertilizer and seed to obtain the specified application rates. Add seed to tank after fertilizer has been added. Maintain constant agitation to keep contents in homogenous supervision. Prolonged delays in application or agitation that may be injurious to the seed will be the basis of rejection of material remaining in the tank.

C. Distribute informally a slurry mixture of water and seed or water, seed and fertilizer at a minimum rate of fifty-seven (57) gallons per one thousand (1,000) square feet. Quality Assurance/Quality Control

personnel or the Project Director may order the amount of water per area increased if distribution of seeding material is not uniform.

D. At no time shall mulch be added to the seed and water or seed, water and fertilizer mixture. Mulching shall be performed separately from hydroseeding.

2.09 Maintenance

A. If any staples become loosened or raised, or if any matting becomes loose, torn, or undermined, or if any temporary erosion and sediment control measures are disturbed, repair them immediately.

B. If the seed is washed out before germination, repair any damage, re-fertilize, and re-seed at no additional cost to the Owner.

C. Maintain mulched and matted areas, silt stops, and other temporary control measures until the permanent control measures are established and no further erosion is likely.

D. Water and protect all seeded areas until final acceptance of the vegetated surfaces.

END OF SECTION

SECTION 180,000.00

WASTE RELOCATION

1.0 GENERAL

1.1 Scope of Work

A. The Contractor shall provide all labor, materials, equipment and services, necessary for, and incidental to, the preparation of the site, protection, excavation, embankment, drainage, dewatering for site grading as shown on the Contract Drawings, Plans and herein specified.

B. The Contractor will accept the site in the condition in which it exists at the time of the award of the Contract.

C. The Project Director/Engineer will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 Definitions and Materials

A. Waste relocation shall refer to the process by which: topsoil, clayey cap soils and intermediate cover soils are stripped and stockpiled, landfilled refuse is excavated from areas designated on the Plans and backfilled and compacted in areas shown on the Subgrade

Recontouring Plan as requiring fill or backfill material and the excavated areas are reclaimed with topsoil, seed and mulch to the grades and elevations shown or as directed by the Project Director.

B. Waste shall be defined by the 6 NYCRR Part 360 "solid waste" to mean: all putrescible and nonputrescible materials or substances that are discarded or rejected as being spent, useless, worthless or in excess to the owners at the time of such discard or rejection, including but not limited to garbage, refuse, industrial and commercial waste, sludges from water or wastewater treatment facilities, rubbish, tires, ashes, contained gaseous material, incinerator residue, discarded automobiles and offal.

2.0 EXECUTION

2.1 Preparation

A. Establish property lines, grade lines, levels, contours and datum.

B. Maintain benchmarks and elevation control points. Re-establish same if disturbed or destroyed at no additional cost to the Owner.

C. Establish location and extent of utilities before commencement of grading operations.

2.2 Excavation

A. All topsoil, clayey cap soils and intermediate cover soils will be stripped and stockpiled from the areas where waste relocation or fill/backfill placement is to occur before such relocation and backfill procedures commence.

B. Excavation will consist of the excavation, backfill and compaction of waste as encountered in the areas designated for waste relocation.

C. All suitable material removed in excavation will be used in the construction of embankments, subgrade, slopes and such other areas as directed by the Project Director, who shall be the sole judge of what constitutes suitable material.

D. Excavation will be performed in proper sequence with all other associated operations. Excavation will limit the amount of waste exposed at any one time. Daily cover, six inches (6") of soil or synthetic tarpaulin, will be installed over all exposed waste at the end of each unkind day.

E. Maintain slopes of excavation in a safe condition until completion of grading operation.

F. All excavation will be inspected and approved by the QA/QC Monitor(s) and/or Project Director. Suitability of the subgrade and complete removal of waste will be determined by procedures described in Section 2.8 of this section.

G. Twelve inches (12") of intermediate cover soil will be installed across all areas receiving relocated wastes. The intermediate cover soil may consist of City generated exempt material as a result of demolition of streets and sidewalks from an on-going Community Development project.

2.3 Fill/Backfill

A. All refuse and waste existing outside the limits of the footprint will be collected, hauled, placed and compacted in the areas designated for fill/backfill as shown on the Subgrade Recontouring Plan. Specifically areas along Dennings Avenue have been subject to "midnight" dumping and will be cleaned as described prior to waste relocation excavation.

B. Before depositing fills, the surface of the ground shall be cleared of all brush and large stones.

C. The original ground shall be proof rolled until the underlying soil is thoroughly compacted to the satisfaction of the Project Director before any filling or backfilling is begun. A steel-wheel tandem vibratory roller weighing 8 to 10 tons or equipment capable of obtaining the same compactive effort shall be used to obtain a thoroughly compacted subgrade. Remove or recompact any soft or loose soils as determined by the Engineer prior to filling. Use of vibration during proof rolling shall depend on soil conditions, as directed by the Engineer.

D. Place backfill and fill materials in layers not more than ten inches (10") in loose depth. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with ten inches (10") as a maximum lift height. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the required density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost, ice or ponded water.

E. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced.

2.4 Grading

A. The present, subgrade and finished grade lines are shown on the Contract Drawings. Grade over the entire area, as shown on the Contract Drawings, shall be to the appropriate subgrade levels. Upon completion of this Work, all debris shall be cleaned out and removed from the premises.

B. All cutting, filling, backfilling and grading necessary shall be done to bring the area to the following grade or subgrade levels:

1. For roadway surface areas (if any); to the finished subgrade levels indicated on the Contract Drawings.

2. For areas to be topsoiled and seeded; to within 6-inches of the finished grade.

3. For other surface treatments; as detailed on the Contract Drawings.

C. Sufficient grading must be done during the progress of the Work so that the entire site shall be well drained and free from water pockets.

D. Finish grading, including dressing swales, dressing terraces, disposing of excess material and all other work necessary to prepare the site for topsoil and seeding shall be done after construction of structures and roadway surface areas is substantially complete.

2.5 Compaction Equipment

A. Compaction equipment used for the Work is subject to approval by the Project Director. Any equipment not originally manufactured for compaction purposes and equipment which is not in proper working order will not be approved. Furnish manufacturer's specifications covering data not obvious from a visual inspection of the equipment and necessary to determine its classification and performance characteristics.

B. Vibratory Drum Compactors: A self-propelled compactor classified for use according to the developed compactive force rating per linear inch of drum width (PLI). The actual operating frequency of the compactor will determine the PLI rating. Compute the PLI in accordance with the applicable portions of NYSDOT Standard Specifications Section 203-3.12 in paragraph B. Vibratory drum compactors are intended to compact granular soils.

C. Sheepsfoot Roller: The maximum loose lift thickness shall not exceed the length of the feet plus fifteen percent (15%). The required minimum number of passes shall be determined by job site test as the number of passes necessary before the feet "walk out" of the lift, for a particular machine, material type, and lift thickness, but in no case shall the number of passes be

less than 4. Sheepsfoot rollers shall be operated at speeds not exceeding six feet (6') per second when towed and fifteen feet (15') per second when self propelled. Sheepsfoot rollers are intended to compact clayey silt and silt clay soils.

2.6 Drainage and Dewatering

A. Prevent surface, subsurface or groundwater from flowing into excavations and from flooding project area, as well as surrounding areas.

B. Do not allow water to accumulate in excavations. Promptly remove water to prevent softening of subgrades.

C. Provide and maintain the pumps, well points, sumps, suction and discharge lines, and other dewatering components necessary to dewater and convey water away from excavations.

D. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collection or run-off areas away from excavations.

E. Dewatering operation shall be approved by the Engineer.

2.7 Sedimentation and Erosion

A. The Contractor shall install silt fencing and/or hay bales as shown on the Contract Drawings or as directed by the Engineer in such a manner that objectionable conditions shall not be created in water courses through or adjacent to the project area.

B. Silt fencing or hay bales shall be used as a temporary erosion control device to control erosion and sedimentation during construction, and such temporary control is not associated with permanent sedimentation control features on the project.

C. At the completion of the project, the Contractor shall remove all temporary erosion controls and dispose of off-site.

2.8 Confirmative Testing of Complete Waste Removal

A. Laboratory testing of composite soil samples will be performed from areas where waste relocation is deemed visually complete. One composite sample for each of the three (3) areas of relocation will be conducted. The composite sample will consist of collecting five (5) individual soil samples at a depth of approximately two feet (2') below the limit of excavation. The location of the five samples will be spaced equidistantly to allow for a representative sampling of the area. Each composite sample will be tested using TCLP procedures for Method 8021, 8270 and toxic metals and compared against TCLP Guidance Extraction Values. IF analytic values do not exceed the noted Guidance Values then the waste relocation will be deemed complete. Conversely, if significant evidence of the parameter values are noted than additional excavation will be performed and retesting procedures performed as described on the area will be capped in conformance with the final capping procedures proposed.

BEACON LANDFILL: DRAINAGE CALCULATIONS AND DESIGN

The following drainage calculations are prepared to describe the stormwater management for the Dennings Avenue landfill closure. They are calculated using the U.S.D.S.-S.C.S. Technical Release No. 55 (TR-55) hydrologic modelling methodology. Please refer to the TR-55 design manual for a more detailed explanation of any of the individual techniques performed herein.

Existing Conditions: The total watershed area presently draining toward and through the Beacon Landfill site comprises approximately twenty-eight (28) acres and is subdivided into three distinct subareas (DA-1, DA-2 and DA-3). Refer to the enclosed Drainage Map for subarea designations, soil boundaries, time of concentration flow paths and topographic datum.

Watershed Soils: Also enclosed is a copy of the Dutchess County Soil Survey map for the area. The soils present within the watershed and their U.S.D.A.-S.C.S. TR-55 hydrologic soil groupings are described as follows.

Soil Type	Map Symbol	Hydrologic Group
Cossayuna gravelly loam	Cx	B
Staatsburg gravelly loam	Sd	C
Colonie fine sandy loam	Cm	B
Claverack gravelly loam	Cj	B/D
Colonie fine sandy loam	Cl	B
Colonie fine sandy loam	Ck	B
Hoosic gravelly loam	Hg	A
Hudson silty clay	Hv	C
Made Land	Mc	C

DA-1: This subarea comprises approximately 20.2 acres of land which drains to the existing perimeter drainage swale. This perimeter swale collects runoff from approximately 15 acres upslope and to the east of the landfill footprint plus approximately 5 acres of the landfill itself. TR-55 worksheets (enclosed) were used to determine the composite Curve Number, Time of Concentration and peak runoff for the 25 year, 24 hour design storm.

25 year, 24 hour rainfall = 6.00 inches
Composite CN = 64
Time of Concentration (Tc) = 0.78 hrs.
Qpeak = 21.7 cubic feet per second (c.f.s.)

DA-2: This subarea comprises approximately 4.2 acres of the northern section of the landfill that has and will continue to drain to the northwest section of the property. This condition will remain unchanged in the post-closure condition in that the vegetated cover will not generate additional runoff in comparison to the existing vegetated condition. Presently this area

drains to an existing storm sewer located along the Dennings Avenue frontage of the Beacon Wastewater Treatment Plant.

Composite CN = 70
Tc = 0.43 hrs.
Qpeak = 7.5 c.f.s.

DA-3: This subarea comprises the approximately 3.6 acres of the landfill located along the western section of the footprint. This area presently drains to a low area along the western section of the landfill where runoff either perches within this low area or seeps into the sanitary sewer system through the existing manholes.

Composite CN = 70
Tc = 0.31 hrs.
Qpeak = 7.2 c.f.s.

Pre-1967 Drainage Conditions: Prior to the creation of the landfill in 1968, runoff from the site drained toward and through the western railroad property to the Fishkill Creek. This condition is evidenced by two items. One is an undated topographic map of the area showing this flow path (enclosed with this section). The second is a correspondence from a representative of the New York State Department of Health who inspected the parcel as part of the permit process in effect at that time. This correspondence (enclosed in Appendix F) notes that the parcel drains to the Hudson River and, "Since we can not dispose of refuse into surface waters, this area would have to be diked". The existing bermed area located along the southwestern property line common to the railroad property is this "dike". This dike presently does not allow for an outfall for the site or the perimeter drainage ditch.

Proposed Drainage: DA-1 will continue to drain to the perimeter swale. This swale will be regraded so that centerline slopes of between 0.75-2.0% result. The construction plans contain details of the cross-sectional dimensions of the proposed swale (2' deep, 3' width at bottom, 3H:1V side slopes, grass-lined). The adequacy of this swale to contain and transport the peak 25 year, 24 hour runoff (21.7 cfs) was determined using an open channel program published by CAW, Inc. (CIVILTOOLS). The depth of flow and velocities were iterated for the 2.0 % and 0.75% swale section and determined to be: 0.83 feet and 4.73 feet per second, and 1.06 feet and 3.30 feet per second, respectively (refer to the software printout enclosed in this section.).

The drainage along the southwestern section of the property will be improved by breaching this berm or dike so that a positive drainage condition can again be connected to the Fishkill Creek for the stormwater runoff from the site (DA-1) and upslope lands. This drainage condition will improve upon the pre-1967 condition in that the vegetated cover of the site will generate less runoff than resulted from the barren mined lands of the brick making era of the site. The strip of land between the railway line and the property line is lower in elevation than either the landfill property or the railway and presently drains to the Fishkill Creek as evidenced by the enclosed plan (previously sheet 6 of 10 from the August 1993 submission). The flow path parallels the railway is covered with heavy ballast stone so no erosion will occur in this area. The gullylike depression shown on the strip map (south of the property) draining to

the Fishkill Creek is heavily vegetated therefore no erosional impacts are expected along this flow path. The discharge point from the breached berm will be blanketed with large rip-rap stone to prevent erosion of the areas affected by the proposed drainage improvements.This drainage improvement differs from the detention basin shown on the plans but is the preferred stormwater discharge structure for the reasons described below. If the Department agrees with this description then amendments will be incorporated into the final plans otherwise the drainage improvements can remain as shown.

This office made submission to the NYSDEC in December 1993 which proposed a detention basin structure with a rip-rap lined sheet flow spillway. The detention basin was conceptually intended to reduce the peak flow from the drainage swale to the greatest practicable degree. Obviously the size of the detention basin was limited by the location of the landfill footprint.

The conceptual detention basin was augmented to include a perforated riser pipe so that the basin could drain as quickly as possible after rainfall events. The riser was intended to drain the detention basin of waters not discharged by the rip-rap weir structure therefore limiting the amount of runoff percolating into the local soils, a concern of the Department with respect to potential groundwater mounding and leachate generation. A quickly draining detention basin installed within the clayey soils (noted slug tests of subgrade soils from the December 1990 Hydrogeologic Report prepared by Lawler, Matusky & Skelley indicated permeabilities in the range of 10E-5 to 10E-6 cm/sec.) would not generate appreciable amounts of runoff infiltration above that occurring from a 24 hour design rainfall event.

The detention basin was designed as part of this submission. Plan and cross-section views of the basin and outfall structures are included within the construction plans submitted. As part of the design, the function of maximized detention basin storage volumes per elevation and hydraulics of the riser pipe/rip-rap sheet flow outfall structures were modelled using the U.S.D.A.-S.C.S. TR-20 routing methodology. This modelling, included with this drainage subsection, indicated that the limited size of the detention basin coupled with the function of a weir outfall structure actually increased the peak outfall from the structure relative to the swale flow during the 25 year, 24 hour design storm. Modifications to the detention basin including larger diameter outfall piping for the riser pipe did not result in a reduction of this "increased" rate of runoff, relative to the swale hydraulics. It is apparent that redesign of the detention basin will not improve this condition.

The conceptual detention basin was proposed to serve a dual function. Primarily it was intended to dampen the peak runoff flows to the greatest extent practicable considering the limited area available. Secondly, the detention basin riser structure is intended to allow the detention basin to function as a siltation basin during closure construction.

Due to the modelled performance of the detention basin an alternative design is offered herein for review by the Department. The detention basin will be replaced with a velocity dissipating rip-rap lined level spreader. The level spreader will consist of a seventy foot long rip-rap apron installed to the width of the perimeter swale at the discharge point and having a fifty foot width at it's termination. Channelized runoff would discharge onto the rip-rap level spreader causing the flow velocity, estimated at 3.3 feet per second

within the swale, to be dissipated to approximately 2.6 feet per second. The depth of flow, estimated at 1.06 feet within the swale, would also be reduced to approximately 0.18 feet (two inches) thusly limiting channelized flow impacts to the receiving drainageway.

A grading plan for this proposed design is included in this section of the report. This office is recommending this design over the detention basin installation for two reasons. Firstly, the NYSDEC has expressed concerns over potential groundwater mounding resulting from a detention basin installation. Although the detention basin clayey subsoils would preclude runoff infiltration to a great extent, the level spreader design would not incur extended periods of standing water within the areas in question thus mitigating this potential impact to the closure design. Secondly, the installation of the velocity dissipating rip-rap level spreader will not result an increase in the peak runoff rates versus the flow in the perimeter swale. The construction plans show plan view and sectional details for the detention basin design as originally submitted, however, if the NYSDEC concurs with this office that the rip-rap level spreader would better mitigate impacts to the closure design while conforming to the pre-1967 drainage conditions then appropriate revisions will be applied to the plans. This office therefore requests a conditional approval of the stormwater management schemes relative to the information contained herein and conditional to future and final revisions to the construction plans in this regard, otherwise the detention basin may be installed as designed.

HSG 4/1/93

Cx = Cossayuna Gravelly Loam (3-15%) B

S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DUTCHE

Sd = Stansburg Gravelly Loam (5 600 000/FEET) C

74° 00' 00" Cm = Colonie Fine Sandy Loam (5-15%) B 57'30"

Cj = Claverack Gravelly Loam (0-5% slopes) B/D

Ci = Colonie Fine Sandy Loam (0-3%) B

Ck = Colonie " " " (15-35%) B

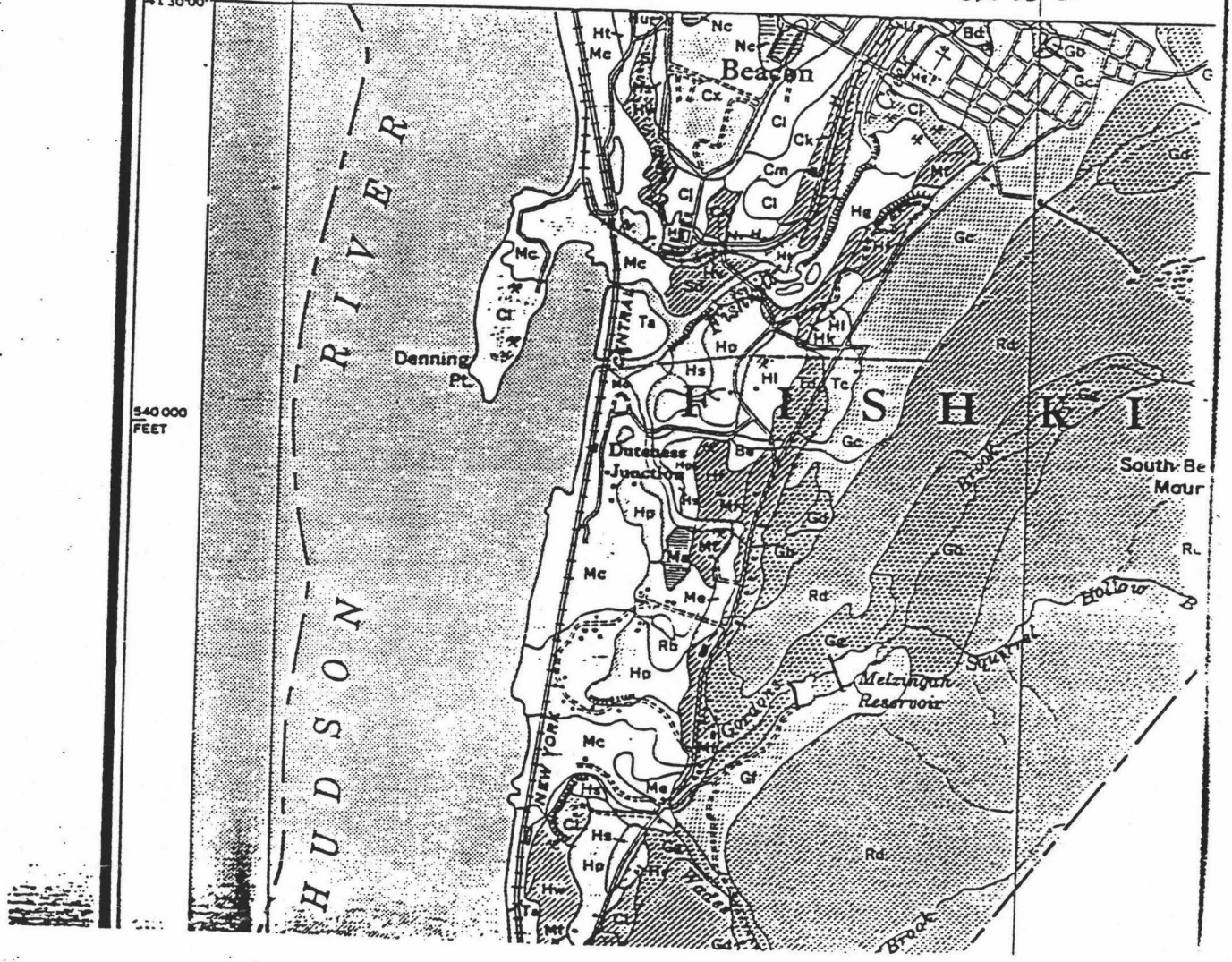
Hv = Hudson Silty Clay Loam (15-30%) C

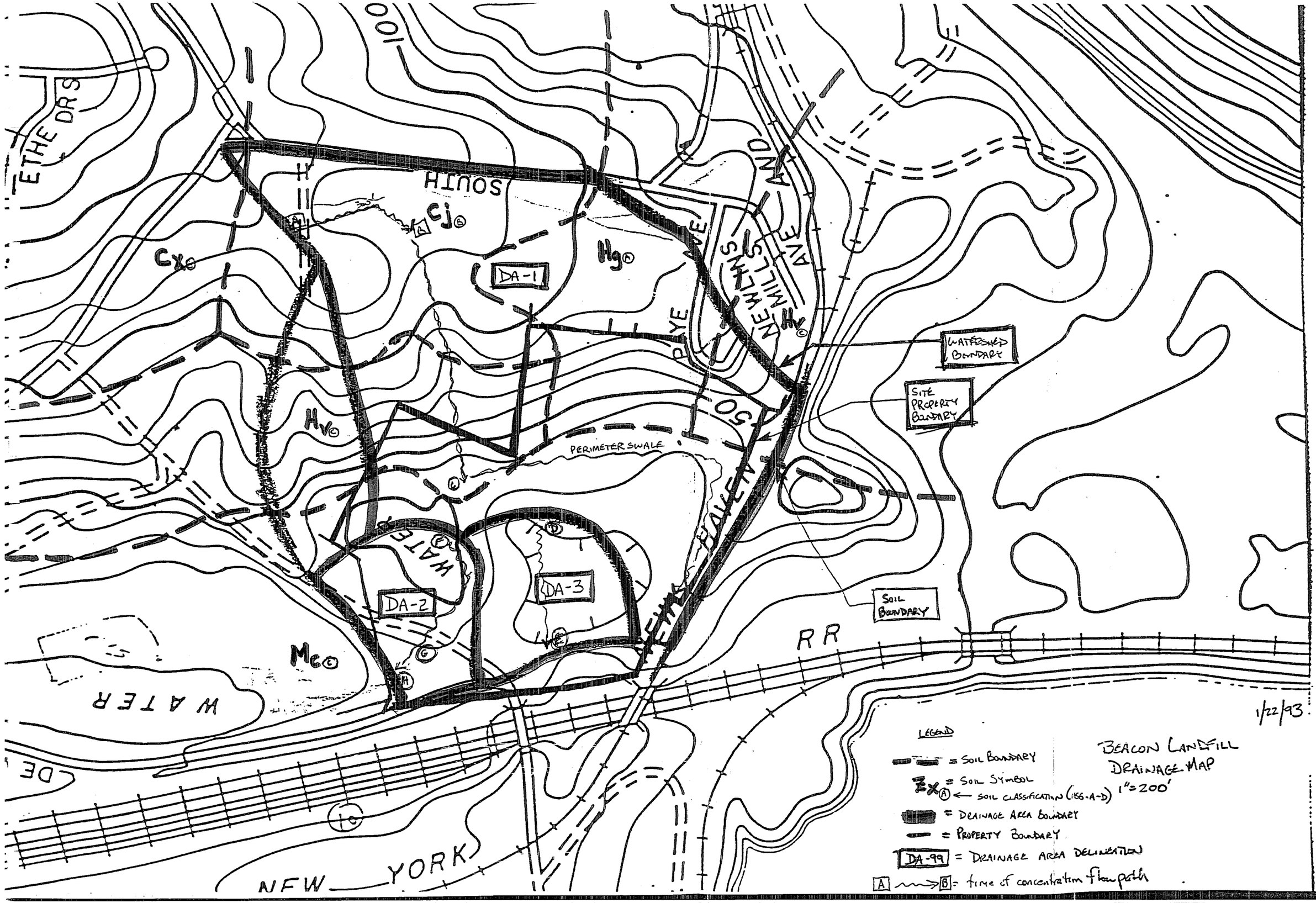
Hg = Hoosic Gravelly Loam (0-8%) A

Mc = Made Land — use as C

41°30'00"

540 000 FEET




ETHE DRS
101
HINOS
Cj
Cx
Hg
DA-1
HAMILTON AVE
RAYE AVE
Hv
WATERSHED BOUNDARY
SITE PROPERTY BOUNDARY
PERIMETER SWALE
WATER
DA-2
DA-3
SOIL BOUNDARY
Mc
WATER
RR
NEW YORK
1/22/93
LEGEND
= SOIL BOUNDARY
= SOIL SYMBOL
← SOIL CLASSIFICATION (USG-A-D)
= DRAINAGE AREA BOUNDARY
= PROPERTY BOUNDARY
DA-99 = DRAINAGE AREA DELINEATION
= time of concentration flow path
BEACON LANDFILL
DRAINAGE MAP
1"=200'

Worksheet 2: Runoff curve number and runoff

Project BEACON LANDFILL By JAA Date 2/1/93

Location BEACON, N.Y Checked ____ Date (COR) 10/21/94

Circle one: Present (Developed) DA-1

1. Runoff curve number (CN)

Soil name and hydrologic group (HYDROLOGIC SOIL GROUP) (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐acres ☐mi² ☐%	Product of CN x area
(A) H_G	RESIDENTIAL (1 ACRE)	51			2.77	141.27
(B) C_S	" (")	68			0.77	52.36
(C) H_V	(")	79			0.26	20.54
(A) H_G	WOODED (FAIR)	36			1.12	40.32
(B) C_S	" "	60			5.48	328.80
(C) H_V, M_C	" "	73			5.96	435.08
(C) M_C	BRUSH	70			3.79	265.30
					20.15	

1/ Use only one CN source per line. Totals =

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1293.67}{20.15} = 63.7$ Use CN = 64

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	100	25	
Rainfall, P (24-hour) ..... in	7.2	6.0	
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	2.77	2.26	

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project BEACON LANDFILL By JHH Date 1/1/93

Location CITY OF BEACON, N.Y. Checked ____ Date ____

Circle one: (Present) Developed DA-1

Circle one: (T_c) T_t through subarea

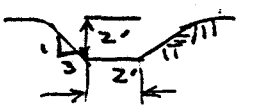
NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A→B	
1. Surface description (table 3-1)		WOODED LIGHT	
2. Manning's roughness coeff., n (table 3-1)		0.40	
3. Flow length, L (total L ≤ 300 ft)	ft	300'	
4. Two-yr 24-hr rainfall, P_2	in	3.3	
5. Land slope, s	ft/ft	0.033	
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.69 +	= 0.69

Shallow concentrated flow	Segment ID	B→C	
7. Surface description (paved or unpaved)		UNPAVED	
8. Flow length, L	ft	610	
9. Watercourse slope, s	ft/ft	0.13	
10. Average velocity, V (figure 3-1)	ft/s	6.0	
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.03 +	= 0.03

Channel flow	Segment ID	C→D	
12. Cross sectional flow area, a	ft^2	16.0	
13. Wetted perimeter, P_w	ft	12.65	
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	---	
15. Channel slope, s	ft/ft	0.0075	
16. Manning's roughness coeff., n		0.030	
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	4.55	
18. Flow length, L	ft	1000	
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.06 +	= 0.06



20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.78

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 4: Graphical Peak Discharge method

Project BEACON LANDFILL By JHA Date 4/1/90

Location CITY OF BEACON, N.Y. Checked ____ rev Date 10/21/94

Circle one: Present (Developed) DA-1

1. Data:

Drainage area ..... A_m = 0.0315 mi^2 (acres/640)

Runoff curve number .... CN = 64 (From worksheet 2)

Time of concentration .. T_c = 0.78 hr (From worksheet 3)

Rainfall distribution type = III (I, IA, II, III)

Pond and swamp areas spread throughout watershed ..... = 0.0 percent of A_m (0.0 acres or mi^2 covered)

			Storm #1	Storm #2	Storm #3
2.	Frequency	yr	100	25	
3.	Rainfall, P (24-hour)	in	7.2	6.0	
4.	Initial abstraction, I_a ..... (Use CN with table 4-1.)	in	1.125	1.125	
5.	Compute I_a/P		0.156	0.188	
6.	Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-III)	csm/in	320	305	
7.	Runoff, Q ..... (From worksheet 2).	in	2.77	2.26	
8.	Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		0.0	0.0	
9.	Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	cfs	27.92	21.71	

Worksheet 2: Runoff curve number and runoff

Project BEACON LANDFILL By JHA Date 4/1/93

Location _____ Checked _____ Date (CN) 10/21/94

Circle one: Present (Developed) DA-2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐acres ☐mi² ☐%	Product of CN x area
(C) Mc	BRUSH	70			4.22	295.40
				Totals =	4.22	295.40

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{295.4}{4.22} = 70$ Use CN = 70

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	100	25	
Rainfall, P (24-hour) ..... in	7.2	6.0	
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	3.79	2.81	

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project BEACON LANDFILL By JHA Date 1/1/93

Location _____ Checked _____ Date _____

Circle one: Present (Developed) DA-2

Circle one: (T_c) T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID			
1. Surface description (table 3-1)		F-G		
2. Manning's roughness coeff., n (table 3-1)		GRASS		
3. Flow length, L (total L ≤ 300 ft) ft		0.24		
4. Two-yr 24-hr rainfall, P_2 in		300		
5. Land slope, s ft/ft		3.5		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t hr		0.04		
		0.42	+	= 0.42

Shallow concentrated flow	Segment ID			
7. Surface description (paved or unpaved)		G-H		
8. Flow length, L ft		GRASS		
9. Watercourse slope, s ft/ft		70		
10. Average velocity, V (figure 3-1) ft/s		0.04		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t hr		32		
		0.01	+	= 0.01

Channel flow	Segment ID			
12. Cross sectional flow area, a ft^2				
13. Wetted perimeter, p_w ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft				
15. Channel slope, s ft/ft				
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V ft/s				
18. Flow length, L ft				
19. $T_t = \frac{L}{3600\,V}$ Compute T_t hr			+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) hr 0.43

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 4: Graphical Peak Discharge method

Project BEACON LANDFILL By JHA Date 4/1/93

Location _____ Checked _____ Date (CN) 10/21/94

Circle one: Present (Developed) DA-2

1. Data:

Drainage area ..... A_m = 0.0065 mi^2 (acres/640)

Runoff curve number .... CN = 70 (From worksheet 2)

Time of concentration .. T_c = 0.12 hr (From worksheet 3)

Rainfall distribution type = III (I, IA, II, III)

Pond and swamp areas spread throughout watershed ..... = 0.0 percent of A_m (____ acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	100	25	
3. Rainfall, P (24-hour)	in	7.2	6.0	
4. Initial abstraction, I_a ..... (Use CN with table 4-1.)	in	0.857	0.857	
5. Compute I_a/P		0.119	0.143	
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-III)	csm/in	430	410	
7. Runoff, Q ..... (From worksheet 2).	in	3.79	2.81	
8. Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		0.0	0.0	
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	cfs	10.59	7.49	

Worksheet 2: Runoff curve number and runoff

Project BEACON LANDALL By JHA Date 4/1/93

Location _____ Checked _____ rev Date 10/21/94

Circle one: Present (Developed) DA-3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
(2) Mc	BRUSH	70			3.63	254.10
	Totals =				3.63	254.10

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{254.10}{3.63} = 70$ Use CN = 70

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	100	25	
Rainfall, P (24-hour) ..... in	7.2	6.0	
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	3.79	2.81	

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project BEACON LANDFILL By JNA Date 4/1/93

Location _____ Checked _____ Date _____

Circle one: Present (Developed) DA-3

Circle one: (T_c) T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	D-E		
1. Surface description (table 3-1)		GRASS		
2. Manning's roughness coeff., n (table 3-1)		0.24		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	3.5		
5. Land slope, s	ft/ft	0.08		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.31	+	= 0.31
Shallow concentrated flow	Segment ID			
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+	=
Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+	=
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.31

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 4: Graphical Peak Discharge method

Project: BEACON LANDFILL By: JHA Date: 4/1/93

Location _____ Checked _____ Date _____

Circle one: Present (Developed) DA-3

1. Data:

Drainage area ..... A_m = 0.0056 mi^2 (acres/640)

Runoff curve number .... CN = 70 (From worksheet 2)

Time of concentration .. T_c = 0.31 hr (From worksheet 3)

Rainfall distribution type = III (I, IA, II, III)

Pond and swamp areas spread throughout watershed ..... = 0.0 percent of A_m (____ acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	100	25	
3. Rainfall, P (24-hour)	in	7.2	6.0	
4. Initial abstraction, I_a ..... (Use CN with table 4-1.)	in	0.857	0.857	
5. Compute I_a/P		0.119	0.143	
6. Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-____)	csm/in	480	460	
7. Runoff, Q ..... (From worksheet 2).	in	3.79	2.81	
8. Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		0.0	0.0	
9. Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	cfs	10.19	7.23	

BEACON LANDFILL – PERIMETER SWALE DESIGN CALCULATIONS

MAN-MADE CHANNELS

VARIABLES LIST:

Y - FLOW DEPTH	B - CHANNEL BOTTOM WIDTH	S - CHANNEL SLOPE
Q - FLOWRATE	M - CHANNEL SIDE SLOPE	N - CHANNEL ROUGHNESS

VARIABLE TO BE SOLVED (Y,Q,B,M,S OR N) ? Y

Q	(CFS)	? 21.7
B	(FT)	? 3
M	(FT/FT)	? 3
S	(FT/FT)	? 0.02
N	(FT^1/6)	? 0.030

RESULTS

Y=	0.83 FT	
A=	4.59 SF	
P=	8.27 FT	
V=	4.73 FPS	
F=	1.10	SUPER-CRITICAL FLOW

<Shift> <Prt Sc> print <Return> repeat <Space Bar> back to menu

---

MAN-MADE CHANNELS

VARIABLES LIST:

Y - FLOW DEPTH	B - CHANNEL BOTTOM WIDTH	S - CHANNEL SLOPE
Q - FLOWRATE	M - CHANNEL SIDE SLOPE	N - CHANNEL ROUGHNESS

VARIABLE TO BE SOLVED (Y,Q,B,M,S OR N) ? Y

Q	(CFS)	? 21.7
B	(FT)	? 3
M	(FT/FT)	? 3
S	(FT/FT)	? 0.0075
N	(FT^1/6)	? 0.030

RESULTS

Y=	1.06 FT	
A=	6.57 SF	
P=	9.71 FT	
V=	3.30 FPS	
F=	0.70	SUB-CRITICAL FLOW

<Shift> <Prt Sc> print <Return> repeat <Space Bar> back to menu

HYDRAULIC PERFORMANCE OF 50' WIDE RIP-RAP DETENTION BASIN SPILLWAY.

MAN-MADE CHANNELS

VARIABLES LIST:

Y - FLOW DEPTH	B - CHANNEL BOTTOM WIDTH	S - CHANNEL SLOPE
Q - FLOWRATE	M - CHANNEL SIDE SLOPE	N - CHANNEL ROUGHNESS

VARIABLE TO BE SOLVED (Y,Q,B,M,S OR N) ? Q

(FT)	? .1	RESULTS	
(FT)	? 44	==========	
N (FT/FT)	? 3	Q= 16.29	CFS
(FT/FT)	? 0.333	A= 4.43	SF
(FT^1/6)	? 0.050	P= 44.63	FT
		V= 3.68	FPS
		F= 2.06	SUPER-CRITICAL FLOW

<Shift> <Prt Sc> print <Return> repeat <Space Bar> back to menu

---

MAN-MADE CHANNELS

VARIABLES LIST:

Y - FLOW DEPTH	B - CHANNEL BOTTOM WIDTH	S - CHANNEL SLOPE
Q - FLOWRATE	M - CHANNEL SIDE SLOPE	N - CHANNEL ROUGHNESS

VARIABLE TO BE SOLVED (Y,Q,B,M,S OR N) ? Q

Y (FT)	? .2	RESULTS	
(FT)	? 44	==========	
(FT/FT)	? 3	Q= 51.80	CFS
S (FT/FT)	? 0.333	A= 8.92	SF
N (FT^1/6)	? 0.050	P= 45.26	FT
		V= 5.81	FPS
		F= 2.30	SUPER-CRITICAL FLOW

<Shift> <Prt Sc> print <Return> repeat <Space Bar> back to menu

---

MAN-MADE CHANNELS

VARIABLES LIST:

Y - FLOW DEPTH	B - CHANNEL BOTTOM WIDTH	S - CHANNEL SLOPE
Q - FLOWRATE	M - CHANNEL SIDE SLOPE	N - CHANNEL ROUGHNESS

VARIABLE TO BE SOLVED (Y,Q,B,M,S OR N) ? Q

Detention Basin Routing - TR-20 Model

```
**********80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY**********

 0B TR-20                    FULLPRINT          SUMMARY
 1TLE 001 DENNINGS AVENUE LANDFILL DETENTION BASIN ROUTING
 5 RAINFL 7              .25
 8          0.000       0.0025      0.005       0.0075      0.010
 8          0.0125      0.0150      0.0175      0.020       0.02255
 8          0.02519     0.02848     0.03075     0.03368     0.03669
 8          0.03980     0.0430      0.04630     0.04969     0.05318
 8          0.05675     0.06043     0.06419     0.06805     0.0720
 8          0.07617     0.08063     0.08542     0.09050     0.09592
 8          0.10163     0.10767     0.11400     0.12088     0.12844
 8          0.13675     0.14575     0.15550     0.16594     0.17713
 8          0.18900     0.20203     0.21650     0.23253     0.25000
 8          0.27124     0.29800     0.35635     0.50000     0.64365
 8          0.70200     0.72876     0.75000     0.76747     0.78350
 8          0.79797     0.81100     0.822875    0.83406     0.84450
 8          0.85425     0.86325     0.87156     0.879125    0.88600
 8          0.89234     0.89838     0.90409     0.90950     0.91459
 8          0.91938     0.92384     0.92800     0.93195     0.93581
 8          0.939575    0.94325     0.946825    0.95031     0.95370
 8          0.95700     0.960215    0.96336     0.96643     0.96944
 8          0.97237     0.97523     0.978025    0.98075     0.98340
 8          0.98598     0.988495    0.99094     0.993305    0.99561
 8          0.99784     1.00000     1.00000     1.00000     1.00000
 9 ENDTBL
 3 STRUCT      01
 8                      24.0         0.0         0.0
 8                      26.0         0.01        0.03443
 8                      28.0         0.02        0.1262
 8                      29.0         0.03        0.1922
 8                      29.1         16.29       0.1940
 8                      29.2         51.80       0.1957
 9 ENDTBL
 6 RUNOFF 1 001        1 0.0315      64.         0.78        1 1   1 1 1 DA-1
 6 RESVOR 2    01 1    4  24.0                                     1 1 1 ROUTING
 6 RUNOFF 1 002        2 0.0065      70.         0.43        1 1   1 1 1 DA-2
 6 RUNOFF 1 003        3 0.0056      70.         0.31        1 1   1 1 1 DA-3
   ENDATA
 7 INCREN 6              0.10
 7 COMPUT 7 001    003   0.0         6.0         1.          7 2  01   01 25 YEAR
   ENDCMP 1
   ENDJOB 2

**********END OF 80-80 LIST**********
```

TR20 XEQ 10-27-94 14:22 DENNINGS AVENUE LANDFILL DETENTION BASIN ROUTING JOB 1 PASS 1
REV PC 09/83(.2) PAGE 1

EXECUTIVE CONTROL OPERATION INCREM MAIN TIME INCREMENT = .10 HOURS RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 3 RECORD ID 25 YEAR
STARTING TIME = .00 RAIN DEPTH = 6.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 7 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .10 HOURS

OPERATION RUNOFF CROSS SECTION 1
OUTPUT HYDROGRAPH= 1
AREA= .03 SQ MI INPUT RUNOFF CURVE= 64. TIME OF CONCENTRATION= .78 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .1040 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.60	22.48	(RUNOFF)

TIME(HRS)		FIRST HYDROGRAPH POINT = .00 HOURS			TIME INCREMENT = .10 HOURS				DRAINAGE AREA =		.03 SQ.MI.
10.00	DISCHG	.00	.00	.00	.01	.03	.06	.10	.16	.22	.30
11.00	DISCHG	.39	.49	.60	.73	.89	1.09	1.37	1.78	2.48	3.68
12.00	DISCHG	5.64	8.48	12.05	15.86	19.29	21.68	22.48	21.81	20.10	17.79
13.00	DISCHG	15.37	13.24	11.45	9.99	8.81	7.88	7.13	6.53	6.05	5.65
14.00	DISCHG	5.32	5.03	4.78	4.55	4.35	4.17	4.02	3.88	3.76	3.65
15.00	DISCHG	3.56	3.46	3.37	3.29	3.20	3.11	3.03	2.94	2.85	2.76
16.00	DISCHG	2.68	2.59	2.51	2.42	2.35	2.28	2.21	2.15	2.10	2.05
17.00	DISCHG	2.00	1.96	1.92	1.87	1.83	1.79	1.75	1.71	1.67	1.63
18.00	DISCHG	1.59	1.55	1.51	1.48	1.44	1.41	1.39	1.36	1.34	1.33
19.00	DISCHG	1.31	1.29	1.28	1.27	1.25	1.24	1.23	1.22	1.20	1.19
20.00	DISCHG	1.18	1.17	1.16	1.15	1.13	1.12	1.11	1.10	1.09	1.08
21.00	DISCHG	1.07	1.06	1.06	1.05	1.04	1.03	1.02	1.01	1.00	.99
22.00	DISCHG	.98	.97	.96	.96	.95	.94	.93	.92	.91	.90
23.00	DISCHG	.89	.88	.87	.86	.85	.84	.83	.83	.82	.81
24.00	DISCHG	.80	.77	.73	.66	.56	.45	.34	.25	.18	.13
25.00	DISCHG	.10	.07	.05	.04	.03	.02	.01	.01	.01	.00

RUNOFF VOLUME ABOVE BASEFLOW = 2.26 WATERSHED INCHES, 45.99 CFS-HRS, 3.80 ACRE-FEET; BASEFLOW = .00 CFS

--- HYDROGRAPH FOR XSECTION 1, ALTERNATE 1, STORM 1, ADDED TO OUTPUT HYDROGRAPH FILE ---

OPERATION RESVOR STRUCTURE 1
INPUT HYDROGRAPH= 1 OUTPUT HYDROGRAPH= 4
SURFACE ELEVATION= 24.00

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.22	18.69	29.11
12.41	25.33	29.13
12.60	28.07	29.13
12.79	25.53	29.13
12.99	20.48	29.11
13.19	16.05	29.10
13.39	12.91	29.08
13.60	10.79	29.07
13.80	9.33	29.06
14.00	8.27	29.05

RUNOFF VOLUME ABOVE BASEFLOW = 1.92 WATERSHED INCHES, 38.95 CFS-HRS, 3.22 ACRE-FEET; BASEFLOW = .00 CFS

--- HYDROGRAPH FOR STRUCTURE 1, ALTERNATE 1, STORM 1, ADDED TO OUTPUT HYDROGRAPH FILE ---

OPERATION RUNOFF CROSS SECTION 2
OUTPUT HYDROGRAPH= 2
AREA= .01 SQ MI INPUT RUNOFF CURVE= 70. TIME OF CONCENTRATION= .43 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0573 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.37	7.37	(RUNOFF)

TIME(HRS)		FIRST HYDROGRAPH POINT = .00 HOURS			TIME INCREMENT = .10 HOURS				DRAINAGE AREA = .01 SQ.MI.		
9.00	DISCHG	.00	.00	.00	.01	.02	.03	.04	.05	.06	.08
10.00	DISCHG	.09	.11	.12	.14	.16	.19	.21	.24	.27	.30
11.00	DISCHG	.33	.36	.41	.47	.54	.62	.76	1.04	1.47	2.26
12.00	DISCHG	3.54	4.99	6.26	7.15	7.33	6.65	5.57	4.45	3.49	2.75
13.00	DISCHG	2.26	1.94	1.69	1.52	1.39	1.30	1.23	1.18	1.13	1.09
14.00	DISCHG	1.04	1.01	.97	.93	.91	.88	.86	.84	.82	.80
15.00	DISCHG	.77	.76	.73	.71	.69	.67	.65	.63	.61	.59
16.00	DISCHG	.57	.55	.53	.51	.50	.49	.48	.47	.46	.45
17.00	DISCHG	.44	.43	.42	.41	.40	.39	.38	.37	.36	.35
18.00	DISCHG	.34	.33	.33	.32	.31	.31	.31	.30	.30	.30
19.00	DISCHG	.29	.29	.29	.28	.28	.28	.28	.27	.27	.27
20.00	DISCHG	.27	.26	.26	.26	.25	.25	.25	.25	.25	.24
21.00	DISCHG	.24	.24	.24	.24	.23	.23	.23	.23	.22	.22
22.00	DISCHG	.22	.22	.22	.21	.21	.21	.21	.21	.20	.20
23.00	DISCHG	.20	.20	.19	.19	.19	.19	.19	.18	.18	.18
24.00	DISCHG	.18	.17	.13	.09	.05	.03	.02	.01	.01	.00

RUNOFF VOLUME ABOVE BASEFLOW = 2.80 WATERSHED INCHES, 11.76 CFS-HRS, .97 ACRE-FEET; BASEFLOW = .00 CFS

--- HYDROGRAPH FOR XSECTION 2, ALTERNATE 1, STORM 1, ADDED TO OUTPUT HYDROGRAPH FILE ---

OPERATION RUNOFF CROSS SECTION 3

4/6

OUTPUT HYDROGRAPH= 3
AREA= .01 SQ MI INPUT RUNOFF CURVE= 70. TIME OF CONCENTRATION= .31 HOURS
INTERNAL HYDROGRAPH TIME INCREMENT= .0413 HOURS

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
12.30	6.90	(RUNOFF)

TIME(HRS)		FIRST HYDROGRAPH POINT = .00 HOURS		TIME INCREMENT = .10 HOURS				DRAINAGE AREA = .01 SQ.MI.			
9.00	DISCHG	.00	.00	.01	.01	.02	.03	.04	.05	.07	.08
10.00	DISCHG	.09	.10	.12	.14	.16	.18	.20	.23	.25	.28
11.00	DISCHG	.31	.34	.39	.45	.52	.60	.77	1.14	1.62	2.64
12.00	DISCHG	4.16	5.44	6.35	6.90	6.38	5.05	3.96	2.99	2.25	1.82
13.00	DISCHG	1.55	1.38	1.25	1.15	1.09	1.04	1.01	.97	.94	.90
14.00	DISCHG	.86	.84	.80	.78	.76	.74	.72	.70	.69	.67
15.00	DISCHG	.65	.64	.62	.60	.58	.56	.55	.53	.51	.49
16.00	DISCHG	.47	.46	.44	.43	.42	.41	.40	.39	.38	.38
17.00	DISCHG	.37	.36	.35	.34	.34	.33	.32	.31	.30	.30
18.00	DISCHG	.29	.28	.27	.27	.27	.26	.26	.26	.25	.25
19.00	DISCHG	.25	.25	.25	.24	.24	.24	.24	.23	.23	.23
20.00	DISCHG	.23	.22	.22	.22	.22	.22	.21	.21	.21	.21
21.00	DISCHG	.21	.20	.20	.20	.20	.20	.20	.19	.19	.19
22.00	DISCHG	.19	.19	.18	.18	.18	.18	.18	.18	.17	.17
23.00	DISCHG	.17	.17	.17	.16	.16	.16	.16	.16	.15	.15
24.00	DISCHG	.15	.13	.09	.04	.02	.01	.00			

RUNOFF VOLUME ABOVE BASEFLOW = 2.80 WATERSHED INCHES, 10.13 CFS-HRS, .84 ACRE-FEET; BASEFLOW = .00 CFS

--- HYDROGRAPH FOR XSECTION 3, ALTERNATE 1, STORM 1, ADDED TO OUTPUT HYDROGRAPH FILE ---

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1 RECORD ID

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

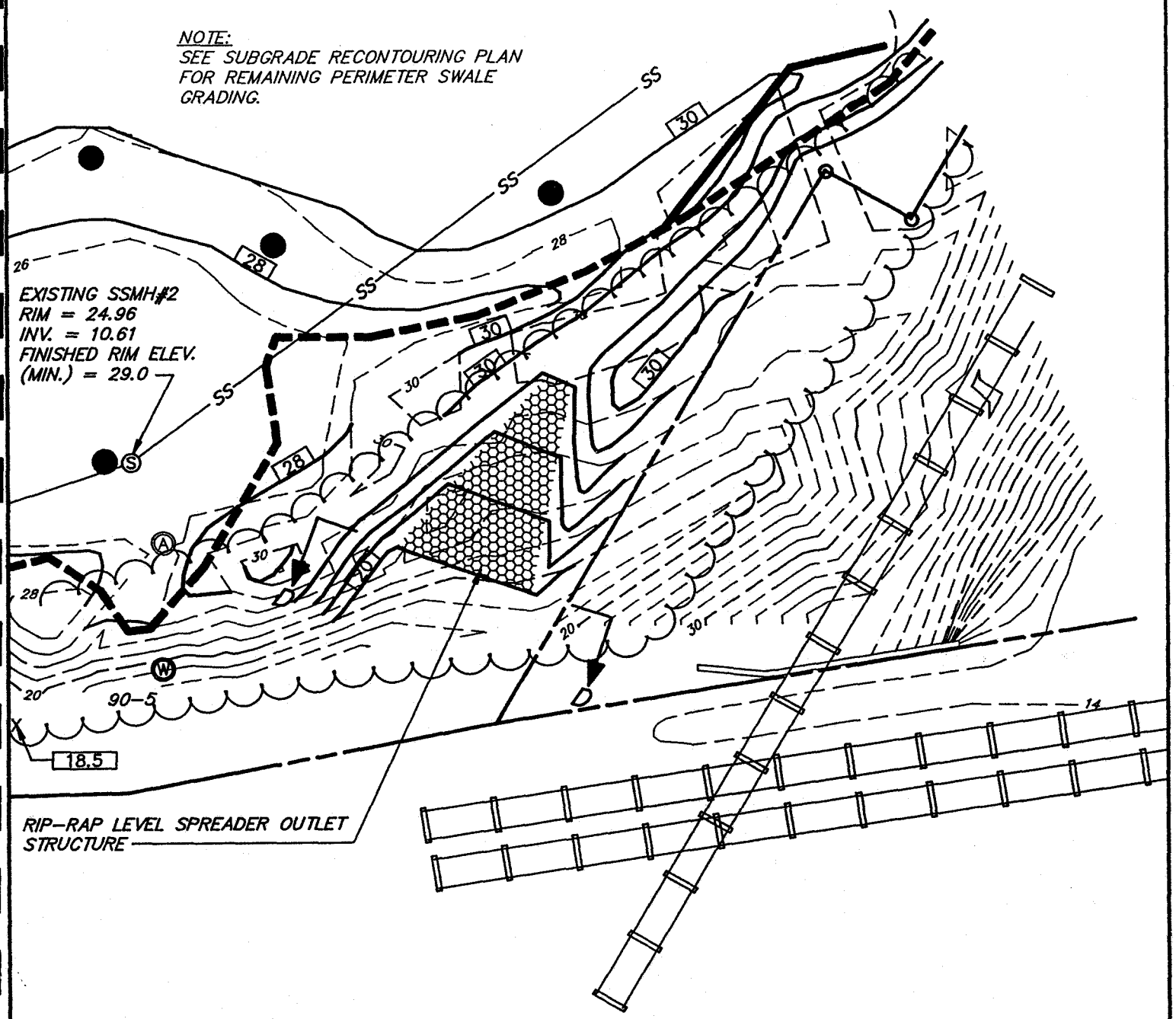
SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

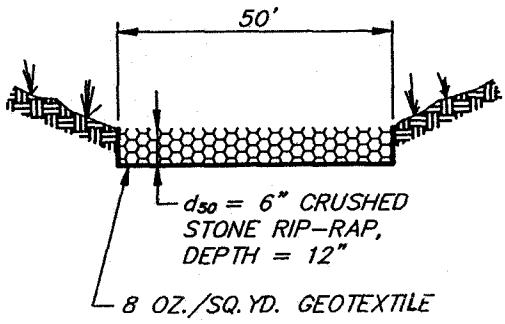
ECTION/ TRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
SECTION 1	RUNOFF	.03	7	2	.10	.0	6.00	24.00	2.26	---	12.60	22.48	713.6
TRUCTURE 1	RESVOR	.03	7	2	.10	.0	6.00	24.00	1.92	29.13	12.60	28.07	891.0
XSECTION 2	RUNOFF	.01	7	2	.10	.0	6.00	24.00	2.80	---	12.37	7.37	1133.8
XSECTION 3	RUNOFF	.01	7	2	.10	.0	6.00	24.00	2.80	---	12.30	6.90	1233.0

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

SECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
STRUCTURE 1		.03	
ALTERNATE	1		28.07
XSECTION 1		.03	
ALTERNATE	1		22.48
XSECTION 2		.01	
ALTERNATE	1		7.37
XSECTION 3		.01	
ALTERNATE	1		6.90

NOTE:
SEE SUBGRADE RECONTOURING PLAN FOR REMAINING PERIMETER SWALE GRADING.





SECTION D-D
N-T-S

REV. No.	ZONE		DATE	BY

CITY OF BEACON LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

DRAINAGE DESIGN
RIP-RAP LEVEL SPREADER

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS-LAND SURVEYORS
367 Violet Avenue, Poughkeepsie, New York 12601
© Copyright 1994

DATE	SCALE	DESIGNED BY: JHA / DRAWN BY: DCV, JK / CHECKED BY: MJM	FILE No.	DRAWING No.
OCT. 1994	1" = 50'		20275.00	1

PLOT 11/1/94 20275LEV.DWG

BEACON LANDFILL – RIP-RAP VELOCITY DISSIPATING LEVEL SPREADER

MAN-MADE CHANNELS

VARIABLES LIST:

Y – FLOW DEPTH	B – CHANNEL BOTTOM WIDTH	S – CHANNEL SLOPE
Q – FLOWRATE	M – CHANNEL SIDE SLOPE	N – CHANNEL ROUGHNESS

VARIABLE TO BE SOLVED (Y,Q,B,M,S OR N) ? Y

	(CFS)	? 22.48	
B	(FT)	? 50	
M	(FT/FT)	? 5	
	(FT/FT)	? 0.08	
	(FT^1/6)	? 0.050	

RESULTS

Y=	0.17	FT
A=	8.75	SF
P=	51.75	FT
V=	2.57	FPS
F=	1.10	SUPER-CRITICAL FLOW

Shift> <Prt Sc> print <Return> repeat <Space Bar> back to menu

U.S.E.P.A. HELP MODEL OUTPUT

****
****

BEACON LANDFILL
GEOMEMBRANE CAP PERFORMANCE
OCTOBER 21, 1994

****
****

GOOD GRASS

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1309 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1309 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.004199999850 CM/SEC

LAYER 2

VERTICAL PERCOLATION LAYER

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1901 VOL/VOL
WILTING POINT	=	0.0848 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1901 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000720000011 CM/SEC

LAYER 3

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER

THICKNESS	=	0.04 INCHES
POROSITY	=	0.4000 VOL/VOL
FIELD CAPACITY	=	0.3560 VOL/VOL
WILTING POINT	=	0.2899 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4000 VOL/VOL

WILTING POINT	=	0.0848 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1901 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000720000011 CM/SEC

LAYER 3

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER

THICKNESS	=	0.04 INCHES
POROSITY	=	0.4000 VOL/VOL
FIELD CAPACITY	=	0.3560 VOL/VOL
WILTING POINT	=	0.2899 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4000 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000000010000 CM/SEC
LINER LEAKAGE FRACTION	=	0.01000000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	54.49
TOTAL AREA OF COVER	=	503600. SQ FT
EVAPORATIVE ZONE DEPTH	=	18.00 INCHES
UPPER LIMIT VEG. STORAGE	=	8.1780 INCHES
INITIAL VEG. STORAGE	=	7.3045 INCHES
INITIAL SNOW WATER CONTENT	=	1.0493 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	3.0826 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

USER SPECIFIED RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND SOLAR RADIATION FOR ALBANY NEW YORK

MAXIMUM LEAF AREA INDEX	=	3.30
START OF GROWING SEASON (JULIAN DATE)	=	137
END OF GROWING SEASON (JULIAN DATE)	=	278

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
21.10	23.40	33.80	46.60	57.50	66.70
71.40	69.20	61.20	50.50	39.30	26.50

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 74 THROUGH 74

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 74 THROUGH 74

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	7.98	2.12	3.10	2.80	3.47	3.31
	4.84	3.53	5.37	1.49	3.83	2.57
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	1.977	1.894	6.029	0.478	0.152	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.478	0.636	2.446	2.774	3.744	4.028
	7.509	4.580	3.378	2.159	1.172	0.578
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
PERCOLATION FROM LAYER 3						
TOTALS	0.0456	0.0432	0.0465	0.0414	0.0410	0.0374
	0.0201	0.0002	0.0011	0.0129	0.0205	0.0379
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 74 THROUGH 74

	(INCHES)		(CU. FT.)	PERCENT
PRECIPITATION	44.41	(0.000)	1863740.	100.00
RUNOFF	10.531	(0.000)	441934.	23.71
EVAPOTRANSPIRATION	33.482	(0.000)	1405110.	75.39
PERCOLATION FROM LAYER 3	0.3479	(0.0000)	14598.	0.78
CHANGE IN WATER STORAGE	0.050	(0.000)	2097.	0.11

PEAK DAILY VALUES FOR YEARS 74 THROUGH 74

	(INCHES)	(CU. FT.)
PRECIPITATION	6.00	251800.0
RUNOFF	1.034	43382.7
PERCOLATION FROM LAYER 3	0.0015	65.0
HEAD ON LAYER 3	18.3	
SNOW WATER	7.05	295835.8
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.4543
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0759

****

****

FINAL WATER STORAGE AT END OF YEAR 74

LAYER	(INCHES)	(VOL/VOL)
1	1.92	0.3197
2	5.44	0.4530
3	0.02	0.4000
SNOW WATER	1.05	

****

****

U.S.E.P.A. HELP MODEL PROGRAM INPUT


```
BEACON LANDFILL
GEOMEMBRANE CAP PERFORMANCE
OCTOBER 21, 1994
 3     1.000000    54.492081       4
    6.00      12.00       0.04       0.00       0.00       0.00      5
    0.00       0.00       0.00       0.00       0.00       0.00      6
  0.4570     0.4530     0.4000     0.0000     0.0000     0.0000      7
  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000      8
  0.1309     0.1901     0.3560     0.0000     0.0000     0.0000      9
  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     10
  0.0580     0.0848     0.2899     0.0000     0.0000     0.0000     11
  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     12
    0.004199999850       0.000720000011       0.000000010000       0.000000000000 13
    0.000000000000       0.000000000000       0.000000000000       0.000000000000 14
    0.000000000000       0.000000000000       0.000000000000       0.000000000000 15
  0.1309     0.1901     0.4000     0.0000     0.0000     0.0000     16
  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     17
    503600.      18
   1     1     4     0     0     0     0     0     0     0     0     19
    0.00       0.00       0.00       0.00       0.00       0.00     20
    0.00       0.00       0.00       0.00       0.00       0.00     21
     0.0        0.0        0.0        0.0        0.0        0.0     22
     0.0        0.0        0.0        0.0        0.0        0.0     23
1.00000000 1.00000000 0.01000000 1.00000000 1.00000000 1.00000000     24
1.00000000 1.00000000 1.00000000 1.00000000 1.00000000 1.00000000     25
   0.0000      26
4  0  1
```

APPENDIX D

CONTINGENCY PLAN

FOR USE

DURING CONSTRUCTION AND MAINTENANCE OF THE LANDFILL COVER

CITY OF BEACON, DENNINGS AVENUE LANDFILL
CITY OF BEACON, DUTCHESS COUNTY, NEW YORK 12508

PREPARED BY:

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS
367 VIOLET AVENUE
POUGHKEEPSIE, NEW YORK 12601

APRIL 1993
REVISED OCTOBER 1994

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II.	SITE INFORMATION.....	2
III.	ORGANIZATIONAL RESPONSIBILITIES.....	3
IV.	CONTINGENCY EMERGENCY SITUATIONS AND RESPONSE ACTIONS.....	4
V.	ENVIRONMENTAL MONITORING.....	5
VI.	EMERGENCY PROCEDURES.....	6

APPENDICES

D.1 POTENTIAL HAZARDS AND CAUSES OF EMERGENCIES
D.2 STANDARD SAFETY PRACTICES
D.3 CERTIFICATION

I. INTRODUCTION

This Contingency Plan has been prepared to provide for courses of action in the event of contingent emergency conditions encountered during the closure of the Dennings Avenue Landfill in the City of Beacon, Dutchess County, New York. By their nature, solid waste landfills may present potential physical and chemical hazards which are described herein. All personnel working on these sites shall certify that they have read and understand this Plan, including the emergency procedures, and have been briefed on the site specific hazards they may encounter at the landfill. Only personnel who understand and have signed the certification declaring their knowledge of the Contingency Plan shall be allowed on the site.

II. SITE INFORMATION

Name: Dennings Avenue Landfill

Date: April 1993

Address/Location: Dennings Avenue, City of Beacon, Dutchess County, New York

Size (Acres): 16 acres (11 ac. ± footprint)

Topography (flat, gentle slopes, steep slopes): gentle slope on landfill

Condition (open garbage (during waste relocation), grass cover, heavily vegetated): existing clayey soil cap with topsoil and established vegetation

On site or nearby water courses: Fishkill Creek to the South, Hudson River to the West

Surrounding population: City of Beacon (1990 census) = 13,243

Known contaminants and related information: see Appendix E.1

Personnel: Project Team Leader: to be determined prior to start of closure construction

Site Safety Officer: to be determined prior to start of closure construction

Locate evacuation routes on site plan: Dennings Avenue

Locate access control points on site plan: Northwest site entrance

Locate known hazard areas on site plan: None

Locate work zone on site plan: Waste relocation to be performed at northwest, northeast and southerly sections of landfill perimeter.

Locate nearest telephone: Adjacent City of Beacon Wastewater Treatment Plant

III. ORGANIZATIONAL RESPONSIBILITIES

See Section II - Site Information for Designated Individuals

A. Project Team Leader

1. Directs emergency response operations.

B. Site Safety Officer

1. Recommends that work be stopped if any operation threatens workers or public health or safety.

2. Knows emergency procedures, evacuation routes and the appropriate telephone numbers including: ambulance, medical facility, poison control center, fire department and police department.

3. Notifies local public emergency officials.

4. Provides for emergency medical care on site.

IV. CONTINGENCY EMERGENCY SILTATIONS AND RESPONSE ACTIONS

It should be noted that the facility has had a soil cap installed since 1986 and has not experienced any of the emergency situations described herein thus the unliklihood of the occurrence of such issues with the sole exception being the waste relocation phase of construction.

The following emergency situations may arise in the course of the construction and maintenance of the landfill closure final cover system. This section is intended to provide response actions to the site personnel involved.

A. Personal Injury

In the event of personal injury to any of the site personnel, the Project Team Leader, Site Safety Officer or person of responsible charge will contact the Beacon Fire Department [(914) 831-2121], the Beacon Volunteer Ambulance Services [(914) 473-0021] and/or the St. Francis Hospital in Beacon [(914) 431-8220]. Section VI.D also lists the telephone umber of the Beacon Police Department [(914) 831-4111] and the Poison Control Center [1-800-336-6997].

Off-site personnel responding to emergency calls should be provided with information concerning site specific hazards and the personal injury.

B. Equipment Breakdown

The City will be performing the majority of the landfill closure work, with the exception of the geomembrane installation and hydroseeding to cover, and

plan to rent the majority of the equipment required. In the event of equipment breakdown, the rental agency will be contacted to provide maintenance for the specific piece(s) of equipment and/or additional replacement equipment will be provided by the rental agent or other local agents.

C. Air Contamination

1. Odors - Diligent application of six inches (6") of daily cover soil across all open wastes or the use of synthetic tarpaulins as a substitute for daily cover soil will preclude odors to the greatest extent practicable. If odors are persistent to the point of posing an unexceptional nuisance to the site personnel and/or offsite receptors then odor masking agents and/or lime will be periodically applied to the exposed wastes to mitigate odor propagations. Operations will be temporarily suspended and daily cover applied until such measures are readily available.

2. Dust is a potential nuisance condition that can occur during earthwork operations. City water service is supplied to the site via two hydrants located at the southeast and northwest corner of the site. Site soils will be periodically wetted to mitigate dust generation in this eventuality.

3. Explosive Gases

Waste relocation will occur through open excavation and backfill procedures thus the unlikelihood of an explosive gas condition. If,

however, an explosive gas situation is suspected during waste relocation procedures, site equipment and personnel will be evacuated from the suspect area and the air in the vicinity will be sampled by a combustible gas indicator (CGI) to determine the percent LEL existing. If no condition exists then waste relocation procedures will resume. If an explosive gas environment exists, the area will be monitored to determine if the condition is persistent. A consistent condition warranting cessation of waste relocation and extension of the gas venting and final cover system over the area in question.

Post closure maintenance of the installed final cover system with respect to explosive gas conditions will be addressed in the Post-Closure Monitoring and Maintenance Manual, a stand-alone document.

D. Water Contamination

Contamination of public and private water supplies due to the construction and maintenance of the landfill cap is not anticipated as the City of Beacon is service by a city-wide public water system supplied from the Beacon Reservoir located atop North Beacon Mountain and isolated from the project. No public or private water supplies are located within one-quarter mile upgradient or one mile downgradient from the project.

Waste relocation will be limited to the smallest practicable area and the application of daily cover (soils or synthetic tarpaulins) will preclude leachate

generation and runoff which could preclude contamination of surface waters. If necessary, earthern berms will be constructed to contain any leachate seeps that result during waste relocation procedures with collected leachate pumped and hauled to the adjacent Beacon Wastewater Treatment Plant for treatment and disposal.

E. Waste Handling

1. Litter - The waste relocation phase of the construction is the sole potential source for litter. The age and compacted nature of the waste having been buried since 1986 precludes the possibility of blowing litter. Judicious application of daily cover soils and/or tarpaulins will mitigate the potential for blowing litter.

2. Vectors - The waste relocation operations will occur over a brief period as defined by the Closure Construction Schedule which will mitigate generation of vector populations. Also the use of daily cover soils and/or synthetic tarpaulins will mitigate vector populations. In the event that vectors are detected during this phase of the construction, a licensed pest control firm or specialist will be contracted to employ eradication or deterrent measures resulting in the removal of vectors.

3. Fires - In the event that fire or combustion of landfill wastes, construction equipment or materials occurs, the Project Team Leader or Site Safety Officer will contact the Beacon Fire

Department [(914) 831-2121)]. The site is services by the City water system via two hydrants located at the southeastern and western property boundaries which will allow for the fire fighting measures.

4. Hazardous or Toxic Materials - Detection of hazardous or toxic materials is only likely to occur during the waste relocation phase of construction. Appendix __.1, Section II identifies descriptions and symptoms typical of chemicals encountered at landfills. All site personnel will be made aware of these chemical descriptions and exposure symptoms prior to commencement of waste relocation.

   Should these chemicals or exposure symptoms be noted during waste relocation then the construction will be halted and the area evacuated. Air and water(if present) quality sampling for these chemical substances will be affected. If these contaminants are found above Permissible Exposure Limits (PEL) then waste excavation and relocation will be discontinued and the final capping system will be extended to cover the areas in question.

V. ENVIRONMENTAL MONITORING

Environmental monitoring to include air monitoring, site soil and water monitoring will be enacted in the event of an emergency situation as described in Section IV of this part. Air monitoring shall be conducted at during the waste relocation phase of the project for volatile organics compounds and combustible gases in the event of such a suspect condition. Air monitoring shall be conducted by personnel trained in the use of the particular equipment. Should problems arise then more frequent air monitoring along with soil and water monitoring will be implemented as the situation warrants.

At each monitoring session, instrument field calibration and background levels will be measured at the access to the site. Combustible gas indicator (CGI) readings shall be taken at ground surface; all other instruments will be read at breathing level (approximately four feet above ground surface).

VI. EMERGENCY PROCEDURES

A. Evacuation Routes

Evacuation routes and alternate evacuation routes are depicted on the site plan. Personnel should familiarize themselves with the evacuation routes prior to the start of work at the site.

In the event of an emergency all personnel shall immediately report to the Beacon Wastewater Treatment Plant (access control point).

Personnel shall not reenter the worksite until the conditions resulting in the emergency have been corrected and/or the hazards have been reassessed.

B. Internal/External Communications

1. Internal Communications

Radios shall be used on site if available.

The following noisemakers may be used to indicate an emergency:

- Horns
- Bells
- Siren
- Whistle
- Megaphone

One long blast means evacuate area by the nearest emergency exit.

Two short blasts means there is a localized problem (not dangerous to workers).

Two long blasts means that all is clear.

2. External Communications

The nearest telephone is located at the adjacent City of Beacon Wastewater Treatment Plant. On site personnel should know how to access police, etc. on radios if radios are used on site or by telephone.

C. Emergency Response Personnel

The project team leader or site safety officer shall assume total control and decision-making on site and also serve as the liaison with government officials and off-site emergency personnel.

D. Off-Site Emergency Response Agencies

The following off site emergency response personnel should be contacted in the event of an emergency:

Agency	Phone
St. Francis Hospital, Beacon, N.Y.	(914) 431-8220 (emerg. dept.) (914) 431-3500 (main number)
Poison Control Center	800-336-6997
Beacon Volunteer Ambulance Service	(914) 473-0021
Beacon Fire Department	(914) 831-2121
Beacon Police Department	(914) 831-4111

Off site emergency personnel should be provided information concerning site specific hazards, appropriate response techniques (in the event of chemical related problem) and site emergency procedures.

E. Site Mapping

Detailed information about the site depicted on a map may be useful in emergency situations. Details shown on the map should include:

1. Hazard areas.
2. Site terrain: topography, buildings, barriers.
3. Evacuation routes.
4. Site accessibility.
5. Off site populations or environments at potential risk.

F. Training

All personnel shall be briefed on basic emergency procedures such as communications and evacuation routes.

G. Rescue Response Action

Based on the available information, the type of action required should be decided and the necessary steps implemented. No one should attempt emergency response or rescue until backup personnel and evacuation routes have been identified. Rescue/response actions may include:

1. Enforce the buddy system. No one should enter the area of an emergency without a partner.
2. Survey casualties. Locate victims and assess their condition. Determine off site emergency response agencies required.
3. Assess existing and potential hazards to site personnel and to the off-site population.
4. Allocate on-site personnel and equipment to rescue and incident response operations.
5. Remove or assist victims from the area.

APPENDICES

APPENDIX D.1

POTENTIAL HAZARDS
AND
CAUSES OF EMERGENCIES

POTENTIAL HAZARDS

I. The following general safety hazards can be expected at solid waste landfills:

A. Holes or ditches
B. Precariously positioned objects
C. Sharp objects
D. Slippery surfaces
E. Steep grades
F. Uneven terrain
G. Unstable surfaces

II. Workers shall be advised that the following chemicals are typically found at solid waste landfills. The levels encountered will generally be well below the recommended exposure limits due to the well vented conditions (open atmosphere). Air monitoring will be used to determine the presence of these compounds.

TYPICAL LANDFILL CHEMICALS

Chemical	Description	PEL*	Symptoms of Exposure
Methane	-	-	-
Ammonia	colorless gas with pungent suffocating odor	50 ppm	eye, nose throat irritation
Hydrogen	-	-	-
Carbon Dioxide	colorless, odorless gas	500 ppm	headache, dizziness, restlessness
Nitrogen	-	-	-
Oxygen	-	-	-
Hydrogen Sulfide	colorless gas with rotten egg odor	20 ppm** 50 ppm	apnea, coma, convulsion
Sulfur Dioxide	colorless liquid or gas with a pungent odor	5 ppm	eye, nose, throat irritation
Carbon Monoxide	colorless odorless gas	50 ppm	headache, tackypnea, nausea
Benzene	colorless liquid with an aromatic odor	10 ppm	irritation to eyes, nose, respiratory system
Toluene	colorless liquid with an aromatic order	200 ppm	fatigue, weakness, confusion, euphoria
Methylene Chloride	colorless liquid with pleasant aromatic odor	500 ppm	lightheadness confusion, nausea, vomiting and headache
Perchloroethylene	-	-	-
Carbonyl sulfide	-	-	-

*Permissable Exposure Limit

**ceil

CAUSES OF EMERGENCIES

II. Worker-Related

a) Minor accident (slips, trips, falls, etc.)
b) Chemical exposure
c) Medical problems (heat stress, heat stroke, aggravation of pre-existing conditions, etc.)
d) Physical injury (injuries from hot or flying objects, loose clothing entangling in machinery, serious falls, vehicle accidents, etc.)
e) Electrical (burns, shock, electrocution, etc.)

IV. Waste-Related

a) Fire
b) Explosion
c) Release of toxic vapors

APPENDIX D.2

STANDARD SAFETY PRACTICES

STANDARD SAFETY PRACTICES

Personal Precautions

1. No smoking, eating or drinking in the work area.

2. No matches or lighters in the work area.

3. Check in at the Access Control Point before entering the work area.

4. Check out at the Access Control Point before leaving the work area.

5. If any signs of radioactivity, explosive or unusual conditions such as dead animals are discovered in the work area, exit immediately and report the finding to the site foreman.

6. All personnel going on site must be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures and communications.

7. Contact with contaminated surfaces or suspected contaminated surfaces should be avoided. Whenever possible do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, set or place equipment on drums, containers, or the ground.

Tools and Heavy Equipment Precautions

1. Personnel shall be trained in proper operating procedure.

2. Appropriate equipment guards and engineering controls shall be installed on tools and equipment. These include roll-over protective structures, seat belts, emergency shut off in case of roll over, and backup warning lights and signals.

3. Only equipment and tools that are intrinsically safe and not capable of sparking and pneumatically and/or hydraulically driven equipment shall be used in combustible atmospheres.

4. At the start of each day, brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering and splash protection shall be inspected.

5. All non-essential people shall not be permitted in the work area.

6. Loose fitting clothing and long loose hair shall be prohibited around moving machinery.

7. Cabs shall be kept free of all non-essential items and all loose items shall be secured.

8. The rated load capacity for vehicles shall not be exceeded.

9. Equipment operators shall report to their supervisor's any abnormalities such as equipment failure, oozing liquids, unusual odors, etc.

10. When an equipment operator must maneuver in tight quarters, a second person shall be utilized to ensure adequate clearance.

11. All blades and buckets shall be lowered to the ground and parking brakes shall be set before shutting off the vehicle.

12. An ongoing maintenance program shall be implemented for all tools and equipment. Any defective items shall be promptly repaired or replaced.

13. Work will be suspended during periods of moderate and heavy rains, or when weather conditions may be apt to create hazardous conditions.

APPENDIX D.3

CERTIFICATION

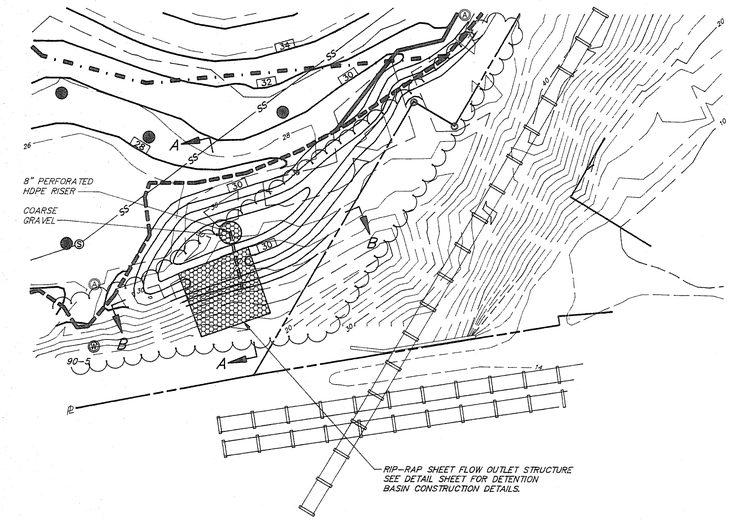
I, _____, have read the Health and Safety Plan and been briefed on the site specific hazards and emergency procedures at the _____ Landfill and understand all information provided to me.

_____

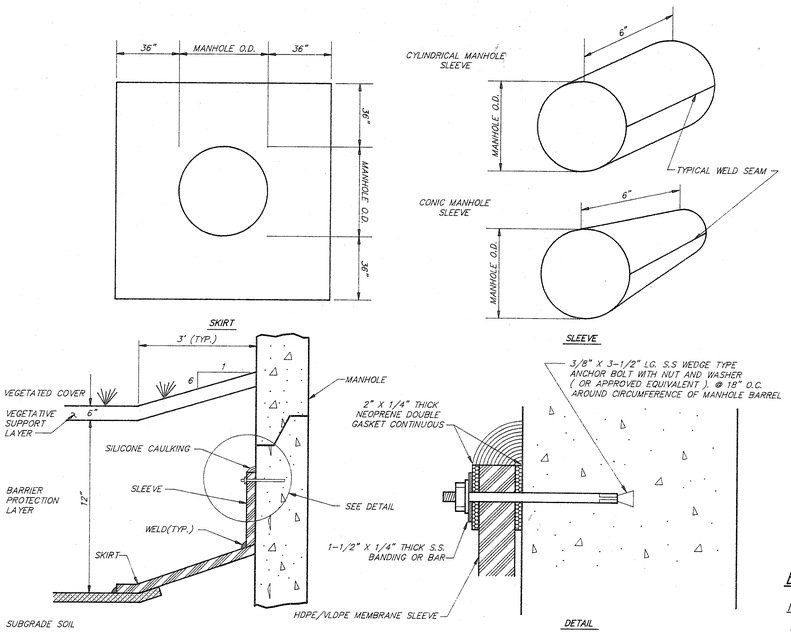
Name

_____

Date



PLAN
SCALE: 1"=50'



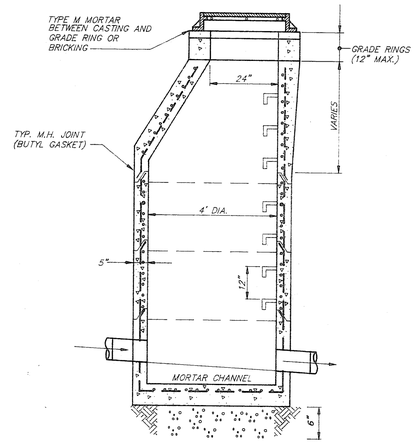
SLEEVE

DETAIL

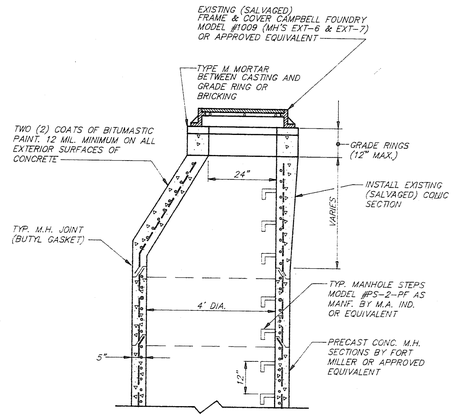
MANHOLE INTERFACE WITH GEOMEMBRANE MANHOLE BOOT
N.T.S.

NOTES:

1. 40 MIL. HDPE/VLDPE GEOMEMBRANE SHALL BE USED TO CONSTRUCT BOOT.
2. BOLTS TO BE SET A MINIMUM OF FOUR (4) INCHES FROM JOINT EDGE OF MANHOLE SECTION CASTING.
3. REGRADE SUBGRADE SOIL AROUND BASE OF MANHOLE AS PER VEGETATIVE SUPPORT LAYER GRADES PRIOR TO INSTALLATION OF GEOMEMBRANE.



EXISTING MANHOLE



MANHOLE EXTENSION

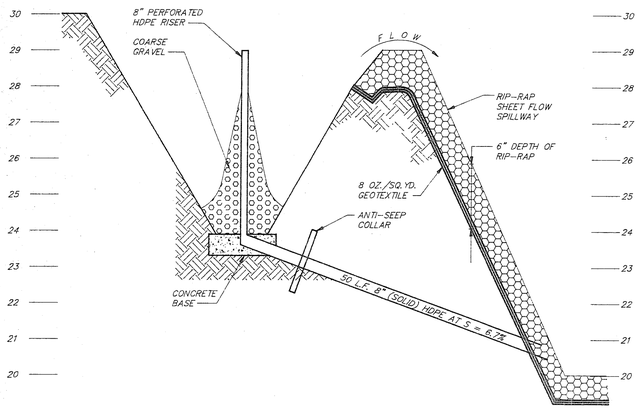
NOTE:

REMOVE AND SALVAGE CONIC BARREL SECTION, CASTING AND LID. INSTALL APPROPRIATE SIZE (VARIES) BARREL REINSTALL SALVAGED CONIC BARREL SECTION, CASTING AND LID (AND GRADE RING(S) IF NECESSARY).

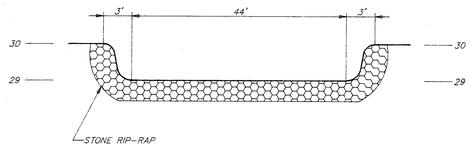
EXISTING PRECAST CONCRETE MANHOLE AND PROPOSED EXTENSION DETAILS
N.T.S.

NOTES:

1. EXTENDED MANHOLE TO CONFORM TO ASTM C-478
2. EXTENSION TO MANHOLES TO BE ACCOMPLISHED USING BARREL ADDITION. IN ALL CASES THE EXISTING CONIC SECTION, CASTING & LID SHALL BE SALVAGED AND REUSED.
3. REFER TO SUBGRADE RECONTOURING PLAN (50 SCALE) FOR EXISTING AND PROPOSED (MINIMUM) RIM ELEVATIONS OF MANHOLES REQUIRING EXTENSIONS. DIMENSIONS OF EXTENSIONS ARE BASED ON RIM ELEVATIONS REFERENCED, WITH INTENT BEING TO HAVE FINISHED MANHOLE AT OR ABOVE PROPOSED (MIN.) RIM ELEVATIONS REFERENCED.



SECTION A-A
SCALE: 1"=10' HORZ.
1"= 2' VERT.

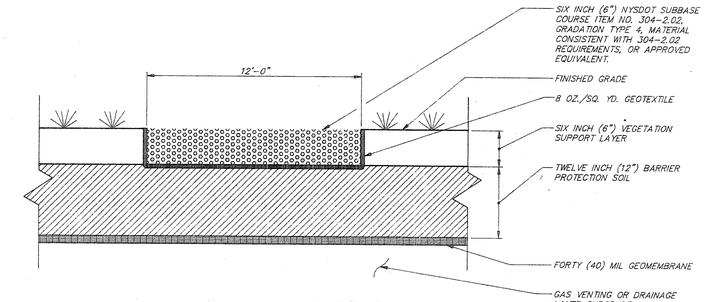


SECTION B-B
SCALE: NTS HORZ.
1"= 2' VERT.

DETENTION BASIN PLAN, SECTIONS AND DETAILS

NOTES:

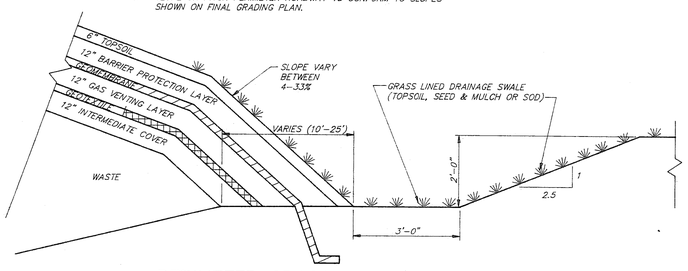
1. ALL SOIL SURFACES DISTURBED THROUGH CONSTRUCTION TO BE SEED AND MULCHED.



SITE ACCESS ROAD
N.T.S.

NOTE:

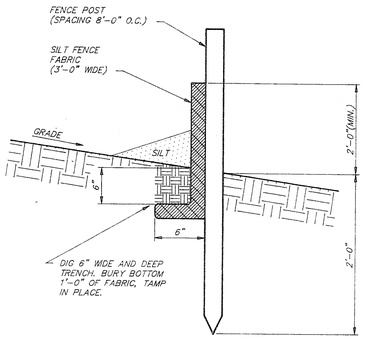
1. SLOPE OR PITCH PERIMETER ROADWAY TO CONFORM TO SLOPES SHOWN ON FINAL GRADING PLAN.



PERIMETER GRASS LINED DRAINAGE SWALE
N.T.S.

NOTE:

1. THE INTENT OF THE GEOMETRY SHOWN IS TO REDEFINE THE EXISTING INTERCEPTOR DRAINAGE SWALE ACCORDING TO THE SLOPES SHOWN ON THE PLAN. THIS DITCH SHALL COLLECT ALL UPGRADIENT STORM WATER RUNOFF AND TRANSPORT IT OFF SITE AND AWAY FROM THE LANDFILL MOUND.
2. REFER TO GEOMEMBRANE ANCHOR TRENCH DETAIL FOR CONSTRUCTION GEOMETRY.
3. CENTER LINE SWALE GRADES VARY BETWEEN 0.75% AND 2.0% REFER TO SUBGRADE AND FINAL GRADING PLANS FOR SLOPES.



SILT FENCE DETAIL
N.T.S.

It is a violation of the New York State Education Law for any person to alter these plans, specifications or reports in any way, unless he is acting under the direction of a Licensed Professional Engineer.

REV. No.	ZONE	DESCRIPTION	DATE	BY
1	ALL	REVISED PER 8/23/94 DEC COMMENTS	10/21/94	DCV

CITY OF BEACON
LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

DETAIL SHEET

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS-LAND SURVEYORS
367 Violet Avenue, Poughkeepsie, New York 12601
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LICENSED PROFESSIONAL ENGINEER MICHAEL MORRIS No. 041280 STATE OF NEW YORK

DATE	SCALE			FILE No.	DRAWING No.
APR. 1993	AS NOTED	DESIGNED BY: JHA DRAWN BY: DCV, JK CHECKED BY: MJM		20275.00	6 of 8

PLOT 10/26/94 20275MS2.DWG

LEGEND

- EXISTING SANITARY SEWER MANHOLE
- 85–1 EXISTING MONITORING WELL
- EXISTING MONITORING WELL OR PIEZOMETRIC TUBE TO BE ABANDONED
- SS EXISTING SANITARY SEWER
- EXISTING FENCE LINE
- 200 EXISTING CONTOUR
- 36 PROPOSED CONTOUR
- EXISTING HYDRANT
- APPROXIMATE PROPERTY LINE
- EXISTING EDGE OF WASTE LIMITS
- PROPOSED EDGE OF WASTE LIMITS (LIMITS OF WASTE RELOCATION)
- TREE LINE
- PROPOSED "BLANKET" GAS VENT RISER
- PROPOSED "STAND ALONE" GAS VENT RISER
- LIMIT OF "BLANKET" GAS VENTING SYSTEM

CENTER LINE SWALE GRADE = 2.0% ±

CENTER LINE SWALE GRADE = 0.75% TO DETENTION BASIN

90–3

85–7

PROPOSED "BLANKET" GAS VENT RISER (TYP.)

PROPOSED SITE ACCESS ROADWAY

47.7

41.8

50.0

CONSERVATIVE WASTE LIMITS AS DETERMINED FROM TEST PIT EXCAVATIONS PERFORMED APRIL 1990 AND ELECTROMAGNETIC SURVEY CONDUCTED NOVEMBER 1990.

LIMIT OF TWELVE INCH (12") THICK GAS VENTING LAYER INSTALLATION.

PROPOSED "STAND ALONE" GAS VENT RISER (TYP.)

EXISTING SSMH#1 RIM = 34.60 INV. = 12.52

R = 20' MIN.

20' MIN.

DITCH

EXISTING SSMH#4 RIM = 24.34 INV. = 10.02 FINISHED RIM ELEV. (MIN.) = 26.5

EXISTING SSMH #5 RAISE RIM TO 39.0 INV. = 9.82

SMH LOCATION AS PER "FINAL GRADING PLAN – CITY OF BEACON LANDFILL" DATED SEPT, 1984 AND IS NOT FIELD LOCATED.

CITY OF BEACON WASTEWATER TREATMENT FACILITY

EXISTING UTILITY POLE (TO BE REMOVED)

23.0

90–5

18.5

85–1

85–6

85–8

DENNINGS AVENUE

MEET EXISTING SITE ACCESS ENTRANCE WITH SITE ACCESS ROADWAY

EXISTING SSMH#3 RIM = 20.95 INV. = 10.23 FINISHED RIM ELEV. (MIN.) = 23.0

BRIDGE

ABANDONED ONE STORY CINDERBLOCK GATE HOUSE

EXISTING SSMH#2 RIM = 24.96 INV. = 10.61 FINISHED RIM ELEV. (MIN.) = 29.0

RIP–RAP SHEET FLOW OUTLET STRUCTURE SEE DETAIL SHEET FOR DETENTION BASIN CONSTRUCTION DETAILS.

GENERAL NOTES:

1. ALL REFUSE AND MUNICIPAL SOLID WASTE FOUND OR LOCATED OUTSIDE THE WASTE MASS "FOOTPRINT" (E.G. – WIND BORN REFUSE, DISCARDED/ABANDONED ITEMS, ETC.) SHALL BE RELOCATED WITHIN THE PROPOSED "FOOTPRINT" AS DIRECTED BY THE ENGINEER PRIOR TO COMPLETION OF WASTE RELOCATION OR IMPORTATION OF FILL.
2. PROPOSED LOCATIONS OF GAS VENT RISER PIPES ("BLANKET" AND "STAND ALONE" TYPES) ALSO SHOWN ON GAS VENTING SYSTEM PLAN.
3. VEGETATED COVER TO BE ESTABLISHED WITHIN FOUR (4) MONTHS OF PLACEMENT OF VEGETATIVE SUPPORT LAYER.
4. IMPROVEMENTS TO PERIMETER STORMWATER INTERCEPTION DITCH TO BE COMPLETED PRIOR TO PLACEMENT OF FINAL CAP THEREFORE GRADING/REGRADING SHOWN AS EXISTING ON THIS PLAN. REFER TO SUBGRADE RECONTOUR PLAN FOR PROPOSED DITCH GRADING.

It is a violation of the New York State Education Law for any person to alter these plans, specifications or reports in any way, unless he is acting under the direction of a Licensed Professional Engineer.

REV. No.	ZONE		DATE	BY
2	ALL	REVISED PER 8/29/94 DEC COMMENTS	10/21/94	DCV
1	ALL	REVISED DRAINAGE	2/29/94	JK

CITY OF BEACON LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

FINAL GRADING PLAN

LICENSED PROFESSIONAL ENGINEER MICHAEL MORRIS No. 041020 STATE OF NEW YORK

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS–LAND SURVEYORS
367 Violet Avenue, Poughkeepsie, New York 12601
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DATE	SCALE		FILE No.	DRAWING No.
APRIL 1993	1" = 50'	DESIGNED BY: JHA DRAWN BY: DCV, JK CHECKED BY: MJM	20275.00	5 of 8

PLOT 10/22/94 20275FIG.DWG

LEGEND

- EXISTING SANITARY SEWER MANHOLE
- 85–1 EXISTING MONITORING WELL
- EXISTING MONITORING WELL OR PIEZOMETRIC TUBE TO BE ABANDONED
- SS EXISTING SANITARY SEWER
- x x EXISTING FENCE LINE
- 200 EXISTING CONTOUR
- 36 PROPOSED CONTOUR
- EXISTING HYDRANT
- APPROXIMATE PROPERTY LINE
- EXISTING EDGE OF WASTE LIMITS
- PROPOSED EDGE OF WASTE LIMITS (LIMITS OF WASTE RELOCATION)
- TREE LINE
- PROPOSED "BLANKET" GAS VENT RISER
- PROPOSED "STAND ALONE" GAS VENT RISER
- LIMIT OF "BLANKET" GAS VENTING SYSTEM

PROPOSED "BLANKET" GAS VENT RISER (TYP.)

CONSERVATIVE WASTE LIMITS AS DETERMINED FROM TEST PIT EXCAVATIONS PERFORMED APRIL 1990 AND ELECTROMAGNETIC SURVEY CONDUCTED NOVEMBER 1990.

LIMIT OF TWELVE INCH (12") THICK GAS VENTING LAYER INSTALLATION.

PROPOSED "STAND ALONE" GAS VENT RISER (TYP.)

SMH LOCATION AS PER "FINAL GRADING PLAN – CITY OF BEACON LANDFILL" DATED SEPT. 1984 AND IS NOT FIELD LOCATED.

EXISTING SSMH #5 RAISE RIM TO 39.0 INV. = 9.82

EXISTING UTILITY POLE (TO BE REMOVED)

CITY OF BEACON WASTEWATER TREATMENT FACILITY

EXISTING SSMH#4 RIM = 24.34 INV. = 10.02 FINISHED RIM ELEV. (MIN.) = 26.5

EXISTING SSMH#3 RIM = 20.95 INV. = 10.23 FINISHED RIM ELEV. (MIN.) = 23.0

EXISTING SSMH#2 RIM = 24.96 INV. = 10.61 FINISHED RIM ELEV. (MIN.) = 28.0

ABANDONED ONE STORY CINDERBLOCK GATE HOUSE

RIP–RAP SHEET FLOW OUTLET STRUCTURE SEE DETAIL SHEET FOR DETENTION BASIN CONSTRUCTION DETAILS.

EXISTING SSMH#1 RIM = 34.60 INV. = 12.32

DENNINGS AVENUE

DITCH

BRIDGE

85–1 85–2 85–3 85–4 85–5 85–6 85–7 85–8 90–3 90–5

X 41.8 X 23.0 X 18.5

NOTES:

1. THREE INCHES (3") SELECT GRANULAR FILL TO BE INSTALLED ACROSS ALL WESTERN FOOTPRINT LIMITS WHERE TWELVE INCHES (12") BLANKET GAS VENT LAYER IS NOT PROPOSED.

It is a violation of the New York State Education Law for any person to alter these plans, specifications or reports in any way, unless he is acting under the direction of a Licensed Professional Engineer.

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1	ALL	REVISED PER 8/29/94 DEC COMMENTS	10/21/94	DCV

CITY OF BEACON LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

GAS VENTING SYSTEM PLAN

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS–LAND SURVEYORS
367 Violet Avenue, Poughkeepsie, New York 12601
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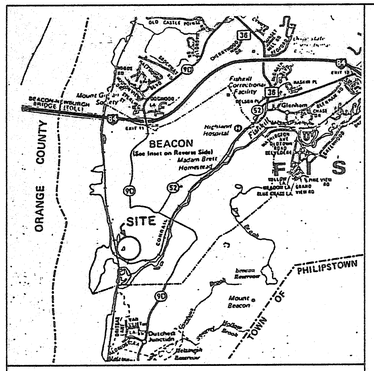
LICENSED PROFESSIONAL ENGINEER MICHAEL MORRIS No. 041290 STATE OF NEW YORK

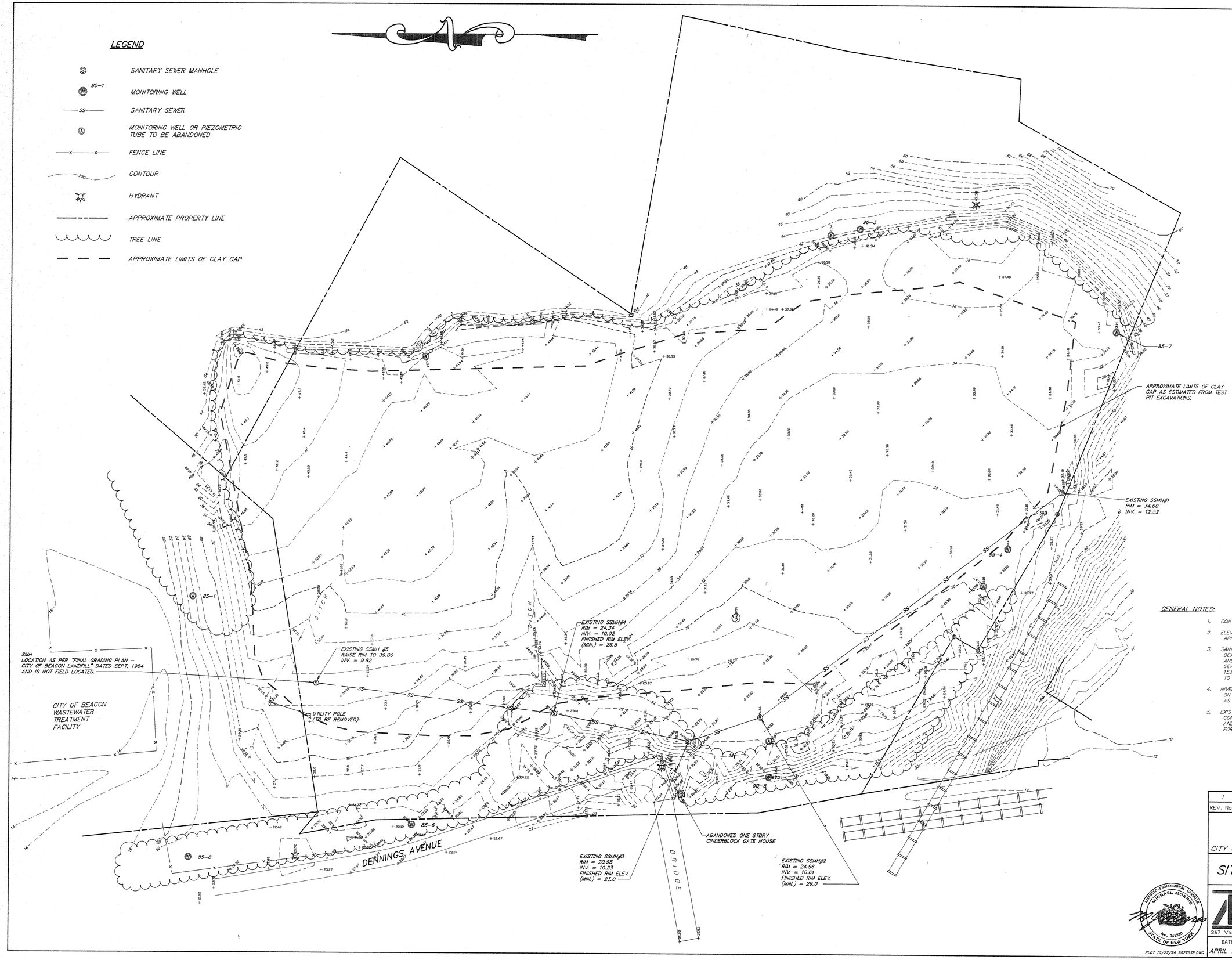
DATE	SCALE	DESIGNED BY: AK, JHA	FILE No.	DRAWING No.
APRIL 1993	1" = 50'	DRAWN BY: JK	20275.00	4 of 8
		CHECKED BY: MJM		

PLOT 10/22/94 202750V.DWG


ORANGE COUNTY
BEACON
SITE
PHILIPSTOWN
TOWN OF
Mount Beacon
Fishkill Correctional Facility
Highland Hospital
Madam Brett Homestead
Old Dutchess Junction
Beacon Reservoir
Sloop Reservoir
Wolcott Reservoir
Long Pond
Fishkill Creek
Matteawan Creek
Brett Hill Road
Route 9D
Route 52
Route 55
Route 84
Route 37
Route 38
Route 82
Route 9
Route 52

LEGEND

- SANITARY SEWER MANHOLE
- 85–1 MONITORING WELL
- SS SANITARY SEWER
- MONITORING WELL OR PIEZOMETRIC TUBE TO BE ABANDONED
- FENCE LINE
- CONTOUR
- HYDRANT
- APPROXIMATE PROPERTY LINE
- TREE LINE
- APPROXIMATE LIMITS OF CLAY CAP



GENERAL NOTES:

1. CONTOUR INTERVAL IS 2 FT. BASED ON U.S.G.S. DATUM.
2. ELEVATIONS TAKEN FROM ACTUAL FIELD SURVEY PREPARED OR BEFORE APRIL 23, 1990 BY JAMES A. BARTLES, L.S. #49640.
3. SANITARY SEWER MANHOLE #5 AND DOWNSTREAM PIPE TO CITY OF BEACON WASTEWATER TREATMENT PLANT NOT FIELD LOCATED. INVERT AND APPROXIMATE LOCATION TAKEN FROM "RECORD MAP OF SANITARY SEWERS, CITY OF BEACON, N.Y." BY ROBERT H. GREENE, N.Y. LIC. # 15308 DATED JANUARY 1940. MANHOLE TO BE FIELD LOCATED PRIOR TO COMMENCEMENT OF CLOSURE CONSTRUCTION.
4. INVERT LISTED FOR EXISTING SANITARY SEWER MANHOLE #5 REFERENCED ON JANUARY, 1940 MAP "SANITARY SEWERS, CITY OF BEACON, NEW YORK" AS PREPARED BY ROBERT H. GREENE N.Y. LIC. #15308.
5. EXISTING AND PROPOSED LIMITS OF WASTE SHOWN ON SUBGRADE RE-CONTOURING PLAN. LIMITS OF EXISTING CLAY CAP TAKEN FROM MORRIS AND ANDROS CLOSURE PLAN DATED OCTOBER 1984 AND PRESENTED FOR AID IN EARTHWORK STRIPPING AND STOCKPILING CONSTRUCTION.

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REV. No.	ZONE		DATE	BY
1	ALL	REVISED PER 8/29/94 DEC COMMENTS	10/21/94	DCV

CITY OF BEACON LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

SITE PLAN EXISTING CONDITIONS

LICENSED PROFESSIONAL ENGINEER MICHAEL MORRIS No. 041989 STATE OF NEW YORK

PLOT 10/22/94 20275SP.DWG

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS–LAND SURVEYORS
367 Violet Avenue, Poughkeepsie, New York 12601

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DATE	SCALE	DESIGNED BY: JHA	FILE No.	DRAWING No.
APRIL 1993	1" = 50'	DRAWN BY: DCV, JK CHECKED BY: MJM	20275.00	2 of 8

LEGEND

- EXISTING SANITARY SEWER MANHOLE
- 85-1 EXISTING MONITORING WELL
- EXISTING MONITORING WELL OR PIEZOMETRIC TUBE TO BE ABANDONED
- SS EXISTING SANITARY SEWER
- EXISTING FENCE LINE
- EXISTING CONTOUR
- 36 PROPOSED CONTOUR
- EXISTING HYDRANT
- APPROXIMATE PROPERTY LINE
- EXISTING EDGE OF WASTE LIMITS
- PROPOSED EDGE OF WASTE LIMITS (LIMITS OF WASTE RELOCATION)
- TREE LINE

WASTE TO BE RELOCATED

CONSERVATIVE WASTE LIMITS AS DETERMINED FROM TEST PIT EXCAVATIONS PERFORMED APRIL 1990 AND ELECTROMAGNETIC SURVEY CONDUCTED NOVEMBER 1990.

85-1

SMH LOCATION AS PER "FINAL GRADING PLAN - CITY OF BEACON LANDFILL" DATED SEPT, 1984 AND IS NOT FIELD LOCATED.

CITY OF BEACON WASTEWATER TREATMENT FACILITY

DENNINGS AVENUE

85-8

85-6

WASTE TO BE RELOCATED

DITCH

DITCH

EXISTING SSMH #5
RAISE RIM TO 39.0
INV. = 9.82

EXISTING UTILITY POLE (TO BE REMOVED)

CENTER LINE SWALE GRADE = 2.0% ±

CENTER LINE SWALE GRADE = 0.75% TO DETENTION BASIN

EXISTING SSMH#4
RIM = 24.34
INV. = 10.02
FINISHED RIM ELEV. (MIN.) = 26.5

EXISTING SSMH#3
RIM = 20.95
INV. = 10.23
FINISHED RIM ELEV. (MIN.) = 23.0

ABANDONED ONE STORY CINDERBLOCK GATE HOUSE

BRIDGE

EXISTING SSMH#2
RIM = 24.96
INV. = 10.61
FINISHED RIM ELEV. (MIN.) = 29.0

RIP-RAP SHEET FLOW OUTLET STRUCTURE SEE DETAIL SHEET FOR DETENTION BASIN CONSTRUCTION DETAILS.

90-3

85-7

85-4

90-5

EXISTING SSMH#1
RIM = 34.60
INV. = 12.52

GENERAL NOTES:

1. TOPSOIL TO BE STRIPPED AND STOCKPILED FROM ENTIRE SITE PRIOR TO WASTE RELOCATION OR IMPORT OF FILL. SUBGRADE SOIL TO BE STRIPPED AND STOCKPILED TO THE MAXIMUM EXTENT PRACTICABLE FROM AREAS DESIGNATED FOR WASTE RELOCATION OR FILL IMPORTATION. SUBGRADE SOIL SHALL BE USED AS COVER SOIL FOR RELOCATED WASTE AND/OR IMPORTED FILL AS DIRECTED BY THE ENGINEER.
2. PROPOSED GRADING SHOWN IN THE THREE (3) AREAS REQUIRING WASTE RELOCATION BASED UPON A FINAL ASSUMED DEPTH OF WASTE (MAXIMUM OF TEN FEET). SUBGRADE SOIL AND TOPSOIL TO BE REPLACED IN AREAS REQUIRING WASTE RELOCATION. DISTURBED AREAS TO BE SEEDED AND MULCHED UPON COMPLETION OF WASTE RELOCATION FOR EROSION CONTROL.
3. EXTENT AND DEPTH OF WASTE RELOCATION TO BE FIELD DETERMINED AND APPROVED BY ENGINEER AND/OR REPRESENTATIVE OF REGION 3, NYSDEC.
4. ALL REFUSE AND MUNICIPAL SOLID WASTE FOUND OR LOCATED OUTSIDE THE WASTE MASS "FOOTPRINT" (E.G. - WIND BORN REFUSE, DISCARDED/ABANDONED ITEMS, ETC.) SHALL BE RELOCATED WITHIN THE PROPOSED "FOOTPRINT" AS DIRECTED BY THE ENGINEER PRIOR TO COMPLETION OF WASTE RELOCATION OR IMPORTATION OF FILL.
5. SANITARY SEWER MANHOLE EXTENSIONS SHOULD BE PERFORMED PRIOR TO FILL IMPORT.
6. TEMPORARY ACCESS ROADWAY FOR IMPORT OF FILL FOR RECONTOURING LANDFILL SUBGRADE TO BE FIELD LOCATED WITH LOCATION AND EXTENT OF ROADWAY APPROVED BY THE ENGINEER.

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REV. No.	ZONE		DATE	BY
2	ALL	REVISED PER 8/29/94 DEC COMMENTS	10/21/94	DCV
1		REVISED SOUTHERLY SUBGRADE SLOPES TO 6% PER NYSDEC APPROVAL	12/29/93	JK

CITY OF BEACON LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

SUBGRADE RECONTOURING PLAN

LICENSED PROFESSIONAL ENGINEER MICHAEL MORRIS NO. 041980 STATE OF NEW YORK

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS-LAND SURVEYORS
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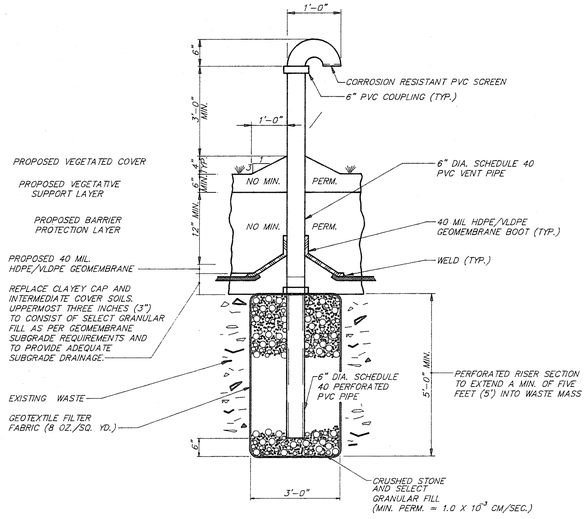
APRIL 1993	1" = 50'	DRAWN BY: DCV, JK	20275.00	3 of 8
		CHECKED BY: MJM		

PLOT 10/26/94 20275SG.DWG

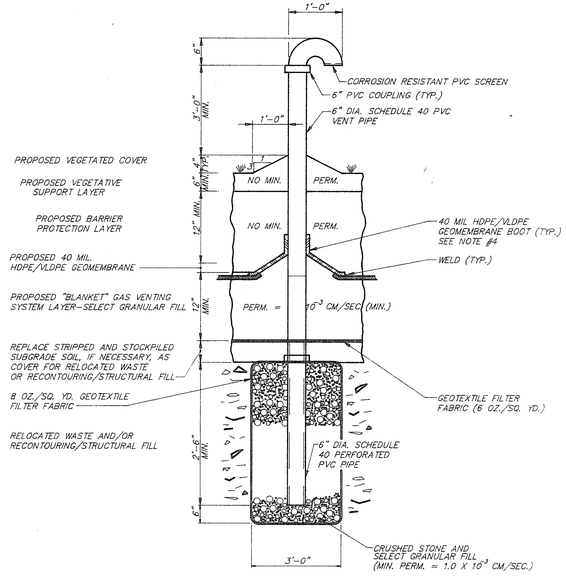


"STAND ALONE" GAS VENT RISER DETAIL

N.T.S.

GENERAL NOTES:

1. "STAND ALONE" GAS VENT RISER TO BE INSTALLED AT LOCATIONS NOT COVERED WITH THE TWELVE INCH (12") THICK GAS VENT LAYER ("BLANKET LAYER"). AS SPECIFIED BY THE GAS VENTING SYSTEM PLAN.
2. JOINTS SHALL BE SOLVENT WELD.
3. GAS VENT RISER PIPES TO BE INSTALLED AT APPROXIMATE LOCATIONS AS SHOWN ON THE GAS VENTING SYSTEM PLAN RESULTING IN A MINIMUM OF FOUR (4) VENTS PER ACRE.
4. CRUSHED STONE OR SELECT GRANULAR FILL OF RISER TO BE ENCASED IN GEOTEXTILE FILTER FABRIC (8 OZ./SQ. YD.) TO PREVENT MIGRATION OF SOIL FINES AND CLOGGING.

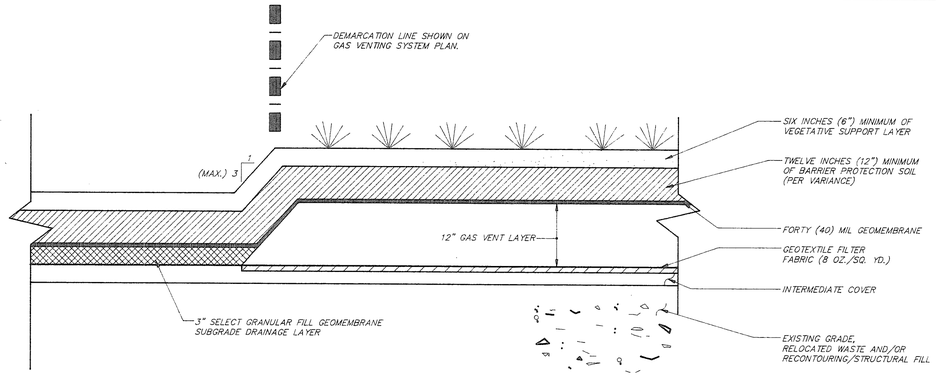


"BLANKET" GAS VENT RISER DETAIL

N.T.S.

GENERAL NOTES:

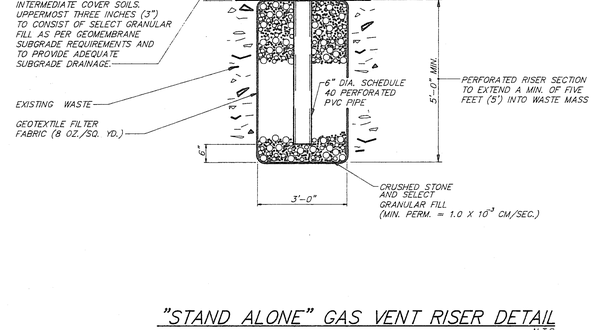
1. "BLANKET" OR STANDARD 6 NYCRR PART 360-2.13(P) GAS VENTING SYSTEM TO BE INSTALLED ABOVE ALL AREAS RECEIVING RELOCATED WASTE OR RECONTOURING/STRUCTURAL FILL AS PER GAS VENTING SYSTEM PLAN AND THE ENGINEER.
2. "BLANKET" GAS VENTING LAYER TO CONSIST OF A MINIMUM OF TWELVE INCHES (12") OF SELECT GRANULAR SOIL PLACED ON A EIGHT (8) OZ./SQ. YD. GEOTEXTILE FILTER FABRIC. GAS VENTING SOIL WILL HAVE A PERMEABILITY NO LESS THAN 1.0 x 10^{-3} CM./SEC..
3. ALL QA/QC TESTING FOR THE GAS VENTING SYSTEM WILL BE COMPLETED AND APPROVED PRIOR TO GEOMEMBRANE PLACEMENT.
4. SKIRT SECTION OF BOOT TO BE PLACED ON TOP OF AND WELDED TO GEOMEMBRANE IF GAS VENT PENETRATES GEOMEMBRANE LAYER.
5. GRADE ALL SUBGRADE SOILS AROUND BASE OF GAS VENT PIPE AS PER TOPSOIL LAYER GRADES PRIOR TO INSTALLATION OF GEOMEMBRANE.
6. PIPE JOINTS TO BE SOLVENT WELDED.



ELEVATION

"BLANKET" – "NON-BLANKET" GAS VENTING SYSTEM INTERFACE DETAIL

N.T.S.

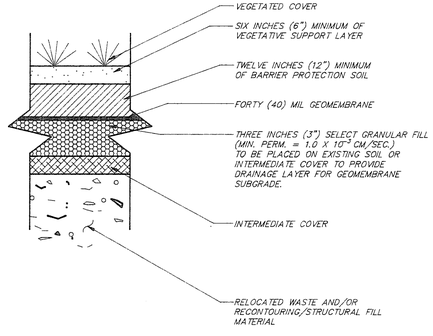


GEOMEMBRANE ANCHOR TRENCH DETAIL

N.T.S.

NOTES:

1. EXCAVATE ANCHOR TRENCH OUTSIDE LIMITS OF WASTE PRIOR TO MOBILIZING GEOMEMBRANE INSTALLER.

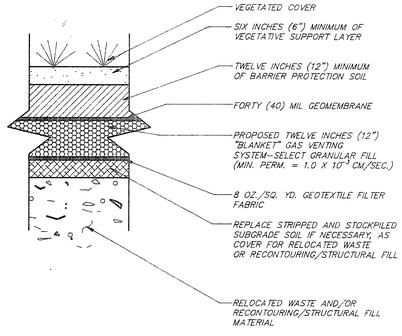


"NON-BLANKET" LANDFILL CAP DETAIL

N.T.S.

NOTES:

1. "NON-BLANKET" LANDFILL CAP INSTALLED ON WESTERLY SECTION OF LANDFILL TO LIMITS SHOWN ON GAS VENTING SYSTEM PLAN.
2. SELECT GRANULAR FILL FOR 3" DRAINAGE LAYER TO MEET GEOMEMBRANE SUBGRADE SPECIFICATIONS (GRADATION TO BE 3/8" MINUS).

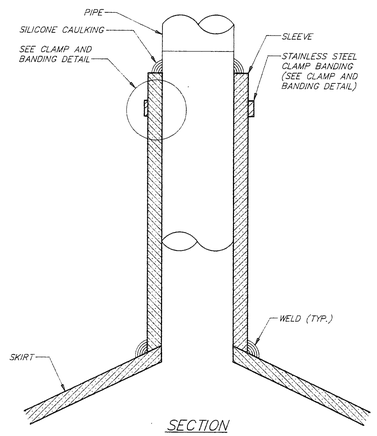


"BLANKET" LANDFILL CAP DETAIL

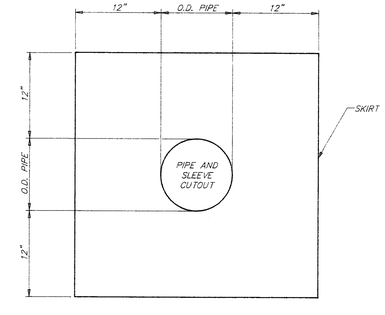
N.T.S.

NOTES:

1. "BLANKET" LANDFILL CAP INSTALLED ON EASTERLY SECTION OF LANDFILL TO LIMITS SHOWN ON GAS VENTING SYSTEM PLAN.
2. GAS VENTING LAYER "BLANKET" MATERIAL TO BE SELECT GRANULAR FILL WITH GRADATION (3/8" MINUS) TO CONFORM TO GEOMEMBRANE SUBGRADE SPECIFICATIONS.



SECTION



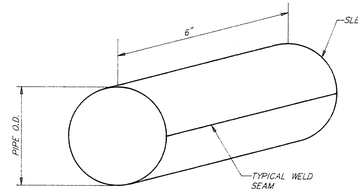
PLAN

GAS VENT PIPE BOOT DETAIL

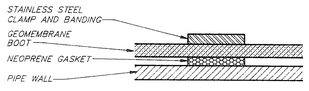
N.T.S.

NOTES:

1. 40 MIL HDPE/VLDPE GEOMEMBRANE SHALL BE USED TO CONSTRUCT BOOT.
2. PIPE BOOT INSTALLED ON HORIZONTALLY OR VERTICALLY INSTALLED PIPES.
3. COMPLETED BOOT AND SKIRT TO BE WELDED TO INSTALLED GEOMEMBRANE COVER AT EACH GAS VENT LOCATION.



ISOMETRIC VIEW



CLAMP AND BANDING DETAIL

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REV. No.	ZONE	DESCRIPTION	DATE	BY
1	ALL	REVISED PER 8/29/94 DEC COMMENTS	10/21/94	DCV

CITY OF BEACON
LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

DETAIL SHEET

LICENSED PROFESSIONAL ENGINEER MICHAEL MORRIS No. 041300 STATE OF NEW YORK

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS-LAND SURVEYORS
367 Violet Avenue, Poughkeepsie, New York 12601
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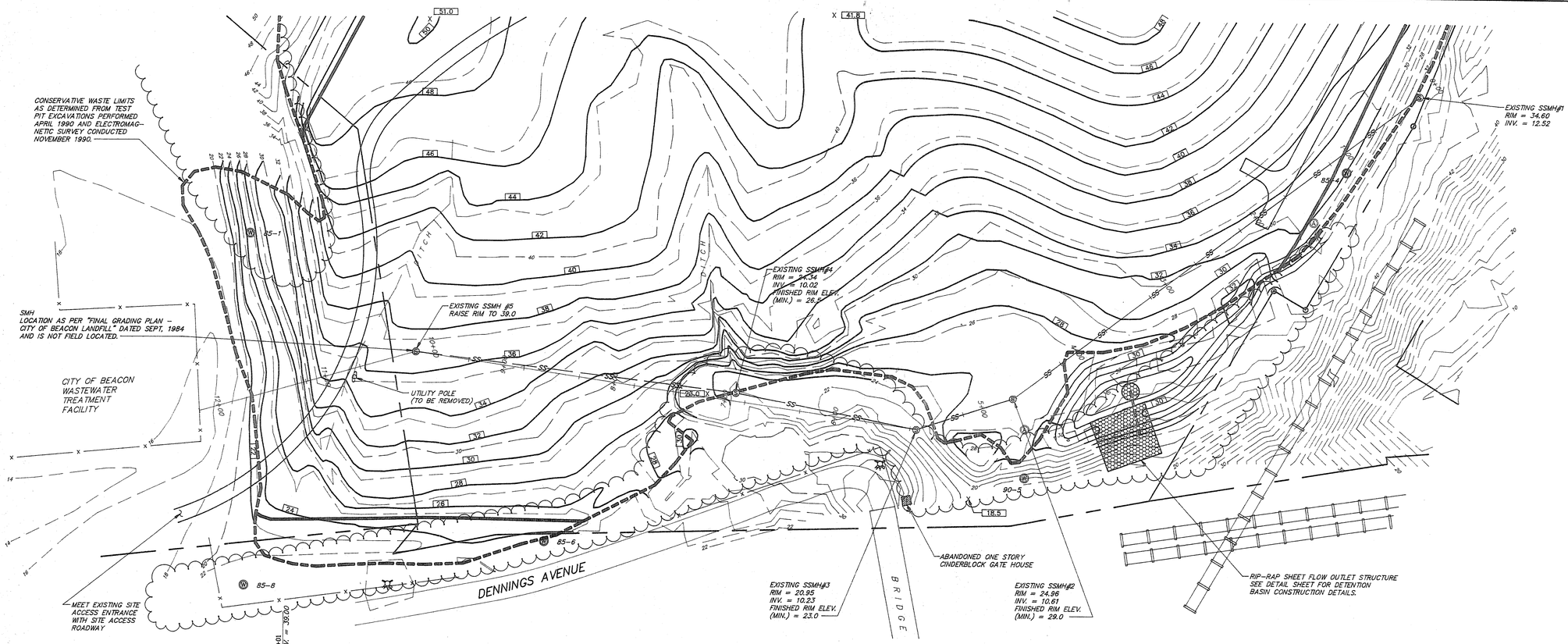
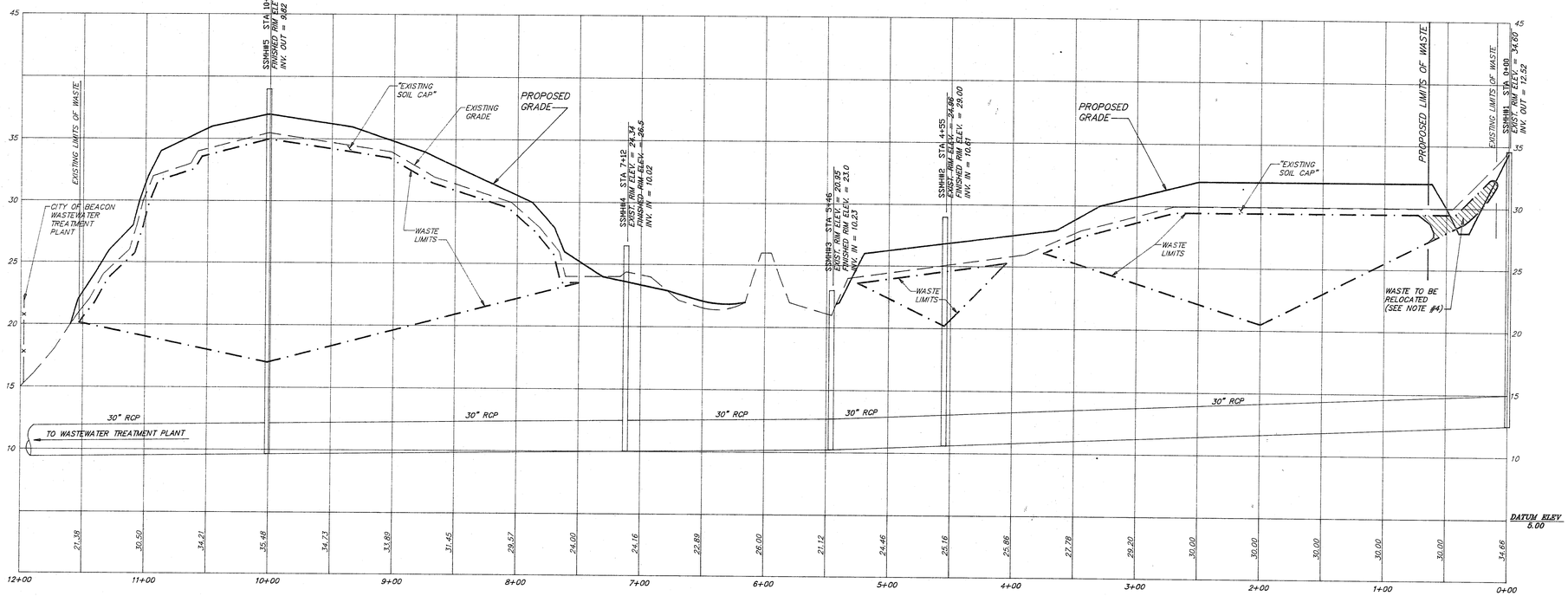
DATE	SCALE			FILE No.	DRAWING No.
APR. 1993	AS NOTED	DESIGNED BY: JHA DRAWN BY: DCV, JK CHECKED BY: MJM		20275.00	7 of 8

PLOT 10/26/94 20275MS3.DWG



LEGEND

- EXISTING SANITARY SEWER MANHOLE
- 85-1 EXISTING MONITORING WELL
- EXISTING MONITORING WELL OR PIEZOMETRIC TUBE TO BE ABANDONED
- SS EXISTING SANITARY SEWER
- EXISTING FENCE LINE
- 200 EXISTING CONTOUR
- 36 PROPOSED CONTOUR
- EXISTING HYDRANT
- APPROXIMATE PROPERTY LINE
- EXISTING EDGE OF WASTE LIMITS
- PROPOSED EDGE OF WASTE LIMITS (LIMITS OF WASTE RELOCATION)
- TREE LINE



EXISTING SEWER LINE PROFILE

SCALE: HORZ. 1" = 50'
VERT. 1" = 5'

NOTES:

1. SANITARY SEWER MANHOLE RIM ELEVATIONS AND INVERTS FIELD LOCATED PER JANUARY 1990 SURVEY WITH EXCEPTION OF SSMH#5.
2. SANITARY SEWER PIPE SIZE AND TYPE AS PER "RECORD MAP OF SANITARY SEWER CITY OF BEACON, N.Y." DATED JANUARY, 1940 BY ROBERT N. GREENE, L.S. 15308.
3. VERTICAL ELEVATIONS AND LIMITS OF WASTE COMPILED FROM: WASTE EDGE PERIMETER FIELD EXCAVATIONS CONDUCTED ON APRIL, 1990 BY MORRIS ASSOCIATES, ELECTROMAGNETIC SURVEY CONDUCTED ON NOVEMBER 1990 BY FOSTER WHEELER ENVIRONSPONSE, INC AND SEISMIC REFRACTION SURVEY CONDUCTED ON SEPTEMBER 1986 BY VIBRA-TECH ENGINEERS, INC.
4. WASTE LIMITS NEAR SSMH#1 TO BE REMOVED AND REPLACED TO THE PROPOSED WASTE LIMITS AS SHOWN ON THE SUBGRADE RECONTOURING PLAN AND THIS PROFILE.

It is a violation of the New York State Education Law for any person to alter these plans, specifications or reports in any way, unless he is acting under the direction of a Licensed Professional Engineer.

REV. No.	DESCRIPTION	DATE	BY
1	ALL REVISED PER 8/29/94 DEC COMMENTS	10/21/94	DCV

CITY OF BEACON LANDFILL

CITY OF BEACON — DUTCHESS COUNTY, NY

EXISTING SANITARY SEWER PLAN AND PROFILE

LICENSED PROFESSIONAL ENGINEER MICHAEL MORRIS No. 041280 STATE OF NEW YORK

MORRIS ASSOCIATES
ENGINEERING CONSULTANTS-LAND SURVEYORS
367 Violet Avenue, Poughkeepsie, New York 12601
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DATE	SCALE	DESIGNED BY: JRA	FILE No.	DRAWING No.
APR. 1993	1" = 50'	DRAWN BY: DCV	20275.00	8 of 8
		CHECKED BY: MJM		

PLOT 10/24/94 20275PP.DWG

V. Summary of Approved Closure Investigation Report (CIR) and Engineers Recommendations for Closure

A CIR dated December 1990 was prepared by Morris Associates and submitted to the NYSDEC. This submission generated an October 30, 1992 comment letter detailing additional information required by the Department. Morris Associates prepared and submitted addendum information on December 2, 1992. This addendum submittal resulted in the NYSDEC December 10, 1992 approval of the CIR (copy enclosed in Appendix F). In recent discussions with Region 3 and pursuant to the August 29, 1994 comment letter, the Department requested a summary of the information presented in the CIR. An overview of the CIR is hereby provided which briefly restates the information within the CIR as it relates to the proposed closure of the Dennings Avenue solid waste facility.

A well defined stratigraphy exists at and under the landfill site as discussed in the Conclusions and Recommendations section of the December 1990 CIR, Hydrogeologic Report Evaluation of the Beacon Landfill page 10-1) as prepared by Lawler, Matusky & Skelley Engineers (LMS). This stratigraphy consists of till cover (existing clay cap and vegetated topsoil layer), fill and refuse, gray-brown silt (with varves), gray clay, glacial till and bedrock. This LMS study also references work performed by Empire/Thomsen, Foster Wheeler Enviresponse and Vibra-Tech Engineering.

Extensive borehole/monitoring well logs and seismic data confirmed this well-defined, coherent stratigraphy in which sediment layers and bedrock (Austin Glen Formation) rise (or become thinner) to the east. Fracture traces using stereo pair aerial photographs were conducted for the landfill and surrounding area but no features showed evidence of hydraulic connection to the Hudson River. No evidence was found to indicate leachate losses from the landfill through these features. Thick layers of silts, silty clays and clayey soils underlie the site. A brick works was reported in operation at the location sometime before 1967. Soil surveys indicate the area to contain Colonie (ci) and Hudson (Hv) soils. These soils display very low permeabilities consistent with brown and blue clays. Grain size analysis of split spoon samplings and slug tests confirmed the underlying soils exhibited low to very low permeabilities (10^{-5} - 10^{-6} cm/sec). In general the landfill is underlain by thick layers of silts and clays which isolate the landfill from bedrock and local surface waters.

The natural groundwater flow budget was described as:

$$P = R_s + R_g + ET$$

where P = annual precipitation

R_s = direct surface runoff

R_g = groundwater runoff

ET = evaportranspiration

Precipitation varies from 38 to 48 inches per year. Various estimates of groundwater recharge exist for till-covered terrains suggesting 16 to 20 inches annual evapotranspiration, 17 to 21 inches of surface runoff and 5 to 8 inches of groundwater runoff. Monitoring well data of the groundwater table by Empire/Thomsen and LMS evidence a direction of flow from east to west paralleling surface topography with a depth to groundwater from between three and nine feet from existing surface grades.

A large series of monitoring wells have been installed across the site from 1983 to 1990. Well logs, screen depths and other pertinent data appear in the CIR's hydrogeologic report and supporting appendices. Monitoring of groundwater quality has occurred quarterly from the existing array of seven (7) wells since 1986. Refer to the closure construction plans for the location of upgradient well 90-3 and downgradient wells 85-7, 85-4, 90-5, 85-6, 85-8 and 85-1. Additional wells exist near 90-3 and 90-5 which will be abandoned and removed or salvaged through closure construction. LMS ran a series of computer models of groundwater flow (using Modflow). A surface cap three feet (3') thick with a recharge rate of 0.0002 ft./day (2% of the mean annual precipitation) and subsurface drains around the entire perimeter of the landfill (10-15 below existing grade) was modelled to produce a maximum flow rate (leachate) in the subsurface drains of 5,600 gallons/day. This model assumed a clay soil barrier layer versus the less permeable 40 mil

geomembrane (1.0 x 10^{-10} cm/sec.) proposed. Modelling the cap performance using the U.S.G.S. - Hydrogeologic Evaluation of Landfill Performance (HELP) and the proposed cap estimated a total leachate generation rate of 14,598 cubic feet per year (approximately 300 gallons per day). This HELP model was conservatively structured assuming a flexible membrane barrier layer with a permeability of 1.0 x 10E-8 cm/sec and a 1.0 percent leakage rate. The HELP model input and output printouts are included at the end of Apeendix C.

The groundwater monitoring program conducted from 1986 to date has shown evidence of leachate indicators sporadically occurring at any one of the downgradient monitoring wells. These leachate indicators "come and go" at various wells seemingly outside any seasonal regularity and appear to indicate sporadic impacts to groundwater. There are no public or private water supplies within one quarter mile. The low leachate generation rates, naturally existing low permeable silt and clay landfill subgrade soil and lack of upgradient or downgradient public/private water supplies is justification reasoning for the proposed cap construction without leachate collection and the five (5) year post-closure monitoring program.

A perimeter explosive gas survey was conducted by LMS on November 28-29, 1990 and by Enviroscience, Inc. in November 1992. Detailed descriptions of the soil gas investigation methodologies are included in the Dec. 1990 (CIR) and December 2, 1992 addendum information package, omitted herein for purposes of brevity. Both investigations showed either a "ND" (not detected) or "below 25% LEL" along the entire perimeter of the facility therefore no mitigative gas systems, outside the proposed final cap gas venting system, are proposed outside the footprint of the landfill. Post-closure quarterly gas monitoring will be conducted subsequent to the completion of final closure construction as detailed by the procedures and protocols defined in the Post-Closure Monitoring and Maintenance Manual.

A surface and fugitive leachate investigation was performed in November 1992 by Enviroscience. No surface or fugitive leachate seeps were identified therefore no mitigative leachate collection systems are proposed.

Vectors in the form of woodchuck burrows were noted by the NYSDEC on their October 14, 1992 field inspection. These vectors will be removed and/or displaced through final cap construction. Given the wooded and undeveloped nature of the surrounding lands, this vector population removal will not be difficult. Contingencies for vector detection are noted in the Contingency Plan (modified Health and Safety Plan) and the Post-Closure Monitoring and Maintenance Manual.

In summary the proposed final closure construction measures proposed ensure that the facility is closed in a manner (and future monitoring proposed to verify) that is not detrimental to the local environment and human health. The highly impervious final cap will greatly reduce or preclude future impacts to groundwater by eliminating surface water infiltration, a sole or predominant source of leachate generation. No impacts to surface waters are noted to date through surface or fugitive leachate discharges. Final cap construction and post-closure monitoring and maintenance will preclude future impacts to surface waters. Explosive gas migration has not occurred to date relative to two separate investigations. The proposed passive gas venting system and post-closure quarterly gas monitoring will preclude future impacts due to explosive gas outside the limits of the property. Vector populations will be removed as described and post-closure monitoring and maintenance will ensure the integrity of the final cap is not impaired.

VI. Closure Plan

The closure of the Dennings Avenue Landfill shall involve the installation of an engineered landfill cap system covering the waste mass "footprint". This capping system shall conform to 6 NYCRR Part 360 (rev. 5/20/91), the Order on Consent and the variances submitted as described herein. All work shall be inspected by a New York State licensed professional engineer who shall in turn prepare a construction certification report upon completion of the closure. This report will certify that all work has been performed in accordance with the NYSDEC approved plans and documents and will be submitted to the NYSDEC within forty-five (45) days of the completion of closure construction.

The closure construction shall involve the following phases:

A) Waste Relocation and Recontouring:

As evidenced by the proposed Subgrade Recontouring Plan of the construction drawings (Appendix E), the waste mass footprint extends beyond the property boundary in three (3) locations. This "footprint" or waste mass boundary was determined through a combination of test pit excavations around the perimeter of the facility and subsurface geophysical investigations conducted in 1990. This waste edge is a conservative combination of the results of these two investigations and was finalized

through the preparation, submission and ultimate acceptance of the Closure Investigation Report.

The first field operation shall be to perform a boundary line survey with stake-out to exactly define the limits of the property in the field. Waste extending beyond the property line in the three (3) areas referenced shall be relocated within the property limits to the extent portrayed by the Subgrade Recontouring Plan or purchased from the respective owner. Waste relocation procedures shall be as follows.

The tree line and scrub brush within the limits of regrading or areas requiring waste relocation shall be cleared and grubbed. The topsoil, existing low permeability clay cap soil and subgrade soils for the areas requiring waste relocation as well as the areas to receive relocated waste and imported fill shall be stripped and stockpiled. Soils shall be stockpiled in the northern and western sections of the property not requiring waste relocation or subgrade recontouring.

All personnel, either privately contracted or force account, shall be educated with respect to protocols addressed in the Contingency Plan (Appendix D). Waste requiring relocation as found along the northeastern and southern sections of the property will likely generate odors if putresible material is unearthed, therefore,

these operations shall be conducted as expeditiously as is feasible. Daily cover in the form of six inches of soil or synthetic tarpaulin cover will be used to preclude odors, fires, leachate generation and vector populations. The northwestern limits of the landfill almost exclusively received ash from the operation of the City incinerator, therefore, odor problems are not anticipated as part of this Work.

Waste shown to fall outside of the property boundary along the northern property line adjacent to the City's Wastewater Treatment Plant shall not be relocated for two reasons. The first is that the parcel adjacent to the landfill to the north is owned by the City which does not object to the encroachment, therefore, it shall not be relocated. Secondly, the City is attempting to negotiate the purchase of the landfill parcel. Should this occur, then the relocation of waste from the wastewater treatment plant parcel to the landfill property would certainly represent a wasteful expenditure of monies (both the City's and State's, considering the secured grant involved).

The waste in all three (3) areas (northwestern, northeastern and southern sections) will be relocated to allow for the installation of drainage structures outside the waste mass as well as the installation of

the landfill cap within the confines of the property in question, with the noted exception along the northerly boundary line. The maximum depth of waste requiring relocation has been estimated at ten feet and tapers to a horizontal lens configuration at the footprint limit. This assumption has led to the regrading portrayed in the Subgrade Recontouring Plan. If less than ten feet of material is encountered along the interior sections of the waste relocations, then the regrading of these areas will be shallower than presently shown. The intent for all these areas is to regrade the subgrade, backfill with stripped subgrade soil and topsoil as necessary to that positive drainage pathways away from the landfill footprint results.

Presently, the southerly half of the landfill has slopes of approximately one and one half to two percent (1.5 - 2%). Because it is not cost-effective to increase the thickness of the gas venting layer in order to bring the slopes to the referenced minimum grade, fill material will be imported as approved by the NYSDEC and noted in their August 29, 1994 comment letter to the City. Briefly restated, this fill will consist of petroleum contaminated soils acceptable for use pursuant to STARS MEMO #1 guidelines.

The imported fill material will not pose a threat to surface or groundwater quality because it will be located under the barrier layer and within the uppermost limits, topographically, of the landfill. This location will isolate the material from contact with surface water percolating vertically downward as well as any contact with seasonal high groundwater. Considering the fact that a geomembrane with a permeability of 1.0×10^{-12} cm/sec. is to be used as the barrier layer, there will be essentially no avenue available for percolating stormwater runoff to come in contact with the imported fill.

The Subgrade Recontouring Plan details the areas to receive and grades resulting were from fill importation. This fill consisting of the relocated waste and petroleum contaminated soil. The relocated waste shall be used as fill on the waste mass immediately adjacent to the excavations. The "petroleum contaminated soil fill" will be placed exclusively on the southern half of the landfill where slopes are below minimum grade. The City estimates there will be approximately thirty thousand cubic yards (30,000 cu.yds.) of soil imported to the site for recontouring. The grading plan proposes placing fill such that six percent (6%) slopes are created in the southerly section of the landfill.

B) Stormwater Management:

The perimeter drainage swale along the eastern and southern sections of the site was constructed in conformance with the Orders on Consent. This swale will be recut and redefined concurrently with the waste relocation and subgrade recontouring.

It is intended that this swale will collect the upslope stormwater runoff and convey it to a storm water detention basin that shall be constructed at the southwestern corner of the property. This detention basin will discharge collected runoff to the Fishkill Creek near its confluence with the Hudson. The enclosed map entitled "Pre-1967 Contours" shows evidence that the landfill once drained in this proposed direction. A November 27, 1967 correspondence from the New York State Department of Health to the City documents that the landfill site once drained to the Hudson River and that a "berm" was to be constructed of on-site clayey soils from the brick works to preclude future off-site drainage. Refer to Appendix F of this report for a copy of this correspondence. Also enclosed hereafter is a map of the existing topography showing the drainage pathway to the Fishkill Creek at its confluence with the Hudson River. The proposed detention pond will dampen the off-site flow to the best extent practicable. The proposed drainage pathway conforms to a previous drainage condition thus off-site drainage impacts are

not resulting. The rip-rap spill way, ballast lined existing grade and existing vegetated drainage way to the Fishkill Creek will preclude any erosional effects of runoff. A small portion of the landfill, approximately five acres, will continue to drain to the low area along the western section of the site. The Subgrade Recontouring Plan calls for the berm-like ridge at the southwestern section of the site to be breached and regraded thereby allowing runoff to flow south to the Fishkill Creek. The northwest section of the landfill will continue to drain toward an existing catch basin in front of the wastewater treatment plant with the recontouring after waste relocation better channeling this runoff away from the landfill proper.

Detailed drainage calculations can be found in the Technical Data and Calculations section (Appendix C) of this report.

C) Gas Venting System:

Because an existing clay cap exists across the majority of the site, and because the perimeter gas monitoring investigation showed no off-site gas migration, two (2) types of gas venting systems are proposed.

The standard Part 360 "blanket" gas venting system will be installed atop all landfill subgrades where waste has been relocated or imported fill will be placed. This system, consisting of a geotextile filter fabric and twelve inches (12") of select granular material (minimum permeability = 1.0×10^{-3} cm/sec. with a minimum of one (1) gas vent riser per acre, will be installed to the limits depicted on the Gas Venting System Plan (refer to Appendix E). Upon completion of the subgrade recontouring (waste relocation and fill placement), the stockpiled subgrade soil will be replaced atop the fill areas, as necessary. This fine grained soil (mainly consisting of stripped clayey soils) will create a smooth subgrade to receive the "blanket" gas venting system.

A gas venting system in conformance with Local Government Regulatory Relief Initiative (LGRRI) standards will be installed across the "westerly" sections of the landfill, covering

approximately 5.2 acres, where subgrade recontouring operations are not required.

Individual gas vent ("Stand Alone") risers will be keyed into the waste mass at a rate of four (4) vents per acre to the dimensions and locations specified on the construction drawings. Gas vent risers are also proposed alongside each sanitary sewer manhole within the footprint so that should gases be migrating through the stone backfill at either the sewer pipe or manhole locations, this gas can be vented to atmosphere. It should be noted that the sanitary sewer exists at an elevation below the bottom of the landfill so the proposed vent configuration described is a pre-cautionary measure. A three inch (3") thick layer of select granular fill will be installed across the entire "western" half of the footprint. This layer will allow for; adequate drainage of the geomembrane, subgrade in conformance with the LGRRI requirements for the barrier protection layer variance, collection of gases not venting at a "stand-alone" riser and a suitable subgrade for the geomembrane installation.
Variance form work for this described design is included at the end of this subsection. The reasoning for the design variation being the nature of the fill in the noted areas, the adequacy of the proposed gas management system as compared to the Part 360 "blanket" gas venting

system and the financial savings that can be realized by the City by incorporating this two part gas venting system.

D) Barrier Layer:

The barrier layer proposed for the City of Beacon landfill will be a forty (40) mil geomembrane. The geomembrane will be either HDPE or VLDPE with this office preferring the VLDPE due to its material characteristics (namely its flexibility as compared to the more rigid HDPE). Suppliers and installers have indicated that there is no price difference between the two products, however, VLDPE is more forgiving with respect to subgrade preparation. VLDPE does not "bridge" across low spots like HDPE can and "grabs" the subgrade and cover soil due to its elastic quality. VLDPE has no 'percent elongation at yield' specification because it will stretch 800-1000% without the material yielding, which makes for an excellent landfill cover where the amount of subsidence of the waste mass overtime is essentially unknown. Refer to the technical specification section (Appendix B) of this report for the list of minimum values for each geomembrane material.

This geomembrane barrier layer will be installed in intimate contact with either the gas venting soil of the "blanket" system or the three inch (3") thick select

granular subgrade soil of the "trench" gas vent system. In either case the material or site preparation specification for the subgrade and cover soil will conform to recommended geomembrane manufacturers' requirements for particle size, uniformity and density.

The geomembrane cover will be installed across the entire, redefined waste mass (with new limits after waste relocation as proposed by the plan details and project specifications). Quality Assurance/Quality Control protocols for the barrier layer are presented in Appendix A of this report.

E. Barrier Protection Layer:

Upon completion of the geomembrane installation with review and approval of all QA/QC testing, the barrier protection soil layer will be installed. The nature of the geomembrane requires the select granular soil specification for the initial lift. Depending upon the type of earthwork equipment to be utilized, the initial lift of select granular material will have a specified minimum uncompacted thickness of six inches (6") or more as necessary to preclude damage to the geomembrane. Density and compaction QA/QC testing will be as specified by the QA/QC Plan and Technical Specifications.

The remaining soil to be used in constructing the barrier protection layer can be non-select in gradation as it will not be in intimate contact with the geomembrane. The technical specification section of this report will defines the gradation and type of soils acceptable in constructing the barrier protection layer.

The minimum thickness of the barrier protection layer for the capping system will be twelve inches (12"). Submission for a design variance against the minimum thickness of the barrier protection layer is presented within this report, as available through the Local Government Regulatory Relief Initiative. The required formwork with addendum explanations are included at the end of this section and identify: the specific provisions of Part 360 for which a variance is sought, compliance with the identified provisions that cause unreasonable economic, technological burdens and that there will be no adverse impact to or public safety or welfare, the environment or natural resources.

F) Vegetative Support Layer:

The six inch (6") topsoil layer specified by Part 360 will be substituted with six inches (6") of material capable of continually supporting the vegetated cover. Similar to the Barrier Protection Layer, a variance for

this design alternative is submitted within this subsection. Approximately three thousand cubic yards (3,000 cu. yds.) of topsoil will be stripped from the site and mixed with approximately six thousand cubic yards (6,000 cu.yds.) of compost to generate the nine thousand yards of "topsoil" required for the work.

The City of Beacon has been operating a composting facility at the site of the old incinerator with great success. Because of the extended closure dates requested, it will be possible to generate considerable amounts of compost which will augment the topsoil stripped from the site. This compost has been tested and is confirmed capable of continually supporting the proposed vegetated cover. The topsoil is capable of supporting vegetation as a grassy cover and has been maintained across the site without vegetation burn-out for the past nine years.

G) Vegetated Cover

As per Part 360 requirements, a vegetated cover will be established within four (4) months of the installation of the vegetated support layer. This vegetated cover will consist of a meadow grass seed mix specified by Lofts, Inc. for use with the proposed landfill capping system. The agronomist from Lofts has determined that this seed mix will not impinge upon the function or

integrity of the geomembrane barrier layer as necessary for the NYSDEC to grant a barrier protective layer variance. A written affirmation in this regard is included with the respective variance formwork.

H) Leachate Collection System:

The installation of the landfill capping system with a geomembrane barrier layer will almost completely isolate the waste from surface water infiltration, considering the permeability of the specified geomembrane materials is approximately 1.0×10^{-12} cm/sec. The regrading of the diversion ditch and other referenced subgrade recontouring should preclude off-site stormwater runoff from infiltrating into and through the waste mass. Based on these closure system upgrades and installations, the cost-benefit of installing leachate collection system does not appear productive relative to the sites location.

The landfill is located on an isolated parcel of land with no private or public wellheads one-quarter mile upgradient or one mile downgradient from the facility. The properties downgradient from the facility to the south and west are occupied by narrow corridor railways which would appear to diminish the possibility of industrial/commercial/residential development and thus the potential for groundwater resource development. The

existence of a City wide water system also mitigates any potential impacts to upgradient or downgradient groundwater use local to the landfill.

Considering the site conditions, facility location and proposed landfill capping system components; it would appear that the cost of installing a leachate collection system, estimated at approximately $1.9 million in the Closure Investigation Report, far outweighs the benefits provided thus the system does not appear financially viable for the landfill closure.

A computer simulation of the function of the proposed final capping system was created using the U.S.E.P.A.'s Hydrogeologic Evaluation of Landfill Performance (HELP) model. The topsoil, barrier protection layer and geomembrane barrier layers were described within the context of the HELP model and evaluated over the course of one years worth of climate conditions. The rainfall index information was revised to include a U.S.D.A.-S.C.S. TR-55 25 year, 24 hour rainfall event (six inches). The landfill capped with a geomembrane barrier layer (permeability = 1.0×1.0^{-8}, conservatively), assuming a small fraction (1.0%) of imperfections in the installation, will generate an average daily volume of 300 gallons of leachate. Relative

to the area and configuration of the landfill, a leachate collection system (in the form of a toe drain) installed along the downgradient perimeter of the footprint just above seasonal high groundwater would likely only intercept approximately ten to twenty percent (10 - 20%) of the leachate generated or between 30 and 60 gallons per day. The cost of proposed system in comparison to the benefits accrued and the lack of impacts to human health and the environment do not warrant an installation.

Leachate indicators will be tracked and trended through a five (5) year post-closure period. If there is an appreciable drop in leachate indicators over this monitoring period then the performance of the final cap will be confirmed. The duration of the monitoring period, five years, was chosen to allow for the dewatering of the waste mass and coincides with the 6 NYCRR Part 360 protocol for future review of the monitoring program.

VII. PROPOSED VARIANCES AND DESIGN MATERIAL REQUESTS

Incorporated into the closure of the Dennings Avenue solid waste facility are design variances and alternative material requests which will comply with the regulatory stipulations of 6 NYCRR Part 360 while not compromising the health, safety or welfare of the public or environment.

The intent of these variances and alternative material requests complies with 6 NYCRR Part 360 and LGRRI protocols in order to not jeopardize the State Assistance grant while optimizing financial expenditures incurred by the City of Beacon.

A) Proposed Variances:

Three (3) variances from standard 6 NYCRR Part 360 (rev. 5/28/91) are requested herein with the appropriate formwork for each included at the end of this section of the report. As per the March 1, 1993 workshop meeting conducted by the NYSDEC to define the requirements of the Local Government Regulatory Relief Initiative (LGRRI), each variance request will:

- identify the provision of 360 from which a variance is sought.
- demonstrate that compliance would impose an unreasonable economic, technological or safety burden.

- demonstrate that the variance will not adversely impact the public health, safety or welfare or on the environment.

i. The first variance request is for the combined gas venting system. The standard 6 NYCRR Part 360 ("blanket" type) gas venting system shall be installed above the "eastern" half of the facility. A gas venting system composed of four "stand-alone" gas vent risers per acre and a three inch (3") porous layer of select granular fill is proposed (refer to the Gas Venting System Plan) for the "western" half of the facility thus a variance is requested against 360-2.13(p), specifically 360-2.13(p)(2)(i) due to the configuration of the trenches versus a continuous layer.

The nature of the fill in the northwestern sections of the landfill, predominantly incinerator ash, suggests that little or no decompositional gases will be generated. The results of the soil gas survey performed by Lawler, Matusky and Skelly and reported in the approved Closure Investigation Report, which were conducted across the surface of the landfill mound, showed no off-gassing occurring in the area where the variance gas venting system will be installed. Perimeter soil gas

investigations performed by LMS and Enviroscience also showed no off-site gas migration occurring. This investigative information suggests that the variance from design standard will not adversely impact the public health, safety or welfare of the environment due to the existing gas migration, or lack of, from this area. Furthermore, the use of the standard Part 360 gas venting system along the "eastern" half of the facility will protect against gas migration that may occur from the facility to the east which is the direction to the closest off-site enclosed structures (residential). Therefore installing the standard gas venting system as the "eastern" half of the facility will provide adequate protection to human health in regard to utilizing the variance gas vent system across the "western" half of the site. The cost of installing the variance gas venting system is considerably less than a "blanket" layer system meaning that the installation of such a standard "blanket" type system will impose an unreasonable economic burden on the municipality, while not necessarily providing increased component performance.

The individual ("stand-alone") gas vent risers, as detailed, will be keyed into the waste mass in a

grid pattern spaced approximately one hundred feet (100') apart. Installing gas vent riser pipes at each grid intersection point will result in at least four (4) vents per acre. Gas vent riser backfill will be wrapped in a geotextile filter fabric to preclude migration of fines into the porous media and the potential for clogging. The backfill will be crushed stone or select granular fill which meets the regulatory requirement of 1.0 x 10^{-3} cm/sec minimum permeability.

The variance gas venting system shall extend into the "blanket" type gas venting system via connection of the three inch (3") layer directly into the twelve inch (12") thick "blanket" thereby ensuring the functional uniformity of the gas system as a whole.

ii. Barrier Protection Layer

The barrier protection layer proposed will be a minimum of one foot (1') thick verses the regulatory standard defined by 360-2.13(q)(2)(iii). This design variance is requested due to the use of geomembrane materials in constructing the barrier layer.

A correspondence from the agronomist at Lofts, Inc. of Bound Brook, New Jersey stating that the reduced soil thickness will support their reclamation seed mix specified and that the vegetation will not damage the integrity of the geomembrane is included in Appendix F of this report.

The nature of the slopes on site, the installation and improvements to the stormwater diversion system plus the installation of the select granular soil of "blanket" and variance gas venting systems across the site will ensure that the subgrade of the geomembrane is sufficiently well drained to prevent frost heave damage to the barrier layer.

The economic implications are self-evident. Reducing the design thickness of the barrier protection layer results in less material requiring purchase, transport, placement and compaction thus the reduced financial expenditure required of the municipality.

iii. Vegetative Support Layer

The proposed uppermost soil layer will consist of a minimum of six inches (6") of material capable of continually supporting the proposed vegetative cover. This design variance request is made in

lieu of 360-2.13(s) requirements regarding the use of topsoil only versus alternative materials capable of performing the same function.

The City of Beacon operates a composting facility on a parcel adjacent to the landfill site, located on the grounds of the former incinerator, which collects and processes yard wastes (i.e.-grass clippings, leaves, plant trimmings, etc.) generated by City residents into Class I compost. Depending on the volume of material delivered and collected, this facility produces between one and three thousand cubic yards (1-3,000 c.y.) of compost annually.

A sample of this compost has been sent to the Cornell Cooperative Agricultural Extension Service for testing in order to confirm that the compost is capable of continually supporting the meadow grass vegetative cover seeding proposed for the facility. Appendix F contains correspondence stating that the compost indeed capable of sustaining vegetative growth.

The landfill closure will itself generate an undetermined amount of topsoil when the site is stripped prior to waste relocation and subgrade

recontouring. Since the construction of a clay cap and topsoil layer pursuant to the 1984 Consent Order, a continuous stand of vegetation has been maintained across the site yielding proof that an adequate grade or quality of topsoil presently exists. It is estimated that nine thousand cubic yards (9,000 yds.) of vegetative support soil will be required to cover all areas disturbed by earthwork operations. The City generated compost will be used to augment the volume of topsoil stripped from the site to ensure that enough material is available.

The use of compost to augment recovered site soil will not adversely impact the public health, safety or welfare or the environment. Also the use of City generated compost represents a potential financial savings versus the purchase of off-site soil, thus relieving the municipality of an unnecessary economic burden.

B. Variance Formwork and Supporting Materials

C. Alternate Design Material Request

The closure of the Dennings Avenue landfill proposes to offer the use of either 40 mil HDPE or (VLDPE) in the construction of the barrier layer.

APPLICATION FOR VARIANCE FROM 6 NYCRR 360

SEE APPLICATION INSTRUCTIONS ON REVERSE SIDE

DEPARTMENT ACTION ☐ Approved ☐ Disapproved | DATE

1. OWNER'S NAME	2. ADDRESS (Street, City, State, Zip Code)	3. Telephone No.
City of Beacon	427 Main Street, Beacon, NY 12508	831-0302
4. OPERATOR'S NAME	**5. ADDRESS (Street, City, State, Zip Code)**	**6. Telephone No.**
City of Beacon	427 Main Street, Beacon, NY 12508	831-0302
7. ENGINEER'S NAME	**8. ADDRESS (Street, City, State, Zip Code)**	**9. Telephone No.**
Morris Associates	367 Violet Avenue, Poughkeepsie, NY 12601	454-3411, ext. 46

10. PROJECT/FACILITY NAME
Dennings Avenue Landfill (Case # 3-0924/86-03)

11. PROJECT STATUS	12. COUNTY IN WHICH FACILITY IS LOCATED	13. ENVIRONMENTAL CONSERVATION REGION
☒ Public ☐ Private ☐ Proposed ☒ Existing	Dutchess	Region 3

14. DESCRIBE SPECIFIC LOCATION OF FACILITY
Dennings Avenue, Beacon, New York

15. TYPE OF PROJECT FACILITIES: ☐ Composting ☐ Transfer ☐ Shredding ☐ Baling ☒ Sanitary Landfill ☐ Incineration ☐ Pyrolysis ☐ Resource Recovery-Energy ☐ Resource Recovery-Materials ☐ Other

16. BRIEFLY DESCRIBE THE PROJECT INCLUDING THE BASIC PROCESS AND MAJOR COMPONENTS
Construction of final landfill cap for sanitary landfill that ceased accepting waste in 1985. Final cap to include gas venting systems, geomembrane barrier layer, barrier protection layer and vegetated topsoil layer.

17. SPECIFIC PROVISION OF 6 NYCRR 360 FROM WHICH A VARIANCE IS REQUESTED: Section 2.13(s) | Paragraph 1 | Variance Request No. 1

18. BRIEFLY DESCRIBE PROPOSED VARIANCE
The City proposes to use 3,000 cubic yards of topsoil stripped from the existing soil cap and blended with 6,000 cubic yards of compost generated by the City. Both materials are capable of sustaining vegetated growth and replace the "topsoil" referenced by 360-2.13(s)(1).

19. IMPACTS OF VARIANCE APPROVAL OR DISAPPROVAL:

a. Environmental Impact:
Conservation of resources by incorporating compost with existing topsoil versus off-site purchase of topsoil.

b. Economic Impact:
Reduced financial impact to the City due to compost product generated by City versus purchase of topsoil from off-site source.

20. CERTIFICATION:
I hereby affirm under penalty of perjury that information provided on this form and attached statements and exhibits is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

10/28/94
Date

[signature], P.E. ; Project Engineer
Signature and Title

47-19-5 (6/77)
Formerly SW-23

CENTRAL OFFICE COPY

APPLICATION FOR VARIANCE FROM 6 NYCRR 360

SEE APPLICATION INSTRUCTIONS ON REVERSE SIDE

DEPARTMENT ACTION ☐ Approved ☐ Disapproved | DATE

1. OWNER'S NAME	2. ADDRESS (Street, City, State, Zip Code)	3. Telephone No.
City of Beacon	427 Main Street, Beacon, NY 12508	831-0302
4. OPERATOR'S NAME	**5. ADDRESS (Street, City, State, Zip Code)**	**6. Telephone No.**
City of Beacon	427 Main Street, Beacon, NY 12508	831-0302
7. ENGINEER'S NAME	**8. ADDRESS (Street, City, State, Zip Code)**	**9. Telephone No.**
Morris Associates	367 Violet Avenue, Poughkeepsie, NY 12601	454-3411, ext. 46

10. PROJECT/FACILITY NAME

Dennings Avenue Landfill (Case # 3-0924/86-03)

11. PROJECT STATUS	12. COUNTY IN WHICH FACILITY IS LOCATED	13. ENVIRONMENTAL CONSERVATION REGION
☒ Public ☐ Private ☐ Proposed ☒ Existing	Dutchess	Region 3

14. DESCRIBE SPECIFIC LOCATION OF FACILITY

Dennings Avenue, Beacon, New York

15. TYPE OF PROJECT FACILITIES: ☐ Composting ☐ Transfer ☐ Shredding ☐ Baling ☒ Sanitary Landfill ☐ Incineration ☐ Pyrolysis ☐ Resource Recovery-Energy ☐ Resource Recovery-Materials ☐ Other

16. BRIEFLY DESCRIBE THE PROJECT INCLUDING THE BASIC PROCESS AND MAJOR COMPONENTS

Construction of final landfill cap for sanitary landfill that ceased accepting waste in 1985. Final cap to include gas venting systems, geomembrane barrier layer, barrier protection layer and vegetated topsoil layer.

17. SPECIFIC PROVISION OF 6 NYCRR 360 FROM WHICH A VARIANCE IS REQUESTED: Section 2.13(r) | Paragraph (2)(iii) | Variance Request No. 2

18. BRIEFLY DESCRIBE PROPOSED VARIANCE

Use of twelve inches (12") of barrier protection layer versus twenty-four inches (24") (as offered through Local Government Regulatory Relief Initiative) over geomembrane barrier layer.

19. IMPACTS OF VARIANCE APPROVAL OR DISAPPROVAL:

a. Environmental Impact:

Will incorporate a three inch (3") thick layer of select granular fill under the geomembrane along the "western" half of the facility which, when coupled with the standard twelve inch (12") thick gas venting layer, will provide adequate subgrade drainage to protect against frost heave damage to barrier layer. Also proposed grassy cover will not cause damage to the barrier layer.

b. Economic Impact:

Financial savings realized through halving the quantity of soils to be purchased and installed across landfill cap.

20. CERTIFICATION:

I hereby affirm under penalty of perjury that information provided on this form and attached statements and exhibits is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

10/20/94
Date

[signature], P.E.; Project Engineer
Signature and Title

7-19-5 (6/77)
ormerly SW-23

CENTRAL OFFICE COPY

SEE APPLICATION INSTRUCTIONS ON REVERSE SIDE

DEPARTMENT ACTION ☐ Approved ☐ Disapproved | DATE

1. OWNER'S NAME	2. ADDRESS (Street, City, State, Zip Code)	3. Telephone No.
City of Beacon	427 Main Street, Beacon, NY 12508	831-0302
4. OPERATOR'S NAME	**5. ADDRESS (Street, City, State, Zip Code)**	**6. Telephone No.**
City of Beacon	427 Main Street, Beacon, NY 12508	831-0302
7. ENGINEER'S NAME	**8. ADDRESS (Street, City, State, Zip Code)**	**9. Telephone No.**
Morris Associates	367 Violet Avenue, Poughkeepsie, NY 12601	454-3411, ext.46

10. PROJECT/FACILITY NAME

Dennings Avenue Landfill (Case # 3-0924/86-03)

11. PROJECT STATUS	12. COUNTY IN WHICH FACILITY IS LOCATED	13. ENVIRONMENTAL CONSERVATION REGION
☒ Public ☐ Private ☐ Proposed ☒ Existing	Dutchess	Region 3

14. DESCRIBE SPECIFIC LOCATION OF FACILITY

Dennings Avenue, Beacon, New York

15. TYPE OF PROJECT FACILITIES: ☐ Composting ☐ Transfer ☐ Shredding ☐ Baling ☒ Sanitary Landfill ☐ Incineration ☐ Pyrolysis ☐ Resource Recovery-Energy ☐ Resource Recovery-Materials ☐ Other

16. BRIEFLY DESCRIBE THE PROJECT INCLUDING THE BASIC PROCESS AND MAJOR COMPONENTS

Construction of final landfill cap for sanitary landfill that ceased accepting waste in 1985. Final cap to include gas venting systems, geomembrane barrier layer, barrier protection layer and vegetated topsoil layer.

17. SPECIFIC PROVISION OF 6 NYCRR 360 FROM WHICH A VARIANCE IS REQUESTED: Section 2.13(p) | Paragraph | Variance Request No. 3

18. BRIEFLY DESCRIBE PROPOSED VARIANCE

Using four (4) gas vents per acre installed a minimum of five feet (5') into the waste mass across "western" half of facility as permissible through the Local Government Regulatory Relief Initiative (LGRRI). Also incorporate a three inch (3") layer of select granular fill across same area for subgrade drainage, gas collection and geomembrane subgrade preparation.

19. IMPACTS OF VARIANCE APPROVAL OR DISAPPROVAL:

a. Environmental Impact:

Conservation of resources of requiring importation of less material from off-site sources. "Eastern" half of facility will contain standard twelve inch (12") gas venting layer precluding gas migration in this direction, location of closest habitable enclosed structures (residential).

b. Economic Impact:

Financial savings realized through reduced materials requiring purchase and installation across half of site.

0. CERTIFICATION:

I hereby affirm under penalty of perjury that information provided on this form and attached statements and exhibits is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

10/20/94
Date

[signature], P.E.; Project Engineer
Signature and Title

-19-5 (6/77)
rmerly SW-23

CENTRAL OFFICE COPY

A review of 360-2.13(r) suggests that the use of VLDPE should not present a conflict to regulatory standard. The polyethylene material offers: an adequate permeability, or impermeability, chemical and physical resistance to materials it might come in contact with as a capping material and can accommodate the forces and stresses caused by settlement. In particular, VLDPE is an excellent material suitable for barrier layer construction particularly with respect to the last noted regulatory requirement (settlement) due to the hyper-elastic nature of the material. VLDPE typically has zero percent elongation at yield, versus a ten percent (10%) parameter specification for HDPE, and has a greater percent elongation at break than other geomembrane materials making it an ideal product for landfill covers where structural integrity is a concern. This formal proposal to use an alternate material (VLDPE) is due to the apparent exclusive use of HDPE for constructing geomembrane covers in Region 3.

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

DEC 10 1992

Mr. Albert Romanelli
Commissioner
Department of Public Works
427 Main Street
Beacon, NY 12508

RECEIVED
DEC 14 1992
CRAWFORD & ASSOCIATES

Dear Mr. Romanelli:

Re: Closure Investigation Report Approval
City of Beacon Landfill
Dutchess County

Please be advised that the Department has reviewed the Closure Investigation Report (CIR) for the City of Beacon Landfill. The document which was reviewed as parts of the CIR is the "Closure Investigation Report - City of Beacon Landfill" dated December 1990.

We have also reviewed the December 1992 letter from Michael Morris, Morris Associates, to Richard Baldwin which satisfactorily addresses the deficiencies in the CIR. This CIR is approved as amended.

If you have any questions regarding this, please call me at (518) 485-5855.

Sincerely,

Richard W. Baldwin, P.E.
Supervisor
Landfill Closure Section
Bureau of Facility Management
Division of Solid Waste

cc: R. Manna, DEC Region 3
M. Morris, Morris Associates

APPENDIX F

Cornell Cooperative Extension

Dutchess County

Farm and Home Center
Route 44
PO Box 259
Millbrook, NY 12545-0259
914-677-8223
FAX 914-677-6563

April 26, 1993

Shabazz Jackson
c/o City Hall
427 Main St.
Beacon, NY 12508

Dear Shabazz,

The enclosed soil test results from the Beacon compost material and the topsoil at the landfill site are within appropriate range to support the growth of grass. Incorporating the compost with the topsoil would also be favorable for growing grass.

The pH level of 8.0-8.3 is relatively high. The recommendation to apply elemental sulfur at a rate of 2 lb. per 1000 sq. ft. would help to bring the pH in line with levels to support healthy grass (pH of 6.2-6.5). Also the nitrogen recommendation will be important for establishment of the grass.

Please feel free to contact our office if you have other questions concerning the test results.

Sincerely,

Leslie C. Hulcoop

Leslie C. Hulcoop
Cooperative Extension Agent

Helping You Put Knowledge to Work

Cornell Cooperative Extension in Dutchess County provides equal program and employment opportunities.
The programs provided by this agency are partially funded by moneys received from the County of Dutchess.

recycled paper

Cornell Nutrient Analysis Laboratories

New York State College of Agriculture and Life Sciences * A Statutory College of the State University
804 Bradfield Hall, Cornell University, Ithaca, NY 14850 * Telephone 607/255-4540 FAX 607/255-2644

IDENTIFICATION

LAB ID	SAMPLED	RECEIVED	REPORTED	COUNTY	BAG #	SAMPLE ID	AGENTS PHONE
2364-40 (H)	04/07/93	04/12/93	04/17/93	DUTC	111681	TOPSOIL	(914)677-5006

ADDRESSES

REPRESENTATIVE	GROWER	COOPERATIVE EXTENSION AGENT
	SHABAZZ JACKSON 427 MAIN ST C/O CITY HAL BEACON NY 12508	STEPHANIE MALLOZZI FARM AND HOME CT BOX 259 MILLBROOK NY 12545

BACKGROUND INFORMATION

SITE	CROP	TURFGRASS	TREES AND SHRUBS	AMENDMENTS
Environment: SUNNY	Crop Code: ROU	Species : POA ANN.	Age/ht/dia:	Manure Type:
Drainage : GOOD	Variety : LANDFILL	Cut Height:	Location :	Manure, #/M:
Texture : CLAYEY	Recommend: MAINTENANCE	Clippings :	Top Prune :	Compost, in:
Topography : PLAIN	Month :	Irrigation:	Tree Type :	Lime, #/M :
		Irr. Rate :	Growth :	Sulfer, #/M:

SOIL TEST RESULTS

			Very Low -	Low +	- Medium +	- High +	Excess
pH		8.0	**********	**********	**********	**********	
PHOSPHORUS	(P #/A)	67	**********	**********	**********	**********	
POTASSIUM	(K #/A)	75	**********	**********			
MAGNESIUM	(Mg #/A)	1130	**********	**********	**********	**********	
CALCIUM	(Ca #/A)	11470	**********	**********	**********	**********	

Aluminum	(Al #/A):	23	Zinc	(Zn #/A):	8.4	Salts (mmho/cm):	0.540
Iron	(Fe #/A):	29	Organic Matter	(%):	2.4	Salts (K x 100000):	54
Manganese	(Mn #/A):	73	Nitrate	(NO3-N #/A):	8		

LIME AND FERTILIZER RECOMMENDATIONS

CROP: ROUGH (ROU)

-------- Recommendations per acre --------	----- Recommendations per 1000 sq ft ------	---- Recommendations per 100 sq ft ----
Lime (T/A): 0	Lime (#/M): 0	Lime (#/100 SQ FT): 0
Nitrogen (N #/A): 40-80	Nitrogen (N #/M): 0.9-1.8	Nitrogen (#/100 SQ FT): 0.09-0.18
Phosphate (P2O5 #/A): 0	Phosphate (P2O5 #/M): 0	Phosphate (#/100 SQ FT): 0
Potash (K2O #/A): 120	Potash (K2O #/M): 2.8	Potash (#/100 SQ FT): 0.28

ST YEAR. ROUGH (ROU)

1. IF AN ANALYSIS RESULT IS NOT REFFERED TO SPECIFICALLY IN THE RECOMMENDATIONS OR COMMENTS THEN LEVELS ARE CONSIDERED NORMAL.
2. NITROGEN SHOULD BE APPLIED AT RATES OF 0.5 TO 1 #/M. HIGHER RATES MAY BE USED WHEN SLOW RELEASE SOURCES ARE USED.
3. THE RECOMMENDED RATES ABOVE ARE AN ANNUAL NUTRIENT REQUIREMENT FOR THIS CROP.
4. APPLY NO MORE THAN 80 #/A (2 #/M) OF POTASH PER APPLICATION.
5. APPLY ELEMENTAL SULFUR AT 2 #/M IN SPRING AND FALL. RETEST pH.
6. NITROGEN RECOMMENDATIONS IN THE TABLE ABOVE ARE FOR THE ENTIRE YEAR.

Abbreviation key: lb = pound, # = pound, T = tons, A = acres, M = 1000, N = nitrogen, and SQ FT = square feet.

Maintain a good sampling program and keep a record of all nutrient analyses and recommendations.

Cornell Nutrient Analysis Laboratories

New York State College of Agriculture and Life Sciences * A Statutory College of the State University
804 Bradfield Hall, Cornell University, Ithaca, NY 14850 * Telephone 607/255-4540 FAX 607/255-2644

IDENTIFICATION

LAB ID	SAMPLED	RECEIVED	REPORTED	COUNTY	BAG #	SAMPLE ID	AGENTS PHONE
2364-41 (H)	04/07/93	04/12/93	04/17/93	DUTC	111682	COMPOST	(914)677-5006

ADDRESSES

REPRESENTATIVE	GROWER	COOPERATIVE EXTENSION AGENT
	SHABAZZ JACKSON 427 MAIN ST C/O CITY HAL BEACON NY 12508	STEPHANIE MALLOZZI FARM AND HOME CT BOX 259 MILLBROOK NY 12545

BACKGROUND INFORMATION

SITE	CROP	TURFGRASS	TREES AND SHRUBS	AMENDMENTS
nvironment: SUNNY	Crop Code: ROU	Species :	Age/ht/dia:	Manure Type:
Drainage : EXCEL	Variety :	Cut Height:	Location :	Manure, #/M:
Texture :	Recommend: MAINTENANCE	Clippings :	Top Prune :	Compost, in:
opography :	Month :	Irrigation:	Tree Type :	Lime, #/M :
		Irr. Rate :	Growth :	Sulfer, #/M:

SOIL TEST RESULTS

			Very Low -	Low +	- Medium	+	- High	+ Excess
		8.3	■■■

HOLLIS S. INGRAHAM, M.D.
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF HEALTH

DISTRICT OFFICE
34 South Street
Middletown, N. Y., 10940

JOHN A. DEGEN, JR., M.D.
DISTRICT HEALTH OFFICER

November 22, 1967

Mr. Ralph Flynn
Commissioner of Public Works
Beacon, New York

Dear Mr. Flynn:

I inspected the Capolino property on November 15 in the company of Messrs. Forman and Stella to determine its suitability as a landfill site for the City of Beacon.

The only ready means for getting to the site at the present time was along the New York Central Railroad tracks. From the tracks it is apparent that the low area is partially swampy and drains to the Hudson River and also floats on the tide. Since we can not dispose of refuse into surface waters, this area would have to be either diked or filled so as to keep all waste materials out of and above high tide levels.

It was impossible to determine whether there was any fill available on the site. It would appear that the natural clay in this area would have been used by the brick works and currently the remaining material was basically boulder and rock outcropping. This would be similar to what we could determine from the hilltop.

Another problem that arises is in the construction and maintenance of a year round access road to the dumping area. We require that the dump area be available at all times of the year with a passable road that is kept plowed.

After reviewing the several sites during the past few months, I still feel that the one I recommended in a prior letter is the best.

Very truly yours,

M. J. Schleifer, P. E.
District Sanitary Engineer

Lofts Seed, Inc.

Chimney Rock Road, P.O. Box 146
Bound Brook, New Jersey 08805
(908) 356-8700
(800) 526-3890

(908) 356-5607 FAX

April 12, 1993

Mr. Jefferson H. Akins, P.E.
Morris Associates
367 Violet Ave.
Poughkeepsie, NY 12601

Dear Mr. Akins:

Re: New York Landfill Closures
Varience for Barrier Protection
Soil Layer per NYSDEC
M/A #20275.00 & 00256.00

Persuant to your letter of April 8th, I would like to offer the following comments. It is our opinion that 6 inches of topsoil over 12 inches of barrier protection soil layer would be sufficient to support the growth of the seed mixture specified, i.e.:

40% Clemfine Tall Fescue
20% Weeping Lovegrass
10% Reliant Hard Fescue
10% Jamestown Chewings Fescue
10% Palmer Perennial Ryegrass
5% White Clover
5% Blackwell Switchgrass

We feel that the growth of this mixture would not damage the barrier when grown on 6" of topsoil over 12" of barrier protection layer.

Very truly yours,

Mary Beth Ruh

Mary Beth Ruh, CPAg
Agronomist